5

DISCOURSES AROUND DECLINE

Comparing the debates on coal phase-out in the UK, Germany and Finland

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5.1 Introduction

Decline of unsustainable practices is a crucial process in sustainability transitions (Markard and Rosenbloom 2020; Rosenbloom and Rinscheid 2020). Only if problematic practices or technologies decline, and eventually vanish, is there a chance for ecosystems to recover and for socio-technical systems to become more sustainable. To tackle climate change, for example, massive reductions in the use of fossil fuels are required (IPCC 2022). If we want to remain within the 1.5°C target, power generation from coal and natural gas has to decline worldwide at a speed for which there are hardly any historic precedents (Vinichenko et al. 2021).

Decline can happen without policy intervention (e.g., DVDs being replaced by video streaming) but it may also be guided by public policy. An example for the latter is the policy driven phase-out and ban of incandescent light bulbs (Stegmaier et al. 2021). Especially when time is running out and negative consequences accumulate as in the case of climate change, it is essential for policymaking to act swiftly and to accelerate processes of decline.

A key approach to guide and accelerate decline is *phase-out policies*: 'governance interventions aimed at terminating specific technologies, substances, processes, or practices that are considered harmful' (Rinscheid et al. 2021: 27). Phase-out policies may specify a date by which the practice has to end, a path or steps toward that end, compensations for those negatively affected by the phase-out, and other details (ibid.). Phase-out policies have been implemented for toxic substances such as DDT (Maguire and Hardy 2009), products such as light bulbs (Stegmaier et al. 2021) or gasoline vehicles (Meckling and Nahm 2019) and technologies such as nuclear power (Markard et al. 2020).

Phase-out policies are typically very much contested, which is why the underlying politics, i.e., the political processes leading to phase-out, are very important

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(Isoaho and Markard 2020; Rosenbloom 2018). In the case of coal, for example, environmental NGOs, social movements and scientists have been observed to argue in favor of phase-out, while utility companies, coal producers and unions seek to avert or delay phase-out (Brauers et al. 2020; Leipprand and Flachsland 2018). The struggle over phase-out policies is also very much a struggle over the legitimacy of the focal practice or technology (Markard et al. 2021). Only if the established technology loses its legitimacy can we expect widespread societal and political support to enact phase-out policies.

In this chapter,[1] we study political struggles over technology legitimacy and phase-out across three different countries. We focus on coal-fired power generation, which is one of the main global sources of CO_2 emissions and therefore key to tackling climate change (IEA 2021). We conceptualize coal as a *technological innovation system in decline*. To illuminate the unfolding political conflicts, we analyze the public discourses where arguments in favor of and against phase-out are expressed by a broad variety of actor groups and stakeholders (Hajer 1995; Hajer 2006). Tracing general discourse dynamics, major arguments (storylines) and the actor groups that mobilize them, provides key insights into the political processes leading to a phase-out decision.[2]

Our analysis includes three countries: the United Kingdom, Germany and Finland. We chose these countries because they all decided to phase out coal and have several 'macro-level' similarities which improve comparability: culture (Western European), societal values (sustainability and climate change are important), political system (parliamentary democracies), mature electricity/energy markets (low growth rates). At the same time, they vary in key dimensions including: relevance of coal for electricity supply and jobs, age of power plants, availability and progress of alternatives such as renewable energies, nuclear energy and natural gas. Two country case studies (UK, Germany) have already been published (Isoaho and Markard 2020; Markard et al. 2021). The Finnish case and the comparative perspective are novel.

Our article complements prior research on coal decline, which analyzed early stages of decline and regime destabilization (Turnheim and Geels 2012, 2013), debates and conflicts around phase-out (Leipprand and Flachsland 2018; Liersch 2022; Rosenbloom 2018) and strong resistance against phase-out (Stutzer et al. 2021; Trencher et al. 2020). We also add to an emerging line of comparative studies on coal decline (Diluiso et al. 2021), including cross-country comparisons (UK and Germany) focusing on justice concerns (Bang et al. 2022) or general hurdles and drivers (Brauers et al. 2020).

We make three contributions: the commonalities and differences we identify in the public discourse may help to inform policymaking in other places and cases; our comparative analysis and methodological learnings can inspire and inform related research; and our theoretical framing may help to widen the conceptual repertoire in transition studies.

Next, we introduce our theoretical background and review existing work. Section 5.3 provides a short overview of the three countries in terms of power

generation, the role of coal and the phase-out decision. Section 5.4 introduces our approach, data sources and analysis. Section 5.5 presents the results. Section 5.6 discusses the findings and conclusions.

5.2 Theoretical background

Decline is an essential part of socio-technical transitions: as innovations and new system configurations emerge and diffuse more widely, established practices, structures and technologies decline. Eventually, they may even vanish. One example is the decline of large sailing ships, which were replaced by steamships in the course of the 19th century (Geels 2002). Examples in the realm of consumer products include video cassettes, DVDs or ('non-smart') mobile phones (Markard 2020).

In the literature on sustainability transitions, decline is receiving increasing attention (Köhler et al. 2019; Markard et al. 2020; Rosenbloom and Rinscheid 2020). One reason behind this is that ongoing transitions in energy or transport have entered a new phase of development, in which innovations such as renewable energies or electric vehicles diffuse rapidly and established technologies such as coal or conventional vehicles are in decline (Markard 2018). Another reason is that, in order to cope with urgent sustainability challenges such as climate change, public policies are needed to phase out problematic practices as quickly as possible to prevent further damage (IPCC 2021; Vinichenko et al. 2021).

In transition studies, decline processes have been analyzed from different perspectives.[3] With a focus on incumbent actors, Turnheim and Geels (2012) introduced the concept of industry or regime destabilization. As external pressures mount in an industry, or socio-technical regime, the provision of financial resources drops, legitimacy declines and the commitment of incumbent actors crumbles (ibid.). These dynamics may also include an increasing involvement of policy-making, which might eventually result in major policy changes, e.g. in the form of stricter regulations (Geels and Penna 2015), removal of policy support (Roberts 2017) or even phase-out (Brauers et al. 2020; van Oers et al. 2021).

Recently, scholars have also started to study decline from a technological innovation systems (TIS) perspective. The TIS approach highlights that different kinds of actors and institutions interact, thereby shaping the development of the focal technology (Bergek et al. 2008a; Markard 2020). While the framework was developed, and often used, to study the emergence of innovations (Bergek et al. 2008a; Markard and Truffer 2008), it can also be mobilized to capture processes of decline, which are a 'natural' part of technology or industry life cycles (Klepper 1997; Markard 2020).

A focal TIS is interacting with other systems in its context (Bergek et al. 2015; Markard and Hoffmann 2016). These include other technological innovation systems and sectors as well as broader 'societal' systems such as the policy system, the scientific system or civil society. All of these systems interact and can support or hinder the development of the focal system. For example, when a competing TIS grows (e.g., around electric vehicles) this typically has a negative effect on the focal

TIS (e.g., around conventional vehicles). The opposite holds for complementary TIS such as domestic coal mining. For example, Stutzer et al. (2021) have shown that coal mining companies, their shareholders and traditional mass media played an essential role in legitimizing the approval of a large new coal mine in Australia.

