Climate Governance and Federalism: The case of Germany

Peter Eckersley[1,2], Kristine Kern,[1,3] Wolfgang Haupt[1] and Hannah Müller[1]

[1]Leibniz Institute for Research on Society and Space, Erkner, Germany

[2]Nottingham Trent University, Nottingham, UK

[3]Åbo Akademi University, Turku, Finland

1. Introduction

As a highly industrialised country with a large manufacturing sector, many parts of Germany are still reliant on coal and other traditional industries, and in 2019 the country's per capita greenhouse gas emissions were above the EU average. However, Germany was one of the first countries in the world to take environmental and climate policy seriously: it has had a strong Green Party for several decades and has established numerous government departments and agencies to tackle environmental problems across different levels (Jänicke 2011). More recently, its high-profile energy transition (*Energiewende*) strategy – an explicit policy to shift away from nuclear and fossil-based energy and towards renewable sources – won recognition around the world and was initially very popular domestically (Hirschhausen 2014).

A key factor underpinning the energy transition's initial success was the country's federal structure, which facilitated cooperation and buy-in from different public bodies across tiers of government (Weidner and Mez 2008; Eckersley 2018b). Germany's federal structure and the close relationships between different levels of government are the products of the country's unique historical development and contrast markedly with other federal countries, such as the USA. As this chapter will show, however, the bonds that supported this

collaboration may be weakening, as the policies necessitated by the transition become more controversial, particularly in regions that are still heavily reliant on traditional industries.

The chapter sets out how Germany's federal structure and industrial interests play a key role in shaping climate politics within the country, and the concomitant impact of these evolving politics on the policies of individual states (*Länder*) and the federation. It draws on an extensive literature search of academic studies, federal and *Land* government websites, grey literature and a total of ten expert interviews with officials in the state administrations of Mecklenburg-Western Pomerania, North Rhine-Westphalia, Hamburg, Brandenburg and Baden-Wurttemberg. This research revealed notable contrasts between different parts of Germany, which led us to group the *Länder* according to their reliance on different energy sources (see also Eckersley et al forthcoming). We set out this categorisation in section 3 of the chapter and use it to highlight how different contexts at the state level shape policy processes and outputs across the federation.

The next section provides a brief overview of how climate policy in Germany has evolved over recent decades, including its role in international efforts to tackle the problem, and sets out the main challenges that the country faces in both mitigation and adaptation. We then sketch out the nature of federalism within the country and highlight how the formal and informal institutions associated with Germany's governance arrangements shape climate policymaking processes. This is followed by a specific focus on the activities of several federal states (*Länder*) in both the west and the east of the country, which highlights how they have influenced policy implementation at the subnational level. In particular, we stress that the sixteen *Länder* are responding to high-level policy objectives in increasing diverging ways, by adopting their own distinct strategies according to local contexts (see also Kern 2008; Scheiner 2017). We point out that Germany's cooperative style of federalism helps to mobilise and coordinate activity between policy actors where there is a political consensus, and this helped the country to make rapid progress in the

early days of its energy transition (*Energiewende*). However, a high number of 'veto players' (Tsebelis 1995) within the policy-making system means that decisions are taken on the basis of the lowest common denominator at the federal level, in what Scharpf (1988) characterised as the 'joint decision trap'. Therefore, we caution that an increasing reluctance in some states to adopt a more ambitious climate and energy strategy is likely to hamper attempts to maintain momentum and make it difficult for the country to introduce initiatives that are sufficiently ambitious to meet its climate objectives (see also Ohlhorst et al. 2013; Scheiner 2017). As such, we conclude by suggesting that climate policy in Germany is a microcosm of the global approach to tackling these issues: the federation provides a high-level framework within which the constituent *Länder* operate, but the actions of individual states and municipalities reflect their own particular economic and political interests and could hold back progress overall.

Therefore, to return to the framework set out in Chapter 2, this chapter highlights how multiple forums for policy-making within federal systems present both opportunities and challenges for ambitious climate policy. This is because federal structures enable governing units at different levels to seize the initiative and fill the void created by inaction elsewhere, but may also reduce pressures on more reluctant actors to respond and thereby impede policy coordination. Relatedly, although decentralized structures empower the *Länder* to pursue their own policies and may help innovative ideas to diffuse horizontally between states and municipalities, these initiatives do not always complement each other or contribute towards a coherent and effective response to climate change.

2. Climate Change in Germany

Germany is a highly advanced industrial economy and the third largest exporter in the world after China and the USA (World Bank 2019). Manufacturing accounts for 23% of national output, and much of this sector relies on energy-intensive processes: carmakers such as

Volkswagen, BMW, Audi, Mercedes-Benz, Opel and Porsche are all based in the country. In 2019, Germany's per capita greenhouse gas (GHG) emissions of 10.4 tonnes per annum were significantly above the EU average of 8.23 (OECD 2019a; 2019b), with energy and transport as the highest contributory sectors. In 2016/17 renewable sources provided 13.4% of primary energy consumption across the country, although some areas are far more dependent on fossil-based fuels than others. Much of Germany's climate strategy, including its GHG emissions reduction targets, is shaped by its membership of the European Union; however, as the bloc's largest and most powerful member state it also exerts significant influence over the direction of EU climate and energy policy (Szuleki et al 2016; Jänicke and Wurzel 2019).

Despite producing above-average GHG emissions, several factors led Germany to be portrayed as an energy and climate leader in the 1990s and 2000s (Kern et al 2004; Scheiner 2017; Steuwer and Hertin 2021). These included its early development of institutions such as climate and energy agencies, a strong Green Party (particularly in the west), and the *Energiewende* strategy that facilitated a rapid shift towards solar and wind power in many parts of the country (Weidner and Mez 2008). A key part of this strategy involved subsidising small-scale renewable electricity generation through feed-in-tariffs (FiTs), which led to a major increase in solar PV, wind and biomass installations (Mendonca *et al*., 2010). The *Energiewende* exemplified the concept of 'ecological modernisation', which Germany's federal government adopted from 1998 onwards, in order to replace higher-polluting sectors with low-carbon industries quicker than its international competitors and therefore gain a first-mover advantage (Jänicke 2011).

Underpinning this approach was the idea that economic growth and environmental protection were mutually reinforcing. This helped to ensure that the *Energiewende* was initially very popular with the German public (Hirschhausen 2014), although there was some opposition to it from those southern *Länder* that relied heavily on nuclear power. Indeed,

the country's energy transition served as a model that other developed countries sought to emulate (Hennicke and Welfens 2012), to the extent that the German term began to be used in English-language debates (Beveridge & Kern 2013). Germany was also one of the few developed economies to meet its commitments under the Kyoto Protocol (in its case a reduction in GHG emissions of 21% between 1990 and 2012), which also suggested that its approach was successful. Notably, however, most of the country's initial progress in reducing carbon emissions was due to the closure of heavy industry and fossil-fuel power facilities in the former GDR; the country's progress in climate mitigation slowed markedly after these 'wall-fall' benefits were exhausted from the late 1990s onwards (Schleich et al 2001). The high-level figures also mask regional variations within Germany: as section 4 will show, some states are still highly dependent on fossil fuels.

Nonetheless, Germany has pledged to cut its GHG emissions by at least 55% by 2030 (compared to the 1990 baseline) and achieve 'extensive greenhouse gas neutrality by the middle of the century' in line with the Paris Agreement (Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety 2016, 6). Following the adoption of climate protection legislation in eight of the sixteen *Länder*, the federal government enshrined these targets into law at the end of 2019 (Kern et al, in preparation; buzer.de 2019). In May 2021, the federal Cabinet proposed raising the 2030 target to a 65% reduction in GHG emissions and bringing forward the date for carbon neutrality from 2050 to 2045, although at the time of writing these revised targets have not yet entered the statute book. As Table 1 suggests, the federal targets are similar to those of many *Länder* that had previously passed legislative climate acts. This does not come as a surprise, because the target set by the federal climate protection act in 2019 was included in earlier concepts and plans (such as the federal government's *Klimaschutzplan 2050*) and thus served as a point of reference for the *Länder.*

State	Enactment	GHG emission reduction goals (base year 1990)				
		2020	2025	2030	2040	2050
North Rhine-Westphalia	23.01.2013	25%				80%
Baden-Württemberg	17.07.2013/ 14.10.2020	25%		42%		90%
Rhineland-Palatinate	23.07.2014	40%				climate neutrality; minimum 90%
Bremen	24.03.2015	40%				80-95%
Berlin	22.03.2016	40%		60%		85%; climate neutrality
Schleswig-Holstein	07.03.2017	40%		55%	70%	80-95%
Thuringia	18.12.2018			60-70%	70-80%	80-95%
Hamburg	20.02.2020	(40%)		55%;		95%; climate neutrality
Bavaria	13.11.2020		5.5 t. /cap.	below 5 t./ cap.		climate neutrality
Lower Saxony	09.12.2020			55%		80-95%
Germany	**15.11.2019**			**55%**		**climate neutrality**

Table 1: GHG emissions enshrined in Land *and Federal Climate Protection Acts*

Reflecting geographical and meteorological factors, climate change will affect different parts of Germany in different ways. In a study conducted for the Federal Environmental Agency, Buth et al (2015) found that it would probably have a major impact on the following:

- soil quality
- biodiversity (particularly related to the spread of invasive species)
- agricultural growth periods
- forests
- fish stocks
- river and flash flooding (with concomitant risks on transport, buildings, commerce and other critical infrastructures), particularly in urban centres and districts along the Elbe, Weser, Ems and the Lower Rhine rivers.

