Policy Change: Concept, Measurement, and Causes

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Preface

When I decided to come to Cologne in order to write my dissertation at the Research Training Group Social Order Life Chances Institute and the Cologne Center for Comparative Politics, I had no idea of the extraordinary scientific environment that awaited me. I was impressed by the inspiring and professional research climate, the strong integration of members, and the team spirit among colleagues was overwhelming. I also appreciated the support of our Soclife board. This environment helped me to develop the topic of my dissertation.

First of all I would like to express my deep gratitude to my research supervisors Professor Kaiser, Professor Andreß, and Professor Rohlfing for their patient guidance, enthusiastic encouragement and useful critiques of this research work. I gained much support from the numerous colloquia and seminars, where my research thoughts were discussed and evaluated. My special thanks goes to the Soclife board and my colleagues who did not get tired of repeatedly commenting on my dissertation. I also want to thank all of the scholars from both cohorts that helped me to refine my research in various personal discussions, colloquia, and seminars. Organizing workshops with them gave me tremendous feedback. My special thanks are extended to the following scholars of Soclife that read and commented on my papers with enormous patience: Jenny Bennett, Katja Möhring, Annelene Wengler, Alexander Schmitt, Dennis Spies, Pascal Siegers, Richard Norrie, and Judith Niehues. Advice given by Romana Careja has been a great help; especially in the first years of my research work. I am grateful to her for her intensive guidance in the beginning of my research.

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Content

Chapter 1: Introduction

Introduction

> "Change is the core business of all sciences, from biology and genetics to anthropology and sociology. The question is: why, when, and how does change occur, and what does such change really mean? Trying to provide answers to such questions is the unending task of all involved in the field of scientific study."(Capano, 2009)

> "Climate change is the most intractable collective action challenge in human history, being inherently global, extremely long term, technologically demanding, and replete with distributional difficulties, among countries, people, and generations." (Wolf, 2012, p. 777)

Policy change is one of the central issues of political science, public administration, sociology, and law studies (Grant and Kelly, 2008, Howlett and Cashore, 2009, Jones and Baumgartner, 2012, Sabatier, 2007, Tsebelis, 1999, Clinton and Dryzek, 2006, Knill et al., 2010a). Research on this theme dates back to the late 1950s when scholars like Herbert Simon (1957), Charles Lindblom (1959), and Thomas Kuhn (1962) postulated "that general patterns of policy development cannot only be identified but predicted" (Howlett and Cashore, 2009). Understanding and explaining policies and policy change became important with the increasing involvement of the state in more and more realms of social life: "The modern state is widely seen as an active and as a proactive state, increasingly managing, shaping, even creating its constituent population" (Pierson, 2004a).

The analysis on policies and policy change is at the core of current political science scholarship because the theoretical and empirical insights are strongly related to the other dimensions of political systems: *polity* (political institutions) and *politics* (maneuvering and bargaining of political actors) (Tosun, 2013, Mahoney, 2000, Baumgartner et al., 2011, Tsebelis, 2010). As Dye has stated: "policy analysis is finding out what governments do, why they do it, and what difference it makes" (Dye, 1976). Policy analysis therefore creates an

essential link between polity and politics on the one side and policy outcomes on the other side.

The last two decades have seen a tremendous activity in the explanation of policy change. Debates have centered on the role of ideas (Beland and Hacker, 2004, Pedersen, 2007, Schmidt, 2008, Blyth, 2003), actors (Richardson, 2000, Schmidt, 1996, Allan and Scruggs, 2004, Iversen and Stephens, 2008, Vis and van Kersbergen, 2005, Sabatier and Jenkins-Smith, 1993), and institutions (Immergut, 1994, Tsebelis, 1995, Kaiser, 1997, Peters, 1999, MacIntyre, 2002) as competing and coordinated explanatory accounts. However, despite a plethora of studies, there is little generalization and comparability of findings. Recently, a number of scholars have attributed this inconsistency to the lack of a common understanding and operationalization of the concept of policy change – the so-called "dependent variable problem" (Cashore and Howlett, 2007, Howlett and Cashore, 2009, Graham et al., 2012, Green-Pedersen, 2004, Kuhner, 2007, Pierson, 2001).

Therefore, my dissertation attempts to make three major contributions towards solving this problem: 1) the thesis provides a theoretical framework for *policy output* and develops an empirical measurement for it; 2) it argues that one needs to consider entire *policy portfolios* rather than individual instruments for a meaningful assessment of policy change; 3) and it analyzes how the nature of the *policy field* affects the assessment and explanation of policy change.

At the core of the "dependent variable problem" is the conceptual and methodological challenge to capture what we really mean by policy output. The challenges are interdependent. An undefined concept of policy output and policy change has resulted in simplistic and highly variable measurements of policies and policy change such as the diffusion of single policy instruments across countries. These in turn have limited scholars ability for theory testing, refinement, and development. My contribution integrates the

concept of policy instruments into a three-level schema of goals/instrumental logics, objectives/mechanisms, and settings/calibrations as suggested by Howlett and Cashore (2007, 2009) and provides a comparable measure of policy output: the *Index of Climate Policy Activity*. The major focus is on the level of policy instruments as "a technical device with the generic purpose of carrying a concrete concept of the politics/society relationship and sustained by a concept of regulation" (Lascoumes and Le Gales, 2007). This "set of techniques by which governmental authorities wield their power in attempting to ensure support and effect social change" (Bemelmans-Videc *et al.* 1998, p. 50) reveals concrete policy output with real and actual consequences. This focus allows an integration of the specific settings/calibrations as a measure of the policy instruments' intensity as well as an aggregation of these characteristics towards an instrumental logic or policy style of the policy portfolio.

Second, a large number of studies on policy change is on single or pre-selected sets of policy instruments rather than on the policy portfolio, i.e. the entirety of all instruments adopted and active in a policy field. This approach is limited when investigating policy change of whole policy fields because it might give a selective impression that is not valid for the whole portfolio. I demonstrate the utility of a portfolio perspective for two theoretical approaches of policy change. One central heuristic to understand policy change has been the difference between evolutionary incremental and path-breaking revolutionary shifts in the policy paradigm (Capano, 2009, Capano and Howlett, 2009, Cashore and Howlett, 2007). In this model, innovations are seen as a substantial trigger of policy change. My dissertation shows that this perspective requires policy portfolios as a basis for assessment since the innovative character of policies cannot be defined in absolute terms but relative to the existing policy context. The second debate has looked at policy change in a qualitative perspective asking the question if there is a trend in policy-making towards a lower involvement of the

state (Dent et al., 2007, Lemos and Agrawal, 2006, Steurer, 2011). My results reveal that despite the existence of new instruments, traditional policy predominates even in the newly emerging policy field of climate mitigation where national-policymaking starts from scratch.

Third, the majority of studies on policy change were conducted in long established policy fields such as social security (Gough, 2001, Hölsch and Kraus, 2006, Whiteside and Salais, 1998, Bouget, 2003, Olesen, 2009, Kuhner, 2007, Korpi and Palme, 2003) or economic policy (Keefer and Stasavage, 2003, Hall, 1993, Hallerberg and Basinger, 1998, Merkel, 2003, Tsebelis and Chang, 2004). Theoretical work similarly assumes that policy change consists mostly of policy successions (Hogwood and Peters, 1982, Hogwood and Peters, 1983) which are often path-dependent (Pierson, 2001). Consistent with the observation that the state filters into more and more areas of society (Pierson, 2004a), many new policy fields have emerged over the last decades and continue to emerge. These new fields provide a very different context for decision-making considering that new actors and coalitions are evolving, preferences have to be formed, and both are more variable and subject to framing processes or political bargaining (Massey and Huitema, 2013, Howlett et al., 2009, Hogwood and Peters, 1983). This high level of dynamic and the uncertainty in the decision-making context of new fields could challenge assumptions of the policy change literature relying on fields with engrained institutions, relatively stable actor coalitions, epistemic communities and preferences. Therefore, it is important to understand if policy change looks and works differently under these conditions. This dissertation focuses on climate mitigation policies as an exemplary case of a new policy field that only started to be under public regulation in the early 1990s (Harrison and Sundstrom, 2007, Wurzel and Connelly, 2011). My findings show that climate mitigation policy, although newly established, relies predominantly on traditional instruments. My research also indicates that mobilizing actors (climate leaders) are more important than veto players preferences for explaining policy change in this field.

In Section 1 of this introduction, I discuss existing frameworks of policy output and outline how this dissertation attempts to address the levels of abstractions discussed by Howlett and Cashore (2007, 2009). In Section 2, I demonstrate the limitations of policy change analyses, which focus on single instruments, and the benefits of a policy portfolio perspective. Section 3 describes the challenges of emerging policy fields in general and climate mitigation policy in particular. The state-of-the-art empirical studies in the newly emerging field of climate mitigation are discussed in Section 4. I summarize the contribution of this dissertation and assess the selected research design in Section 5. Finally Section 6 provides an overview of the four publications constituting this cumulative dissertation, clarifies their publication status, and explains how they interrelate to the overarching goal of improving our understanding of policy change.

1 The "Dependent Variable Problem" and Policy Output

The "dependent variable problem" of policy change points to the fact that policy output as the core concept of policy change is analyzed differently across studies (Howlett and Cashore, 2009, Green-Pedersen, 2004, Kuhner, 2007). The concept of policy output describes political action capturing laws, policy, policy instruments, measures, principles, or policy programs giving "concrete form to the generalized intentions of statements of policy. [...] [Policy outputs] [...] combine in different ways the basic resources and tools of governments – laws, public personnel, public expenditure, tax incentives and exhortation" (McConnell, 2010).