In order to study whether a TIS prospers or does not do well, scholars have suggested a set of TIS functions such as knowledge development, resource mobilization or market formation (Bergek et al. 2008a; Hekkert et al. 2007). While TIS functions have mostly been used to study emerging technologies, they can also be adapted and used to study the decline of a TIS (Bento et al., in review). One of these functions is about the *creation, or destruction, of legitimacy* (Bergek et al. 2008b; Markard et al. 2016). When an innovation emerges, actors that support it seek to create legitimacy, e.g. as they explain what it is about and mobilize arguments why it is needed (Aldrich and Fiol 1994; Binz et al. 2016). When technologies decline, the opposite happens, as actors argue why it should not be used any more. During decline, we see struggles of actors that seek to undermine legitimacy (e.g. highlighting the associated risks) and those that try to maintain or re-establish legitimacy (Isoaho and Markard 2020; Rosenbloom 2018).

In this study, we analyze struggles over legitimacy with the help of argumentative discourse analysis (Hajer and Versteeg 2005; see section 5.4.1 for more detail). This approach identifies statements of different actors about a focal issue (here: coal-fired power generation as an established technology). These statements, or *storylines*, highlight certain values, technology characteristics and relationships, while excluding others. With these storylines, actors frame a technology in a specific way, thereby shaping its legitimacy. Below, we compare how the discourse unfolds over time, which actors and actor groups are involved, what storylines are more frequent than others and who uses which storylines.

Figure 5.1 shows a simple conceptual framework that informed our analysis. The focal TIS (on coal-fired power generation) interacts with other TIS in its context. Here we depict those that are the most relevant later in the empirical analysis. The focal TIS is part of the larger electricity supply system for which different technologies are available (competing TIS). At the same time, there are complementary TIS such as those that are located upstream (coal mining) or downstream (carbon capture and storage technology) in the value chain (Andersen and Markard 2020). The TIS also interacts with energy consumption systems, policy and science systems, and civil society. In all of the aforementioned systems there are (different kinds of) actors that have an interest when it comes to coal phase-out. In the public discourse, with the storylines they use, actors are either seeking to destroy the legitimacy of the focal TIS or to uphold it. A decline of legitimacy eventually facilitates the policy decision to phase out the focal technology.

Our empirical analysis (and the results section) concentrates on the dashed arrows: the arguments actors use to influence the legitimacy of the focal technology. While most of these storylines are related to the focal technology, some also relate to competing and complementary TIS.

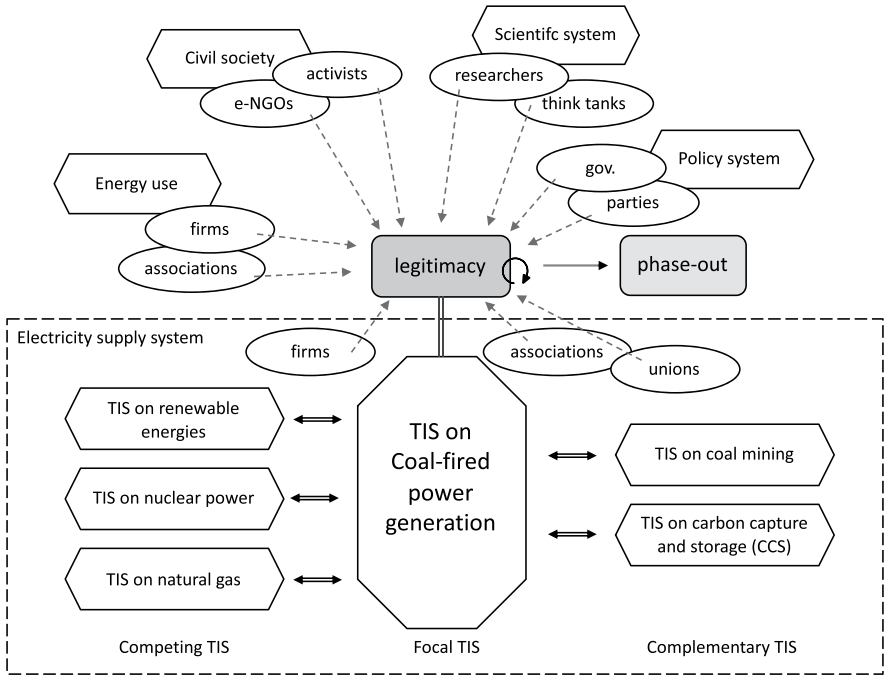


FIGURE 5.1 Focal TIS, context systems, actor groups and struggles over decline

5.3 Coal TIS and contexts: A brief overview across countries

This section provides a brief overview of the main characteristics and developments in the electricity supply system in the three countries and the developments around coal and phase-out.[4] Figure 5.2 displays four main sources of power generation: coal, nuclear, gas and renewables. Table 5.1 lists some key characteristics.

Coal decline is most advanced and almost completed in the UK, where it dropped from a 32% share of total power generation in 2000 to less than 2% in 2020. In this period, coal was primarily replaced by wind power and, to some extent, by natural gas. The UK is building new nuclear power plants. The country already saw an earlier wave of coal decline in the 1990s as a consequence of electricity market liberalization and the rapid expansion of gas-fired power plants (Turnheim and Geels 2012; Winskel 2002). In 2015, in the context of the Paris Climate Agreement, the British government pledged to phase out coal by 2025. In 2021, the goal was brought forward to 2024. At the time of the pledge, many coal power plants were already set for closure because they were not meeting EU emission regulations any more.

In Germany, coal decline was very moderate at first but it has accelerated recently. In 2013, power generation from coal had a share of 48%, which dropped to 23% in 2020.[5] The German coal phase-out was suggested by a commission in 2019 and passed through Parliament in 2020 (Markard et al. 2021). The phase-out