- Coastal erosion in northern areas caused by storm surges and sea level rise, although all of Germany's main population centres are inland and therefore the direct risks to human habitation is lower than in many other federal countries.
- Glacial melt from the Alps and landslides in the far south of the country
- Heatwaves and heat stress, particularly in the south west of the country.

Overall, therefore, we can see how issues associated with climate mitigation and adaptation have had differentiated impacts across Germany. In terms of mitigation, those *Länder* that are more reliant on traditional industries and fossil fuel extraction and combustion face major economic challenges in the next phase of the *Energiewende*, whereas the effects of climate change will be distributed asymmetrically across the country.

3. Climate Change and Federalism in Germany

Along with other members of the European Union (EU), climate policy in Germany is shaped to a high degree by decisions taken in Brussels, including initiatives such as the EU's 2030 climate and energy framework (which includes binding targets for GHG emissions reductions and renewable energy generation[1]), its emissions trading scheme, procurement regulations and the Green Deal. Most recently, the European Commission has proposed the first European Climate Law, including a new GHG emissions reduction target of at least 55% by 2030 (compared to 1990 levels). If adopted, the new target will put additional pressure on Germany's federal government because effort-sharing among the EU member states would eventually result in an even higher target for Germany. The EU also contributes some of the resources that support policy development and implementation through its funding programmes (such as for research or regional development), institutions (such as the European Environment Agency) and initiatives (such as the Covenant of Mayors).

[1] These targets are 'binding' in the sense that the EU can impose fines on any country that fails to achieve them.

Within this context, member states develop their own strategies and – in federal countries like Germany at least – regional governments work with municipalities to implement policy objectives. Importantly, Germany has a long tradition of decentralised governance with origins in the Middle Ages, and did not become a unified nation state until 1871. The country's decentralised approach continued until the Nazis took power in 1933 and was reinstituted in the west of the country after the Second World War (Eckersley 2017) – although the former GDR did have a centralised and hierarchical administrative structure until unification in 1990 (Wollmann 2021). These factors contributed to the development of a specific federal system, which dates from the immediate post-1945 period and the postwar settlement in the West, when the Allies (particularly the USA) were determined to ensure that constitutional arrangements in the successor state to the Third Reich would prevent the return of dictatorship (Conradt, 2001). Following the end of the Cold War, structures within the 'new' eastern states were modelled on those in the 'old' western part of the country, with the result that each *Land* possesses the same legislative powers and competences (Wollmann 2021), including the right to pass climate legislation.

Reflecting the period in which it was written, the post-war Basic Law (*Grundgesetz*) did not allocate legal responsibility for climate change or renewable energy to specific tiers of government. Indeed, protecting the environment was only recognised as a public function in 1994 (Erbguth & Schlacke, 2014). Furthermore, the cooperative nature of German federalism means that the legal boundaries that demarcate specific competences to particular tiers of government are somewhat blurred compared to many other federal countries (Scheiner 2017). It is also worth noting that municipalities do not have to take action on climate change unless the respective *Land* government has passed primary legislation stipulating which specific tasks they must undertake, and provides them with the necessary resources.
In contrast to policy areas where the states have exclusive legislative powers (such as culture and education), climate policy falls under the so-called 'concurrent legislation'

principle, which prevents individual states from introducing new regulations where the federal government has already passed a law. Some environmental sectors, including nature protection, are exempt from these restrictions, but in climate policy most decisions are made in Brussels or Berlin. In many areas of climate policy (for example efficiency standards for buildings, or regulations on renewable energy), EU directives are transposed into national law and implemented by the *Länder* (see Table 2). As a result, the *Länder* governments do not have formal decision-making powers in many areas that are highly relevant for the generation of GHG emissions. This applies, for example, to CO_2 performance standards for new cars, the phase-out of nuclear energy and the EU Emissions Trading System. However, the *Länder* governments and their administrations are responsible for implementing most federal laws. Thus, the *Länder* can decide on organisational issues, procedures and control. This is particularly important for the environmental sector (Newig et al 2014; Gallata and Newig 2017), where initiatives require coordinated input from a whole host of societal actors to be effective (Wurzel et al 2013).

Moreover, many federal laws contain provisions that allow the states to enact their own legislation. If federal legislation explicitly clarifies that the *Länder* can pass legislation on specific issues, they are also free to do so. Examples include the federal Climate Change Act, which allows the *Länder* to introduce own climate change acts, or the federal Renewable Energy Heat Act, which requires that heating and cooling for *new* buildings must come partly from renewable sources (at least 15% if the source is solar heating, and 50% in cases of liquid or solid biomass and geothermal energy (Bundesministerium für Wirtschaft und Energie 2009)). State governments are not able to set higher standards in this area, but they are free to introduce their own regulations for *older* buildings – and indeed Baden-Württemberg has done so – because the federation has not (yet) introduced such legislation. Therefore, the states are free to be more ambitious in areas where no EU or federal legislation currently exists, or where federal legislation allows them to introduce

more stringent regulations. However, the principle nonetheless restricts the ability of the *Länder* to legislate in many areas related to climate policy, including strategic energy and transportation systems.

<table>
<tr><th>Role of the states (Länder) in different forms of decision-making</th><th>European Union</th><th>Federal government (Bund)</th><th>States (Länder)</th></tr>
<tr><td>Joint decision making and responsibilities - mandatory
EU directives are transposed into national law and implemented by the states</td><td colspan="3">Renewable energy:
EU Renewable Energy Directive; Federal Renewable Energy Act (Erneuerbare-Energien-Gesetz), State Ordinances on Wind Energy (Windenergie-Erlasse)

Efficiency standards for buildings:
EU Energy Performance of Buildings Directive; Federal Energy Act for Buildings (Gebäudeenergiegesetz); State administrative ordinances</td></tr>
<tr><td>Joint decision making and responsibilities – optional
EU directives are transposed into national law and implemented by the states
Federal government may allow but not mandate states to enact own legislation</td><td colspan="2">GHG emissions reduction goals and climate change acts
European Climate Act
Federal Climate Protection Act (Bundes-Klimaschutzgesetz)</td><td>GHG emissions reduction goals
State climate change acts (in 10 out of 16 states)
State energy and climate plans and strategies</td></tr>
<tr><td rowspan="2">Exclusive decision-making and responsibilities
Decision making restricted to one (or two) levels

May exclude the states</td><td>CO_2 emissions performance standards for new cars and vans (EU regulation)</td><td>Phase-out of nuclear energy
Revision of the Federal Nuclear Energy Act (Gesetz zur Änderung des Atomgesetzes)</td><td>Implementation of climate policies (organisation, procedures, control)</td></tr>
<tr><td colspan="2">EU Emission Trading System
EU ETS Directive; Federal GHG Emission Trading Act (THG-Emissionshandelsgesetz)</td><td>Today, states have almost no responsibilities</td></tr>
</table>

Table 2: Climate responsibilities across tiers of government in Germany

In addition, alongside spatial planning and regional development, the *Länder* do have jurisdiction over local government – an area which can play a key role in climate policy, due to the importance of policy coordination across tiers of governance for successful

implementation (Eckersley 2018b). Indeed, the very fact that individual states have responsibilities for local government has led to a patchwork of multi-level structures across Germany: for example, some *Länder* increased the size of municipal units significantly since the 1970s and others have kept much smaller authorities (Wollmann 2004b). To illustrate these contrasts, Rhineland-Pfalz has over 2,300 municipalities for a population of just over four million, whereas NRW's 17.9m inhabitants are served by only 396 municipalities and 31 county councils. Nonetheless, many common principles apply across Germany, and a particularly important rule ensures that *Land* governments have to provide municipalities with sufficient resources to engage in new policy sectors or undertake new functions. As a result, action on climate change remains voluntary for local government in most of the states, which has led to some municipalities introducing more ambitious policies than others.

Despite these contrasts between different *Länder*, Germany is often portrayed as a classic example of 'cooperative federalism': studies have found that tiers of government tend to operate in a more complementary and collaborative way than in many other federal countries, particularly the USA (Müller 1998). This collaboration is underpinned and reinforced by various constitutional and institutionalised structures that date from the end of the Second World War (Scharpf et al 1976). For example, *Länder* governments are represented in the *Bundesrat* (the second parliamentary chamber at the federal level), which gives them significant veto power over federal legislation (see Scheiner (2017) for an analysis of how this has shaped the federal response to climate change). Other provisions also serve to facilitate cooperation, such as constitutional arrangements that ensure money is re-distributed from wealthier to poorer states and a system of shared taxes (Scherf 2010; Auel 2014). Federal-state associations (*Bund-Länder Arbeitsgemeinschaften*) in various policy sectors reinforce this collaborative approach, including in the climate, energy, mobility and sustainability sectors (Bundesregierung 2019; Flaskühler 2018).

