

Closing the Implementation Gap: Obstacles in Reaching Net-Zero Pledges in the EU and Germany

Perino, Grischa; Jarke-Neuert, Johannes; Schenuit, Felix; Wickel, Martin; Zengerling, Cathrin

Veröffentlichungsversion / Published Version
Zeitschriftenartikel / journal article

Empfohlene Zitierung / Suggested Citation:

Perino, G., Jarke-Neuert, J., Schenuit, F., Wickel, M., & Zengerling, C. (2022). Closing the Implementation Gap: Obstacles in Reaching Net-Zero Pledges in the EU and Germany. *Politics and Governance*, 10(3), 213-225. <https://doi.org/10.17645/pag.v10i3.5326>

Nutzungsbedingungen:

Dieser Text wird unter einer CC BY Lizenz (Namensnennung) zur Verfügung gestellt. Nähere Auskünfte zu den CC-Lizenzen finden Sie hier: <https://creativecommons.org/licenses/by/4.0/deed.de>

Terms of use:

This document is made available under a CC BY Licence (Attribution). For more information see: <https://creativecommons.org/licenses/by/4.0>

Article

Closing the Implementation Gap: Obstacles in Reaching Net-Zero Pledges in the EU and Germany

Grischa Perino ^{1,2,3,*}, Johannes Jarke-Neuert ², Felix Schenuit ^{3,4}, Martin Wickel ^{2,5}, and Cathrin Zengerling ⁶

¹ Department of Socioeconomics, University of Hamburg, Germany

² Center for Earth System Research and Sustainability, University of Hamburg, Germany

³ Center for Sustainable Society Research, University of Hamburg, Germany

⁴ German Institute for International and Security Affairs, Germany

⁵ Department of Urban Planning, HafenCity University Hamburg, Germany

⁶ Institute for Environmental Social Sciences and Geography, University of Freiburg, Germany

* Corresponding author (grischa.perino@uni-hamburg.de)

Submitted: 28 January 2022 | Accepted: 3 May 2022 | Published: 21 September 2022

Abstract

The European Union and Germany have recently committed themselves to greenhouse-gas neutrality by 2050 and 2045, respectively. This substantially reduces their *gaps in ambition* to the Paris climate goals. However, the current climate policy mix is not sufficient to reach these targets: There is a major *implementation gap*. Based on economic, legal, and political science perspectives, this article identifies key obstacles in legislating stringent climate policy instruments and making them effective. Using a simple framework, we map the stage of the process in which the obstacles are at work. Moreover, we discuss the potential effectiveness of a select list of prominent drivers of climate-related regulation in overcoming said obstacles and conclude by pointing towards conditions for closing the implementation gap. In doing so, we focus on the current legislative processes of the “Fit-for-55” package by the European Commission and the 2021 Federal Climate Change Act in Germany. Our analysis builds on the extant literature, and we suggest avenues for further research.

Keywords

ambition gap; climate policy; European Union; Germany; implementation gap

Issue

This article is part of the issue “Exploring Climate Policy Ambition” edited by Elina Brutschin (International Institute for Applied Systems Analysis) and Marina Andrijevic (International Institute for Applied Systems Analysis).

© 2022 by the author(s); licensee Cogitatio (Lisbon, Portugal). This article is licensed under a Creative Commons Attribution 4.0 International License (CC BY).

1. Introduction

The world is currently heading towards well above 2°C warming by 2100 (Intergovernmental Panel on Climate Change [IPCC], in press-a; Sognaes et al., 2021), which indicates the failure of the Paris Agreement. The reason for this can be broken down into two deficiencies of climate-related regulation: the *ambition gap* and the *implementation gap*. The ambition gap is defined in relation to the carbon budget implied by the 1.5°-to-well-below-2.0°C corridor set by the Paris Agreement (Friedlingstein et al., 2022). Thus, the gap is essentially

an incongruity between the agreed-upon goal and states’ emission reduction pledges in the form of nationally determined contributions (NDCs). The adoption of net-zero emission targets by several countries has sparked hopes that the ambition gap is shrinking (Meinshausen et al., 2022).

Much less attention has been devoted to the implementation gap which is the subject of this article. Echoing the new emphasis on the implementation gap in the IPCC’s Working Group III summary for policymakers (IPCC, in press-b), which defines this gap as the difference between implemented policies and NDCs, we argue that

the bottom-up elements of the Paris Agreement require shifting the attention to this gap and zooming in on the conditions for closing it. In what follows, implementation refers to what is required to move from a jurisdiction's respective abatement target to the target being met. Hence, it includes the policy-formulation stage as far as it concerns climate policy instruments aiming to bring emissions in line with the climate targets adopted but not the process of adopting the targets. We define the implementation gap as the difference between a jurisdiction's targeted reduction path and the actual and projected reductions achieved with the current set of climate policy instruments (policy outcome). We subdivide the implementation gap into two components: First, the stringency of policy outputs might not be in line with the targets, and second, policy outputs fail to fully translate into the intended policy outcomes. The implementation gap thus captures insufficient stringency as well as limitations arising from counterproductive interactions and imperfect enforcement of concrete sets of policy instruments put in place to achieve a jurisdiction's abatement targets. Recent quantitative assessments indicate that the magnitude of the implementation gap is substantial (IPCC, in press-b; Liu & Raftery, 2021; REN21, 2021).

The EU and Germany have seen major increases in mitigation ambition since 2020. The new European Commission (EC) has pledged greenhouse-gas (GHG) neutrality by 2050, a 55% reduction in GHG emissions by 2030, and has announced the European Green Deal as its key transformation narrative and policy framework. In July 2021, the EC presented a set of legal initiatives to overhaul the entire set of climate policy instruments making them "Fit for 55," i.e., the 55% reduction target (Schlacke et al., 2022). In light of the new EU targets, a historic ruling by its constitutional court, and the upcoming federal elections, Germany raised its ambition in 2021 to GHG neutrality by 2045.

One might be tempted to conclude that committing to these targets will induce the required mitigation efforts. The fundamental transformation of production processes, infrastructure, and lifestyles requires stringent climate-policy instruments. Several concerns motivate the focus on the obstacles to closing the implementation gap. First, only part of the implementation gap is due to recent increases in ambition. Current policies are also insufficient to meet the previous, less ambitious targets (Edenhofer et al., 2021). Second, the recent rise in energy prices spurred severe opposition both to the "Fit for 55" proposal (van Gaal, 2021) as well as key existing policies such as the EU Emission Trading System (ETS; Morawiecki, 2022). Third, governance mechanisms might be insufficient (Knodt et al., 2021). Fourth, current emission trajectories and government assessments confirm the relevance of the implementation gap. Emissions in Germany have risen substantially from 2021 to 2022, including a 17% increase in emissions from coal-fired power plants with sector targets in housing and transport being missed (Federal

Environment Agency & German Federal Ministry for Economic Affairs and Climate Action, 2022). In January 2022, the German government stated that "the speed of climate action must nearly triple" (Federal Ministry for Economic Affairs and Climate Action, 2022, p. 1) to achieve the adopted targets.

After presenting a conceptual framework that decomposes the implementation gap into two main components and helps structure our analysis in Section 2, we zoom in on the implementation gap in the EU and Germany and explore key obstacles to closing it in Section 3. In Section 4, we assess how effective a select list of prominent drivers of climate-related regulation is in overcoming these obstacles. Along the way, we suggest avenues for further research.

2. Conceptual Framework

The process of moving from a formalized abatement target to actually cutting emissions in line with said target involves several steps and many intertwining threads. Each thread typically involves at least one policymaking process where a climate policy instrument is (re-)designed and legislated. The new or revised instrument then impacts current and future emissions by directly and indirectly creating incentives for consumers and producers to change behaviors and technologies. The impact on emissions qualitatively and quantitatively depends on the design of the instrument, its interactions with other instruments, enforcement, and the economic, political, and cultural context.