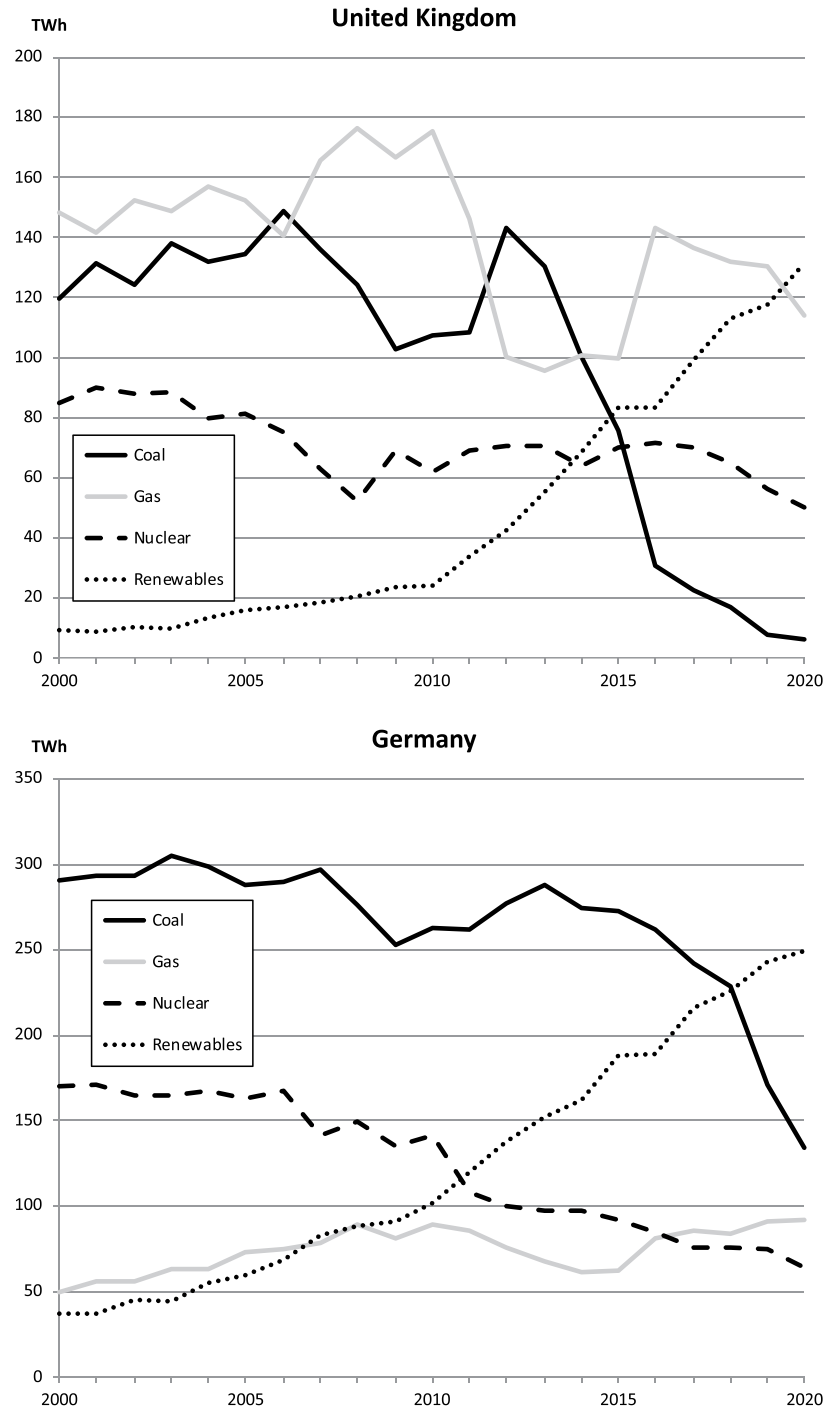


FIGURE 5.2 Electricity generation by source (2000–2020)

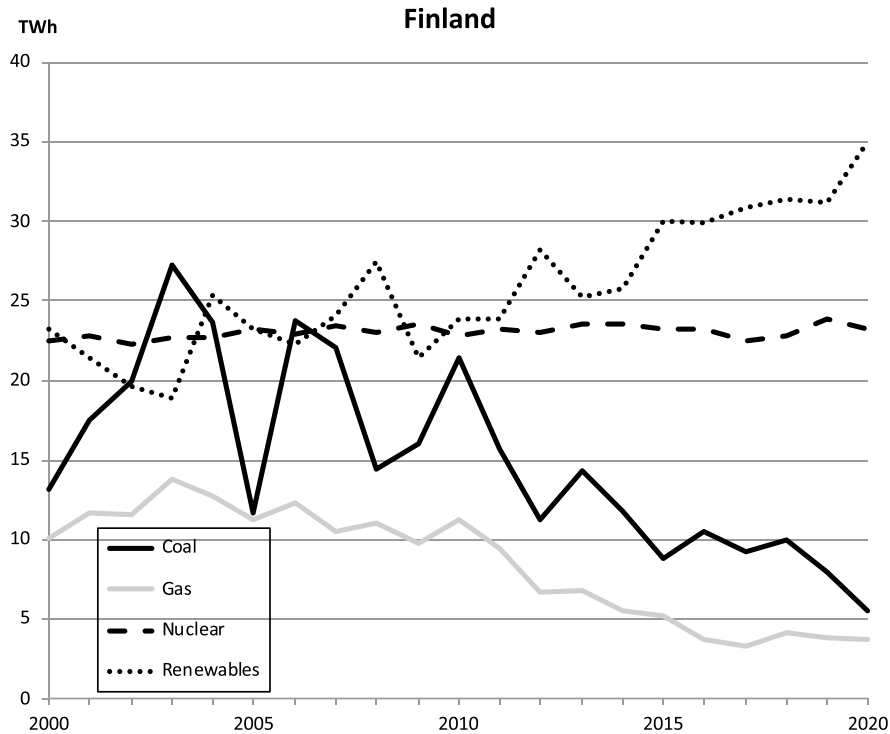


FIGURE 5.2 (Cont.)

deadline is 2038. Alongside coal, nuclear power is also in decline. The nuclear phase-out was decided in 2000 and accelerated in 2011 following the Fukushima accident. For decades, German energy policy has been characterized by very intense socio-political conflicts over the risks and costs of nuclear energy (Markard et al. 2020; Skea et al. 2013). Nuclear declined from 31% (2000) to 11% (2020) and will be phased out by the end of 2022. Both coal and nuclear have been primarily replaced by renewables (up from 7% to 40%) but also by natural gas (up from 9% to 15%, see Figure 5.2).

In Finland, coal-fired power generation has seen ups and downs in the early 2000s (due to fluctuations in energy/electricity prices and winter temperatures) and a moderate decline since around 2010. Plans to phase out coal were first announced by the government in 2016. In 2018, a phase-out proposal was submitted to Parliament and it passed in 2019. The phase-out deadline is 2029. In 2018, the share of coal for power generation was 14%. In Finland, district heating is very common and most district heating systems are connected to combined heat and power plants, in which coal is used, next to biomass or waste. Finland, unlike the other two countries, has important hydropower resources (around 20% of the power supply) but the country is also a net importer of electricity (15 TWh in 2020). Finland, similar to the UK, is expanding nuclear power.

TABLE 5.1 Key characteristics of electricity supply systems, coal, phase-out and related TIS

	UK	*Germany*	*Finland*
Power generation (TWh)	335 (2018)	574 (2020)	69 (2020)
Coal phase-out decision	Nov. 2015 (pledge)	Jan. 2019 (commission) July 2020 (Parliament)	Apr. 2018 (pledge) Feb. 2019 (Parliament)
Target date	2025 (now: 2024)	2038	2029
Coal TIS			
Share of coal at time of pledge	23% of power generation	28% of power generation	14% of power generation
Particularities	Old, inefficient coal plants, many were not meeting future emission standards	Mostly state-of-the-art, several new plants built recently	Most plants from 1980s and 90s, some newer; coal for district heating
TIS on domestic coal mining	Last major wave of decline in domestic coal mining in the 1980s	Lignite mining with about 20,000 workers; black coal mining ended in 2018	No domestic coal mining
Competing TIS	Renewables, gas, nuclear	Renewables, gas; nuclear phase-out	Renewables, gas, nuclear

5.4 Methods and data

Our analyses begin in 2000 for all three countries. At this time, concerns over climate change had been clearly formulated but coal phase-out was not an issue yet. The analyses end after the phase-out decisions had been made. For the UK, we collected data until the end of 2017, where we saw that the discourse cooled off after the decision. For Finland and Germany, we therefore set the cut-off date in the month or shortly after the phase-out passed parliament: April 2019 for Finland and July 2020 for Germany. Our results for the UK (Isoaho and Markard 2020) and Germany (Markard et al. 2021) have already been published. Here, we add the comparative perspective as well as unpublished data from Finland.

5.4.1 Methodological background

In our study, we analyze the public discourse as it is expressed in newspaper articles. Following earlier studies (e.g. Isoaho and Markard 2020; Leipprand et al. 2016; Rosenbloom et al. 2016), we build on Hajer's (1995, 2006) argumentative approach to discourse analysis. This approach grants arguments on a specific topic, brought forward by stakeholders, a key role in the political process. Through discourse, shared understandings of social and physical phenomena are created and conflicting views become apparent. A central concept in discourse analysis is the

storyline: 'a condensed statement summarizing complex narratives, used by people as "short hand" in discussions' (Hajer 2006: 69). 'Through storylines, actors select certain aspects of the discourse while excluding others, thereby reducing the complexity of policy issues … For example, the storyline "Coal is bad for the climate" condenses complex arguments on the release of CO_2 through the burning of coal, how CO_2 contributes to climate change and how climate change is bad for society and nature' (Markard et al. 2021: 317).