One framework addressing the conceptual vacuum by Howlett and Cashore (2007, 2009) is to consider two commonalities: (i) distinguishing between ends and means, and (ii) differentiating between levels of abstraction. Differentiating between ends and means is established practice in policy science (Cashore and Howlett, 2007, Howlett and Cashore, 2009, Hall, 1993) although sometimes different terms such as goals and means (Jenkins,

1978), goals and tools (Ingram et al., 2007, Schneider and Sidney, 2009), intention and tools (McConnell, 2010), as well as intention and action (Page, 2006) are used. As Howlett and Cashore (2007, 2009) argue, this differentiation can be made on three analytical levels of abstraction (see Table 1). On the highest level of abstraction, overarching goals determine the general policy targets while norms of goal-implementation define what kind of instruments are used to reach these goals. The medium level includes objectives and mechanisms, i.e. the specific types of policy instruments that are used. On the lowest level of abstraction, settings define the specific on-the-grounds requirements of policy instruments whereas calibrations describe the way in which instruments are used. Howlett and Cashore (2007, 2009) argue that the levels of abstraction are interdependent:

> "the range of choices left at the micro-level of concrete targeted policy tool calibrations is restricted by the kinds of meso level decisions made about policy objectives and policy tools, and both of these, in turn, are restricted by the kind of choices made at the highest or meta-level of general policy aims and implementation preferences" (Howlett and Cashore, 2009).

This trajectory allows us to systematize the variety of studies on policy change according to their assumption on which level of abstraction different modes of policy change take place. Scholars widely agree upon Hall's (1993) distinction between an evolutionary incremental and revolutionary paradigmatic mode of change but come to different conclusion on which levels these changes occur (Capano, 2009, Coleman et al., 1996). Hall argues that first order change in settings/calibrations and second order changes of objectives/mechanisms are considered to be incremental whereas third order change is inherently paradigmatic, constituting a more fundamental shift in goals/instrument logic (Cashore and Howlett, 2007, Howlett and Cashore, 2009, Coleman et al., 1996). There are at least three competing approaches which discuss this argumentation: path dependency, process sequencing, and what

can be captured under the term of cumulative incrementalism (for a review see Capano, 2009, Howlett and Rayner, 2006, Van der Heijden, 2013).

Table 1 Taxonomy on Ends and Means and Different Levels of Abstraction

			Policy Content	
		High Level Abstraction	Programme Level Operationalization	Specific On-the-Ground Measures
	Policy Ends or Aims	**GOALS** **What General Types of Ideas Govern Policy Development?** (e.g. environmental protection, economic development)	**OBJECTIVES** **What Does Policy Formally Aim to Address** (e.g., saving wilderness or species habitat, increasing harvesting levels to create processing jobs)	**SETTINGS** **What are the Specific On-the-ground Requirements of Policy** e.g. considerations about the optimal size of designated stream-be riparian zones, or sustainable levels of harvesting)
Policy Focus				
	Policy Means or Tools	**INSTRUMENT LOGIC** **What General Norms Guide Implementation Preferences?** (e.g. preferences for the use of coercive instruments, or moral suasion)	**MECHANISMS** **What Specific Types if Instruments are Utilized?** (e.g. the use of different tools such as tax incentives of public enterprises)	**CALIBRATIONS** **What are the Specific Ways in Which the Instrument is used?** (e.g. designations of higher levels of subsidies, the use of mandatory vs. voluntary regulatory guidelines or standards)

Source: Howlett and Cashore (2009)

First, the path dependency approach describes in detail what has been formulated by Hall (1993) that paradigmatic change appears only "top-down" from the highest level of abstraction which determines shifting objectives/mechanisms and settings/calibrations (Hacker, 2004, Mahoney, 2000). In contrast, change on the lower levels of abstraction is only incremental and has no paradigmatic influence on the goals/instrument logic. In general, early, stochastic events in a sequence have significant influence on the trajectory due to reinforcing mechanisms whereas later events are inertial and incremental (Howlett and Rayner, 2006, Mahoney, 2000, Pierson, 2000, Pierson, 2001). At critical junctures or during

windows of opportunity, is "when anomalies accumulate, policies fail, and the authority of the original policy paradigm is undermined" (Coleman et al., 1996), and there is the possibility for paradigmatic change to a new path (Collier and Collier, 1991, Kingdon, 1995).

Second, the process sequencing approach and its most prominent application, the punctuated equilibrium model, follows the idea of cycles switching between incremental and paradigmatic sequences of change (Howlett, 2009, Baumgartner and Jones, 2009). Previous policies can create stable sequences accomplished by non-cumulative negative feedbacks (Bardach, 2006, Mahoney, 2000). They can also entail positive feedbacks by negative externalities when strong public and media attention on external shocks (e.g., catastrophic events like Hurricane Sandy in the US in October 2012) draws a new issue on the political agenda and mobilizes new interests among stakeholders (Haydu, 1998, De Vries, 2000, De Vries, 2005, Baumgartner et al., 2009, Jones and Baumgartner, 2012). This situation might eventually require more radical adjustments, transformations, or even the revision of policies (Van der Heijden, 2013, Genschel, 1997). Again, changes on the lower levels of abstraction in settings/calibrations as well as objectives/mechanisms are rather incremental whereas more substantial and paradigmatic change only occurs "top-down" from the highest level of goals/instrument logic.

Third, cumulative incrementalism describes a number of approaches all criticizing process sequencing on the basis of empirical cases where "shocks do not always result in institutional change, and institutional change does not always come from such shocks" (Van der Heijden, 2010, see also Genschel, 1997, Pierson, 2004b) but rather as a result of cumulative adaption (Capano, 2003, Cashore and Howlett, 2007, Coleman et al., 1996, Lee and Strang, 2006, Ramesh and Howlett, 1995)[1]. Incrementalism argues that paradigmatic

[1] This form of incrementalism is based on what has been discuss in the literature on institutional change under the terms "layering", "conversion", "drifting" or "displacement"; see Hall, P. A. & Thelen, K. A. (2008)

policy change might also occur "bottom-up" from the lower levels of abstraction by unpredicted and influential consequences of policy adjustments (Howlett and Cashore, 2009, Daugbjerg and Sonderskov, 2012). These feedbacks "may change the perceived distributional effects and thus change stakeholders' policy interests" (Daugbjerg and Sonderskov, 2012) including processes of increasing returns and policy learning which require further adjustments and eventually lead to a paradigmatic shift (Coleman et al., 1996, Pierson, 1993). Coleman, et al.'s (1996) findings even suggest:

> "Rather than paradigm shift that follows a society-wide debate in the partisan political arena or a principled confrontation in the judicial system, the paradigm change we have described is gradual and results from negotiations conducted over a number of years within the relatively depoliticized confines of an existing policy network." (p. 298)

Institutional Change in Varieties of Capitalism. *Socio-Economic Review,* 7**,** 7-34, Mahoney, J. & Thelen, K. A. (2010) *Explaining Institutional Change: Ambiguity, Agency, and Power,* Cambridge, Cambridge University Press, van der Heijden, J. (2011) Institutional Layering: A Review of the Use of the Concept. *Politics,* 31**,** 9-18, Streeck, W. & Thelen, K. A. (2005) *Beyond Continuity: Institutional Change in Advanced Political Economies,* Oxford, Oxford University Press. For a discussion and typology on how "layering", "conversion", "drifting" or "displacement" addresses different levels of abstraction see also Kern, F. & Howlett, M. (2009) Implementing Transition Management as Policy Reforms: a Case Study of the Dutch Energy Sector. *Policy Sciences,* 42**,** 391-408. Specific models captured under the term "cumulative incrementalism" are called neo-homeostatic (endogenous determinants lead to gradual paradigmatic steps by changing settings and calibrations), quasi-homeostatic (paradigmatic change by objectives and types of instruments), or thermostatic (endogenous change in objectives and settings with no change in goals and instrumental logic), see Cashore, B. & Howlett, M. (2007) Punctuating Which Equilibrium? Understanding Thermostatic Policy Dynamics in Pacific Northwest Forestry. *American Journal of Political Science,* 51**,** 532-551, Howlett, M. & Cashore, B. (2009) The Dependent Variable Problem in the Study of Policy Change: Understanding Policy Change as a Methodological Problem. *Journal of Comparative Policy Analysis,* 11**,** 33-46.

Unto this point it should be clear from the discussion of the different approaches that considering policy change on these different levels of abstraction is critical for understanding the complexity of the dependent variable. It will be demonstrated in Section 5 that the environmental policy literature lacks this holistic perspective and only focuses on single levels of abstraction rather than applying an inclusive concept of policy output.

2 The "Dependent Variable Problem" and the Policy Portfolio

Policy change has been studied in various ways but is dominantly based on case study research either on single countries, innovations, or types of policy instruments (Howlett and Rayner, 2004, Cashore and Howlett, 2007, van der Heijden, 2012, Harrison, 2010). The case study literature provides detailed insight on the process of policy making and implementation. We gain substantial knowledge about when, how, why and under what circumstances certain actors, coalitions, ideas or interests accomplished the adoption of specific types of policy instruments or modes of governance.

However, this methodological approach hardly allows studying policy change in its complexity of the policy portfolio. In the literature, there is a debate on whether policy change means a fundamental "modification of existing policy arrangements" (Tosun, 2013, see also Hacker, 2004, Pierson, 2004b, Huitema and Meijerink, 2010) or wether it is simply the adoption of a new policy (Knill et al., 2012b, Knill et al., 2010b, Busch et al., 2005). In fact, all theories on policy change discussed in Section 1 include a notion of an incremental accumulation of policy instruments towards a certain point in the process where the portfolio "tips" towards a new paradigmatic shift (Hall, 1993, Cashore and Michael, 2007, Capano and Howlett, 2009, Howlett, 2009). Path dependency assumes that the accumulation of policy instruments is only incremental but leads to a more paradigmatic shift at a certain external "key breakpoint in history" while all following policy instruments adopted after this point in

time can be interpreted as ”a series of reactions that logically follow from this breakpoint” (Mahoney, 2000, see also Hall, 1993). Process sequencing also applies an aggregate perspective on policy change arguing that in sequences of stability policy instruments cluster around the status quo and only occasionally accumulate in a tipping point towards a new shift in the policy paradigm if the policy equilibrium is “punctuated” by external shocks (Baumgartner et al., 2011). Studies following the idea of cumulative incrementalism even assumes that there are cases of paradigmatic policy change that result from an accumulation of policy instruments in the policy portfolio set into one direction that is independent from external shocks, punctuations or windows of opportunities (Cashore and Michael, 2007).