We contribute by identifying different obstacles that interfere with this process and locating them within this two-step model of the climate-target implementation process (Section 3). First, we focus on obstacles that hamper the policy-formulation process, from target-setting to specific policy *output*. The policy-formulation process is represented by the left-hand side in Figure 1. Examples of such obstacles are the salience of distributional conflicts, ill-defined, scattered, or overlapping competencies, and capacity constraints in the face of holistic reforms (Section 3.1). Second, we investigate what reduces the effectiveness of existing climate policy instruments (Knill et al., 2012) focusing on the processes from policy output to policy *outcome* (Cairney et al., 2019), e.g., counter-productive interactions with other instruments and lack of enforcement (Section 3.2). Policy effectiveness occupies the right-hand side of Figure 1. Finally, we probe the ability of a select list of potential drivers to overcome these obstacles. With the conceptual framework, we aim at providing a helpful way to both organize existing empirical evidence as well as identify areas for future research to better understand the challenges faced when closing the implementation gap. Using the EU and Germany as examples, we explore the ongoing and crucial phase of moving from ambitious new climate targets to actually decarbonizing our societies.

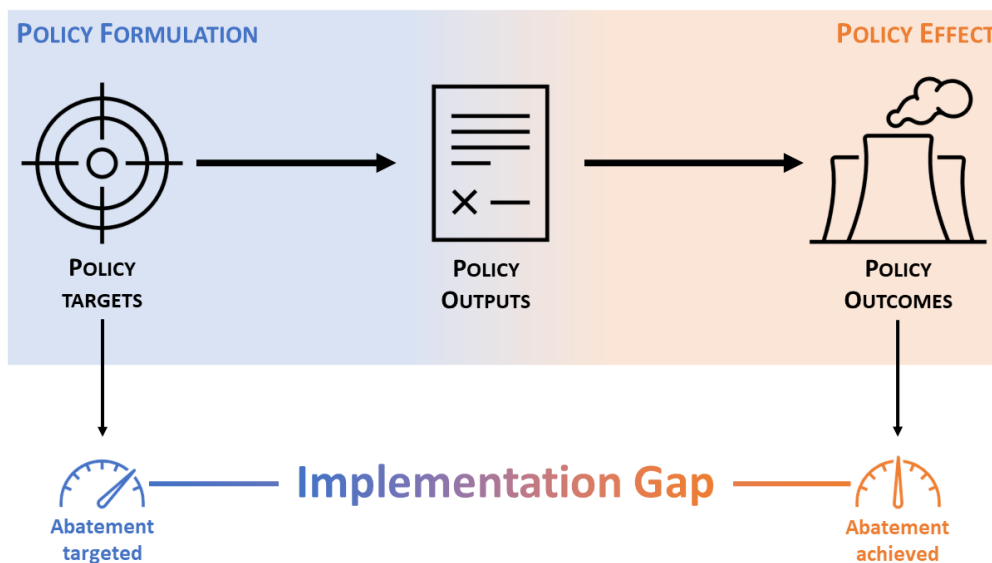


Figure 1. Conceptual illustration of the implementation gap.

3. What Impedes Implementation of Climate Targets?

The obstacles in implementing climate targets are rooted in the diversity of sources of GHG emissions. The production or consumption of most goods and services currently involve GHG emissions either directly or indirectly. The new net-zero paradigm highlights that all processes need to completely decarbonize, compensate the residuals with carbon dioxide removal, or stop happening. Given the multitude of sources and processes emitting GHG, from burning fossil fuels in power plants, passenger cars, production processes in the heavy and chemical industries, agriculture, and many more, it is a widely held tenet that no single regulatory instrument will suffice. Their scope is limited by jurisdictions, technologies, sectors, and the response patterns of actors. In contrast to defining an overarching climate target that encompasses all emitters irrespective of their type and location, implementation needs to tackle the complexity and diversity on the ground. In this section, we investigate obstacles to closing the implementation gap effectively at different stages of the process.

3.1. Obstacles to the Policy-Formulation Process

The first set of obstacles interferes with the implementation of climate targets primarily, but not necessarily exclusively, during the policy-formulation process, i.e., the (re-)designing and legislating of climate policy instruments.

3.1.1. Coordination of Interventions

The heterogeneity of sources, sectors, and sites currently emitting GHGs implies that no single legislative body in the EU or Germany bears exclusive responsibility for implementing climate targets and that for each legisla-

tive body or government, several policy fields and departments are involved, respectively. Hence, both external and internal coordination is required for closing the implementation gap.

At the EU level, the European Climate Law (Regulation of 30 June 2021, 2021) sets overall reduction targets for GHG emissions. They are allocated to three clusters of sectors each with its own regulatory framework. These frameworks are the ETS, covering energy and industry; the Effort Sharing Regulation (ESR; Regulation of 30 May 2018, 2018), spanning transport, buildings, non-ETS industry, and waste; and the Land Use, Land Use Change, and Forestry Regulation (LULUCF). There is some flexibility between these frameworks, as removal credits from LULUCF and, for nine member states, ETS allowances can be used to some extent for compliance under the ESR. Internally, the regulatory frameworks follow different principles of how reduction efforts are spread between member states and individual emitters. While the ETS relies on the market to coordinate the allocation of reduction efforts, the ESR sets reduction goals for each member state and delegates implementation to national governments. In the past, the two regulatory approaches coexisted at the EU level without much interference as they covered different sectors. However, the Fit-for-55 package proposes a second ETS for ESR sectors while maintaining the national targets of the ESR. How the two regulatory approaches would interact depends on the details of their final design and is a question for further research.

The different regulatory approaches at the EU level also imply that the vertical coordination between the EU and member states differs for the ETS and ESR sectors. For ETS sectors, the carbon market directly involves individual emitting installations. Member states are therefore tasked with administering the ETS and should otherwise focus on addressing obstacles that interfere with

the efficiency of the carbon market or alleviating undesirable distributional consequences. In practice, however, the market-based approach of the ETS is supplemented by additional interventions targeting emissions at the member-state level as we illustrate in the case of Germany.

On a national level, Germany sets overall reduction targets in its Federal Climate Change Act (FCCA) and defines annual carbon budgets for six sectors. For ESR sectors, such as housing and transport, national sector targets are the first step towards implementation. For ETS sectors, e.g., energy and industry, their role is less obvious. The explanatory memorandum to the FCCA states that, in ETS sectors, targets ensure the contribution of non-ETS installations that are part of these sectors (Deutscher Bundestag, 2019, p. 19). This is in line with the total GHG emissions of ETS installations being determined at the EU level by the number of emission allowances issued. However, the German Coal Phaseout Act legislated in 2020 was justified by arguing that the ETS cannot guarantee that FCCA targets for the energy sector are met (Deutscher Bundestag, 2020, pp. 4–5, 178). Hence, a cornerstone of German climate policy is motivated by a perceived conflict between a key EU climate policy instrument and national abatement targets. We elaborate on the interactions created between these overlapping climate policies in Section 3.2.1.

3.1.2. Saliency of Burdens and Conflicts

The choice, design, stringency, and mix of climate policy instruments determine who is going to bear the burden of the transition. From an economic perspective, target setting focuses on balancing the total costs with total benefits. The policy-formulation process focuses on spreading the costs across different groups. Costs refer both to monetary and non-monetary burdens. The latter include right infringements, changes in lifestyles or consumption patterns, the displeasure of facing a wind turbine or transmission line in one's backyard, and trade-offs with other policy areas such as nature protection and the efforts to reduce unemployment and poverty. Interest groups will do their best in fending off burdens by lobbying for different or weaker interventions (Cory et al., 2021; Meng & Rode, 2019). Solving distributional conflicts at the policy-formulation stage might hence be the core challenge of climate policy (Aklin & Mildemberger, 2020).