Critics argued that these arrangements were opaque and undemocratic (because individual actors could not be held accountable for specific policy decisions), and that they also led to suboptimal and bureaucratic decision-making (because individual *Länder* could exert significant influence over policy and therefore decisions were taken on the basis of the 'lowest common denominator' (Scharpf 1988; Schultze 1999; Adelberger 2001; Monstadt and Scheiner 2014)). To try and address these problems, the federal government introduced reforms in 2006 and 2009, which aimed to clarify the roles of different tiers of government and weaken the influence of the *Bundesrat* in federal lawmaking. However, although these changes did demarcate clearer responsibilities in some areas, some argued that they had little impact on the overall system (Zohlnhöfer 2009; Scharpf 2009).

Nonetheless, despite its collaborative policymaking culture, the German federal system does allow different *Länder* to adopt contrasting strategies and initiatives to try and achieve similar objectives within a common overall framework. In addition, in cases where different actors agree on policy goals, the system can help to coordinate activity and therefore result in more effective implementation (Wollmann 2004a), particularly when problems span tiers of government and policy sectors – such as the COVID-19 pandemic (Bouckaert et al. 2020; Kuhlmann and Franzke 2021). This also applies to climate change, where support for the *Energiewende* helped to mobilise resources and activity both within and across different organisations and ensured that initiatives could be implemented and enforced across different levels (Eckersley 2018a).

Recognising the often-decisive role that the availability of resources can play in shaping whether municipalities can implement and enforce climate policies effectively, the federal government has sometimes bypassed the *Länder* to provide significant funds directly to local authorities to help with their climate strategies. For example, since 2008 the *Kommunalrichtlinie* initiative has financed the development of local climate protection plans and strategies, and the *Masterplan* scheme provides additional funding to leading

municipalities (Kern 2019). Such schemes have ensured that municipalities in those parts of Germany with less ambitious *Land* or local governments have still been able to make some progress (Göpfert 2014). However, the principle of 'concurrent legislation' means that once the federation acts to tackle a particular issue, the *Länder* are often unable to develop more ambitious legislation of their own.

Given that the *Länder* vary significantly in terms of population size and density, as well as their political and economic interests, it is perhaps unsurprising that the federation has felt the need to bypass the state level on occasions. The next section examines the approaches of some of the *Länder* in more detail, highlighting how these contextual factors have shaped their climate strategies and ultimately influenced those of the federal government.

4. Case Study of Climate Governance and Federalism in Germany

Notwithstanding the similarities in each state's legal and constitutional position, the sixteen *Länder* vary significantly in terms of their geographic size, population, socioeconomic make-up, energy mix and levels of greenhouse gas emissions (see Table 3). For example, the largest state, North Rhine-Westphalia (NRW), is almost exactly the same geographical size as the Netherlands and has a similar population (17.9m), whereas the smallest, Bremen, has fewer than 700,000 inhabitants. The two southernmost *Länder* (Bavaria and Baden-Württemberg) are notably wealthier than most other parts of Germany, particularly the East.

Despite Germany's initial progress in the *Energiewende*, and the federal government embracing the concept of 'ecological modernisation' from 1998 onwards (Jänicke 2011; Kern et al 2008), some parts of Germany still rely heavily on fossil fuels. This has contributed to several *Länder* adopting more ambitious climate and energy strategies than the federal government, in terms of the legislation they adopted, the institutions they have created and the resources they make available to help municipalities develop strategies and

implement policy initiatives. For example, eight of the sixteen *Länder* had adopted climate acts that enshrined GHG reductions targets into primary legislation before the federal government took this step in late 2019, in what Kern et al (in preparation) characterise as a classic case of policy diffusion. Despite this similarity, however, the state-level laws differ in terms of their target: Hamburg's 2020 Act includes a GHG emissions reduction target of 95% by 2050 and an intermediate target of 55% by 2030 (Hamburgisches Klimaschutzgesetz 2020), whereas NRW – the first *Land* to pass a climate act in 2013 – only aims to reduce emissions by 80% by 2050 (Klimaschutzgesetz Nordrhein-Westfalen 2013).

State	**Population (2018)**	**GHG emissions (2015) in mill. tons**	**GHG emissions / cap. (2015) in tons**	**GHG emissions / cap. (1990-2015) in %**	**Share of renewables in primary energy consumption (2016/2017, %)**
North Rhine-Westphalia	17,932,651	278.85	15.5	- 22.3	4.8
Saarland	990,509	22.12	22.3	- 14.4	4.6
Saxony	4,077,937	51.79	12.7	- 40.0	9.1
Saxony-Anhalt	2,208,321	34.35	15.5	- 25.0	18.7
Brandenburg	2,511,917	62.30	24.8	- 26.9	6.1
Bavaria	13,076,721	90.86	6.9	- 24.1	18.2
Baden-Württemberg	11,069,533	76.73	6.9	- 22.3	13.0
Lower Saxony	7,982,448	83.99	10.5	- 19.7	19.0
Schleswig-Holstein	2,896,712	25.82	8.9	- 30.7	33.1
Mecklenburg-Western Pomerania	1,609,675	15.19	9.4	- 18.9	37.0
Rhineland-Palatinate	4,084,844	31.49	7.7	- 42.4	12.7
Hesse	6,265,809	40.08	6.4	- 26.4	9.8
Thuringia	2,143,145	16.64	7.8	- 38.9	24.5
Berlin	3,644,826	16.02	4.4	- 43.0	4.0
Hamburg[2]	1,841,179	15.46	8.4	+10.9	4.1
Bremen[3]	682.986	13.55	19.8	- 2.7	18.4
Germany	***83,019,200***	***858.66***	***10.4***	***- 28.4***	***13.4***

Table 3: Population, GHG emissions and renewable energy in the German *Länder. Adapted from Kern et al (in preparation)*

[2] Hamburg's GHG emissions decreased steadily between 1990 and 2015, after which its Moorburg coal power station was put into operation and reversed this decline dramatically. With around 8.5 million tons of CO_2 per year, this single plant accounts for around half of the state's total annual emissions.

[3] Bremen's economy relies heavily on carbon-intensive steel industries. As the smallest of the sixteen *Länder* in terms of population, the GHG emissions produced by this sector distort its overall per-capita figures significantly.

Notably, those *Länder* that still characterised by coal-generated electricity have been less likely to introduce such initiatives. In contrast, states that were more reliant on nuclear power prior to the *Energiewende* have made a more rapid and effective transition to cleaner energy and generally provide more support to municipalities to help with this shift. Coal-fired power stations (which burn both the hard 'black' and 'brown' lignite varieties) are likely to remain active in many parts of the country until their scheduled phase-out date of 2038, and the states in which they are located constitute a powerful coalition within the German federal system (particularly the *Bundesrat*, which is made up of representatives from the different *Länder*).

Coal states (coal regions in western and central Germany)	
Brandenburg; North Rhine-Westphalia; Saarland; Saxony; Saxony-Anhalt	Traditional coal states; high CO_2 emissions/cap.; exporters; small renewable energy sector
Nuclear/solar energy states (southern states)	
Bavaria; Baden-Württemberg	Traditional nuclear states; relatively low CO_2 emissions/cap.; growing renewable sector (particularly solar)
Wind energy states (northern, coastal states)	
Lower Saxony; Schleswig-Holstein; Mecklenburg–Western Pomerania	Traditional nuclear states; relatively low to medium CO_2 emissions/cap.; growing renewable sector (particularly wind); becoming energy exporters;
Energy importing states (central states)	
Rhineland-Palatinate; Hesse; Thuringia	Dependent on energy imports; medium CO_2 emissions/cap.; growing renewable sector
City-states	
Berlin; Hamburg; Bremen[1]	Low potential for renewable energy generation; relatively low CO_2 emissions/cap. due to population density; dependent on fossil fuel energy production (coal and gas) and imports

Table 4: Energy-based typology of the German *Länder*. Adapted from Kern et al (in preparation)

Various factors are likely to have shaped these different *Länder* approaches to climate policy. For example, numerous studies have found that larger political-administrative units (such as big cities or big nation-states) are usually able to call upon more resources to develop and implement policy (Hoff and Strobel 2013; Kern 2019; Reckien et al 2018; Salvia et al 2021). Therefore, we might expect the biggest *Länder* to be more active in this area – and it could also be the case that states with larger municipalities have made more progress. In addition, political factors probably play a role: in jurisdictions where the Green Party has significant representation or forms part of the governing coalition, governments at all levels are more likely to take action on the climate (Abel 2019, Wurster & Köhler 2016).

Figure 1: Energy-based typology of the German Länder

However, analysis of the energy base of each state suggests that this is a key factor shaping how different *Länder* have tried to address the issue of climate change. Based on their relative reliance on different sources of energy, and considering the three city-states separately, we group the sixteen *Länder* into five categories that help to explain these contrasting approaches. Table 4 summarises these groupings and they are represented geographically in Figure 1 (see also Eckersley et al forthcoming for a more detailed breakdown of each state). In most cases, these groupings also reflect geographic and climatic factors, which themselves shape the energy resources that are available locally and the strength of certain industries in lobbying and policymaking processes. We discuss each group in turn in the following subsections.