The fact that the accumulation of policy instruments is one central mechanism for policy change supports the position that we need to analyze whole policy portfolios (Tosun, 2013, Hacker, 2004, Pierson, 2004b, Huitema and Meijerink, 2010). And even if we follow the second perspective discussed above – that the adoption of single policy instruments itself constitutes policy change – the question is still how to evaluate their real impact on policy change in the policy field. Kern and Howlett (2009) argue that the magnitude of change that newly adopted policy instruments induce depends on their degree of deviation (inconsistency, incoherence, and incongruence) from the existing policy mix. Furthermore, explanations of policy change take into consideration the specific political context as the major determinant for the adoption of new policy instruments (Van der Heijden, 2010, Tosun, 2013, Mahoney, 2000). The policy portfolio itself constitutes an important part of the context that influences political interests and coalitions, policy preferences, benefits, etc. (Jordan et al., 2013, Tosun, 2013, Lascoumes and Le Gales, 2007). This suggests that the contribution of each newly adopted or modified policy instrument to the actual policy change of the policy portfolio can only be evaluated within the respective context of the existing policy mix of the portfolio. In fact, we find the reflection of single or selected groups of policy instruments on the entire

policy portfolio in a policy field to be a crucial element discussed in the literature on policy innovation (Walker, 1969, Berry and Berry, 2007, Black et al., 2005) and new governance (Dent et al., 2007, Hanssen et al., 2009, Lemos and Agrawal, 2006, Steurer, 2011).

Policy innovation is defined as "a program or policy which is new to the states adopting it, no matter how old the program may be or how many other states may have adopted it" (Walker, 1969). In contrast to policy inventions, innovations are not new in a global perspective but their "innovativeness" depends upon the existing policy portfolio in a specific country. In other words, what is "new" very much depends on the context. For example, if we study the adoption and diffusion of a declared policy innovation such as an eco-tax across countries, we are neither able to assess if this really constitutes an innovation (in the national context) nor if the country is generally innovative (as is often assumed of early adopters) unless we consider the existing policy portfolio. For example, an eco-tax on electricity is widely considered to be highly innovative (Pedersen, 2007, Harrison, 2010, Barker et al., 2007) but which part of it and under which scope exactly is not as straightforward as it seems. For example, from an energy policy perspective, the eco-tax is not a new instrument but simply extends the scope of an instrument that formerly focused on all energy sources equally but is now focused on fossil fuels. In contrast, within the portfolio of environmental instruments, it is an innovation since taxes have not been used before to stimulate environmentally friendly behavior.

Furthermore, the governance literature discusses the role of the state in a changing and increasingly complex and global society (Dent et al., 2007, Hanssen et al., 2009, Lemos and Agrawal, 2006, Steurer, 2011). Whether a shift in the relationship between public authorities and private actors constitute a substantial change in policy output cannot be captured without considering the portfolio of policy instruments. For example, voluntary agreements between national governments and local industries are discussed in the literature as a new instrument

to create inter-organizational, decentralized, and independent networks (Oikonomou et al., 2009, van der Heijden, 2012). The appearance of these instruments are often discussed as an example of how policy output in general is shifting from traditional and hierarchical forms of "government" to new modes of decentralized and non-coercive "governance" (Jordan et al., 2005, Jordan et al., 2003). Without considering the policy portfolio the scholars' ability to test this "government-to-governance" hypothesis is limited. In fact, scholars from this stream of research demonstrate that these new "modes of governance" often manifested in policy instruments as voluntary agreements are mostly working in the "shadow of hierarchy" defined as "the presence of the machinery of government and the (theoretical) option of regulating social and environmental issues hierarchically (Steurer, 2011, see also Scharpf, 1994, Hanssen et al., 2009, Carrigan and Coglianese, 2011). That this "shadow" is not necessarily theoretical but persists in a larger portfolio of traditional and hierarchical instruments has been demonstrated by a number of studies of voluntary agreements (Lyon and Maxwell, 2004, King and Lenox, 2000, Steurer, 2010). Given these findings, voluntary agreements are not as influential on stimulating policy change when considering the overall policy portfolio as they seemed without.

3 The "Dependent Variable Problem" and the Newly Emerging Policy Field

While most of the empirical policy analyses are strongly focused on their individual fields, theories of policy change (as general theories should) assume that their validity is universal. However, in order to substantiate this claim it is of utmost importance to test these theories in policy fields with different characteristics. If these tests can be conceptualized along theoretical dimensions, so-called "mixed evidence" can provide important insights about the conditions under which the theory is valid and thus contribute to its refinement.

The theoretical dimension that this dissertation has focused on is the distinction between old, established and new, emerging policy fields (Massey and Huitema, 2013, Howlett et al., 2009, May et al., 2006, Birkland, 2011, Arts et al., 2006). While empirically it might sometimes be difficult to define the specific moment once a field has transitioned from a new to an established field, historically we can clearly observe a differentiation of existing policy fields (Massey and Huitema, 2013). Defense and foreign policy for instance belong to the state competencies that even feudalist and absolutist states had whereas social policy has its early beginnings at the end of the 19th century and its strong development in the aftermath of the Second World War (Pierson, 2004a). However, even within the last three decades a number of new policy fields and subfields have emerged such as organic farming policy (Moschitz and Stolze, 2009), integration policy (Rosenow, 2009), long-term care policy (Theobald and Kern, 2011), innovation policy (Møller, 2010) and internet policy (Ess and Dutton, 2013).

What makes the distinction between established and emerging fields interesting for the analysis of policy change? New and old policy fields provide a different context for political decision-making and policy change. The most important difference is that in emerging fields – as they are evolving – actors, interests, and ideas, even institutions are more dynamic (e.g, Coleman et al., 1996, John and Margetts, 2003). Historic institutionalism has strongly argued for the significance of path dependencies in established fields: actors, interests, and coalitions are set, existing policies determine future decisions through positive feedback, e.g. vested interests (Pierson, 2004b, Mahoney and Thelen, 2010, Streeck and Thelen, 2005, Thelen, 1999). Most "new" policies in these established fields constitute policy successions, maintenance, and terminations rather than innovations (Hogwood and Peters, 1982, Baumgartner et al., 2009, Hall and Taylor, 1996). Paradigmatic change is rare as it requires

windows of opportunities or the accumulation of small changes over time (Cashore and Howlett, 2007, Howlett and Cashore, 2009, Howlett, 2009).

In contrast to that, new fields are characterized by a high degree of uncertainty about the relevant actors and their preferences, the boundaries of the problems, and the strategies and technologies to tackle them (Howlett et al., 2009). New policy fields do not completely start from scratch and actors and policies from bordering areas will shape discourses and decision-making in the new field. However, newly emerging policy fields address cross-sectoral and multidisciplinary issues which include overlapping institutions of government and interest groups and thus increase the overall number and diversity of actors and interests (John and Margetts, 2003, True et al., 1999). The involvement and the role of new actors have to be clarified and negotiated creating the uncertainty these new fields are characterized by.

The increasing range of policy fields that have emerged during the last thirty to forty years result from the changing perspective of human action in a more and more diversified environment. On the one hand, new policy fields such as integration or internet policy result from human-induced factors such as the internationalization of the private sphere through global trade, mobility, and communication networks (Møller, 2010, Ess and Dutton, 2013, Rosenow, 2009). On the other hand, what has changed is the scientific perspective on our natural environment as a global system which asked for new political solutions to increasingly "wicked" problems (Tollefson et al., 2012, Gale, 2009). On a geographical scale, the environment refers to distinct areas where human infrastructure and natural habitats for animals and plants interact within complex systems such as regional water circles or even global climate. On a temporal scale, scientists nowadays become aware that natural systems are globally dependent and at a constant change influenced by human action such as economic growth, urbanization, exploitation of natural resources, or migration and population growth. This has led towards a development of policy fields addressing the complex and

global human-society-environment interaction with the most renown being the preservation of global biodiversity and the mitigation of climate change.

The case of a newly emerging policy field that this dissertation has focused on is the issue of climate mitigation. There are a number of specific challenges this particular field imposes on traditional policy making. First, political actors striving for climate mitigation are challenged by a high level of uncertainty on the consequences of climate change and the success of actual measures to mitigate global warming (Pearce et al., 1989). One source of uncertainty and failure to predict changes accurately lies in the non-linear character of the process of climate change which assumes that once a tipping point is reached larger climatic changes become irreversible and persistent (Caulfield, 2004, Duhaime and Caron, 2006). Hence, success and failure of certain policy instruments for climate mitigation depend on a variety of uncertain factors such as the development of prices of conventional energy in the world market (Carfi and Schiliro, 2012, Kikuchi, 2011, Laurent-Lucchetti and Leach, 2011, Doman, 2004). For example, until now it is highly controversial whether the EU Emission Trading Scheme will have an actual effect on the net reduction of greenhouse gases (Alexeeva-Talebi et al., 2008, Löschel and Vincent, 2008).

Second, the challenge is that actual policy has to change today's status quo of current behavior, interests, and rents for the reduction of greenhouse gases in order to reach the future long-term and highly uncertain goal of climate mitigation (Stern, 2007, Bowen et al., 2012, Boeters and Koornneef, 2011). On the one hand, it is discussed whether current climate mitigation policy risks decreasing the competitiveness of local industries' products on globalized markets (Löschel and Vincent, 2008, Hentrich et al., 2009, van Asselt and Biermann, 2007). On the other hand, climate mitigation policy is no longer an ideologically driven and diffuse aim of a political subgroup such as the Greens but that emerged as a business model and driver of economic modernization in the field of renewable energy

production and technological innovation (Bohringer et al., 2012, Dewald and Truffer, 2011, Fankhauser et al., 2008, Frondel et al., 2010, Aitken, 2010, Birchfield and Duffield, 2011, Chandler, 2009, Claudy et al., 2011). Thus, it is strongly linked with other political issues such as energy security and independence, centralization vs. decentralization of the energy system, or environmental and intergenerational justice (Bina and La Camera, 2011, Cowell et al., 2011, Ikeme, 2003, Jänicke, 2009, Carley, 2011, Lin et al., 2013, Radoman, 2007, Sovacool et al., 2011). These issues are highly complex but also provide a number of side payments for political bargaining during the process of policy making.