The recent surge in energy prices, mainly driven by increases in gas and coal prices, has intensified the debate over how much (extra) burden companies and consumers should bear. Germany introduced a carbon price for fuels used outside the ETS in 2021. Its level and trajectory have been found to be insufficient even for Germany's old climate targets set in 2014 (Edenhofer et al., 2021). Nevertheless, the coalition agreement of the new government explicitly refrains from raising prices for social reasons in light of rising energy bills

(Koalitionsvertrag, 2021, p. 63), and in response to the war against Ukraine, measures have been adopted to shield consumers and companies from increasing energy prices. The latter reduces the incentives to reduce fuel use and hence emissions. At the EU level, high energy and emission allowance prices have sparked heated debates over both price management in the ETS (Khan, 2021; Morawiecki, 2022) as well as the Fit-for-55 package more generally (van Gaal, 2021). There is an emerging debate on whether redistributing the revenues raised by carbon pricing increases support for this instrument (Mildemberger et al., 2022; Sommer et al., 2022).

The more ambitious the climate targets, the faster and more fundamental the change processes that are required to achieve them. Deep change intensifies the distributional challenge faced when organizing majorities for climate policies: Assets get stranded and business models and careers become obsolete while new ones emerge. Institutions determine the actors and interests represented in decision-making and thus play a crucial role in moderating conflicts, creating new narratives, providing credible commitments, and transferring resources between stakeholders (Meckling & Nahm, 2022). However, research on the role of institutions in climate policymaking is still in its infancy (Dubash et al., 2021) and further conceptual and empirical work is needed.

3.1.3. Passing Along Responsibility: Multilevel Climate Politics in the EU

Given that the implementation of climate targets involves policymakers at multiple levels such as the EU, national, state, and local bodies (Rayner & Jordan, 2016), and that implementation induces distributional conflicts, there are clear incentives to pass along unpopular decisions. At the same time, policymakers try to retain or gain power over resources deemed crucial for their respective constituencies. We illustrate this struggle regarding the location of political responsibilities.

For the EU, legal competencies vary substantially across different climate and energy-relevant policy fields. (Re-)interpreting competencies in and of itself is quite often part of the policy-formulation process (Rayner et al., in press). The Climate and Energy Package 2030 adopted in 2018, for example, advanced the integration of climate and energy policies (Skjærseth, 2021). This was met by fears of infringements on national sovereignty. With net-zero being established as a new "organizing principle" of climate policymaking (Schenuit et al., 2021), member states' concerns about sovereignty have been extended, e.g., to forest or agricultural policy.

The set of policies the EU can choose from is not only influenced by actual competencies. There is a long history of politically motivated "red lines" that inhibited the use of certain policy instruments. One prominent example is the failed carbon tax, a victim of the general aversion in some member states to allowing the

EU to levy taxes (Convery, 2009). Despite shared environmental competencies as laid out in Articles 192 and 194 of the Treaty on the Functioning of the European Union (TFEU), intergovernmentalism still plays a key role in EU climate policymaking (Dupont & Oberthür, 2016). Most prominently, heads of states and governments manage to keep control over the overall climate targets. They successfully requested an EU-wide, instead of member-state specific, 2050 net-zero target, and the European Council communicated the minus 55% target for 2030 to the United Nations Framework Convention on Climate Change (UNFCCC) before official trilogue negotiations with the European Parliament had been finalized. Until now, the so-called Visegrád Group (i.e., Poland, Hungary, Slovakia, and the Czech Republic) has been quite successful in shaping EU legislation (Četković & Buzogány, 2019); however, without “harder” soft governance, the EU risks missing its “55” targets (Knodt et al., 2021) by passing responsibility to close the gap in the policy-formulation process back and forth between national governments and the EU. In light of the Russian invasion of Ukraine, the new importance of energy security also pointed to the sovereignty of member states over their energy mix and related political conflicts that have shaped EU energy policy well before the crisis (Szulecki et al., 2016). How the new security dimension of the EU Green Deal will affect the practice of passing along responsibility and the implementation gap remains to be seen.

Germany, with the highest GHG emissions and a large dependence on Russian gas, is of particular importance in the processes described. But also in this federal state, responsibility is shifted along. The power of legislation in the field of climate protection lies at the national level and is subject to concurrent legislation. With the adoption of the FCCA in 2019, the national government has exercised this competence. The FCCA allows the federal states to legislate themselves (Köck & Kohlrausch, 2021) but does not contain any provisions coordinating the efforts between the national and the state level, raising doubts about the coherence of the various reduction targets (Wickel, 2021). Ten out of 16 states have adopted climate laws that differ in their ambition and content (Wickel, 2022).

The FCCA and some state acts limit themselves to setting a framework and reduction targets, planning instruments, and guiding internal affairs of the administration. Hence, they constitute a stepping-stone of the policy-formulation process, but to close the implementation gap further legislative and administrative decisions are required. Legislative authority for the relevant sectors is divided between national- and state-level: Important legislative powers in energy, emission control, and transport rest with the national government; for the building sector, they are divided between the national and state levels (Fuo et al., 2022); for local infrastructures, they rest with the states. Moreover, state laws in general and national laws in most cases are executed by the states.

Local affairs are governed by the municipalities, in particular decisions concerning land use. In the absence of binding guidelines and targets, successful coordination is much less likely and incentives to pass along responsibility prevail. Research on how to achieve better coordination and joint responsibility of all policymakers involved is desirable.

3.1.4. Complexity: Potential Benefits and Risks of “Holistic” Reform

Related challenges for closing the gap in the policy-formulation process are the complexity of legislative procedures, new linkages between policy fields, and the politics inscribed in the envisaged deep decarbonization in the EU (Dupont et al., 2020; Skjærseth, 2021). The Green Deal was accompanied by substantial communication efforts from the EC emphasizing the positive aspects and “holistic character” of the EU’s new growth strategy and hiding the manifold substantive trade-offs.

The 16 legislative and strategic proposals of the Fit-for-55 package span many policy domains, each with its own path-dependency, actor constellations, political alliances, and legal competencies (Rayner et al., in press). They include revisions of the three main pillars of EU climate policy (ETS, ESR, LULUCF Regulation). Already these comprised many different actors and varying political alliances—and required complex package deals during their adoption. The new linkages to other policy fields, e.g., those between the LULUCF Regulation and the Common Agriculture Policy, add new interests, positions, and alliances (Schenuit & Geden, in press) and with those, complexity. Although wide-ranging reforms are inevitable in closing the implementation gap and key to effective coordination, risks stemming from a “holistic approach” need to be taken into account.

A key constraint is limited resources. Each legislative initiative requires a substantial amount of attention from members of the European Parliament, national lawmakers, environmental NGOs, journalists, business associations, and other stakeholders. Given that even the EC’s resources are stretched to the limit (Guillot, 2021), the impact on effective exclusion of less well-staffed actors is even more pronounced than in less demanding times. This overload leads to transparency and participation problems. In the flood of strategy documents and legislative proposals, it is not only challenging for stakeholders to identify critical points but also hard to make oneself heard. While EU institutions and domestic administrations and policymakers are key actors in enacting policies, it is not only their legislative overburden that could impede implementation. Limitations in stakeholder capacities to deal with complex sets of reform initiatives also create risk. First, important problems and loopholes might remain unnoticed by stakeholders, directly affecting the quality of the policy output. Second, the sidelining of some stakeholders might undermine the legitimacy and acceptability

of the policies. In general, initiatives like the EU Green Deal are promising tools to achieve deep decarbonization, which inevitably requires linkages and coordination between policy fields. However, they also incorporate risks, as political liability and accountability can easily be diffused and the burden on lawmakers and stakeholders can become excessive. This can only be avoided by stretching the process over time and by prior capacity building. In turn, this conflicts with the urgency of closing the implementation gap. How to best strike a balance between these conflicting objectives requires further research.