Discourse analysis has the capacity to reveal conflicts and argumentative reactions, in which some storylines are included and others omitted from the statements of actors (Isoaho and Karhunmaa 2019). The approach also acknowledges that actors' discursive positions are not constant but subject to change. Therefore, it allows the tracing of changes in the discourse over time.

Building on Hajer's concept of storyline, we take a quantitative approach to analyzing discourse, i.e., we count how often certain storylines were mentioned.[6] We do this to facilitate comparability across the three cases. The downside of this approach is that we provide less information on the (qualitative) content of storylines and how they were presented.

Our analysis uses archival data from nationwide newspapers. We focus on newspapers as data source because they are a central medium in which political arguments are exchanged; newspapers, and media more generally, can be viewed as a major environmental policymaking arena alongside more formal venues such as parliamentary debates (Boykoff and Boykoff 2007; Hansen 2010). Moreover, investigating news articles allows us to cover the discourses from both incumbent and niche actors. The media is often interested in highlighting conflicts and struggles to attract attention, and so newspaper articles are likely to contain more diverse actor interests than for example policy documents (Delshad and Raymond 2013).

5.4.2 Data sources and data collection

For the UK case study, we downloaded newspaper articles from the LexisNexis academic database. After a scoping phase with test-runs on several newspapers, *The Guardian* was chosen as the main source as it was the only nationwide quality newspaper available in the database that systematically covered energy and climate issues.[7] For Germany, we chose the daily editions of *Süddeutsche Zeitung* (*SZ*) and *Die Welt* as data sources. Both newspapers report about the German energy market on a regular basis and were accessible through LexisNexis and the Bavarian State Library's online archive.[8] Both newspapers have different ideological stances: *SZ* represents center-left and *Die Welt* conservative, market-liberal values. For the Finnish case study, we chose *Helsingin Sanomat*, the only nationwide newspaper in Finland, and news articles from *YLE*, Finland's nationwide public broadcasting company.[9] Both sources claim to be politically independent and liberally oriented (Teräväinen 2014). To collect relevant articles, we did both a general search for articles on coal used for power generation and a more specific search on coal phase-out.[10] After obtaining the data, we went through all articles and eliminated

TABLE 5.2 Overview of data sources

	UK	*Germany*	*Finland*
Source(s)	*The Guardian*	*Süddeutsche Zeitung* (*SZ*), *Die Welt*	*Helsingin Sanomat* (*HS*), *YLE*
Time period	2000 – Dec 2017	2000 – July 2020	2000 – April 2019
Number of articles	249	329 (*SZ*) 281 (*Die Welt*)	77 (*HS*) 91 (*YLE*)
Storylines coded	471	814	548

duplicates and false positives (e.g., articles about domestic politics, housing, manufacturing etc.). The final data set for the UK consisted of 249 articles (2000–2017), the German data set included 610 articles (2000–2020) and the Finnish 168 articles (2000–2019). See Table 5.2 for an overview.

5.4.3 Data analysis

We developed a common strategy for the analysis of storylines. First, two authors[11] examined a subset of articles (every second or third, depending on the sample size) and *inductively* derived storylines from the sample. Here we followed pre-defined steps: 1) identify key text passages where coal is discussed, 2) code value judgments or arguments related to coal, 3) identify and code actors that make these arguments.

After independent analysis, the results were then compared and discussed between the authors and finally consolidated into a list of storylines. Due to this bottom-up approach, storylines vary across countries. However, we also found many similarities (Table 5.3). Next, the coding rules for each storyline were discussed and aligned. Then the entire data set was coded. All coding was performed using the NVivo software package for qualitative analysis. In a final step, similar storylines were grouped together across countries and paraphrased. Table 5.3 lists all storylines sorted by their frequency.

Actors were first coded by their name and later assigned to actor groups. The groups were created inductively and updated as the analysis went on. Actor groups were aligned across the three case studies.

5.5 Results

We look into four different aspects of the discourses: general dynamic, the most prominent storylines, the most prominent actor groups and which group argues in favor of or against coal phase-out.

5.5.1 Discourse dynamics

We find several similarities but also differences in how the discourses unfolded over time in the three countries (Figure 5.3 and Table 5.4). In all countries, we see a clear

TABLE 5.3 Overview of storylines and number of codes

Storyline (and paraphrase)	*UK*	*Germany*	*Finland*
Bad for climate Coal is bad for the climate.	200	337	171
Coal not needed Coal can be replaced by other energy carriers, it is not needed to secure power supply.	56	56	161
Coal is reliable Coal is needed to keep the lights on.	38	101	43
CCS is a solution CCS technology is a solution to the climate problem, it can capture the emissions.	75	32	23
Bad for economy Coal decline and phase-out have a negative effect on jobs and / or regional economies.	-	68	26
Structural change needed Structural change is inevitable and there are new jobs in sustainable industries.	-	52	31
Coal is cheap	11	46	16
Not so bad Our emissions from coal do not matter at a global scale.	-	27	42
Health risk Burning coal pollutes the air and creates health risks.	45	14	-
Coal is expensive	-	38	16
CCS no solution CCS is too expensive and risky.	29	13	7
Coal is our identity We are a coal country, coal is part of who we are.	17	-	-
Coal ban problematic A ban leaves little time to develop alternatives.	-	-	12
No health risk Coal is not a health risk.	-	5	-

peak in media attention around the time when the coal phase-out was announced (or decided) and lively discourse activity in the years before.[12] While there were some sporadic articles on the topic in the early 2000s, more regular discourse activity started around 2007 (UK) or 2008 (Germany, Finland). In the UK we find two waves of attention, with a first major build-up around 2008–2009. These years are characterized by the implementation of the Climate Change Act (2008) and a specific debate around carbon capture and storage technology (CCS) as a means to decarbonize new coal power plants (Isoaho and Markard 2020). This debate largely disappeared in subsequent years as CCS turned out not to be viable. In Germany, we find a more or less