New policy fields emerge because issues such as global warming are successfully mobilized to the national political agenda (Baumgartner, 2013, Baumgartner and Jones, 2009). This process can take a variety of forms, e.g. external shocks, the accumulation of local problems and/or solutions, etc. As in the case of climate mitigation, however, new issues are more and more often mobilized by international and supranational institutions such as the United Nations and the EU. These institutions play a powerful role in shaping national discourses as will be outlined in the following section.

4 State-of-the-Art: Climate Mitigation Policy in Europe

"Among the factors that challenge environmental governance structures, global climate change promises to be one of the most critical" (Lemos and Agrawal, 2006). Climate change refers to human-induced emission of greenhouse gases (carbon dioxide, methane, nitrous oxide, sulphur hexafluoride) predominantly in the developed world since the industrial revolution. The major emissions come from carbon dioxide produced by fossil-fuel usage for electricity, industrial production and manufacturing, transportation, and agriculture (IPCC, 2007). Long-term effects are rising sea levels, increased droughts, and higher frequency of extreme weather events (IPCC, 2007). As a consequence, climate change is geographically

global but local in its consequences, with contemporary causes but future consequences (Lemos and Agrawal, 2006, Tollefson et al., 2012, Gale, 2009).

The problem of climate change has been addressed on various political levels ranging from international negotiations within the United Nations Framework Convention on Climate Change (UNFCCC), EU climate mitigation programs, and national climate policy. International efforts to reach an agreement on the reduction of greenhouse gas emissions under the UNFCC aim to effectively avoid greenhouse gases where they are cheapest (e.g. Pearce et al., 1989) and to equalize marginal abatement costs across firms, sectors and countries (EBRD, 2011, Schaffrin, forthcoming). Climate change has been on the international agenda since the Rio Summit on Environment and Development in 1992. In the following years, emission targets have been set with the overarching goal of keeping the global temperature rise to 2° C compared to preindustrial levels. This goal was codified in an international treaty, the Kyoto Protocol to the UNFCCC in 1997 and signed by 37 industrialized countries and the EU which agreed to adopt policies on the national-level to meet these targets. However, the achievements to reduce global greenhouse gases after twenty years of debate are highly uncertain given the failure of the international community to establish an agreement at the latest climate conferences in Durban (South Africa, 2011) and Doha (Qatar, 2012) (den Elzen et al., 2009, Campbell, 2013).

Second, on the *supra-national level*, the EU played an outstanding role as an international leader in climate mitigation politics (Conca, 2005, Schreurs and Tiberghien, 2007, Fernandez et al., 2010). Climate change has been intensively discussed since the early 1990s by domestic political elites in Western Europe which was supported by strong environmental movements and the electoral success of green parties throughout European parliaments (Schreurs and Tiberghien, 2007, Rihoux and Rudig, 2006, Fabian, 2010). As early as 1990, the EU sought to set voluntary emission reduction targets and was a major

player during the Kyoto Protocol negotiations in 1997. During the process of ratification from 1998 to 2005, the EU played a key role convincing other countries to make stronger concessions to reduce domestic greenhouse gas emissions (Schreurs and Tiberghien, 2007, Wurzel and Connelly, 2011). In 2005, the EU implemented its carbon emissions trading scheme (ETS) (Directive 2003/87/EC), one of the world's most ambitious and encompassing climate policy instruments covering about 12,000 installations (Schreurs and Tiberghien, 2007, Wurzel and Connelly, 2011, Löschel and Vincent, 2008). Two years later, the European Council announced the 20/20/20 agreement within the EU Climate and Energy Package (Number 406/2009/EC) which comprises a 20% reduction in greenhouse gas emissions of 1990 levels, including a target of 20% of renewables of total energy consumption by 2020 as a keystone to establish effective policies on the national level (Wurzel and Connelly, 2011, Stephenson and Boston, 2010).

However, the European Union's actual influence on national climate mitigation policy remains limited. Despite the Commission's initial support for specific market-based instrument to increase the share of renewable energy in the late 1990s and early 2000s, top-down harmonization ultimately failed in 2005 and since then has largely disappeared from the Union's agenda (Toke and Lauber, 2007). The influence of the Commission is largely limited to monitoring national policies and to assessing whether Member States are on track to reach the national targets laid down in the directives (Kitzing et al., 2012, Haas et al., 2011). Thus, despite the prominence of EU-wide agreements on climate mitigation, nation states are the central actors for actual implementation (e.g., Bulkeley et al., 2012, Green Globe, 2013, Hovi et al., 2009). The core drivers on the national level from the beginning were environmental-leader states such as Denmark, the Netherlands, and Germany which played a crucial role pushing an ambitious climate mitigation policy, outbalancing laggards in Southern and Eastern Europe (Wurzel and Connelly, 2011, Liefferink et al., 2009, Knill et al., 2012a). As a

result, we observe substantial variation in the regulatory efforts and national strategies on climate mitigation among EU member states (Albrecht and Arts, 2005, Kerr, 2007, Tubi et al., 2012, Garrone and Grilli, 2010). National policy portfolios on climate mitigation can be of varying size and shape adopting a range of instruments such as traditional pollution control (regulative instruments or command-and-control) to voluntary or market-based instruments (e.g. carbon taxes, emission trading schemes, feed-in tariffs) (Busch et al., 2005, Tews et al., 2003, Bomberg, 2007, Jordan et al., 2005).

5 State of the Art: Climate Policy Research and Policy Change

While the previous sections have situated the contribution of my dissertation in the general policy literature, this part provides an overview of the state-of-the-art in the policy field my work has focused on: climate mitigation policy. Research on climate mitigation policy is still highly embedded within in the more general environmental policy literature. I demonstrate how my work fits into the existing research in this field and where it moves beyond the current state of knowledge. The "dependent variable problem" identified for policy change can be observed in this literature as well and it is further complicated through the multilevel governance structure outlined in the previous section. Using the schema from Howlett and Cashore (2007, 2009) again, we can systematize existing work according to the level of abstraction and in addition to the level of investigation (from global to local) as shown in Table 2.

On the macro level of goals and the instrumental logic, policy output is conceptualized from an international relations perspective as the national ratification and commitment towards international treaties such as the Kyoto Protocol (Battig and Bernauer, 2009, Bernauer and Böhmelt, 2013, Bhatti et al., 2010, Zahran et al., 2007). The focus of this line of work is on the role of specific actors (governments, non-governmental organizations, business

lobbies, etc.) within the process of political bargaining (Bernauer and Böhmelt, 2013, Böhringer and Löschel, 2003, Pittel and Rübbelke, 2008, Giorgetti, 1999). An analysis of global and supranational agreements is important considering the global nature of the problem and the need for a concerted solution. However, as international agreements are legally binding but hard to enforce, this line of research does not allow drawing conclusions on policy changes on the national level. For example, scholars would be interested to see if challenging international goals are actually translated into measures for climate mitigation with "real teeth" or whether national portfolios are mostly "symbolic". It also lacks an analysis of whether paradigmatic changes in goals are transferred into radical shifts in the instrumental logic and the choice of specific types of policy instruments. For example, highly ambitious national targets for the production of renewable energy can be implemented in a traditional way favoring large, centralized, monopolistic energy suppliers, for example, by supporting mainly large-scale offshore wind parks. Instead, these goals can lead to more radical changes in electricity production when policy measures strongly support decentralized and small-scale on-shore wind energy managed by local communities rather than large businesses (Wiener and Koontz, 2010).

These issues are addressed by research on the meso level which looks at national policy-making in individual countries or in cross-national comparison. One group of studies has emphasized policy stability and path dependency as a result of persistent national styles of regulation and policy making (Bailey and Rupp, 2005, Bailey, 2007, Lees, 2007). In contrast, the literature on environmental pioneer- and leadership (Wurzel and Connelly, 2011, Knill et al., 2012a, Liefferink et al., 2009) seeks to describe and explain policy change as processes of policy diffusion and convergence (Heichel et al., 2005, Busch and Jörgens, 2005a, Holzinger et al., 2011b).

Table 2: Research Perspectives on Different Levels of Abstraction

Level of abstraction	Level of investigation	Environmental policy literature	Concept of policy output
macro: goals and instrument logic	global, supranational, regional	international relations, multilevel governance	commitment/ leadership in international agreements and compliance with emission targets; target setting and implementation of EU regulation
meso: objectives and mechanism	cross-national, national	policy leaders and laggards, pioneers, policy diffusion/ convergence, policy styles, policy innovation	focus on single policy instruments relative to policy portfolio of the country or across countries; adoption of qualitatively distinct types of policy instruments
micro: settings and calibration	national, subnational, local	policy design, policy efficiency	detailed aspects of policy instrumentation such as revenues of taxes or carbon caps

A number of studies analyze the interaction between the levels of goals/instrument logic and objectives/mechanisms within the multilevel setting of EU climate politics (Schreurs and Tiberghien, 2007, Knill and Tosun, 2009, Knill, 1998, Knill et al., 2009). For example, Schreurs and Tiberghien (2007) find that domestic policy output on the meso level influenced the goal setting on the macro level when in fact single member states of the EU pushed for ambitious emission goals on the EU and the international level. At this point in time, these countries already established a portfolio on climate mitigation policies based on traditionally strong regulation for environmental protection of the domestic economy. Their intention had been to establish a global agreement in order to avoid free-riding and to gain competitiveness of their products in global markets. Several studies (Knill and Tosun, 2009, Knill et al., 2009, Knill, 1998) analyze if and how the European Union affects national policy adoption of EU standards on environmental impact assessment, nitrogen oxide emissions, and eco-labels. Their analysis indicates that the EU indeed stimulates new policies in countries but that its impact varies and is constrained by different national administrative traditions and levels of political, economic, or informational integration with the EU and the mode of

governance that is applied, i.e. hierarchical governance or information exchange. Albrecht and Arts (2005) investigate the interaction between the two levels of abstraction more directly looking at how domestic climate mitigation policy complies with international goals on greenhouse gas reduction using data on the National Communications of twenty-three European countries to the UNFCCC. They provide evidence that international targets influence the adoption of national climate mitigation policy and even stimulate a certain degree of convergence in the national policy output (Albrecht and Arts, 2005).