3.1.5. Clash of Ideologies

Political ideology could contribute to the implementation gap by impeding the policy-formulation process both directly and indirectly by making it harder to resolve distributional or coordination conflicts. There is anecdotal evidence around specific policy failures at least partially attributed to ideology (Rosenow & Eyre, 2016). Related evidence backs the hypothesis that ideology matters in policy-formulation processes. First, specific forms of energy production tend to have a clear “political home,” as do specific climate policy instruments (Kulin et al., 2021; Mildenerger et al., 2022; Ziegler, 2017). In the climate-cum-energy realm, three ideologically different transition strategies have been identified: state-centred, market-centred, and grassroots-centred (Thonig et al., 2020). Second, ideologies and environmental values have been shown to shape voters’ preferences over policy instruments (McCright et al., 2016; Sommer et al., 2022).

It is difficult to assess whether ideology is actually shaping policy-formulation processes to a significant extent, as it is not easy to distinguish it from interest-group politics (Carter & Little, 2021) and the framing of policy instruments (Clarke et al., 2015; Stecula & Merkley, 2019). Furthermore, partisan ideologies are a notoriously moving target (Carter & Little, 2021). The yet limited empirical research in this area suggests that ideology has a rather small role on policy ambition (Thonig et al., 2020), but may indeed have an influence on the policy-formulation process stage (Abban & Hasan, 2021; Gromet et al., 2013). Whether this influence is *causal* remains a question for future research.

3.2. *Obstacles to the Impact of Climate-Policy Instruments*

The second set of obstacles interferes with closing the implementation gap primarily, but not necessarily exclusively, during the process of turning policy outputs into outcomes, i.e., emissions reductions. The link between policies formulated and emissions abated might be less than perfect because either the instruments do not work as intended or they are not enforced properly.

3.2.1. Counter-Productive Interactions Between Instruments

Emission impacts of overlapping instruments are typically not additive. In particular, the ETS and other climate policies such as coal phaseouts, renewable support, and energy-efficiency measures interact in complex and sometimes counterproductive ways (Willner & Perino, 2022). Both the extent and direction of interaction are determined by details of the overlapping policy and the ETS. In 2019, the Market Stability Reserve (MSR) was introduced into the ETS to “enhance synergy with other climate and energy policies” (Decision of 6 October 2015, 2015, p. 2). The MSR achieves this only for overlapping policies that induce abatement early on. Interventions that allow market participants to anticipate additional abatement several years in advance (e.g., coal phaseouts) can even increase total emissions. It therefore creates an environment that substantially complicates the creation of a coherent and effective climate policy mix. The Fit-for-55 package contains provisions that amplify both the productive and the counterproductive interaction effects (Perino et al., in press). Overall, this makes it less likely that the impact of individual measures can be tracked and that in total they sum up to the ambitious reduction targets. While first quantifications of these interactions exist (Bruninx & Ovaere, 2022), empirical evidence in particular would be welcome.

The German coal phaseout is a prominent example: In a stepwise process, Germany forces coal and lignite plants out of the market by 2038, with emissions from these plants already being subject to the decreasing cap of the ETS. In 2018, the ETS was adjusted in two ways to ensure that overlapping policies have an impact on overall emissions: The MSR now automatically cancels part of the allowances freed up by overlapping policies, and member states were granted the right to cancel allowances unilaterally to support mandated coal phaseouts (Directive of 14 March 2018, 2018, Art. 12(4)). While automatic cancellations render coal phaseouts partially effective, they reduce the effectiveness of unilateral cancellations (Gerlagh & Heijmans, 2019). The German Coal Phaseout Act explicitly refers to both provisions and cancels allowances, taking the impact of the MSR into account. The government recently commissioned two independent reports to learn what that means in practice.

3.2.2. Compliance, Enforcement, and the Limits of Soft Governance

Enforcement of policy outputs is a crucial prerequisite for them to translate into actual emission reductions. Enforcement can be hampered by a lack of competencies or inadequate procedures and efforts. The EU’s lack of competencies affects the implementation of the GHG target somewhat and that of the renewable and energy-efficiency targets substantially. The reason is that member states retain the sovereignty to at least

broadly determine their own energy mixes, and interfering requires unanimous votes in the Council. Given the current heterogeneity in priorities across member states, this is highly unlikely to occur. As far as emission targets of the ESR and the ETS are concerned, they constitute forms of hard governance that can be enforced, e.g., based on Articles 8 and 9 of the ESR (Peeters & Athanasiadou, 2020). National sovereignty is protected in Article 192(2) of the TFEU only to the extent that measures significantly affecting a member state's choice between different energy sources and the general structure of its energy supply require unanimous votes. For the renewable and efficiency targets, the constraint is more restrictive (TFEU, Art. 194(4)). In the Regulation on the Governance of the Energy Union (Regulation of 11 December 2018, 2018), the EU, therefore, resorts to “soft governance” measures to induce member states to comply with the renewable and efficiency targets. However, there are severe concerns that the tools available will not be sufficient to deliver (Knodt et al., 2021). The proposed strengthening of the renewable and efficiency targets as part of the REPowerEU (European Commission, 2022) in light of the war against Ukraine increases the tension between the EU's ambition and ability to enforce it.

Even in areas where competencies are well defined, policies might not induce the intended emission reductions. Distributional conflicts, complexity, and coordination failures increase the likelihood of ambiguities and loopholes in the legal text (see, e.g., Romppanen, 2020). The incentive to file lawsuits increases in the size of both the stakes involved and loopholes and ambiguities in the law. The salience of conflicts could also result in incentives to invest insufficient effort in monitoring and enforcement. Moreover, the more drastic the measures taken, the more likely are disproportionate infringements on the basic rights of those affected. In Germany, constitutional law requires all state entities to pursue the goals of the FCCA, i.e., compliance with the temperature goals of the Paris Agreement (The Federal Constitutional Court, 2021, 2022). At the same time, the constitution sets limits on mitigation measures, e.g., the fundamental right of property. This constrains how the renovation of the building stock and the phase-out of fossil fuels can be induced. Typically, the proportionality of measures must be ensured through financial compensation, raising the fiscal costs of closing the implementation gap.

4. Which Drivers Help Close the Implementation Gap?

Next, we revisit a select list of drivers of climate-related regulation and assess whether they are effective in closing the implementation gap.

4.1. Climate Protests

The climate protest movement gained massive momentum in 2019. With their focus on protest events organized around major political events such as UNFCCC

Conferences of the Parties (COPs) or elections, Fridays for Future helped target adjustment (Siddi, 2021). The movement has not been equally effective in reducing the implementation gap, yet. This is at least partially intended, as the ambition gap has clear priority for the movement and diverging views about details of implementation may likely risk cohesion of the group. There is evidence of such heterogeneity in the movement (Bugden, 2020; Huttunen, 2021; Marquardt, 2020). Furthermore, the Covid-19 pandemic was a severe setback for the protest movement (Haßler et al., 2021), and even the pre-Covid-19 momentum may have been close to maximum capacity (Jarke-Neuert et al., 2021). In sum, it seems that the climate protest movement as it stands is not a major force in closing the implementation gap. However, new strategies could be taken up to more effectively exert pressure to overcome the salience of the burdens (Section 3.1.2) associated with implementation and to hold all levels of government accountable (Section 3.1.3; Pohlmann et al., 2021). Empirical evidence on the movement's impact on specific instruments is still missing.