4.1 Coal states

These five *Bundesländer* rely heavily on either hard 'black' coal or 'brown' lignite for energy production. Although they have reduced GHGs significantly since 1990, this was from a very high base. In addition, three of the coal states (Saxony, Saxony-Anhalt and Brandenburg) experienced significant industrial decline following unification in 1990, which accounts for a major proportion of their drop in emissions. North Rhine-Westphalia is the only coal state to pass a climate change act that commits it to reductions in GHG emissions. Green Party representatives in the state legislatures of Brandenburg, Saxony-Anhalt, Saarland and Saxony introduced similar legislative initiatives in their respective *Land* parliaments, but they were rejected by the governing majority on each occasion (Kern et al in preparation).

Two coal states – Brandenburg and Saxony-Anhalt – have invested heavily in wind power. Brandenburg aims to increase the share of renewables in energy generation to 32% by 2030 (Land Brandenburg 2012) and Saxony-Anhalt provides a range of funding sources to support municipalities in climate policy development and implementation (Land Sachsen-Anhalt 2014). The other three coal states have been less ambitious, particularly in recent years. For example, after NRW's Social Democratic/Green government was replaced by a

centre-right coalition of Christian and Free Democrats in 2017, its progress on mitigation stalled somewhat. Indeed, the *Land* re-directed funds previously aimed at supporting applications for the European Energy Award (which recognises organisations that are seeking to reduce their GHG emissions) towards bids for the European Climate Adaptation Award, which assesses adaptation capacities (Kern et al in preparation; interviews with Energieagentur NRW and the NRW Environment Ministry). For its part, Saarland produces the lowest share of energy from renewable sources amongst the non-city-states (Statistisches Amt Saarland 2018). Saxony has introduced funding schemes for climate protection and adaptation initiatives (Sächisches Staasministerium für Wirtschaft, Arbeit und Verkehr 2013), but it had still not set any specific targets for further GHG reductions by spring 2021, and its parliament rejected a Green Party proposal to introduce a climate protection act in 2018 (Abgeordnetenwatch.de 2018). As such, we can see how these states lag behind most of the rest of Germany in their climate policies.

4.2 Nuclear/solar energy states

Traditionally, Bavaria and Baden-Württemberg in southern Germany relied heavily on nuclear energy, which meant that they had relatively low GHG emissions per capita. However, since the *Energiewende* initially prioritised the phasing out of nuclear power, both states face significant challenges to bridge the gap between energy supply and demand through renewable sources, primarily solar photovoltaics. In 2018, for example, over 40% of Germany's installed solar PV capacity was located in Bavaria and Baden-Württemberg (Agentur für Erneuerbare Energien, 2019). Both states also sought to promote themselves as climate leaders amongst subnational states through 'paradiplomacy' (see Ralston 2013 for a discussion of Bavaria), and membership of the Under2Coalition of states and regions driving climate action. Indeed, Baden-Württemberg was a founding member of this network and its Green Party state premier Winfried Kretschmann is one of four European co-chairs.

Bavaria claims to have established the world's first environmental ministry in 1970 (Bayrisches Staatsministerium für Umwelt und Verbraucherschutz undated) and has helped to fund municipal climate initiatives for many years (Bayerische Staatsregierung 2009, Kern 2008). Although the *Land* government did not propose a climate protection act until 2019, this law commits the state to climate neutrality by 2050 (Bayrisches Staatsministerium für Umwelt und Verbraucherschutz 2020), thereby increasing competition between leading *Länder* in terms of environmental ambition. Bavaria has made significant progress in terms of solar PV installations, but this is largely due to private investments that were incentivised by feed-in tariffs introduced by the federal government and financed by energy customers up until 2017, rather than a specific *Land* initiative[4].

Baden-Württemberg was also a forerunner in environmental protection; it established an environment ministry in 1975 and a climate protection and energy agency in 1994, and in 2013 it became the second state to pass a Climate Protection Act, committing the *Land* to a 90% reduction in GHG emissions by 2050 (Landtag von Baden-Württemberg 2013). Like Bavaria, it has overseen a significant expansion in renewable (particularly solar) energy generation in recent years (Diekmann et al 2019). However, total GHG emissions in the state have fallen more slowly than in other parts of the country (partly due to a considerable population increase), and – at least before the Corona crisis – it looked unlikely that the *Land* would meet its initial target of a 25% reduction by 2020.

4.3 Wind states

Traditionally, Germany's three northernmost states (Lower Saxony, Schleswig-Holstein and Mecklenburg-Western Pomerania) have relied on nuclear power and imported energy. However, their coastal location and climatic conditions have enabled them to shift towards wind power (both on- and offshore) more easily than their inland counterparts.

[4] The 2017 federal Renewable Energy Act replaced these subsidies with a tendering system that makes renewable installations much less financially attractive (Fell 2017).

In contrast to three of the other eastern *Länder*, Mecklenburg-Western Pomerania did not have substantial carbon-intensive industry during the GDR period, and was therefore not as badly affected by the 1990s deindustrialisation or the later energy transition. Indeed, its geographical location has facilitated the creation of large green manufacturing and services sectors (Diekmann et al 2019). However, parliamentary attempts by opposition Green representatives to introduce a climate protection act were rejected by the ruling SPD-CDU coalition government.

More people are employed in low-carbon industries in Lower Saxony than in any other German state, and over 40% of electricity generated in the *Land* comes from renewable sources (Niedersächsisches Ministerium für Umwelt, Energie, Bauen und Klimaschutz 2020). The SPD-CDU state government passed a climate protection act in 2020, which commits the *Land* to legally-binding targets of 80-95% reductions in GHG emissions and a complete transition to renewable energy by 2050 (Niedersächsisches Landtag 2019). At the same time, however, Lower Saxony still provides significant subsidies for oil and natural gas and provides fewer funding opportunities for municipal climate action than some other states (Eckersley et al forthcoming).

With long coastlines on both the North and Baltic Seas, Schleswig-Holstein is very well-located to benefit from wind power and has been able to exploit this advantage by overseeing a major expansion in installations. Like Mecklenburg-Western Pomerania, the state is largely rural and has little heavy industry, and per capita GHG emissions are relatively low. The state's 2017 Climate Protection Act committed it to GHG reductions of 40% by 2020, 55% by 2030, 70% by 2040 and 80-95% by 2050 (Landesregierung Schleswig-Holstein 2017), and in 2019 the German Institute for Economic Research judged Schleswig-Holstein and Baden Württemberg to be the two leading states in Germany for renewable energy (Diekmann et al 2019).

4.4 Energy importer states

Three states in southern-central Germany (Rhineland-Palatinate, Hesse and Thuringia) have small (albeit growing) renewable sectors but are largely reliant on energy imports. None of them have had large fossil fuel or nuclear sectors, and therefore the *Energiewende* presents them with a smaller economic and political challenge than some other states.

Hesse was one of the first *Länder* to adopt an active environmental policy, with a comprehensive sustainability strategy in 2008 that also covered issues of climate protection. The state also introduced GHG reduction targets of 30% by 2020, 40% by 2025 and 90% by 2050, against the baseline year 1990 (Hessisches Ministerium für Umwelt, Klimaschutz, Landwirtschaft und Verbraucherschutz 2017). In addition, Hesse has introduced a major funding scheme through which municipalities can acquire grants to finance climate-related initiatives (Hessisches Ministerium für Umwelt, Klimaschutz, Landwirtschaft und Verbraucherschutz 2019). However, its government has not adopted a climate protection act and therefore its climate targets are not anchored in legislation.

Rhineland-Palatinate adopted a climate protection act in 2014, which established legally-binding targets to reduce GHG emissions by 40% by 2020 and 90-100% by 2050 against the baseline year of 1990 (Rheinland-Pfalz Ministerium der Justiz 2014). As the state has over 2,300 municipalities, nearly all of which have fewer than 2,000 inhabitants, the *Land* government encourages and facilitates significant horizontal collaboration between local authorities, in order to help them access necessary resources and increase the state's capacity to develop and implement effective policy.

Thuringia reduced its GHG emissions by over 61% between 1990 and 2020 – a larger percentage drop than in any other *Land* – and renewable sources (mostly wind and solar) now account for 59% of electricity production within the state (Thüringer Landesamt für Statistik 2019). In 2018 it became the only *Land* in the former GDR to have adopted a climate protection act outside Berlin: this sets out a series of legally-binding staged targets for GHG emission reductions, culminating in 80-95% by 2050 (Freistaat Thüringen 2018).

The state also provides funding schemes for municipalities to invest in climate protection and adaptation initiatives, including applications for European Energy Award accreditation.

Despite their progress, however, these three states do not have the wind resources of the northern *Länder*, and private actors have invested less in solar power than in the southern states. As a result, they will probably continue to rely on energy imports for the foreseeable future and therefore have less control over the way in which this energy they consume is generated.

4.5 City states

Due to being densely-populated 'city states', Berlin, Hamburg and Bremen face different climate challenges than the other *Länder* and have sought to respond to them in different ways. More densely-populated areas tend to be less carbon-intensive, because transport, energy and heating networks can serve a greater number of people and therefore normally operate more efficiently (Timmons et al 2016). It may be also easier to coordinate policy implementation within a single urban area than in a larger territory comprising numerous different municipalities. All three city-states were forerunners in the area of climate mitigation policy and took the very first steps in this policy area as early as 1990 (Berlin and Hamburg) and 1991 (Bremen).