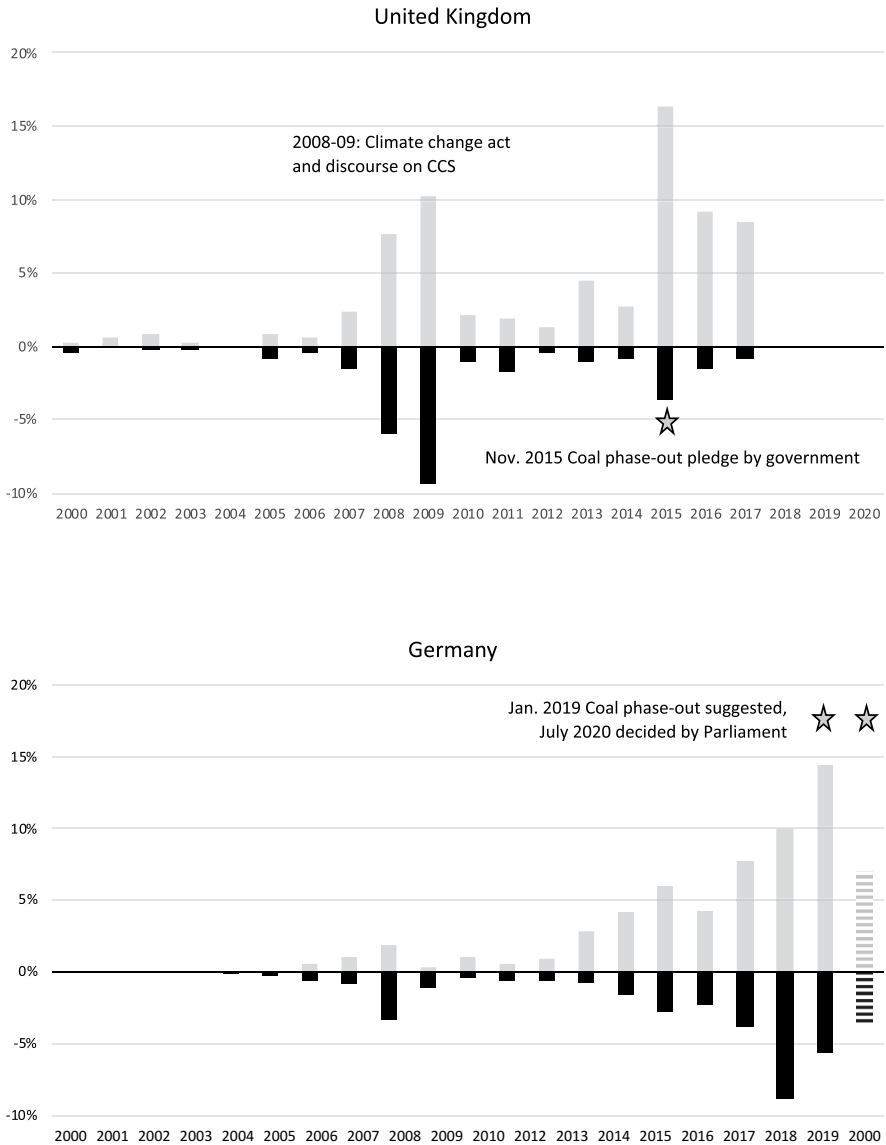
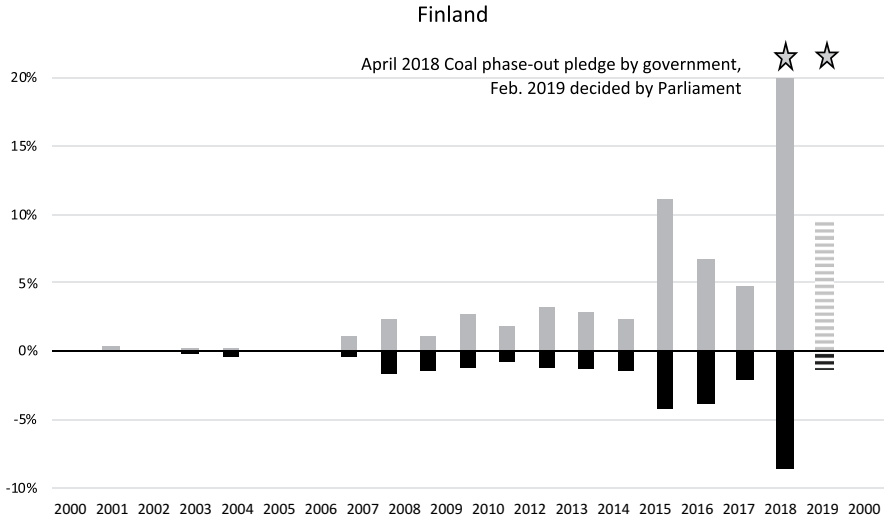


FIGURE 5.3 Discourse activity over time per country
Share of storylines in favor of phase-out (light grey, positive) and against (dark grey, negative). To calculate the share, we divided the number of storylines in a specific year by the overall number of storylines for the entire period for each country. The columns for the final year in Germany and Finland are shaded because data collection stopped in July and April, respectively.



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steady build up with high discourse activity around the phase-out decision. In 2008, there was also a debate around CCS technology and announcements of pilot plants. In Finland, we see a steady but low discourse activity from 2008–2014, then a first peak in 2015 when there was an intense debate about a new coal power plant in Helsinki, then decreasing attention until a major peak in 2018, when the government proposed to phase-out coal.

The timespan from when discourses became more intense until the phase-out decision was about 9 years in the UK (2007–2015), 11 years in Finland (2007–2018) and more than 12 years in Germany (2008–2020).

Comparing storylines in favor (displayed as positive numbers) and against phase-out (negative numbers), we also find commonalities. In all three countries, pro phase-out storylines outnumber contra storylines. As a general development, we see that the early years are characterized by a more equal weight of pro/contra arguments,[13] while in later years, the discourses tilt in favor of pro phase-out arguments. This pattern is most clearly visible in the UK. In Germany, there are two years at the beginning of the debate in which contra arguments had a majority. Contra arguments also remain strong closer to the phase-out decision. The ratio of pro to contra storylines is highest in Finland (2.4), followed by the UK (2.3) and Germany (1.8). The high value in the UK might be an effect of using *The Guardian*, a left-leaning newspaper. In Germany, the center-left newspaper *SZ* has a ratio of 2.1 (pro vs contra), while the conservative *Die Welt* has a value of 1.6.

5.5.2 Which storylines are mobilized?

There are many similarities across the three countries with regard to the storylines mentioned (Table 5.3). This is an interesting finding in itself because our bottom-

up approach for identifying storylines (see above) could have led to a very different result. In Figure 5.4, we present six topics in the debate over coal phase-out. For each topic, we list arguments and counter-arguments and how frequently they were mobilized in each country (if at all). We excluded storylines that appeared in one country only.

By far the most prominent storyline is that 'coal is bad for the climate'. It is the cornerstone of the criticism towards coal use in all three countries and it is used in high frequency over the entire time. There is little opposition to this storyline. In Germany and Finland, we see occasional responses arguing that using coal is 'not so bad' because there are far bigger emitters elsewhere in the world. We did not find this argument in the UK discourse.

A second key topic is about whether coal is needed or not. The most important argument against coal phase-out is about reliability: coal is said to be needed for a stable and secure power supply. This storyline is present in all three countries to a similar extent, although somewhat more frequently in Germany. The counter-argument is that 'coal is not needed'. It is argued, for example, that renewable energy sources can reliably replace it. This storyline was used very often in Finland, but much less so in Germany, where the share of coal for power generation was still rather high at the time of the discussion.

Another debate centers around the economic effects of phasing out coal. Some argue that a phase-out is 'bad for the economy', e.g., pointing to job losses in German coal mining regions. Others respond that structural changes are needed anyway in these regions and that there are also economic opportunities when developing technological alternatives to coal. These arguments appeared both in Germany and Finland but not in the UK, where jobs in coal mining had already been lost many years before.

A fourth topic is about carbon-capture and storage (CCS) technology. Some argue that CCS could be a viable approach to retain the emissions from coal-fired power plants ('clean coal'), while others were skeptical about the technological and financial viability of CCS and the associated risks. The CCS debate gained prominence in the UK around 2008–2009 and it was also associated with hopes to create a new industry around CCS and to become an international leader (and technology exporter) in this field. CCS was much less of an issue in the other two countries. However, CCS was also discussed in Germany in the same years. Vattenfall Europe built a CCS pilot plant in Eastern Germany[14] and also two other major German utilities, RWE and E.On, argued in favor of CCS technology. In Finland, there was little attention given to CCS at that time. The country saw a CCS debate 10 years later in 2018, when the Finnish utility Fortum announced a pilot project in Norway.

Another discussion addressed the costs of coal-fired power generation. Opponents of phase-out argued that coal should be kept because it is cheap, while those in favor of phase-out pointed to the costs that are not accounted for.