4.2. Climate Litigation

Another driver pushing towards effective climate-related regulation is climate litigation in favor of decarbonization (Zengerling et al., 2021). For about two decades, there has been a rise in lawsuits against governments, administrations, and companies that seek to enhance creation, design, and enforcement of climate law on various scales (Setzer & Higham, 2021). While some of the recent climate cases, for example, the Urgenda case and the Climate Case Ireland, have targeted the ambition gap, climate litigation also has significant potential to contribute to closing the implementation gap. For example, in April 2021 the German Federal Constitutional Court issued a landmark climate ruling in response to four constitutional complaints which had been brought by individuals and NGOs (The Federal Constitutional Court, 2021, 2022). Complainants had challenged the target and the design of the German 2019 FCCA, especially in regard to its effective implementation. Their winning argument was that the FCCA does not sufficiently specify the emission reduction pathway from 2031 onwards. The decision had two key effects on the implementation gap. As an immediate consequence of the ruling, the German government enacted a revised version of the FCCA which is significantly more precise in its emission reduction pathway beyond 2031. Breaking down the long-term targets into annual sub-targets is a first step in framing tailored climate policies. In addition, and arguably groundbreaking, the court decision established a new fundamental right to climate protection in interpreting the German constitution in an innovative way (Callies, 2021). This new fundamental right paves the way for a new generation of climate litigation in Germany and has great potential to contribute to closing implementation gaps.

It significantly strengthens the constitutional basis for framing legal arguments on the admissibility, as well as on the merits, of climate cases against the national and state governments as well as private companies (Deutsche Umwelthilfe, 2022). Future research should assess how much it contributes to enforcement (Section 3.2.2) and the policy formulation process (Section 3.1).

4.3. Knowledge Production and Scientific Advice

There is wide consensus on the science of climate change (IPCC, in press-a). While targets are always political rather than purely scientific objects (Livingston & Rummukainen, 2020), scientists, by and large, have rallied behind the Paris targets and adjusted their research agendas accordingly (Hänsel et al., 2020; Tollefson, 2021). There is widespread agreement that achieving the 1.5°C target requires reaching net-zero carbon emissions around the middle of this century which, for example, implies phasing out (“unabated”) coal power (COP26, 2021). However, whether coal should be replaced by renewables or nuclear or cleaned up with carbon capture and storage is disputed in both science and politics as the recent debate over the EU taxonomy has highlighted. Expert advice on instrument choice and design is also heterogeneous (European Association of Environmental and Resource Economists, 2019; Rosenbloom et al., 2020; van den Bergh & Botzen, 2020). Instruments differ in the distribution of control, economic costs and benefits, and blame and glory between actors and groups within societies, and hence directly contribute to raising the salience of burdens (Section 3.1.2). Stakeholders tend to support instruments that minimize their own burden, and jointly with scientific experts form “instrument constituencies” (Simons & Voß, 2018) advocating for certain modes of governance. At the same time, scientific expertise is crucial in designing instruments that are effective in reducing emissions, i.e., by avoiding counter-productive interactions within the regulatory landscape (Section 3.2.1). The combination of insights from different disciplines and types of expertise into a comprehensive assessment of climate policy mixes and communication of it to policymakers remains a challenge for the scientific community.

4.4. UN Climate Governance

The Paris Agreement has been an important driver in raising climate policy ambitions in the EU—and vice versa (Oberthür & Groen, 2017). However, in terms of implementation, it is much less effective. This is, to a significant extent, by design. The compliance mechanism of the Paris Agreement is only “facilitative” and “non-punitive,” and the enforcement branch established under the Kyoto Protocol was not maintained (Paris Agreement, Art. 15; Voigt, 2016). The transparency framework tasked to “promote effective implementation” also explicitly restricts its role to be “facilitative” and “respectful of national sovereignty, and [to] avoid placing undue burden on

Parties” (Paris Agreement, Art. 13). In practice, the principle of “naming and shaming” meant to provide incentives for both raising ambitions and implementing NDCs has turned into “claiming and shining” where countries showcase punctual successes and specific critique is rare (Aykut et al., in press).

5. Conclusions

The world is currently heading towards the failure of the Paris Agreement. We have identified the implementation gap as the key reason and argue in favor of shifting attention to this gap and zooming in on the conditions for closing it.

Our contribution in this respect is threefold. First, we offer a conceptual framework that helps researchers and policymakers fix ideas on the implementation gap. Second, we highlight a set of generic obstacles for closing this gap from economic, legal, and political science perspectives and locate them in the “upstream” policy-formulation and the “downstream” policy-effect legs, respectively. We believe this aids in focusing efforts on closing the gap. Third, we discuss the potential effectiveness of a selected list of prominent drivers of climate-related regulation in overcoming the obstacles.

Overall, we arrive at the following assessment: Closing the implementation gap under the voluntary architecture of the Paris Agreement requires voters and interest groups to place continuous pressure on governments at all levels not only to set and stick to abatement pledges but to put effective climate policy instruments in place. Litigation might play an important role in keeping governments on track even if polls or vested interests urge them to take it easy. Furthermore, the quality of the social and institutional fabric of our societies will be crucial in moderating inevitable distributional, ideological, and responsibility conflicts. Better understanding the role of formal and informal institutions as facilitators—or obstacles—in transformation processes and the role of the (social) sciences themselves, are important avenues for future research.

Acknowledgments

All authors gratefully acknowledge financial support from the German Research Foundation under Germany’s Excellence Strategy—EXC 2037 “CLICCS: Climate, Climatic Change, and Society”—Project No. 390683824. We thank Stefan Aykut, Anne Gerstenberg, Kai-Uwe Schnapp, Frank Wendler, and Antje Wiener as well as three anonymous referees for helpful comments and Jane Torbert, Anna Hendrych, and Finn Faber for research assistance.

Conflict of Interests

Grischa Perino has received a research grant (2016–2021) from the Federal Ministry of Economic Affairs, Germany, and has acted as a consultant for the

Directorate-General for Climate Action (DG CLIMA) of the European Commission, the German Federal Ministry of Economic Affairs and Climate Action, and the German Emission Trading Authority on issues relating to the EU ETS. Specifically, he is part of the team preparing one of the reports on the number of emission allowances to be cancelled as part of the German coal phaseout mentioned in Section 3.2.1. No party had the right to review or did review the article prior to submission. All other authors declare no conflict of interests.