Crucially, however, cities have far less space to set up renewable installations (particularly wind turbines) than rural areas, and are therefore highly reliant on existing fossil fuel-based facilities within their territory, as well as energy imports. Compared to rural areas, their systems and infrastructures are often more vulnerable to some of the impacts of climate change, such as flash flooding and the urban heat island effect (Eckersley et al 2018). Perhaps because of this, all three of Germany's city states have engaged heavily in adaptation initiatives and developed detailed strategies to improve their resilience to climate threats (Otto et al forthcoming).

As the national capital, Berlin occupies a unique position within the German federal system. It is highly-networked internationally and has access to a range of scientists, experts, think tanks and other influential actors who contribute towards its climate strategy. Berlin made substantial progress in reducing GHG emissions during the early 1990s, but still relied on fossil fuels for 90% of its energy by 2016, when hard coal generated over 40% of the city's electricity (Berlin Senate Department for the Environment, Transport and Climate Protection 2019). Given this situation, it remains unclear whether Berlin can meet its target of climate neutrality by 2050, as set out in its 2016 Energy and Climate Act. However, it has been more active in the area of adaptation than many other states, proposing a range of adaptation initiatives that aim to reduce the impact of extreme weather events – particularly heatwaves and storms – on the city's infrastructure (Senatsverwaltung für Umwelt, Verkehr und Klimaschutz 2016).

The *Bundesland* with the smallest population, Bremen, also still relies heavily on coal-fired power stations for its electricity – although its substantial steelmaking sector, which accounts for around half of the state's GHG emissions, skews its climate-related statistics to a large extent. The state parliament did pass an energy act as early as 1991, focusing on energy conservation and efficiency, and then adopted climate protection legislation in 2015 that included GHG reduction targets of 80-95% by 2050 (Kern et al in preparation). The *Land* also has an adaptation strategy (published in 2018), which seeks to address concerns about water management, heatwaves and flood risks (Freie Hansestadt Bremen 2018).

Like the other city states, Hamburg relies heavily on fossil fuels, particularly coal, for its energy; renewables accounted for only around 4% of consumption 2017. Indeed, the new Moorburg coal-fired power station, which began generating electricity in 2015, has meant that the city's GHG emissions have actually increased by 20 per cent in the last five years (Kern et al, currently in preparation). However, the *Land* has set ambitious targets in its climate protection act: a 55% reduction in CO2 emissions by 2030 (compared to 1990) and

climate neutrality by 2050 (Hamburgisches Klimaschutzgesetz 2020), and has also adopted a climate adaptation strategy (Bürgerschaft der Freien und Hansestadt Hamburg 2013).

4.6 Discussion

Despite the existence of an elite consensus about the serious threat that climate change poses, the above illustrations show how approaches to the issue are becoming more fragmented and diverse across Germany, because some *Länder* want to make faster progress than others. This is largely driven by political, economic and geographic factors within each state. In political terms, where the Green Party has formed part of the coalition government, the *Land* has normally adopted a climate change act and more ambitious mitigation policies. In contrast, in those areas where the Greens have mostly been in opposition, their attempts to introduce climate legislation have been stymied (Kern et al in preparation). Regarding the local economy, a greater dependence on fossil fuels in the energy mixes of some states has made them more reluctant to engage in far-reaching mitigation activities (such as phasing out coal), although these *Länder* are perhaps also more focused on adaptation than other parts of Germany. Ultimately, these economic factors (and the powerful lobby groups that represent political and industry interests) are themselves shaped by geography: the governments of those *Länder* where renewable energy resources are more plentiful (such as the windy north or sunnier south) have been more enthusiastic about the energy transition than their counterparts in central Germany. These other states still rely heavily on imports and/or coal-fired electricity (indeed, brown coal is still mined in some parts of the country), which leads to greater reluctance amongst policymaking elites to introduce ambitious initiatives.

Another related issue here is the extent to which state and municipal governments can access the resources necessary to develop and implement ambitious policies. Public institutions in wealthier cities and states often have more money to spend on policy

initiatives, and their residents may also be more likely to view climate change as a priority issue (Moser and Kleinhückelkotten 2018). Leaving aside the three city states, those *Länder* that have performed better on climate mitigation tend to be wealthier (see Table 3). Politically speaking, such factors should make it easier for governments to introduce ambitious climate policies. Access to other resources, particularly relevant knowledge and expertise, can also shape a subnational government's climate strategy: therefore, those state and municipal governments that are able to work with universities and research institutions may be better placed to develop and implement far-reaching strategies (Lerman et al 2021).

As with most other federal systems, Germany's institutional architecture enables the states to develop their own strategies and legislation in response to these specific circumstances. The flexibility that they can exercise within this framework has led to examples of collaboration, policy diffusion and copying, such as with the proposing and passing of climate acts in many *Länder*, or the development of climate and energy agencies to support implementation at the regional and local levels. However, the consensual nature of German federalism means that public disagreements are rare; instead, federal policy often moves at the speed of the slowest participant. Therefore, there is a risk that some *Länder* will try to prevent federal laws from being sufficiently ambitious to address climate change effectively. Most obviously, the influence of the coal states on federal policy means that many fossil-fuel power stations are scheduled to continue operating until 2038. In addition, however, *Land* opposition to federal regulations on the siting of wind turbines in rural areas, or the construction of north-south power lines to transmit renewable electricity, could also prove significant (Eichenauer 2016; Neukirch 2020).

There is an emerging academic debate about the factors that may be preventing Germany from making quicker progress on climate change. Some scholars suggest that the inflexibilities and number of veto points within the federal system are primarily to blame

(Scheiner 2017), in line with the 'joint decision-making trap' argument. However, others stress the importance of agency within these structures and argue that powerful lobby groups such as car manufacturing and the coal industry have managed to shape decision-making by influencing the occupants of key federal economy and transport ministries in the SPD and centre-right parties (Töller 2019). In reality, both factors are important: the federal system provides industry groups with multiple venues through which they can pursue their interests and persuade policymakers to slow down progress, particularly if politicians perceive that action to protect the climate could entail electoral costs. Interestingly, however, the Green Party looks set to enter the federal government – possibly as the largest party – after the September 2021 elections for the first time since 2005. Since the Greens have far fewer links with the fossil fuel and automobile industries than the governing SPD, CDU and CSU parties, and their presence in *Land* governments has resulted in more ambitious climate policies, such an eventuality could herald a major shift in Germany's overall strategy. Alternatively, attempts to introduce more far-reaching federal initiatives (such as bringing forward the date at which Germany will phase out coal-fired electricity from 2038) might fall into the joint decision-making trap and fail to make it onto the statute book.

Although Germany's climate policy hitherto has been largely based on the principles of collaboration, the federal government may need to take a more balanced approach to take it to the next level - regardless of the result of the 2021 election. Its major climate achievements have been characterised by coordinated action across tiers of government, combined with support from the federal or state level for municipalities that may otherwise have been unable or unwilling to act. The legal framework within which the *Länder* operate, particularly the requirement to provide municipal governments with the necessary resources to undertake new functions, means that the states do influence how climate policy is implemented within Germany, but a greater element of coercion from the federal

government might be necessary to ensure that the country achieves its objective of climate neutrality by 2050 (or even 2045). The adoption of a climate change act in late 2019 does point in this direction, but this was criticised by domestic experts as being insufficient (Steuwer and Hertin 2021). In addition, the current version is no more ambitious than state-level legislation and is likely to result in no additional laws being enacted at the *Land* level (Kern et al in preparation). Germany's tradition of cooperative federalism did help to mobilise activity in the early phases of the *Energiewende*, but the 'joint decision trap' may well re-emerge to hinder progress in the near future.

5. Conclusion

As this chapter has shown, Germany's federal system does enable the *Länder* to move forward with their own strategies for climate mitigation and adaptation. This has led to a degree of competition between some states for the unofficial title of Germany's climate leader, as well as the diffusion of climate change acts and some institutional arrangements, but also it largely reflects the political and economic conditions within each *Land*. Cooperative federalism has resulted in the federal government providing a climate framework that applies in all of the states, but individual *Länder* are able to introduce additional policies that exceed this minimum level of ambition – as long as federal legislation does not prevent them from doing so. As a result, policy can move forward within the constituent parts of the federation in the absence of consensus, but this has meant that the various states are travelling at different speeds.

This situation has led to innovations and experimentation within the different states, particularly at the institutional level. The diffusion of climate change acts across the country, many of which were inspired by the legislation passed first in NRW and Baden-Wurttemberg and bore striking similarities to each other, is a case in point. The spread of climate and energy agencies to every *Land* also shows how the states adopted a similar institutional

response, although the functions of these bodies do vary across the country. Indeed, closer analysis reveals how local contexts have shaped the strategies, polices and approaches to implementation in the different *Länder.* The availability of renewable energy resources and a state's existing dependence on fossil fuels plays a key role in mitigation policy, and the extent to which a *Land* is vulnerable to the impact of climate change influences its adaptation approach.