The majority of empirical research in this field applies a small-N case study design either focusing on individual types of instruments (e.g., voluntary agreements) (Bailey, 2008, van der Heijden, 2012, Fouquet and Johansson, 2008, Garrone and Grilli, 2010) or instruments with special characteristics (e.g., policy innovations) (Berry and Berry, 2007, Voß, 2007, Carley, 2011, Jordan et al., 2003, Jordan et al., 2005, Jordan et al., 2011, Jordan et al., 2013). These case studies provide evidence, for example, that new modes of governance have been evolving in climate mitigation policy but co-exist with traditional modes. However, if the aim is to comprehensively describe policy change in this field and to identify general trends and patterns, one needs to consider whole portfolios rather than individual instruments. Large-N analysis based on quantitative data can complement these analyses with a systematic assessment of country differences and changes for answering questions such as who are leaders, which countries are most innovative, etc.? There are only a handful of large N analysis with similar attempts (Kerr, 2007, Tubi et al., 2012, Garrone and Grilli, 2010, Knill et al., 2010a, Knill et al., 2012b) but they are either focused mostly on environmental rather than climate policies or use very limited measures for policy output such as the existence of a national climate policy program or public energy R&D spending. Tubi et al (2012) comes closest to a portfolio perspective by relying on the Germanwatch Index an expert rating of national climate mitigation performance for a comprehensive assessment of policymaking.

However, as a summary measure it lacks detailed information on instruments and their characteristics on the level of settings and calibrations.

Busch and Jörgens (2005b, 2005a) and Tews et al. (2003) find that a set of "new" environmental policy instruments and policy innovations such as energy taxes or eco-labels constitute new regulatory patterns in a number of countries through causal mechanisms of global policy convergence such as non-obligatory diffusion, legal harmonization and coercive imposition. However, its implicit assumption that the adoption of a number of "new" environmental instruments or policy innovations automatically constitutes a substantial change in the overall policy portfolio is questionable. First, single policy innovation might only be the exception from the rule if the majority of the policy portfolio remains with traditional modes of governance (Lemos and Agrawal, 2006, Jordan et al., 2013). Second, what is more influential to trigger policy change than the actual policy innovation is its interaction within the existing policy mix (Duval, 2008, Enevoldsen and Brendstrup, 2000, Johnson, 2007, Kemp and Pontoglio, 2011). Policy instruments that fit into the existing policy mix would not have substantial impact on policy change whereas highly deviating policy instrument might trigger interaction effects changing the whole policy portfolio. Third, as we know from the extensive case study literature, there is substantial variation in the specific settings and calibrations of policy instruments (Duval, 2008). Thus, "new" environmental policy instruments such as eco-taxes adapt to the specific administrative style predominant in the countries (Enevoldsen and Brendstrup, 2000, Harrison, 2010, Pedersen, 2007).

The last argument hints to the point that on this level of abstraction on objectives and mechanisms it is important to integrate settings and calibrations as well as the instrumental logic in order to provide a full picture of policy change. A number of studies only focus on policy instruments as the object of concern (Holzinger and Knill, 2005, Knill et al., 2010a, Busch and Jörgens, 2005b, Busch and Jörgens, 2005a, Tews et al., 2003). One network of

scholars clustered around Andrew Jordan, Rüdiger Wurzel, and Anthony Zito investigates the history of "new" environmental policy instruments in a number of countries (Jordan et al., 2003, Jordan et al., 2005, Wurzel and Connelly, 2011, Wurzel et al., 2013). These studies aggregate the findings from different case studies on the level of objectives and mechanisms to conclude on a change in the instrumental logic from traditional "government" to new modes of environmental "governance". Furthermore, we find a number of studies with the focus on policy objectives and mechanisms which include calibrations as a measure of the policy instruments' intensity, i.e. the "specific calibration of a given regulatory instrument" (Knill et al., 2012b) (Knill et al., 2010b, Knill et al., 2012b, Liefferink et al., 2009, Holzinger et al., 2011b, Jahn and Kuitto, 2011, Tosun, 2013). Each of these measures makes an important contribution by highlighting specific aspects about the instruments applied, for example, their scope, their instrument type or their calibration but no measure has tried to integrate these different dimensions.

The micro level is constituted by settings and calibrations. Studies on this level focus on the policy design and refinement of policy instruments concerning, for example, specific tax-rates of eco-taxes (van Asselt and Biermann, 2007, Verde and Tol, 2009, Raymond and Cason, 2011). The overarching question for this line of research has been to what extent nation states with different characteristics are capable of designing effective climate policy instruments (e.g., Carley and Miller 2012; Wiener and Koontz 2010). On this level, national characteristics and administrative styles have been identified as determinants which can either enable or hinder policy change and achievement of international goals (Matisoff, 2008, Dimitrova and Steunenberg, 2000, Weale et al., 1996, Weale et al., 2000). For instance, „[e]specially, high-regulating countries with a comprehensively and consistently developed regulatory framework of environmental instruments might face considerable problems of adjustment, if European policies reflect regulatory approaches that depart from domestic

arrangements.“ (Holzinger et al., 2011b) Scholars from this perspective argue that some of these administrative styles are more resistant towards policy change. Vogel (2003), for example, states that the institutionally powerful British government is constrained to certain types of instruments by its informal approach to enforcement and minimal use of prosecution against environmentally negative businesses on the lowest level of abstraction.

Considering, the young age of this policy field, there has been a great deal of research interest into policy change in climate mitigation policy. However, I have demonstrated that the focus of these studies is highly variable and measurement approaches are often selective and limited. While some studies try to bridge two levels of abstraction, for example, objectives and instruments, most work has focused on one of the three levels. A comprehensive analysis of instruments including goals/instrument logic, the level of objectives/mechanisms as well as calibrations/settings does not exist. Although the research questions of the work is highly diverse, many studies are interested in identifying leaders, (innovative) policy change or trends in policymaking (e.g., towards new modes of governance). However, the chosen research designs focusing mostly on case studies of selected instruments allow only a partial answer to these questions as they lack a comprehensive assessment of policy-making in the field. As I will outline in the following section, my dissertation addresses this research gap by investigating policy change by an integrative approach of the three levels of abstractions and focusing on the entire policy portfolio.

6 My Contribution

This dissertation addresses the research question of how to understand and explain policy change in a newly emerging policy field. Capturing policy change has been a conceptual, methodological, and substantive challenge described as the "dependent variable problem". The challenges are interdependent. An undefined concept of policy output and policy change has resulted in simplistic and highly variable measurements of policies and policy change. This variation restricts the scholars' perspective and the usefulness of the results for political actors, for example, to uncover symbolic policy innovation or to predict major changes in the modes of governance. The overview of the literature on climate mitigation policy reveals three highly critical issues for the research on policy change which are discussed in my dissertation: (1) the conceptualization of policy change on different levels of abstractions, (2) the consideration of the entire policy portfolio, and (3) the newly emerging policy field. These issues, if properly addressed, serve as a basis to describe, explain, and predict policy change and its impact on policy outcome (Knill et al., 2012b, Bailey and Ditty, 2009, Verde and Tol, 2009, Poloni-Staudinger, 2008, Bernauer and Koubi, 2009).

Theoretical contribution

The theoretical contribution of the debate within this dissertation lays in the attempt to integrate different concepts of policy output and policy change on three levels of abstraction – goals and instrument logic, objectives and mechanisms, and policy settings and calibrations. As discussed above, this distinction is crucial for theory-testing since competing approaches postulate policy change on different levels. My dissertation contributes to the literature by providing a conceptualization which integrates these three levels of abstractions into an analysis on policy instruments. In Chapter 2, it is discussed that policy actors are able to intentionally design objectives and mechanisms to be congruent with more general goals and

instrumental logic and, at the same time, incorporate rules and principles of settings and calibration on how to distributes benefits and burdens, including structures for implementation (Bobrow, 2006, Howlett and Lejano, 2012, May, 2003, Schneider and Sidney, 2009, Almond, 2004, Ingram et al., 2007, Jenkins, 1978, McConnell, 2010). First, from the policy analysis literature we know that the design of a policy instrument comprises a wider range of settings and calibrations which are set already during the policy process (Almond, 2004, Eliadis et al., 2005, Hepburn, 2010, Howlett and Rayner, 2007, Ingram et al., 2007, Schneider and Sidney, 2009). Thus, policy instruments are not a black box but comprise very different characteristics which all determine the instruments' intensity as discussed by Knill et al. (2012b) (see also Carley and Miller, 2012, Holzinger et al., 2011a, Clinton and Dryzek, 2006, Grant and Kelly, 2008, Howell et al., 2000, Knill et al., 2010a, Lapinski, 2008, Liefferink et al., 2009, Mayhew, 1993, Tsebelis, 1999). Chapter 2 extends this literature and discusses this concept of policy intensity by theoretically deriving a wider and more systematic set of settings and calibrations which influence the actual policy output.

Focusing on the level of policy instruments on the level of objectives and mechanisms including respective settings and attributes also allows an aggregation of information from both these levels to the highest level of the instrumental logic. First, Chapter 2 and Chapter 3 demonstrate that the aggregation of calibrations and settings in the country cases reflect on the dominant administrative styles as described in the case study literature (Howlett, 1991, Howlett, 2003). Second, how an aggregation of information on the specific type of instruments can be used to locate country specific changes in the degree of innovativeness and modes of governance is presented in Chapters 2, 3 and 4.