References

- Abban, A. R., & Hasan, M. Z. (2021). Revisiting the determinants of renewable energy investment: New evidence from political and government ideology. *Energy Policy*, 151, Article 112184.
- Aklin, M., & Mildemberger, M. (2020). Prisoners of the wrong dilemma: Why distributive conflict, not collective action, characterizes the politics of climate change. *Global Environmental Politics*, 20(4), 4–27.
- Aykut, S., Schenuit, F., d'Amico, E., & Klenke, J. (in press). It's a performance, not an orchestra! Rethinking soft coordination in global climate governance. *Global Environmental Politics*.
- Bruninx, K., & Ovaere, M. (2022). Covid-19, Green Deal and recovery plan permanently change emissions and prices in EU ETS Phase IV. *Nature Communications*, 13(1), Article 1165. <https://doi.org/10.1038/s41467-022-28398-2>
- Bugden, D. (2020). Does climate protest work? Partisanship, protest, and sentiment pools. *Socius: Sociological Research for a Dynamic World*, 6. <https://doi.org/10.1177/2378023120925949>
- Cairney, P., Heikkilä, T., & Wood, M. (2019). *Making policy in a complex world*. Cambridge University Press.
- Callies, C. (2021). Das "Klimaurteil" des Bundesverfassungsgerichts: „Versubjektivierung“ des Art. 20aGG? [The "Climate Ruling" of the Federal Constitutional Court: "Subjectification" of Article 20aGG?]. *Zeitschrift für Umweltrecht*, 6, 355–357.
- Carter, N., & Little, C. (2021). Party competition on climate policy: The roles of interest groups, ideology and challenger parties in the UK and Ireland. *International Political Science Review*, 42(1), 16–32.
- Ćetković, S., & Buzogány, A. (2019). The political economy of EU climate and energy policies in Central and Eastern Europe revisited: Shifting coalitions and prospects for clean energy transitions. *Politics and Governance*, 7(1), 124–138.
- Clarke, C. E., Hart, P. S., Schuldt, J. P., Evensen, D. T., Boudet, H. S., Jacquet, J. B., & Stedman, R. C. (2015). Public opinion on energy development: The interplay of issue framing, top-of-mind associations, and political ideology. *Energy Policy*, 81, 131–140.
- Convery, F. J. (2009). Origins and development of the EU ETS. *Environmental and Resource Economics*, 43(3), 391–412.
- COP26. (2021). *The Glasgow Climate Pact*. <https://unfccc.int/documents/310475>
- Cory, J., Lerner, M., & Osgood, I. (2021). Supply chain linkages and the extended carbon coalition. *American Journal of Political Science*, 65(1), 69–87.
- Decision (EU) 2015/1814 of the European Parliament and of the Council of 6 October 2015 concerning the establishment and operation of a market stability reserve for the Union greenhouse gas emission trading scheme and amending Directive 2003/87/EC (2015). *Official Journal of the European Union*, L 264.
- Deutsche Umwelthilfe. (2022). *Wir klagen für mehr Klimaschutz* [We are suing for more climate protection]. <https://www.duh.de/klimaklagen>
- Deutscher Bundestag. (2019). *Entwurf eines Gesetzes zur Einführung eines Bundes-Klimaschutzgesetzes und zur Änderung weiterer Vorschriften* (Bundestagsdrucksache 19/14337) [Draft law for the introduction of a Federal Climate Change Act and amendment of further rules].
- Deutscher Bundestag. (2020). *Entwurf eines Gesetzes zur Reduzierung und zur Beendigung der Kohleverstromung und zur Änderung weiterer Gesetze (Kohleausstiegsgesetz)* (Bundestagsdrucksache 19/17342) [Draft law for the reduction and termination of coal-based power generation and amendment of further rules (Coal Phaseout Act)].
- Directive (EU) 2018/410 of the European Parliament and of the Council of 14 March 2018 amending Directive 2003/87/EC to enhance cost-effective emission reductions and low-carbon investments, and Decision (EU) 2015/1814 (2018). *Official Journal of the European Union*, L 76.
- Dubash, N. K., Pillai, A. V., Flachsland, C., Harrison, K., Hochstetler, K., Lockwood, M., MacNeil, R., Mildemberger, M., Paterson, M., Teng, F., & Tyler, E. (2021). National climate institutions complement targets and policies. *Science*, 374(6568), 690–693. <https://doi.org/10.1126/science.abm1157>
- Dupont, C., & Oberthür, S. (2016). While EU institutions and domestic administration and policymakers are key actors in enacting policies, it is not only their legislative overburden that poses a risk. In R. K. W. Wurzel, J. Connelly, & D. Liefferink (Eds.), *The European Union in international climate change politics: Still taking a lead?* (pp. 66–79). Routledge.
- Dupont, C., Oberthür, S., & von Homeyer, I. (2020). The Covid-19 crisis: A critical juncture for EU climate policy development? *Journal of European Integration*, 42(8), 1095–1110.
- Edenhofer, O., Franks, M., & Kalkuhl, M. (2021). Pigou in the 21st century: A tribute on the occasion of the 100th anniversary of the publication of *The Economics of Welfare*. *International Tax and Public Finance*, 28(5), 1090–1121.
- European Association of Environmental and Resource Economists. (2019). *Economists' statement on carbon pricing*. <https://www.eaere.org/statement>

- European Commission. (2022). *Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions REPowerEU: Joint European Action for more affordable, secure and sustainable energy* (COM/2022/108 final).
- Federal Environment Agency, & German Federal Ministry for Economic Affairs and Climate Action. (2022, March 15). *Treibhausgasemissionen stiegen 2021 um 4,5 Prozent* [Greenhouse gas emissions up 4.5 per cent in 2021] [Press release]. <https://www.umweltbundesamt.de/presse/pressemitteilungen/treibhausgasemissionen-stiegen-2021-um-45-prozent>
- Federal Ministry for Economic Affairs and Climate Action. (2022). *Germany's current climate action status*. <https://www.bmwi.de/Redaktion/EN/Downloads/E/germany-s-current-climate-action-status.pdf>
- Friedlingstein, P., Jones, M. W., O'Sullivan, M., Andrew, R. M., Bakker, D. C. E., Hauck, J., Le Quééré, C., Peters, G. P., Peters, W., Pongratz, J., Sitch, S., Canadell, J. G., Ciais, P., Jackson, R. B., Alin, S. R., Anthoni, P., Bates, N. R., Becker, M., Bellouin, N., . . . Zeng, J. (2022). Global carbon budget 2021. *Earth System Science Data*, *14*(4), 1917–2005. <https://doi.org/10.5194/essd-14-1917-2022>
- Fuo, O., Zengerling, C., & Sotto, D. (2022). A comparative legal analysis of urban climate mitigation and adaptation in the building sector in Brazil, Germany, and South Africa. *Climate Law*, *12*(1), 32–97.
- Gerlagh, R., & Heijmans, R. J. (2019). Climate-conscious consumers and the buy, bank, burn program. *Nature Climate Change*, *9*(6), 431–433.
- Gromet, D. M., Kunreuther, H., & Larrick, R. P. (2013). Political ideology affects energy-efficiency attitudes and choices. *Proceedings of the National Academy of Sciences*, *110*(23), 9314–9319.
- Guillot, L. (2021, June 25). Eurocrats burn out under “insane” Green Deal workload. *Politico*. <https://www.politico.eu/article/european-commission-green-deal-staff-burnout-workload>
- Hänsel, M. C., Drupp, M. A., Johansson, D. J. A., Nesje, F., Azar, C., Freeman, M. C., Groom, B., & Sterner, T. (2020). Climate economics support for the UN climate targets. *Nature Climate Change*, *10*, 781–789. <https://doi.org/10.1038/s41558-020-0833-x>
- Haßler, J., Wurst, A.-K., Jungblut, M., & Schlosser, K. (2021). Influence of the pandemic lockdown on Fridays for Future's hashtag activism. *New Media & Society*. Advance online publication. <https://doi.org/10.1177%2F14614448211026575>
- Huttunen, J. (2021). Young rebels who do not want a revolution: The non-participatory preferences of Fridays for Future activists in Finland. *Frontiers in Political Science*, *3*, Article 672362.
- Intergovernmental Panel on Climate Change. (in press-a). *Climate change 2021: The physical science basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge University Press.
- Intergovernmental Panel on Climate Change. (in press-b). *Climate change 2022: Mitigation of climate change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge University Press.
- Jarke-Neuert, J., Perino, G., & Schwickert, H. (2021). *Free-riding for future: Field experimental evidence of strategic substitutability in climate protest*. ArXiv. <https://doi.org/10.48550/arXiv.2112.09478>
- Khan, M. (2021, December 17). EU leaders battle over carbon price as energy costs soar. *Financial Times*. <https://www.ft.com/content/eefea72d-0441-4edf-9d56-2e4d835cd4dc>
- Knill, C., Schulze, K., & Tosun, J. (2012). Regulatory policy outputs and impacts: Exploring a complex relationship. *Regulation & Governance*, *6*(4), 427–444.
- Knodt, M., Müller, R., Schlacke, S., & Ringel, M. (2021). (Un)Fit for 55! Ohne eine verschärfte Governance-Verordnung sind die Klimaziele 2030 nicht zu erreichen [(Un)Fit for 55! Without tightened governance regulation, the 2030 climate targets cannot be achieved]. *Integration*, *44*(4), 287–300.
- Koalitionsvertrag. (2021). *Mehr Fortschritt wagen: Bündnis für Freiheit, Gerechtigkeit und Nachhaltigkeit* [Dare more progress: Alliance for freedom, justice and sustainability]. <https://www.bundesregierung.de/breg-de/service/gesetzesvorhaben/koalitionsvertrag-2021-1990800>
- Köck, W., & Kohlrausch, L. (2021). Klimaschutzgesetzgebung im Bundesstaat—Zur Zukunft der Landesklimaschutzgesetze [Climate protection legislation in the federal state: On the future of state climate protection legislation]. *Zeitschrift für Umweltrecht*, *2021*(11), 610–617.
- Kulin, J., Sevä, I. J., & Dunlap, R. E. (2021). Nationalist ideology, rightwing populism, and public views about climate change in Europe. *Environmental Politics*, *30*(7), 1111–1134.
- Liu, P. R., & Raftery, A. E. (2021). Country-based rate of emissions reductions should increase by 80% beyond nationally determined contributions to meet the 2°C target. *Communications Earth & Environment*, *2*(1), Article 29.
- Livingston, J. E., & Rummukainen, M. (2020). Taking science by surprise: The knowledge politics of the IPCC Special Report on 1.5 degrees. *Environmental Science & Policy*, *112*, 10–16.
- Marquardt, J. (2020). Fridays for Future's disruptive potential: An inconvenient youth between moderate and radical ideas. *Frontiers in Communication*, *5*, Article 48.
- McCright, A. M., Dunlap, R. E., & Marquart-Pyatt, S. T. (2016). Political ideology and views about climate change in the European Union. *Environmental Politics*, *25*(2), 338–358.