In this sense, the governance of climate change in Germany is something of a microcosm of global efforts to tackle the issue: individual states adopt their own strategies within a wider institutional framework, and these approaches reflect their economic situation and political priorities. In both cases this results in a fascinating mix of different policies that reflect local and regional contexts, but it remains to be seen whether they will be sufficient to achieve their objectives: Germany's federal targets for reducing GHG emissions on the one hand, and the Paris Agreement's pledge to keep global temperature increases below 2°C on the other. As such, we can see how the traditional criticisms of cooperative federalism in Germany might well apply to the case of climate change: the need to seek consensus in a bureaucratic decision-making system that involves many veto players could well ultimately result in suboptimal policy. Although strong intergovernmental structures did help to coordinate and mobilise activity throughout the policy chain in the initial phases of the *Energiewende*, and this strengthened the hand of the state in implementing policy objectives, it has become increasingly difficult to maintain momentum. As Chapter 2 suggested, therefore, Germany's federal system has contributed to progress slowing down, because it provides different interests with multiple venues to push their cause and veto more ambitious initiatives (see also Töller 2019). Individual states remain free to develop more far-reaching policies within the constitutional framework, but the (new) federal government may need to adopt a more coercive approach in order to ensure that other parts of the country do not fall too far behind.

Overall, therefore, Germany's experience suggests that federal systems can have beneficial effects for policy experimentation, coordination and implementation, but they may be less effective where political consensus becomes strained. Nonetheless, the unique nature of the German case makes it difficult to draw definitive conclusions and lessons about the comparative efficacy of federal and unitary governmental systems for combating climate change. Similarly, it is likely that Germany's culture of collaboration between tiers of government cannot be transferred easily to other jurisdictions. It is the product of the constitutional settlement introduced in the aftermath of World War Two, which was itself deliberately designed to prevent the re-emergence of a highly-centralised state. Moreover, as a founding member of the European Communities, the German political system has been influenced by ongoing European integration since the 1950s, which is particular important for environmental and climate policies. Although most key decisions on climate policy are nowadays made in Brussels and Berlin, federalist institutional structures that foster collaboration, such as federal-state institutions and the integration of *Länder* governments into federal decision-making through the *Bundesrat*, could well be adopted in other countries where they do not currently exist. However, without agreement amongst key actors within different levels of government about the need to adopt far-reaching climate policies, some subnational actors could still ensure that national frameworks are insufficiently ambitious to tackle the issue effectively.

References

Abel, D. 2019. The diffusion of climate policies among German municipalities. *Journal of Public Policy.* Available at: https://doi.org/10.1017/S0143814X19000199.

Abgeordnetenwatch.de. 2018. *Gesetz zur Förderung des Klimaschutzes in Sachsen*. Available at : https://www.abgeordnetenwatch.de/sachsen/6/abstimmungen/gesetz-zur-foerderung-des-klimaschutzes-sachsen.

Adelberger, K. 2001. Federalism and its discontents: fiscal and legislative power-sharing in Germany, 1948-1999. *Regional & Federal Studies,* 11 (2), 43-68.

Agentur für Erneuerbare Energien. 2019. *Bundesländer-Übersicht zu Erneuerbaren Energien: Installierte Leistung Photovoltaik*. Available at: https://www.foederal-erneuerbar.de/uebersicht/bundeslaender/BW%7CBY%7CB%7CBB%7CHB%7CHH%7CHE%7CMV%7CNI%7CNRW%7CRLP%7CSL%7CSN%7CST%7CSH%7CTH%7CD/kategorie/solar/auswahl/183-installierte_leistun/#goto_183.

Auel, K. 2014. Intergovernmental relations in German federalism: cooperative federalism, party politics and territorial conflicts. *Comparative European Politics,* 12, 422-443.

Bayrisches Staatsministerium für Umwelt und Verbraucherschutz. 2020. *Bayerische Klimaschutzoffensive*. Available at: https://www.stmuv.bayern.de/themen/klimaschutz/klimaschutzgesetz/index.htm.

Bayerisches Staatsministerium für Umwelt, Gesundheit und Verbraucherschutz. 2007. *Klimaprogramm Bayern 2020: Minderung von Treibhausgasemissionen; Anpassung an den Klimawandel; Forschung und Entwicklung*. Available at: https://www.bayern.de/wp-content/uploads/2014/06/Klimaprogramm-Bayern-2020.pdf.

Bayrisches Staatsministerium für Umwelt und Verbraucherschutz. Undated. *Ein halbes Jahrhundert Bewahrung unserer Lebensgrundlagen: das Bayerische Umweltministerium*. Available at: https://www.stmuv.bayern.de/ministerium/aufgaben/geschichte_umweltministerium.htm.

Berlin Senate Department for the Environment, Transport and Climate Protection. 2019. *Berlin Energy and Climate Protection Programme 2030*. Available at:

https://www.berlin.de/sen/uvk/_assets/klimaschutz/publikationen/bek2030_broschuere_en.pdf.

Beveridge, R. & Kern, K. 2013. The ‚Energiewende' in Germany: Background, Development and Future Challenges. *Renewable Energy, Law and Policy,* 2013(1), 3-12.

Bouckaert, G., Galli, D., Kuhlmann, S., Reiter, R. & van Hecke, S. 2020. European coronationalism? A hot spot governing a pandemic crisis. *Public Administration Review*, available at https://doi.org/10.1111/puar.13242.

Bundesregierung 2019. *Klimaschutzprogramm 2030 der Bundesregierung zur Umsetzung des Klimaschutzplans 2050*. https://www.bundesregierung.de/resource/blob/975226/1679914/e01d6bd855f09bf05cf7498e06d0a3ff/2019-10-09-klima-massnahmen-data.pdf.

Bürgerschaft der Freien und Hansestadt Hamburg. 2013. *Aktionsplan Anpassung an den Klimawandel*. Available at: https://www.hamburg.de/contentblob/4357564/e1b7549bfc46806b9cafa9d89963bd62/data/d-20-8492-aktionsplan-anpassung-an-den-klimawandel.pdf.

Buth M., Kahlenborn, W. Savelsberg, J. Becker, N. Bubeck, P. Kabisch, S. Kind, C. Tempel, A. Tucci, F., Greiving, S., Fleischhauer, M., Lindner, C., Lückenkötter, J., Schonlau, M. Schmitt, H., Hurth, F., Othmer, F., Augustin, R., Becker, D., Abel, M., Bornemann, T., Steiner, H., Zebisch, M., Schneiderbauer, S. & Kofler, C. 2015. *Germany's vulnerability to Climate Change*. Federal Environment Agency. Available at: http://www.umweltbundesamt.de/publikationen/vulnerabilitaet-deutschlandsgegenueber-dem.

Buzer.de. 2019. *Bundes-Klimaschutzgesetz*. Available at: https://www.buzer.de/s1.htm?g=Bundes-Klimaschutzgesetz.

Conradt, D.P. 2001. *The German Polity*. New York: Longman.

Deutscher Bundestag. 2016. Zur Kompetenz- und Lastenverteilung zwischen Bund, Ländern und Kommunen hinsichtlich der europäischen Klima- und Energieziele. WD 8 - 3000 - 062/16, available at https://www.bundestag.de/resource/blob/480032/b7046e177327b2294f37f07d196eb239/wd-8-062-16-pdf-data.pdf

Diekmann, J., Schill, W. D., Püttner, A., Walkner, M., Kirrmann, S. & Maier, M. 2019: *Vergleich der Bundesländer: Analyse der Erfolgsfaktoren für den Ausbau der Erneuerbaren Energien 2019. Indikatoren und Ranking*. Berlin/Stuttgart. Available at: https://www.diw.de/documents/publikationen/73/diw_01.c.698754.de/diwkompakt_2019-145.pdf.

Eckersley, P. 2017. Cities and Climate Change: How historical legacies shape policy-making in English and German municipalities. *Politics*, 37 (2), 151-166.

Eckersley, P. 2018a. Who shapes local climate policy? Unpicking governance arrangements in German and English cities. *Environmental Politics,* 27 (1), 139-160.

Eckersley, P. 2018b. *Power and Capacity in Urban Climate Governance: Germany and England Compared*. Oxford: Peter Lang.

Eckersley, P., England, K. & Ferry, L. 2018. Sustainable development in cities: collaborating to improve urban climate resilience and develop the business case for adaptation. *Public Money & Management,* 38 (5), 335-344.

Eckersley, P., Kern, K., Haupt, W., & Müller, H. Forthcoming. *The multi-level context for climate governance in German municipalities: the role of the federal states*. IRS Dialog, Erkner: Leibniz Institute for Research on Society and Space.

Eichenauer, E. 2016. Energiekonflikte – Proteste gegen Windkraftanlagen als Spiegel demokratischer Defizite. In J. Radtke und N. Kersting (eds): *Energiewende. Politikwissenschaftliche Perspektiven*. Wiesbaden: Springer VS.

Erbguth, W. & Schlacke, S. 2014. *Umweltrecht*. Baden-Baden: Nomos.

Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB). 2016. *Climate Action Plan 2050: Principles and Goals of the German Government's Climate Policy*. Available at: https://www.bmu.de/fileadmin/Daten_BMU/Pools/Broschueren/klimaschutzplan_2050_en_bf.pdf.