The dissertation more generally contributes to the literature on policy change using this integrative approach to define a number of concepts such as policy innovations, symbolic innovations, or modes of governance. A policy innovation in Chapter 3 is defined on the meso

level of abstraction if it is either new in the policy portfolio (new mechanism) or if it addresses new objectives. Symbolic innovations are seen as those innovations which are constituted by low intensity in calibrations and settings on the micro level of abstraction. It could be demonstrated in Chapter 3 that high intensity in policy innovations reveal substantial policy change in the overall policy portfolio. In Chapter 4, new modes of governance on the level of the instrument logic are revealed by the aggregation and combination of certain types of instruments from the level of objectives and mechanisms.

An additional theoretical contribution of the dissertation is its amplification to place policy instruments in the context of the national policy portfolio. It is argued that policy change as a whole can only be analyzed when considering the full set of the countries' policy instruments within a respective policy field. As demonstrated in Chapter 3, policy instruments are only new and innovative in a specific context where no such policy exists at the point of adoption. In Chapter 4, the results reveal that looking at only single or selected sets of policy instruments would reveal substantial bias whereas the focus on the policy portfolio allows to demonstrating the dominance of traditional modes of government within the countries.

The dissertation presents a theoretical discussion on how to apply mainstream theory on policy change on the case of newly emerging policy fields such as climate mitigation policy. Here, the high level of uncertainty, fragmentation of political actors and interests, changing party positions and policy preferences, and diffuse side payments raises question on when new interests and political coalitions are stabilized to provide substantial and long-term policy investment in the national portfolio of climate mitigation. Chapter 5 on veto player theory and Chapter 4 on the "government-to-governance" hypothesis both identify the specific challenges that a newly emerging policy field induces for these mainstream theories. The results suggest that more theory building is necessary to include the concept of climate leaders into veto player theory. Furthermore, Chapter 4 contributes evidence that questions

the general trend proposed by the "government to governance" hypothesis and argues for a more refined conceptualization of how, when, and why different modes of governance persist.

Methodological contribution

In all chapters, the dissertation relies on a cross-national and longitudinal research design which allows to identify, compare and explain different patterns of policy change. It thereby goes beyond the existing body of research focusing on individual policy instruments or portfolios of single countries. This literature cumulates substantial value and insight to the literature on policy change pointing out the mechanisms of policy adoptions, diffusion, and convergence. However, as identified by the "dependent-variable problem" the ability to compare and integrate their results is limited not only because concepts are insufficiently defined but also because applied indicators are highly variable, have low concept validity and often rely on subjective, expert evaluations of changes that do not rely on systematic criteria for assessment. Thus, the methodological contribution of this dissertation lies in the development of a theory-based and sound measurement that matches the conceptual outline of policy change and its application for identifying and comparing dynamics of innovations across countries.

First, the approach enables the operationalization of policy output and policy change on various levels of abstractions, different types of innovations and instruments, and as a substantial part of the policy portfolio. In Chapter 2, the validity, reliability, and usefulness of the Index of Climate Policy Activity is demonstrated. It serves not only to capture policy output of national policy portfolios but provides a mean to compare types of instruments, innovations, or even single tools across countries and for a longer period of time. Even though the approach is applied only in the context of climate mitigation for a selected set of countries,

with minor adaptations it is universally applicable to study policy change in other policy fields in a variety of contexts.

Second, the Index of Climate Policy Activity's applicability is also demonstrated in Chapter 3 where national trajectories of policy innovations within the countries can be analyzed. Furthermore, the specific design features of single policy instruments give insight whether they are "symbolic" or designed with "real teeth".

While the four individual contributions are united by their cross-national and longitudinal focus, they use different research designs that were identified as the best way to fulfill their individual purposes. The focus of Chapter 2 and 3 is descriptive – the aim is to develop new measurements and to use them for describing patterns of policy change. They rely on a comparative case study design of three countries: Austria, Germany, and the United Kingdom. The reasons for selecting these cases is outlined in the chapters. However, the index is designed for the use of large N analysis as well.

Chapter 4 relies on a large-N design of policy portfolios for testing the "government-to-governance" hypothesis. This provides innovative evidence to the debate in two ways: First, by looking at portfolios it allows quantify the rise of new modes of governance in comparison to other policy measures. Second, it investigates the generalizability of case study research by looking if the described pattern can be found in all EU member states or just for selective groups of countries.

Finally, Chapter 4 combines the merits of quantitative analysis for testing competing theories and qualitative case studies for discerning the underlying mechanisms (Rohlfing, 2008, Tashakkori and Teddlie, 2010). Mechanisms in our case do not refer to the temporal order of cause and effect (Lieberman, 2005) but is rather an illustration of the processes outlined by the theory that are responsible for the effect of climate leaders – thus mediating variables which are not available for the quantitative analysis.

Substantive contribution

The dissertation provides a number of substantial contributions for the research on climate mitigation policy. It addresses the challenges of a newly emerging policy field and discusses how different interests, actors, and policy preferences influence national climate politics in Chapter 5. For the context of EU climate politics, the analyses demonstrate that national climate mitigation varies across the member states both in the quantitative size of the policy portfolio (Chapter 2 and Chapter 5) and qualitative aspects of innovativeness (Chapter 3). A systematic overview on country patterns in national choices of policy instruments and the role of the state for new modes of governance is given in Chapter 4. In general, it is one step further towards a systematic measurement that allows the comparison, evaluation, and even ranking of national policy portfolios using a quantitative method on the basis of publicly available data. It adds to the existing and more generally applied tools such as the Germanwatch Climate Performance Index which serve as an orientation on how nation states can be evaluated in terms of climate action. Furthermore, this dissertation provides the basis for more research on the determinants on the adoption of climate mitigation policy and its actual performance in the reduction of greenhouse gases.

Limitations

Although this dissertation aims to shed new light from the perspective of a newly emerging field, it is outside of the scope to provide a systematic comparison of results for old and new fields (e.g. in a meta-analysis). Nevertheless, results generated on the basis of these articles are compared with existing theoretical and empirical work in established fields and its results. Part of the contribution of this dissertation has been the collection of new data summarized in the Index of Climate Policy Activity. Due to data availability, this however is reduced to policies of energy production (Chapter 2 and 3), energy efficiency, or renewable energies

(Chapter 5). The operationalization of the Index of Climate Policy Activity has been very time consuming because it demands information on six settings and calibrations to be coded for every policy instrument in the national portfolio from 1998 to 2010. This is the reason why for Chapter 2 and Chapter 3 only three countries, Austria, Germany, and the UK, were selected to demonstrate the feasibility and applicability of this approach. Thus, these novel data are available only for the three countries so that for the larger N Perspective of Chapter 4 and 5 I had to rely on different approaches to operationalize policy output such as the density approach in Chapter 4 and weighted intensity in Chapter 5 (see discussion in Chapter 2).

Although climate mitigation policies are taken as an exemplary case for newly emerging fields, it has specific characteristics which may limit the transferability of the results to other new fields: (1) As stated repeatedly, the implications and time frame of climate change are unclear. This puts decision-makers in a very different situation than in other new fields such as long-term care or immigration policy where developments and implications are not good but definitely better predictable for individual nation states. (2) Climate mitigation policy in the EU is highly regulated under the Effort Sharing Agreement of the Climate and Energy Package (Number 406/2009/EC). This puts significant pressure on member states to be active in this field. It makes the EU to a leader in climate policies – however it limits the transferability of the results to climate-policy making in other areas of the world. However, while the results may look different – the concepts (policy output, policy portfolio, instrument choice and definition of innovation) and measurements (Index of Climate Policy Activity) are transferable and future research using them could bring important comparative insights.

7 Overview

As outlined in the previous section, the aim of this dissertation has been to illuminate change in climate mitigation policy and using this new field of policy-making to derive general

conclusions for theories and empirical testing of policy change. The individual chapters contribute in different ways to this overarching goal of understanding and explaining policy change. The major advancement that connects the work in all contributions is the idea that whole policy portfolios rather than individual policies need to be the basis for a meaningful theoretical and empirical analysis of policy change. All four papers leverage the new field of climate mitigation policy as a case study for how policy change can be theoretically conceptualized, empirically measured, understood and explained to advance not only this particular field but general political science scholarship on policy analysis.

Chapter 2 (with Sebastian Sewerin and Sybille Seubert) provides the theoretical basis for my dissertation research by developing a new concept for understanding policy output and policy change. Comparing national policies is a complex research project, and existing attempts at comparisons are fragmented. A major shortcoming of existing work is the focus on single policy instruments, which is limited considering that countries have whole portfolios of policies that interact and commonly produced intended and unintended policy outcomes. We reconsider the concept of policy output and propose a refined measure as a function of both the density of regulation (number of policy instruments) and the intensity of the policy instruments (content of policy instruments). We theoretically derive six policy-design features (objectives, scope, integration, budget, implementation, monitoring), which are used for weighting national climate policy instruments on an *Index of Climate Policy Activity*. Focusing on national climate policy for energy production in Austria, Germany, and the UK from 1998 to 2010, the article presents an empirical application and compares the policy-specific data to other measurement approaches (density, strictness, and scope approach). A comparison with expert evaluations of Germanwatch and results from the case study literature demonstrates that our Index of Climate Policy Activity provides valid results for national policy output. It provides a novel theoretical tool to operationalize policy output and to

conduct cross-national analysis of policy change that can advance analysis of climate policy portfolios but is also generally applicable to other policy fields.

Chapter 3 (with Sebastian Sewerin and Sybille Seubert) directly builds on the Index of Climate Policy Activity presented in the previous chapter and the collected data. It is the first part of a research endeavor that aims to describe and understand change in policy portfolios from different theoretical perspectives. The theoretical concept underlying this chapter is the idea of policy innovation. This paper examines policy change in the area of climate mitigation and investigates the role of policy innovations in radically altering a policy portfolio. We analyze whether policy innovations are merely symbolic or truly radical and if they contribute to `tipping´ policy portfolios towards a new instrumental logic. We study policy innovations in the context of policy portfolios, distinguish between levels of policies at which innovations might occur, and analyze policy dynamics over time. The analysis utilizes the Index of Climate Policy Activity for assessing the relative importance of policy innovations in complex policy portfolios. Thus, the paper can serve as a blueprint for further systematic comparative analyses. Empirically, we analyze policy innovations in the energy production policy portfolios of Austria, Germany and the UK between 1998 and 2010 and find high stability in the instrumental logic but substantial deviation in policy settings and calibrations.