- Meckling, J., & Nahm, J. (2022). Strategic state capacity: How states counter opposition to climate policy. *Comparative Political Studies*, 55(3), 493–523.
- Meinshausen, M., Lewis, J., McGlade, C., Gütschow, J., Nicholls, Z., Burdon, R., Cozzi, L., & Hackmann, B. (2022). Realization of Paris Agreement pledges may limit warming just below 2 °C. *Nature*, 604(7905), 304–309. <https://doi.org/10.1038/s41586-022-04553-z>
- Meng, K. C., & Rode, A. (2019). The social cost of lobbying over climate policy. *Nature Climate Change*, 9(6), 472–476.
- Mildenberger, M., Lachapelle, E., Harrison, K., & Stadelmann-Steffen, I. (2022). Limited impacts of carbon tax rebate programmes on public support for carbon pricing. *Nature Climate Change*, 12, 141–147.
- Morawiecki, M. (2022, January 3). PM Morawiecki: The EU ETS system driven by speculators must be reformed. *EURACTIV*. <https://www.euractiv.com/section/emissions-trading-scheme/opinion/pm-morawiecki-the-eu-ets-system-driven-by-speculators-must-be-reformed>
- Oberthür, S., & Groen, L. (2017). The European Union and the Paris Agreement: Leader, mediator, or bystander? *Wiley Interdisciplinary Reviews: Climate Change*, 8(1), Article e445.
- Peeters, M., & Athanasiadou, N. (2020). The continued effort sharing approach in EU climate law: Binding targets, challenging enforcement? *Review of European, Comparative & International Environmental Law*, 29, 201–211.
- Perino, G., Willner, M., Quemin, S., & Pahle, M. (in press). Policy Brief—The EU ETS Market Stability Reserve: Does it stabilize or destabilize the market? *Review of Environmental Economics and Policy*.
- Pohlmann, A., Walz, K., Engels, A., Aykut, S. C., Altstaedt, S., Colell, A., Dietrich, U., Feddersen, H., Friedrich, A., Klenke, J., Krieger, F., Schenuit, F., Datchoua-Tirvaudey, A., Schulz, M., & Zengerling, C. (2021). It's not enough to be right! The climate crisis, power, and the climate movement. *GAIA—Ecological Perspectives for Science and Society*, 30(4), 231–236. <https://doi.org/10.14512/gaia.30.4.5>
- Rayner, T., & Jordan, A. (2016). Climate change policy in the European Union. In H. von Storch (Ed.), *Oxford research encyclopedia of climate science*. <https://doi.org/10.1093/acrefore/9780190228620.013.47>
- Rayner, T., Szulecki, K., Jordan, A., & Oberthür, S. (Eds.). (in press). *Handbook on European Union climate change policy and politics*. Edward Elgar.
- Regulation (EU) 2018/842 of the European Parliament and of the Council of 30 May 2018 on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030 contributing to climate action to meet commitments under the Paris Agreement and amending Regulation (EU) No 525/2013 (2018). *Official Journal of the European Union*, L 156.
- Regulation (EU) 2018/1999 of the European Parliament and of the Council of 11 December 2018 on the Governance of the Energy Union and Climate Action, amending Regulations (EC) No 663/2009 and (EC) No 715/2009 of the European Parliament and of the Council, Directives 94/22/EC, 98/70/EC, 2009/31/EC, 2009/73/EC, 2010/31/EU, 2012/27/EU and 2013/30/EU of the European Parliament and of the Council, Council Directives 2009/119/EC and (EU) 2015/652 and repealing Regulation (EU) No 525/2013 of the European Parliament and of the Council (2018). *Official Journal of the European Union*, L 328.
- Regulation (EU) 2021/1119 of the European Parliament and of the Council of 30 June 2021 establishing the framework for achieving climate neutrality and amending Regulations (EC) No 401/2009 and (EU) 2018/1999 ('European Climate Law') (2021). *Official Journal of the European Union*, L 243.
- REN21. (2021). *Renewables 2021: Global status report*. https://www.ren21.net/wp-content/uploads/2019/05/GSR2021_Full_Report.pdf
- Romppanen, S. (2020). The LULUCF regulation: The new role of land and forests in the EU climate and policy framework. *Journal of Energy & Natural Resources Law*, 38, 261–287.
- Rosenbloom, D., Markard, J., Geels, F. W., & Fuenfschilling, L. (2020). Opinion: Why carbon pricing is not sufficient to mitigate climate change—And how “sustainability transition policy” can help. *Proceedings of the National Academy of Sciences*, 117(16), 8664–8668.
- Rosenow, J., & Eyre, N. (2016). A postmortem of the Green Deal: Austerity, energy efficiency, and failure in British energy policy. *Energy Research & Social Science*, 21, 141–144.
- Schenuit, F., & Geden, O. (in press). Carbon dioxide removal: Climbing up the EU climate policy agenda. In T. Rayner & K. Szulecki (Eds.), *Handbook on European Union climate change policy and politics*. Edward Elgar.
- Schenuit, F., Colvin, R., Fridahl, M., McMullin, B., Reisinger, A., Sanchez, D. L., Smith, S. M., Torvanger, A., Wreford, A., & Geden, O. (2021). Carbon dioxide removal policy in the making: Assessing developments in 9 OECD cases. *Frontiers in Climate*, 3, Article 638805. <https://doi.org/10.3389/fclim.2021.638805>
- Schlacke, S., Wentzien, H., Thierjung, E. M., & Köster, M. (2022). Implementing the EU Climate Law via the “Fit for 55” package. *Oxford Open Energy*. Advance online publication. <https://doi.org/10.1093/ooenergy/oiab002>
- Setzer, J., & Higham, C. (2021). *Global trends in climate litigation: 2021 snapshot*. Grantham Research Institute on Climate Change and the Environment; Centre for Climate Change Economics and Policy. <https://www.lse.ac.uk/granthaminstitute/wp-content/uploads/>