Fell, H.J. 2017. *The shift from feed-in-tariffs to tenders is hindering the transformation of the global energy supply to renewable energies.* Policy paper for IRENA, July 2017. Available

at: http://energywatchgroup.org/wp-content/uploads/2018/01/2017-07-15-Policy_Paper_Feed-in_Tariff_Tenders.pdf.

Flaskühler, C.A. 2018. *Föderale Klimaschutzgesetzgebung in Deutschland im Lichte des wohlgeordneten Rechts*. Baden-Baden: Nomos

Freie Hansestadt Bremen. 2018. *Anpassungsstrategie an die Folgen des Klimawandels für das Land und die Städte Bremen und Bremerhaven*. Available at: https://www.bauumwelt.bremen.de/klimaschutz/klima_und_energie/klimaanpassung/anpassungsstrategie_an_die_folgen_des_klimawandels_fuer_das_land_und_die_staedte_bremen_und_bremerhaven-60162.

Freistaat Thüringen 2018. *Thüringer Gesetz zum Klimaschutz und zur Anpassung an die Folgen des Klimawandels*. Available at: http://landesrecht.thueringen.de/jportal/?quelle=jlink&query=KlimaSchG+TH&psml=bsthueprod.psml&max=true.

Gallata, J.A.M. & Newig, J. 2017. Policy implementation through multi-level governance: analysing practical implementation of EU air quality directives in Germany. *Journal of European Public Policy*, 24 (9), 1308-1327.

Göpfert, C. 2014. *Der Beitrag von Klimaschutzkonzepten zum kommunalen Klimaschutz: Eine empirische Analyse zusätzlicher Effekte von im Rahmen der Kommunalrichtlinie geförderten Klimaschutzkonzepten auf die lokalen Klimaschutzaktivitäten*, Wuppertaler Studienarbeiten zur nachhaltigen Entwicklung, No. 6, Wuppertal Institut für Klima, Umwelt, Energie, Wuppertal. Available at: http://hdl.handle.net/10419/95870.

Hamburg.de. 2020. *Hamburgisches Gesetz zum Schutz des Klimas*. http://www.landesrecht-hamburg.de/jportal/portal/page/bshaprod.psml?showdoccase=1&doc.id=jlr-KlimaSchGHA2020rahmen.

Hennicke, P. & Welfens, P.J.J. 2012. *Energiewende nach Fukushima – Deutscher Sonderweg oder weltweites Vorbild?* München: Oekom Verlag.

Hessisches Ministerium für Umwelt, Klimaschutz, Landwirtschaft und Verbraucherschutz. 2019. *Richtlinie des Landes Hessen zur Förderung von kommunalen Klimaschutz- und Klimaanpassungsprojekten sowie von kommunalen Informationsinitiativen.* Available at:

https://umwelt.hessen.de/sites/default/files/media/hmuelv/klima-richtlinie_barrierefrei_0.pdf

Hessisches Ministerium für Umwelt, Klimaschutz, Landwirtschaft und Verbraucherschutz. 2017. *Integrierter Klimaschutzplan Hessen 2025*. Available at: https://umwelt.hessen.de/sites/default/files/media/hmuelv/integrierter_klimaschutzplan_web_barrierefrei.pdf.

Hessisches Statistisches Landesamt 2016*. Nachhaltigkeitsstrategie Hessen Ziele und Indikatoren. Fortschrittsbericht 2016*. Available at: https://www.hessen-nachhaltig.de/files/content/downloads/ziele_und_indikatoren/ziele_und_indikatoren_fortschrittsbericht_2016.pdf.

Hirschhausen, C. 2014. The German "Energiewende" – an introduction. *Economics of Energy & Environmental Policy*, 3 (2), 1-12.

Hoeft, C., Messinger-Zimmer, S. & Zilles, J. 2017. *Bürgerproteste in Zeiten der Energiewende: Lokale Konflikte um Windkraft, Stromtrassen und Fracking*. Göttinger Institut für Demokratieforschung.

Hoff, J.V. & Strobel, B. W. 2013. A municipal 'climate revolution'? The shaping of municipal climate change policies. *Journal of Transdisciplinary Environmental Studies,* 12 (1), 4-16.

Hörter, A., Schirrmacher, J., Beer, M., Sommer, B. & Utz, J. 2018. *Schlüsselakteure bewegen kommunalen Klimaschutz. Erfolgreicher Klimaschutz dank Schlüsselakteuren. Projektergebnisse und Handlungsempfehlungen für lokale Klimaschutzakteure*. Zentrum für Nachhaltige Energiesysteme, Europa-Universität Flensburg. Available at: http://schluesselakteure.de/wp-content/uploads/2018/05/Leitfaden_Erfolgreicher-kommunaler-Klimaschutz-dank-Schl%C3%BCsselakteuren.pdf.

Jänicke, M. 2011. German climate change policy: Political and economic leadership. In R.K.W. Wurzel und J. Connelly (eds), *The European Union as a Leader in International Climate Change Politics*. London: Routledge.

Jänicke, M. & Wurzel, R.K.W. 2019. Leadership and lesson-drawing in the European Union's multilevel climate governance system. *Environmental Politics*, 28 (1), 22-42.

Kern, K. 2019. Cities as leaders in EU multilevel climate governance: embedded upscaling of local experiments in Europe. *Environmental Politics*, 28 (1), 125-145.

Kern, K. 2008. Sustainable Development Initiatives in Federal States in Germany, In Baker, S. & Eckerberg, K. (eds.), *In Pursuit of Sustainable Development: New Governance Practices at the Sub-National Level in Europe,* London/New York: Routledge, pp. 122-144.

Kern, K., Koenen, S. & Löffelsend, T. 2004. Red-Green Environmental Policy in Germany. Strategies and Performance Patterns, In: Reutter, W. (ed.), *Germany on the Road to "Normalcy". Policies and Politics of the First Red-Green Government (1998-2002),* New York: Palgrave Macmillan, pp. 183-206.

Kern, K., Haupt, W., Eckersley, P. & Müller, H. In preparation. Climate change acts on the move: diffusion and dynamics in the German multi-level system.

Kuhlmann, S. & Franzke, J. 2021. Multi-level responses to COVID-19: crisis coordination in Germany from an intergovernmental perspective. *Local Government Studies*. DOI: 10.1080/03003930.2021.1904398

Land Brandenburg 2012. *Energiestrategie 2030.* https://mwae.brandenburg.de/media/bb1.a.3814.de/Energiestrategie2030_2012.pdf.

Land Sachsen-Anhalt. 2014. *Energiekonzept 2030 der Landesregierung von Sachsen-Anhalt*. *Available at* https://mule.sachsen-anhalt.de/fileadmin/Bibliothek/Politik_und_Verwaltung/MLU/MLU/04_Energie/Energiepolitik/00_Startseite_Energiepolitik/Energiekonzept_2030.pdf.

Landesregierung Schleswig-Holstein. 2017. *Gesetz zur Energiewende und zum Klimaschutz in Schleswig-Holstein.* Available at: http://www.gesetze-rechtsprechung.sh.juris.de/jportal/?quelle=jlink&query=EWKSG+SH+%C2%A7+1&psml=bsshoprod.psml&max=true.

Landtag Niedersachsen. 2019. *Gesetzentwurf: Niedersächsisches Gesetz zur Förderung des Klimaschutzes und zur Anpassung an die Folgen des Klimawandels.* Available at: https://www.landtag-niedersachsen.de/Drucksachen/Drucksachen_18_05000/04501-05000/18-04839.pdf.

Landtag von Baden-Württemberg. 2013. *Gesetz zur Förderung des Klimaschutzes in Baden-Württemberg*. Available at: https://vm.baden-wuerttemberg.de/fileadmin/redaktion/m-mvi/intern/Dateien/PDF/Klimaschutz_Gesetzesbeschluss_Klimaschutzgesetz-1.pdf.

Lerman, V., Gerstlberger, W., Lima, M.F. & Frank, A.G. 2021. How do governments, universities, and companies contribute to renewable energy development? A municipal innovation policy perspective of the triple helix. *Energy Research & Social Science*, 71, 101854, doi: 10.1016/j.erss.2020.101854.

Mendonca, M., Jacobs, D. & Sovacool, B. 2010. *Powering the Green Economy: The Feed-In Tariff Handbook*. London: Earthscan.

Ministerium des Inneren des Landes Nordrhein-Westfalen. 2013. *Klimaschutzgesetz Nordrhein-Westfalen.* Available at: https://recht.nrw.de/lmi/owa/br_text_anzeigen?v_id=10000000000000000574.

Ministerium für Wirtschaft, Arbeit und Tourismus. 2011. *Aktionsplan Klimaschutz Mecklenburg-Vorpommern 2010 . Teil A - Grundlagen und Ziele*. Available at: http://service.mvnet.de/_php/download.php?datei_id=36298

Monstadt, J. & Scheiner, S. 2014. Allocating greenhouse gas emissions in the German federal system: regional interests and federal climate governance. *Energy Policy,* 74, 383-394.

Moser, S., & Kleinhückelkotten, S., 2018. Good intents, but low impacts: Diverging importance of motivational and socioeconomic determinants explaining pro-environmental behavior, energy use, and carbon footprint. *Environment and Behaviour*, 50 (6), 626-656.