Chapter 4 continues the analysis of policy portfolios from a different theoretical perspective — the (changing) role of the state in policy-making. It builds on the debate of changing modes of governance and its central hypothesis that policymaking in modern states moves away from traditional hierarchical regulation form of "government" and towards new forms of decentralized network "governance" (government-to-governance hypothesis). The theoretical part provides a typology of policy instruments along the dimensions of monocentrism/polycentrism and coercion. The empirical analysis of instrument choice in climate mitigation policy extends previous analysis in two important ways. First, unlike

earlier studies that focus on the dimension of monocentrism/polycentrism, the analysis includes the level of coercion as an indicator of change from government to governance. Second, it provides a more systematic test by assessing instrument choice in the context of whole policy portfolios and compares instruments across nineteen EU countries. The findings cast doubt on the general trend of "government-to-governance" in climate policy and reveals substantial differences between countries in the development of climate mitigation policy across time. Typical instruments for "governance" complement rather than replace the dominant traditional forms of "government". Instrument choice seems to follow a sequential pattern where traditional government forms the basis of policymaking and is then extended in some (but not all cases) to new forms of governance such as tradable permits or voluntary agreements.

Chapter 5 (with Dr. Karolina Jankowska) aims to explain policy change by testing hypotheses of veto player theory in the field of climate mitigation. Veto player theory has been selected as one of the most prominent approaches to explain policy stability and change. While existing empirical tests focus on established policy fields such as social or economic policy, this chapter discusses and tests to what extent its predictions hold in the context of newly emerging policy fields such as climate mitigation policy. New fields provide a different context for political decision-making, with a status quo outside the median preferences, a lack of policy baggage and newly emerging actors and interests that challenge some of the theoretical mechanisms underlying veto player theory. We argue for an extension of veto player theory based on an absolute anchoring of preferences (rather than using the range) and the identification of policy leaders. The influence of veto players and their preferences is tested in a comparative mixed-methods design combining a large-N pooled time-series cross-section analysis of national policies on energy efficiency in 25 EU member states from 1998 to 2010 with a case-study analysis of the renewable electricity laws in Poland (2005) and

Germany (2000). The findings demonstrate that climate leaders rather than veto players are important predictors of change in climate mitigation policy. The case study suggests that political actors other than official veto players, such as ministers or the EU, strongly influence the process of agenda setting and decision-making. The findings underscore the importance of including a measure of the internal cohesion of veto players, the presence of leaders, and the consideration of motives other than policy preferences in future analyses.

Table 3: Overview on the Individual Chapter of the Dissertation

Title	**Aim**	**Status**
Toward a Comparative Measure of Climate Policy Output (with Sebastian Sewerin and Sybille Seubert)	Discuss different approaches to conceptualize and measure climate policy output and demonstrate the validity and reliability of the Index of Climate Policy Activity.	Revised and resubmitted to *Policy Studies Journal* (Sept 10, 2013)
The Innovativeness of National Policy Portfolios – Climate Policy Change in Austria, Germany, and the UK (with Sebastian Sewerin and Sybille Seubert)	Elaborate on symbolic innovation and tipping points within a discussion of policy innovations in the context of the climate policy portfolio	Revised and resubmitted to *Environmental Politics* (Oct, 5) as part of the Special Issue „Innovations in Climate Policy - The Politics of Invention, Diffusion and Evaluation“ by Andrew Jordan and Dave Huitema
New Climate Governance and Policy Instruments – A Comparative Analysis of the "Government-to-Governance" Hypothesis	Providing a theoretical framework how to classify policy instruments along the government/governance distinction, testing the „government-to-governance“ hypothesis for climate mitigation policies	Submitted to *Regulation and Governance* (Sept 08, 2013)
Breaks or engines? The role of veto players and leaders in the new field of climate mitigation policy (with Dr. Karolina Jankowska)	Elaborate and test veto player theory and the idea of climate leaders in the context of national climate mitigation policy using a mixed methods approach.	Submitted to *European Political Science Research* (Sept 04, 2013)

The dissertation is a multi-paper dissertation. All chapters share the aim of understanding and explaining policy change in the field of climate mitigation in a cross-national comparative framework. The individual chapters are self-standing manuscripts submitted in the format required for the journals to which they have been submitted. Chapter 3 has been submitted as part of a special issues project and thus builds on other contributions in this issue - specifically the editorial introduction. Table 1 presents a short overview on the individual contributions of the chapters and their publication status.

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Chapter 2

Toward a Comparative Measure of Climate Policy Output

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Abstract: Tangible efforts to mitigate climate change take place today mainly on a national rather than an international level. Comparing national policies is a complex research project, and existing attempts at comparisons are fragmented. We reconsider the concept of policy output and propose a refined measure as a function of both the density of regulation (number of policy instruments) and the intensity of the policy instruments (content of policy instruments). We theoretically derive six policy-design features (objectives, scope, integration, budget, implementation, monitoring), which are used for weighting national climate policy instruments on an *Index of Climate Policy Activity*. Focusing on national climate policy for energy production in Austria, Germany, and the UK from 1998 to 2010, the article presents an empirical application and compares the policy-specific data to other measurement approaches. We demonstrate that our Index of Climate Policy Activity provides valid results for national policy output. Thus, this approach seems a promising concept for further comparative analyses.

Keywords: climate mitigation, policy design, policy output, policy portfolios, policy process

Introduction

Over the last two decades, the efforts of international diplomacy have failed to establish an encompassing regime to address global climate change. This has led to new research interest in how far nation states are capable of designing effective climate policy instruments (e.g., Carley and Miller 2012; Wiener and Koontz 2010). In spite of a growing body of research, different national policy portfolios on climate mitigation, i.e. all national policy instruments, have not been compared in terms of the actual success of the countries' strategies. The reason for this is the lack of a common understanding of the concept of policy output (Graham, Shipan, and Volden 2012; Green-Pedersen 2004; Howlett and Cashore 2009). This article addresses this shortcoming by proposing a comparable conceptualization and measurement of policy output.

Policy output refers to the results of a policy process in which political actors interact, communicate, and bargain within a set of formal and informal procedures, rules, and institutions. The concept has been applied in studies on policy subsystems like environment, energy, or health (May, Sapotichne, and Workman 2006), analyzing the adoption of types of or even single policy instruments (Berry and Berry 2007; Jordan, Wurzel, and Zito 2005; Raymond and Cason 2011). Attempts have been made to investigate policy portfolios using pre-selected policy instruments across different countries (Albrecht and Arts 2005; Knill, Debus, and Heichel 2010; Liefferink et al. 2009). Yet, an analysis of single or pre-selected policy instruments can lead to biased conclusions, predominantly due to undetermined policy interactions or portfolio effects (e.g., Howlett and Rayner 2007). In our view, a comparison of several countries' efforts on climate mitigation needs to focus on the policy output of the whole policy portfolio.

One approach to policy output, advocated by Knill, Schulze, and Tosun (2012), distinguishes between policy density (number of policy instruments) and intensity (content of

policy instruments). They include the specific policy-design features "scope" and "level of regulatory strictness" to determine intensity. As literature on policy design has shown, a policy instrument comprises a wide range of design features, such as goals, the tools to reach these goals, benefits and burdens affecting the target populations, and rationales legitimizing the policy and implementation structures (Bobrow 2006; Eliadis, Hill, and Howlett 2005; Schneider and Sidney 2009). We take the density–intensity approach one step further and consider a whole set of theoretically derived design features to create a new measurement of national policy output. Doing so, we are able to analyze the most common policy instruments in climate policy research: regulatory, soft and market-based instruments, public investments, and framework policies.

We demonstrate the theoretical foundation and validity of our approach in three sections. The first section provides an overview of policy output, discusses current approaches to determining policy intensity, and deduces relevant design features from the public policy literature. In the second section, we outline the empirical application of climate policy output – our Index of Climate Policy Activity calculated as the number of policy instruments and weighted by their intensity. We compiled data by undertaking a context-based analysis of national policy instruments in the energy-supply sector in Austria, Germany, and the UK from 1998 to 2010. The index' validity is demonstrated by taking expert ratings and case-study literature as a point of reference. In the third section, we compare approaches to measuring climate policy output. Finally, we discuss the implications as well as limitations of the analysis.

Theory

Conceptualizing Policy Output and Policy Instruments

The concept of policy output describes political action capturing laws, policies, policy instruments, principles, or policy programs. Policy output gives "concrete form to the generalized intentions of statements of policy … [and] ... combine in different ways the basic resources and tools of governments – laws, public personnel, public expenditure, tax incentives and exhortation" (McConnell 2010, 350). This concept is fundamental to a number of research streams such as policy change (see Howlett and Cashore 2009; Jones and Baumgartner 2012), policy diffusion (e.g., Carley and Miller 2012; Wiener and Koontz 2010), theories on the policy process (see Sabatier 2007; Weible et al. 2012), or analyses of policy outcome (e.g., Jahn and Kuitto 2011; Knill, Schulze, and Tosun 2012). These studies focus on specific types of policy output such as policy innovations (Berry and Berry 2007) or new environmental policy instruments (Jordan, Wurzel, and Zito 2005), investigating leadership or pioneering (Wurzel and Connelly 2012), and convergence (Wiener and Koontz 2010). Hence, scholars stress that despite this plethora of studies, there is little comparability of findings due to the lack of a common operationalization of policy output (Graham, Shipan, and Volden 2012; Green-Pedersen 2004; Howlett and Cashore 2009; Pierson 2001). As a result, larger-N comparative research is rare.