Despite many similarities, there were also differences between the countries. For example, the argument that there are health risks associated with burning coal was

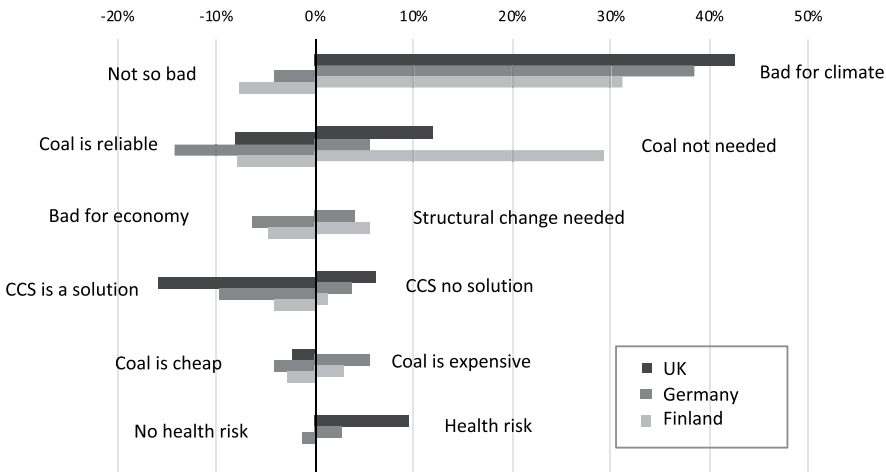

FIGURE 5.4 Storylines and responses for each country
Share of specific storylines in relation to all storylines for the respective country; pro (contra) phase-out: positive (negative) values; no data: storyline was not mentioned.

regularly mentioned in the UK but it was hardly mentioned in Germany and not at all in Finland. In addition, we found a pro-coal storyline around 'coal is part of our national identity' that was unique for the UK. In Finland, we found a couple of arguments that said a coal ban would be problematic, e.g., as there is no flexibility and it does not leave enough time to develop alternatives.

5.5.3 Which actor groups are present in the discourse?

The discourse on coal phase-out is shaped by a broad variety of actors and actor groups. There are six major groups of actors that occur in all three countries, although to varying degrees (Figure 5.5).

Overall, environmental NGOs and climate activists present the most dominant actor group. They are by far the most prominent actor group in the UK[15] and also very prominent in Germany. In Finland, however, they were a much less important voice in the debate. A second important group is electric utilities. They were the most active voice in Finland and had an average discourse activity in Germany. In the UK, they were the least prominent group. Scientific experts and think tanks feature prominently and at a similar level in all three countries and so do government actors. Parties played a prominent role in Germany, while they were less important in the two other countries. Industry actors were most prominent in the UK, of some relevance in the German debate and of hardly any importance in Finland.

Some groups of actors only appeared in one country. In Germany, we found some federal states (Länder) with strong voices and also labor unions. Both are related to lignite mining, which is concentrated in a few states with jobs at stake. In

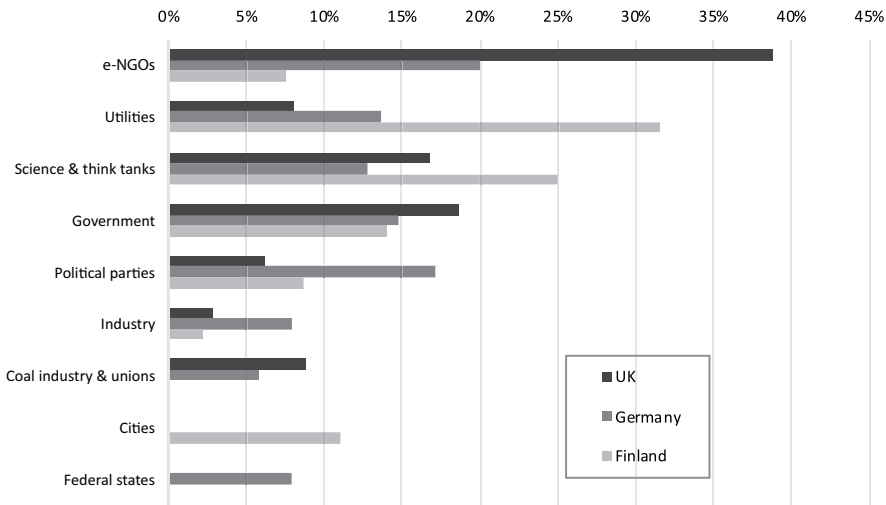

FIGURE 5.5 Main groups of actors for each country
Share of storylines mentioned by members of a specific actor group in relation to all storylines in the respective country.

Finland, cities also had a voice in the debate. Here, most coal power plants are owned by municipal utilities. The plants supply cities with electricity and heat (district heating).

In summary, there are fewer similarities in terms of actor groups across countries than in terms of storylines. In other words, similar arguments and counter-arguments are made—in part by the same groups of actors, in part by other groups.

5.5.4 Which actor groups mobilize which storylines?

Not surprisingly, environmental NGOs and climate activists were the key groups of actors that argued in favor of coal phase-out (Figure 5.6). This pattern holds across all countries, even though NGOs had a much stronger voice in the UK than in Germany and Finland (see above). The main argument of these actors was about climate change. They also argued that coal is not needed. In the UK and Germany, some NGOs were in favor of CCS at the beginning.

Science experts and think tanks also spoke mostly in favor of phase-out. Their main arguments were climate change, alternative energy supply options (coal not needed) and, to a lesser extent, that structural change is needed anyway and that there are also economic opportunities in coal phase-out. In addition, there were several voices that saw a merit in CCS technology, especially in the UK and Finland.

Both of these groups were quite homogeneous in their positions and did not change their arguments over time (except for the pro CCS arguments). Government actors, in contrast, were less homogeneous. We find, for example,

environment ministers often arguing in favor of coal phase-out, while other government officials argued in favor of CCS (especially in the UK) or raised issues around job losses and potential negative economic impacts of phase-out (primarily Germany and Finland). Also, storylines from government actors shifted over time, from pro-coal to pro-phase-out.

Utility companies, coal industry and unions, as well as industry actors, show somewhat contrasting positions to the aforementioned groups. They mobilized more storylines against coal phase-out than in favor and their two most central arguments were security of supply (utilities and coal industry), job losses (coal industry) and costs of supply, i.e. coal being cheap (primarily industry). This pattern is more pronounced in Germany and the UK than in Finland, where coal industry and coal-related labor unions did not play a role in the debate. In Finland, we also found many utilities in favor of phase-out, especially in the year when it was finally decided.

A more detailed analysis of the main opposing storylines (Figure 5.7) shows several similarities between the UK and Germany: climate change as the main argument pro phase-out, primarily mobilized by e-NGOs, science actors and parts of government, plus 'coal not needed' as an additional but much less prominent argument. In Finland, both climate and 'not needed' are of equal importance with all four actor groups mobilizing them (but e-NGOs comparably less). On the 'pro-coal' side we find reliability as the key storyline in all three countries, mostly used by utilities. The UK is an exception here with CCS playing a major role (see above) and the government having quite a prominent voice. In fact, the UK government was the main actor defending a continued use of coal in the early years of the UK discourse.