[2021/07/Global-trends-in-climate-change-litigation_2021-snapshot.pdf](https://doi.org/10.1080/15567249.2020.1811806)

- Siddi, M. (2021). Coping with turbulence: EU negotiations on the 2030 and 2050 climate targets. *Politics and Governance*, 9(3), 327–336.
- Simons, A., & Voß, J.-P. (2018). The concept of instrument constituencies: Accounting for dynamics and practices of knowing governance. *Policy and Society*, 37(1), 14–35.
- Skjærseth, J. B. (2021). Towards a European Green Deal: The evolution of EU climate and energy policy mixes. *International Environmental Agreements: Politics, Law and Economics*, 21(1), 25–41.
- Sognaes, I., Gambhir, A., van de Ven, D.-J., Nikas, A., Anger-Kraavi, A., Bui, H., Campagnolo, L., Delpiazzi, E., Doukas, H., Giarola, S., Grant, N., Hawkes, A., Köberle, A. C., Kolpakov, A., Mittal, S., Moreno, J., Perdana, S., Rogelj, J., Vielle, M., & Peters, G. P. (2021). A multi-model analysis of long-term emissions and warming implications of current mitigation efforts. *Nature Climate Change*, 11(12), 1055–1062. <https://doi.org/10.1038/s41558-021-01206-3>
- Sommer, S., Mattauch, L., & Pahle, M. (2022). Supporting carbon taxes: The role of fairness. *Ecological Economics*, 195, Article 107359.
- Stecula, D. A., & Merkley, E. (2019). Framing climate change: Economics, ideology, and uncertainty in American news media content from 1988 to 2014. *Frontiers in Communication*, 4, Article 6. <https://doi.org/10.3389/fcomm.2019.00006>
- Szulecki, 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.
- The Federal Constitutional Court. (2021). *Beschluss des Ersten Senats vom 24. März 2021* (1 BvR 2656/18) [Order of the First Senate of 24 March 2021]. http://www.bverfg.de/e/rs20210324_1bvr265618en.html
- The Federal Constitutional Court. (2022). *Beschluss der 1. Kammer des Ersten Senats vom 18. Januar 2022* (1 BvR 1565/21) [Order of the Federal Constitutional Court, 1st Chamber of the First Senate of 18th January 2022] http://www.bverfg.de/e/rk20220118_1bvr156521.html
- Thonig, R., Del Río, P., Kiefer, C., Lázaro Touza, L., Escrivano, G., Lechón, Y., Späth, L., Wolf, I., & Lilliestam, J. (2020). Does ideology influence the ambition level of climate and renewable energy policy? Insights from four European countries. *Energy Sources, Part B: Economics, Planning, and Policy*, 16(1), 4–22. <https://doi.org/10.1080/15567249.2020.1811806>
- Tollefson, J. (2021). Top climate scientists are skeptical that nations will rein in global warming. *Nature*, 599(7883), 22–24.
- Treaty on the Functioning of the European Union (Consolidated version), 2012.
- van den Bergh, J., & Botzen, W. (2020). Low-carbon transition is improbable without carbon pricing. *Proceedings of the National Academy of Sciences*, 117(38), 23219–23220.
- van Gaal, W. (2021, December 21). Poland threatens to veto EU’s Fit for 55. *EUobserver*. <https://euobserver.com/climate/153877>
- Voigt, C. (2016). The compliance and implementation mechanism of the Paris Agreement. *Review of European, Comparative & International Environmental Law*, 25(2), 161–173.
- Wickel, M. (2021). Das Bundes-Klimaschutzgesetz und seine rechtlichen Auswirkungen [The Federal Climate Protection Act and its legal implications]. *Zeitschrift für Umweltrecht*, 2021(6), 332–339.
- Wickel, M. (2022). Klimaschutz—und Energiegesetze der Länder [State climate protection and energy laws]. In M. Ludwigs (Ed.), *Berliner Kommentar zum Energierecht, Band 3: Energieumwelt—und Energieeffizienzrecht, Energieanlagenrecht* [Berlin commentary on energy law, volume 3: Energy environment and energy efficiency law, energy system law] (pp. 512–588). Recht und Wirtschaft.
- Willner, M., & Perino, G. (2022). Beyond control: Policy incoherence of the EU emissions trading system. *Politics and Governance*, 10(1), 256–264.
- Zengerling, C., Aykut, S., Wiener, A., & Wickel, M. (2021). Climate litigation. In D. Stammer, A. Engels, J. Marotzke, E. Gresse, C. Hedemann, & J. Petzold (Eds.), *Hamburg climate futures outlook 2021: Assessing the plausibility of deep decarbonization by 2050*. Cluster of Excellence Climate, Climatic Change, and Society.
- Ziegler, A. (2017). Political orientation, environmental values, and climate change beliefs and attitudes: An empirical cross-country analysis. *Energy Economics*, 63, 144–153.

About the Authors



Grischa Perino is a professor of economics at the University of Hamburg, Germany. His research focuses on the choice, design, impact, and interaction of climate policy instruments. An expert on the EU ETS, he has markedly contributed to the understanding of the Market Stability Reserve over the past years and has consulted the European Commission and the German Emission Trading Authority on the Market Stability Reserve. He is a principal investigator within the German Cluster of Excellence “Climate, Climatic Change, and Society” and serves as co-editor at *Environmental and Resource Economics*.



Johannes Jarke-Neuert holds a PhD in economics from Heidelberg University and is currently a research associate at the Center for Earth System Research and Sustainability and a fellow at the cluster of excellence “Climate, Climatic Change, and Society” (CLICCS) of the University of Hamburg. He does theoretical and empirical research on human cooperation, environmental behaviour and governance, and means of climate action.



Felix Schenuit is a research associate at the German Institute for International and Security Affairs in Berlin, Germany. His research focuses on climate change policies and politics in the European Union and under the United Nations Framework Convention on Climate Change (UNFCCC), with a particular focus on the governance of carbon dioxide removal. He is an associated member of the Center for Sustainable Society Research and the German Cluster of Excellence “Climate, Climatic Change, and Society.”



Martin Wickel is a professor of law and administration at the HafenCity University Hamburg. He specializes in planning, building, and environmental law. In his research, he covers these fields as they relate to German constitutional, administrative, and European law. His publications and research projects range from subjects in the field of urban and spatial planning law to infrastructure planning and various subjects in the field of environmental law and, in particular, the law of climate protection and adaptation to climate change. He is a member of the Cluster of Excellence “Climate, Climatic Change, and Society” (CLICCS).



Cathrin Zengerling is an assistant professor at the University of Freiburg and heads the research group “Urban Footprints” as a Freigeist-Fellow of the VolkswagenFoundation. She holds a PhD in international environmental law from the University of Hamburg and a Master of Laws from the University of Michigan. Her research focuses on climate law, (international) environmental and energy transition law, the role of cities in combating climate change and resource depletion, climate litigation, as well as climate change and trade. She is a member of the German Cluster of “Excellence Climate, Climatic Change, and Society” and co-editor of the journal *Klima und Recht*.