Müller, E. 1998. Differences in climate change policy in Germany and the United States from a political science perspective. *Energy & Environment*, 9 (4), 463-477.

Neukirch, M. 2020. Grinding the grid: Contextualizing protest networks against energy transmission projects in Southern Germany. *Energy Research & Social Science* 69, 101585.

Newig, J., Challies, E., Jager, N. & Kochskämper, E. 2014. What role for public participation in implementing the EU Floods Directive? A comparison with the Water Framework Directive, early evidence from Germany and a research agenda. *Environmental Policy and Governance*, 24, 275-288.

Niedersächsischer Landtag. 2019. *Niedersächsisches Gesetz zur Förderung des Klimaschutzes und zur Anpassung an die Folgen des Klimawandels*. Available at: https://www.landtag-niedersachsen.de/Drucksachen/Drucksachen_18_05000/04501-05000/18-04839.pdf.

Niedersächsisches Ministerium für Umwelt, Energie, Bauen und Klimaschutz. 2019. *Energiewendebericht 2019*. Available at: https://www.umwelt.niedersachsen.de/startseite/themen/energie/energiewendebericht/energiewendebericht-119325.html.

OECD 2019a. *Greenhouse gas emissions*. Available at: https://stats.oecd.org/Index.aspx?DataSetCode=AIR_GHG.

OECD 2019b. *Historical population*. Available at: https://stats.oecd.org/Index.aspx?DataSetCode=HISTPOP.Ohlhorst D., Tews K., Schreurs M. (2014) Energiewende als Herausforderung der Koordination im Mehrebenensystem. In: Brunnengräber A., Di Nucci M. (eds) Im Hürdenlauf zur Energiewende. Springer VS, Wiesbaden, pp. 93-104.

Otto, A., Kern, K., Haupt, W., Eckersley, P. & Thieken, A. Forthcoming. Ranking local climate policy: assessing the mitigation and adaptation activities of 104 German cities. *Climatic Change*

Reckien, D., Salvia, M., Heidrich, O., Church, J.M., Pietrapertosa, F., de Gregorio-Hurtado, S., d'Alonzo, V., Foley, A., Simoes, S.G., & Lorencová, E.K., 2018. How are cities planning to respond to climate change? Assessment of local climate plans from 885 cities in the EU-28. *Journal of Cleaner Production*, 191, 207–219.

Rheinland-Pfalz Ministerium der Justiz 2014. *Landesgesetz zur Förderung des Klimaschutzes*. Available at: http://landesrecht.rlp.de/jportal/portal/t/onc/page/bsrlpprod.psml?pid=Dokumentanzeige&showdoccase=1&js_peid=Trefferliste&documentnumber=1&numberofresults=22&fromdoctodoc=yes&doc.id=jlr-KlimaSchGRPrahmen&doc.part=X&doc.price=0.0&doc.hl=1#focuspoint.

Sächisches Staasministerium für Wirtschaft, Arbeit und Verkehr. 2013. *Energie- und Klimaprogramm Sachsen*. Available at: https://www.klima.sachsen.de/download/EKP2012.pdf

Salvia, M., Reckien, D., Pietrapertosa, F., Eckersley, P., Spyridaki, N.-A., Krook-Riekkola, A., Olazabal, M., De Gregorio Hurtado, S., Simoes, S.G., Geneletti, D., Viguié, V., Fokaides, P.A., Ioannou, B.I., Flamos, A., Csete, M.S., Buzasi, A., Orru, H., de Boer, C., Foley, A., Rižnar, K., Matosović, M., Balzan, M.V., Smigaj, M., Baštáková, V., Streberova, E., Šel, N.B., Coste, L., Tardieu, L., Altenburg, C., Lorencová, E.K., Orru, K., Wejs, A., Feliu, E., Church, J.M., Grafakos, S., Vasilie, S., Paspaldzhiev, I. & Heidrich, O., 2021. Will climate mitigation ambitions lead to carbon neutrality? An analysis of the local-level plans of 327 cities in the EU. *Renewable and Sustainable Energy Reviews*, 135, 110253.

Scharpf, F.W. 2009. *Föderalismusreform: kein Ausweg aus der Politikverflechtungsfalle?* Frankfurt: Campus Verlag.

Scharpf, F.W. 1988. The joint-decision trap: lessons from German federalism and European integration. *Public Administration*, 66 (3), 239-278.

Scharpf, F.W. Reissert, B. & Schnabel, F. (eds) 1976. *Politikverflechtung: Theorie und Empirie des kooperativen Föderalismus in der Bundesrepublik*. Kronberg: Scriptor.

Scheiner, Stefan 2017: *Interessen der Bundesländer in der deutschen Klimapolitik. Föderale Konfliktverarbeitung in drei Handlungsfeldern.* Baden-Baden: Nomos.

Scherf, W. 2010. Die kommunalen Finanzen in Deutschland. In: Wehling, H.-G. & Kost, A. (eds.) *Kommunalpolitik in den Deutschen Ländern: Eine Einführung.* Wiesbaden: VS Verlag.

Schleich, J., Eichhammer, W., Boede, U., Gagelmann, F., Jochem, E., Schlomann, B. & Ziesing, H.J. 2001. Greenhouse gas reductions in Germany—lucky strike or hard work? *Climate Policy,* 1 (3), 363-380.

Senatsverwaltung für Umwelt, Verkehr und Klimaschutz. 2016. *Programm zur Anpassung an die Folgen des Klimawandels in Berlin*. Available at: https://www.berlin.de/sen/uvk/klimaschutz/anpassung-an-den-klimawandel/programm-zur-anpassung-an-die-folgen-des-klimawandels/.

Statistisches Amt Saarland. 2018. *Energiebilanz und CO2-Bilanz des Saarlandes 2016*. Saarbrücken. Available at: https://www.statistischebibliothek.de/mir/servlets/MCRFileNodeServlet/SLHeft_derivate_00005581/SL_Bericht_EIV4_2016-j.pdf.

Steuwer, S. and Hertin, J. 2021. Climate policy in Germany: Pioneering a complex transformation process. In R.K.W. Wurzel, M.S. Andersen and P. Tobin (eds.), *Climate Governance across the Globe: Pioneers, Leaders and Followers*. Abingdon: Routledge.

Szuleki, K., Fischer, S., Gullberg, A.T. & Sartor, O. 2016. Shaping the 'Energy Union': between national positions and governance innovation in EU energy and climate policy. *Climate Policy*, 16 (5), 548-567.

Thüringer Landesamt für Statistik. 2019. *Statistischer Bericht: Energiebilanz und CO_2 – Bilanz Thüringens*. Available at: https://statistik.thueringen.de/webshop/pdf/2016/05402_2016_00.pdf.

Timmons, D., Zirogiannis, N. & Lutz, M. 2016. Location matters: Population density and carbon emissions from residential building energy use in the United States. *Energy Research & Social Science*, 22, 137–146.

Töller, A.E. 2019. Kein Grund zum Feiern! Die Umwelt- und Energiepolitik der dritten Regierung Merkel. In R. Zohlnhöfer und T. Saalfeld (eds.) *Zwischen Stillstand, Politikwandel und Krisenmanagement: Eine Bilanz der Regierung Merkel 2013-2017*. Wiesbaden: Springer.

Tsebelis, G. 1995. Decision Making in Political Systems: Veto Players in Presidentialism, Parliamentarism, Multicameralism and Multipartyism. *British Journal of Political Science*, 25 (3), 289-325.

Weidner, H. & Mez, L. 2008. German Climate Change Policy: A Success Story with Some Flaws. *The Journal of Environment & Development,* 17 (4), 356-378.

Wollmann, H. 2021. Transformation of Public Administration in East Germany following Unification. In S. Kuhlmann, I. Proeller, D. Schimanke and J. Ziekow (eds.) *Public Administration in Germany*. Palgrave online, https://doi.org/10.1007/978-3-030-53697-8

Wollmann, H. 2004a. Local Government Reforms in Great Britain, Sweden, Germany and France: Between Multi-Function and Single-Purpose Organisations. *Local Government Studies*, 30 (4), 639-665.

Wollmann, H. 2004b. The two waves of territorial reforms of local government in Germany. In: Meligrana, John (ed.), *ReDrawing Local Government Boundaries. An International Study of Politics, Procedures and Decisions*. Vancouver: UBC Press.

World Bank 2019. *Exports of goods and services* (BoP, current US$). https://data.worldbank.org/indicator/BX.GSR.GNFS.CD.

Wurster, S. & Köhler, Ch. 2016. Die Energiepolitik der Bundesländer. Scheitert die Energiewende am deutschen Föderalismus? In: Hildebrandt, A. & Wolf F. (eds). Die Politik der Bundesländer. Wiesbaden: Springer, pp. 283-314.

Wurzel, R.K.W., Zito, A.R. & Jordan, A.J. 2013. *Environmental Governance in Europe: A Comparative Analysis of New Environmental Policy Instruments*. Cheltenham: Edward Elgar.

Zohlnhöfer, R. 2009. Der Politikverflechtungsfalle entwischt? Die Effekte der Föderalismusreform I auf die Gesetzgebung. Kurzfassung. *Zeitschrift für Politikwissenschaft*, 1, 39-76.