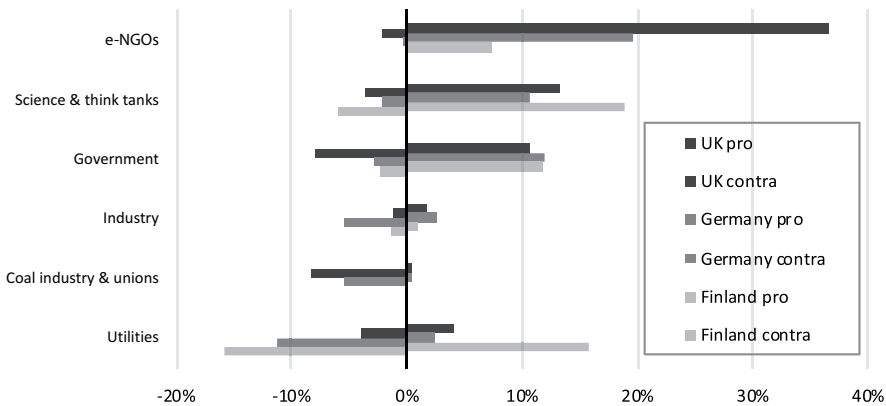

FIGURE 5.6 Main actor groups and whether they were in favor of or against coal phase-out

Share of storylines mentioned by members of a specific actor group (ranked from pro to contra phase-out) in relation to all storylines in the respective country. Pro (contra) phase-out: positive (negative) values.

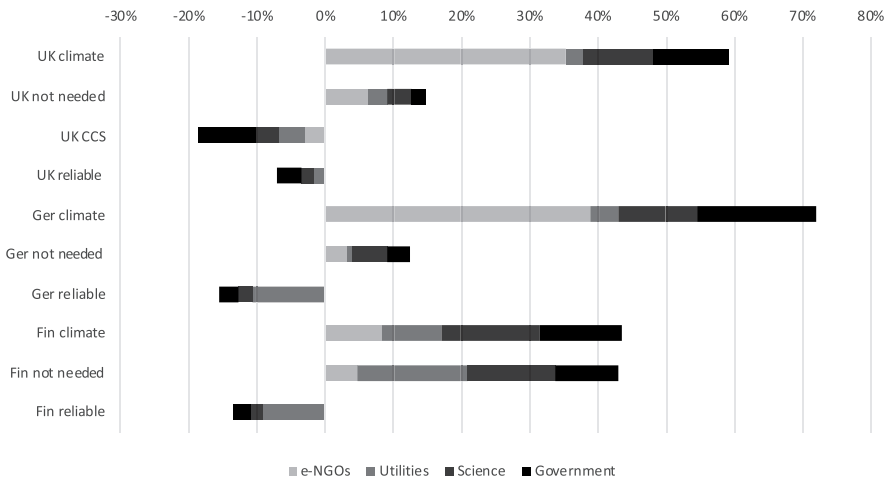

FIGURE 5.7 Most frequent storylines and actor groups for each country
Share of storylines mentioned by a specific actor group in relation to all codes for those storylines and actor groups.

5.6 Discussion and conclusion

This study set out to analyze the public discourses around coal phase-out across three different countries. Inspired by Rosenbloom (2018), we wanted to explore how discourse dynamics, storylines, actors and actor positions in favor or against phase-out compare.

Despite some major differences in the characteristics of the coal TIS and its context systems in the three countries (see section 5.3), we found many similarities. The debates over phase-out showed similar dynamics (especially with regard to duration), the content and frequency of the main storylines (climate, reliability, not needed) were very much alike, and there were many commonalities in terms of actor groups (e-NGOs, science actors, governments, utilities), their prominence in the discourse and the arguments they mobilized. The storyline around climate impacts, prominently and continuously pushed by e-NGOs, science actors and think tanks, was the most influential argument in favor of phase-out in all three countries. The argument that coal was needed for a reliable energy supply was the most common storyline for those who wanted to keep coal such as utilities and government representatives. Scientists, e-NGOs and (later also) utilities countered that it was not needed any more.

These arguments and actor positions are very much in line with similar studies in places such as Ontario where coal phase-out was successful (Rosenbloom 2018) as well as places such as Japan or Australia where it was not (Trencher et al. 2020; Stutzer et al. 2021). Vested interests related to coal mining and coal-based power generation, especially if they are politically well connected, are clearly a major obstacle to phase-out (ibid.; Brauers et al. 2020). A topic that seems to differ across

places is the debate about health issues caused by emissions from coal-fired power plants. In Ontario, health was mentioned as a critique as frequently as climate change, while in our cases it only played some role in the UK and there it was much less frequent than the climate argument.

In our sample, phase-out debates lasted from 9 years (UK) to 12 years (Germany). This is similar to the findings from Ontario where it took about 8 years (Rosenbloom 2018). However, there were some differences in dynamic: we found two waves in the UK, a steady rise of attention in Germany and two phases in Finland. In Ontario, the dynamic was yet different with a build-up until an original phase-out date, which was then postponed for 4 years. These dynamics seem to be very much influenced by case-specific developments (e.g., anti-coal protests, CCS pilot plants, policy announcements), but we also found some imprint of international events such as the climate conferences.

We also saw differences with regard to actor groups. In the UK, utilities were rather silent and e-NGOs had a comparably strong voice. This may also be due to the data source. As a left-leaning newspaper, *The Guardian* can be expected to report more frequently on anti-coal protests or views of e-NGOs than other news outlets. Finland almost shows the opposite picture with e-NGOs being rather silent, while (municipal) utilities were the most prominent. The latter can be explained by the importance of coal for municipal district heating (Karhunmaa 2019).

Another difference lies in the economic repercussions of coal phase-out. This was most often mentioned in Germany, especially with regard to jobs in lignite mining. In Finland, this argument came up as well and it was also reported by Rosenbloom (2018). The counter-argument that structural changes are needed anyway only occurred in Germany and Finland.

Many of these differences relate to the characteristics of national contexts (Table 5.4). For example, whether coal phase-out is successful and how long it will take clearly depends on the stability of the existing TIS around coal—an idea that is also reflected in the concept of regime destabilization (Turnheim and Geels 2012). This stability depends on a broad range of factors, e.g., whether coal covers a major share of a nation's energy supply (Table 5.1), whether plants are old or new, whether it is relevant for local jobs or for energy security reasons. Future studies might want to explore the issue of TIS stability, and regime strength, in a more systematic way. For example, actors in the coal TIS only showed little innovation effort (e.g., in the form of CCS technology) to avert looming decline. This might be different in other cases, e.g., car manufacturers seeking to build a lifeline for combustion technology with plug-in hybrids.

Finally, a related dimension centers around the availability of power supply alternatives, or competing TIS. If these are mature and can be expanded swiftly (like natural gas and renewables in the UK), coal phase-out can happen quickly compared to cases such as Germany, where nuclear phase-out already puts a strain on the electricity system and renewable energy expansion (especially wind energy) has been confronted with resistance by local initiatives and policymakers (Bues

TABLE 5.4 Summary of phase-out decisions, discourse characteristics and TIS features

	UK	*Germany*	*Finland*
Status of coal phase-out			
Status	Phase-out almost complete	Phase-out has begun	Phase-out has begun
Expected duration[i1]	2015–2024 (moved up from 2025); 9 years	2020–2038; 18 years	2019–2029; 10 years
Discourse characteristics			
Discourse dynamics (5.1)	Duration[ii2]: 9 years; two waves; first wave with debate around CCS	12 years; slow build-up to intense debate over 4 years	11 years; 7 years with moderate discourse plus 4 years of intense debate
Most frequent storylines (5.2)	Coal bad for climate; CCS is a solution; coal not indispensable; coal reliable	Coal bad for climate; coal reliable; phase-out bad for economy; coal not indispensable	Coal bad for climate; coal not indispensable; coal not so bad; coal reliable
Most prominent actor groups (5.3)	NGOs (162), government (80), science (77), industry associations (58)	NGOs (157), parties (126), government (107), utilities (96)	Utilities (140), science (90), government (64), cities (46)
Actors in favor of / against phase-out (5.4)	In favor: e-NGOs, science; Against: Industry, utilities; Changing: government	In favor: e-NGOs, science, government; Against: Industry, utilities; Changing: –	In favor: e-NGOs, science, government; Against: - Changing: Utilities
Coal TIS			
Relevance for energy system (3)	Moderate (at time of phase-out decision), Low (today)	High (also due to nuclear phase-out and slow growth of renewables)	Moderate (also due to district heating)
Techno-economic (3)	Existing plants were old	Recent investments into new coal power plants	Most plants from 1980s and 90s; district heating
Context			
Electricity supply system (3)	Utilities weakened by liberalization	Large influential utility companies	Influential municipal utility companies
Complementary TIS (3)	Domestic mining declined in 1990s and 2000s; CCS was not successful	Domestic lignite mining still ongoing	No mining, no CCS
Competing TIS (3)	Strong political support for nuclear; support for natural gas; moderate support for wind energy	Nuclear phase-out under way (completed in 2022); waning support for renewables, local resistance	Strong political support for nuclear; slowly increasing support for renewables (e.g. biomass for district heating)

2020). Despite these challenges, the new German government, a coalition of Social Democrats, the Green Party and Liberals, wants to move coal phase-out ahead to 2030.[16] Also in Finland, the city of Helsinki has announced the closure of its coal power plant 2 years ahead of schedule.[17]

Our study has shown that discourse analysis can generate important insights into the political struggles that surround technology decline and phase-out decisions. Our analysis of public discourses can nicely complement the study of more formal spheres of interaction such as parliamentary debates (Leipprand et al. 2016; Müller-Hansen et al. 2021). Discourse analysis has clear strengths when it comes to identifying (conflicting) values and ideas, which is why it lends itself to studying politics. At the same time, it cannot capture all dimensions of transition processes. For example, techno-economic and material aspects such as the age of power plants, existing infrastructures or the performance of competing technologies also play into phase-out decisions.

We have demonstrated how discourse analysis can be mobilized to systematically compare different cases. There are some caveats though. To fit all in one article, we focused on a quantitative comparison (here: counting storylines). This helped us to condense information and to facilitate comparability but it came at the expense of more detailed case insights. Future studies may find ways of combining quantitative and qualitative elements of discourse analysis in comparative research designs. Discourse analysis can also be used to delve deeper into the politics of transitions, e.g. identifying coalitions of actors who mobilize the same storylines (Lowes et al. 2020; Markard et al. 2021).

Another analytical challenge is about developments unfolding at different times and largely asynchronously in different places. Originally, we wanted to address this by distinguishing (and then comparing) different phases of development as in the single case studies (Isoaho and Markard 2020; Markard et al. 2021). This would have required a general 'theory' on discourse dynamics, similar to the issue life cycle approach used by Penna and Geels (2012). As it turned out to be more complex than anticipated, we decided to drop the phases and leave some general theory as a topic for future research.

A third issue for improvement is about data sources. In general, newspaper articles are clearly suitable for discourse analytical purposes. However, it is important to have a balanced selection of sources. The fact that, for the UK, we only drew from the left-leaning *Guardian* is clearly a limitation of our study. Learning from this, we widened our selected newspapers for the other two cases. Future studies might also want to consider additional sources such as social media. Especially for larger amounts of data, automated processes for text analysis such as natural language processing create new opportunities.

Let us conclude with a brief conceptual reflection. Applying the TIS framework to technologies in decline is new, and for some it might still be counter-intuitive because there is not necessarily much innovation in decline. At the same time though, the TIS approach provides a generic, systems-based framework to capture technology dynamics (including expansion, stagnation or decline), which has the potential to be applied widely in transitions research (Markard 2020). With the

increasing complexity of the low-carbon energy transition (e.g., as more and more actors, technologies and sectors become involved), the TIS framework might provide crucial building blocks to analyze the dynamics and interactions of a multitude of different technologies in different stages of development (Andersen and Markard 2020; Markard 2020; Rosenbloom 2020). Analyzing TIS dynamics and structures across places[18] (Binz and Truffer 2017) or value chains (Andersen and Markard 2020; Ulmanen and Bergek 2021), understanding various kinds of context systems (Bergek et al. 2015; Ulmanen and Bergek 2021) and identifying key processes of TIS decline (Bento et al., in review) will be important contributions to this larger research agenda.

Notes

1 We thank Julia Bachmann, Sakari Höysniemi, Kamilla Karhunmaa, Christof Knoeri, Zahar Koretsky, Adrian Rinscheid, Peter Stegmaier, Bruno Turnheim and Amanda Williams for their support and comments on earlier drafts. If it were not for the inspiring discussions with Bruno and his patience with the many deadlines Jochen failed to meet, this work might not have seen the light of day. We also got valuable feedback when presenting an earlier version at the International Conference for Sustainability Transitions (IST) in Ottawa, June 23–26, 2019. Jochen Markard acknowledges funding from the Norwegian Research Council (Conflicting Transition Pathways for Deep Decarbonization, Grant number 295062/E20) and from the Swiss Federal Office of Energy (SWEET programme, PATHFNDR consortium).
2 Discourse analysis primarily captures ideational and value-related dimensions of transitions and there is a risk of overlooking material and economic aspects. In the final section, we therefore also discuss broader 'TIS features' to better understand the different approaches to phase-out.
3 See also Koretsky (2023) for a conceptual discussion.
4 Note that the recent developments around the war in Ukraine and the shifting geopolitics of energy supply will certainly affect the future use of, and political decisions related to, natural gas and coal. For more detailed insights into the coal phase-out in the UK and Germany see Brauers et al. (2020), Isoaho and Markard (2020) or Markard et al. (2021).
5 Note that power generation and consumption in 2020 was lower than usual due to the Covid-19 pandemic.
6 This analysis is based on reading, interpretation and manual coding of the articles.
7 Note that *The Guardian* is a left-leaning newspaper, so it is likely that the voices of for example environmental NGOs are reported more frequently than in other outlets.
8 We covered articles until January 2019 to include the phase-out decision of the German coal commission.
9 The Finnish sources could only be accessed through source specific databases, which did not support Boolean operators. We used the same keywords separately and tried to mimic the search string as well as possible with different combinations.
10 These are the exemplary search strings for the UK. General: (GEOGRAPHIC(UK) AND (decline w/p coal) OR (phase-out w/p coal) AND (electricity OR power); Specific: GEOGRAPHIC(UK) AND HLEAD(coal) AND LENGTH>500 AND (electricity OR power OR carbon OR decarbon! OR decline OR phase-out)
11 Only one author for the Finnish case.
12 Note that data for Germany and Finland is truncated in the last reported year. We stopped data extraction for Finland in April 2019, and for Germany in July 2020, when the coal phase-outs were decided in parliament.
13 In Germany in 2008, we even see contra storylines outnumbering pro arguments.

14 The pilot plant was closed in 2014.
15 Note that NGOs might get more of a voice in the left-leaning *Guardian* than in more conservative newspapers.
16 German parties agree on 2030 coal phase-out in coalition talks. *Reuters*, Nov. 2021, www.reuters.com/business/cop/exclusive-germanys-government-in-waiting-agrees-phase-out-coal-by-2030-sources-2021-11-23/, accessed April 30, 2022.
17 Helsinki to shut down coal-fired power plant 2 years ahead of schedule. *YLE News*, June 2021, https://yle.fi/news/3-11993952, accessed April 30, 2022.
18 While we have analyzed country-level developments as largely independent, future research should also address how, e.g., phase-out decisions in one place affect TIS dynamics elsewhere.

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