Policy instruments constitute the core of policy output as the 'set of techniques by which governmental authorities […] wield their power in attempting to ensure support and effect social change' (Bemelmans-Videc, Rist, and Vedung 1998, 50; see also Howlett 2009; Jordan et al. 2003, 2011). They are designed to be congruent with more general goals and rationales and to incorporate rules and principles on how to distribute benefits and burdens (Bobrow 2006; Howlett and Lejano 2012; May 2003; Schneider and Sidney 2009). In climate policy research, policy instruments are discussed from two different angles. The 'tools of

government' approach focuses on the resources available to public authorities. Hood (1983, 2007) distinguishes between four functions of policy tools: nodality, authority, treasure, and organization.

> 'Nodality denotes the capacity of government to operate as a node in information networks—a central point of contact. Authority denotes government's legal power and other sources of legitimacy. Treasure denotes government's assets or fungible resources, and organization denotes its capacity for direct action, for instance, through armies, police, or bureaucracy.' (Hood 2007, 129)

A second typology suggested by Bemelmans-Videc *et al.* (1998) – 'sticks', 'carrots', and 'sermon' - refers to the relationship between public authorities and private actors. 'Sticks' are measures taken up by governmental units to influence people to act in accordance with formulated rules. 'Carrots' try to influence behavior in a less authoritative way as the addressees are not obliged to react. 'Sermon' aims to provide sufficient information for actors to make a reasonable or desired choice. More recent developments on policy instruments extend this typology adding 'ties' such as voluntary agreements and 'adhesives' which are framework policies that combine different measures under a policy package or political process (Lodge and Wegrich 2005; Steurer 2011).

Either of these two angles allows to distinguish between a standard set of policy instruments most widely applied in climate policy research: regulatory measures ('authority', 'stick'), soft instruments ('nodality', 'sermon'), market-based approaches ('treasure', 'carrot'), framework policies ('organization', 'adhesives'), and public investments ('treasure', 'carrot') (see Appendix 1) (Bemelmans-Videc, Rist, and Vedung 1998; Hood 2007; Macdonald 2001; Steurer 2011).

Policy Density and Intensity

Albrecht and Arts suggest two basic elements of policy output, covering "the launching of PAMs [policies and measures] as well as the organization and mobilization of resources to execute these" (2005, 888). Knill, Schulze, and Tosun (2012) pursue this thought and introduce the terms "density" (number of policies) and "intensity" (organization and mobilization of resources) in their effort to conceptualize policy output. Policy density refers to "the degree of penetration and internal differentiation of a policy field, and explores how the numbers of policies or instruments change over time" (Knill, Schulze, and Tosun 2012, 3). Policy intensity, on the other hand, refers to the "specific calibration of a given regulatory instrument" (Knill, Schulze, and Tosun 2012, 5; see also Tosun 2013). This concept has been addressed in various forms under different terms such as "importance", "strength", "innovativeness", "prevalence", "significance", or "stringency" (see Carley and Miller 2012; Clinton and Dryzek 2006; Grant and Kelly 2008). In sum, policy intensity describes the "organization and mobilization of resources" (Albrecht and Arts 2005, 888), namely, the amount of resources, time, effort, activity, or political commitment that is invested or allocated to a specific policy instrument.

Adding policy intensity to policy density is necessary, as Grant and Kelly (2008) point out: "simply counting laws without accounting for their content is likely to produce measurement error when attempting to measure policy production [policy output]" (p. 306). One approach is to count the most intensive policy instruments (e.g., Albrecht and Arts 2005; Jahn and Kuitto 2011; Knill, Debus, and Heichel 2010). Hence, validity greatly depends on well-grounded derivation of the predefined threshold and on the scope of the investigation.

A second approach is to count all the policy instruments (density) in a policy portfolio and weight them by intensity. Weightings can be derived from experts evaluation (e.g., Binder 1999; Coleman 1999; Mayhew 2005) or the media (e.g., Howell et al. 2000; Kelly 1993). The

validity of these approaches depends on the selection of the experts and whether media are ideologically biased (Clinton and Dryzek 2006; Lapinski 2008). Intensity weightings derived from design features of policy instruments are unaffected by such bias. For example, studies operationalize intensity by assessing the design feature regulatory strictness, such as a limit value for vehicle emissions (Carley and Miller 2012; Holzinger, Knill, and Sommerer 2011; Liefferink et al. 2009; Tosun 2013). Knill, Schulze, and Tosun (2012) add the policy instruments' scope as an additional indicator for policy intensity, asking who (scope) is regulated by what standard (strictness) of clean air regulation. Yet, these approaches are very context-specific and difficult to apply to a different set of policy instruments. Thus, we seek to take their approach one step further by considering the wide range of policy instruments' policy-design features.

Policy Intensity, Policy Design Features, and the Policy Process

Using policy-design literature, we derive a systematic set of design features determining the intensity of policy instruments (see Howlett and Lejano 2012 for a review). Policy design describes "an activity conducted by a number of policy actors in the hope of improving policy making and policy outcomes through accurate anticipation of consequences of government actions and the articulation of specific courses of action to be followed" (Howlett and Lejano 2012, 2; see also Bobrow 2006). Policy design incorporates a focus on the available policy options with a procedural component addressing political activities aiming to reach political agreement on one of these options (May 2003). The former substantial component describes the intentions and commitment of political actors shaping design features of policy instruments throughout the policy process. The stronger the commitment of political actors, the more resources, time, effort and activity are invested in the design of the policy instrument, which is reflected in its design features. However, with regard to the procedural

component, policy-design features are not only a result of intentional design but also of bargaining by opposing political actors, ideas, and interests at different stages throughout the policy process (Schlager and Blomquist 1996; Schlager 2007). Whether political key actors, committed to a policy instrument, are able to overcome potential conflict at various stages of the policy process determines the policy-design features of that instrument (Chadwick 2000; Gormley 2007). We go through different stages of the policy process and use political commitment as a proxy to derive relevant design features of a policy instrument in order to determine its intensity. Due to different institutional setups, the set of actors as well as their roles in the policy process varies across countries (Baumgartner et al. 2009; deLeon 1999). It is necessary to focus on the full policy process in order to derive a complete set of policy-design features.

At the stages of agenda setting and policy formulation, establishing *objectives* is a critical step and pre-determines all further progress throughout the policy process (Howlett, Ramesh, and Perl 2009; Howlett 2009). Precise objectives for policy instruments are rare in governmental decisions, due to their distributive character of benefits and burdens for target groups and, thus, the many opposing interests and evolving conflicts among political actors (Ingram and Schneider 1997; May, Sapotichne, and Workman 2006). If ambitious objectives are set, it can be assumed that proponents continue to invest in the intensity of the policy instrument throughout the policy process (Howlett, Ramesh, and Perl 2009).

During policy formulation, the *scope* of a policy instrument is set. It decides about the allocation of resources or economic burden and is likely to produce winners and looser (Ingram and Schneider 1997; May, Sapotichne, and Workman 2006). Thus, with an increasing scope, political bargaining and lobbying becomes more intense (Almond 2004; Howlett, Ramesh, and Perl 2009; Schneider and Sidney 2009). If the scope is ambitious even in the context of marked political opposition, the policy issue should be highly relevant to

political actors and they can be assumed to invest in the intensity of a policy instrument in subsequent stages of the policy process (Hepburn 2010; Ingram, Schneider, and DeLeon 2007). Therefore, we assume that if political actors withstand opposition from a wide range of lobbying groups and present a policy instrument with a wider scope, this instrument also has a higher intensity.

Policy *integration* is an essential issue at the stage of policy formulation (Briassoulis 2005; Howlett 2004). Policy-design literature focuses on whether and how political actors intentionally create new designs of policy packages with explicit goals of optimization and avoidance of contradictory or conflicting mixes of political action (Doremus 2003; Hou and Brewer 2010). Policy portfolios can be designed to be consistent (non-contradictory in objectives), coherent (non-conflicting policy instruments) or congruent (optimal match between objectives and instruments) (Howlett and Rayner 2007). There are three arguments in favor of policy packages' capacity to achieve these aims. First, they should be highly consistent and coherent, due to the larger number of political actors and, hence, more discussion of all policy instruments included in the package. Second, policy packages provide congruence, due to a better matching of the package's goals with policy instruments within the overarching framework policy (Howlett and Rayner 2007; Kern and Howlett 2009; Rogge, Schneider, and Hoffmann 2011). Third, packages attract greater media attention than do single policy instruments, which potentially leads to higher visibility (Koch-Baumgarten and Voltmer 2010) and to sophisticated evaluation of the whole package including its individual instruments. In sum, policy intensity is higher if integrated into a package including framework policy.

Another important design feature occurring at the stage of policy formulation is the *budget* of a policy instrument. This includes financial means that are invested or financial burdens that are imposed on societal groups. As O'Toole (2004) points out, more resources

increase the prospect of accomplishing implementation. Hence, decisions on financial investments or impositions inevitably create winners and losers by (re)distributing resources among societal group and, thus, challenging interests (Almond 2004). A policy instrument with a large public budget that is able to overcome such opposition is characterized by stronger commitment from political actors and thus high intensity (Howlett, Ramesh, and Perl 2009).

Implementation is the penultimate stage of the policy process, where political actors are concerned about how policy instruments are put into practice. Here, in particular, theoretical policy formulation directly affects real interests and provokes conflict between public agencies, administration, and target groups (Howlett, Ramesh, and Perl 2009). Two issues are highly relevant to determining intensity. First, having single instead of multiple implementing agencies avoids potentially expensive cooperating costs caused by inter-organizational bargaining processes (Hepburn 2010; Lundin 2007). Second, as a two-way interaction between the legislative principal and the implementing agency, implementation bears the risk of failure due to inappropriate actions by either entity (May 2003). Contradictions and ambiguity in the formulation of the policy instrument allow opposing interests to dilute its actual stringency during the process of implementation. However, as May (2003) notes, "implementation difficulties can be partially ameliorated with the crafting of appropriate policy designs to build commitment and capacity of intermediaries and to signal policy intent to intermediaries and target groups" (p. 223). Following his argument, we assume that problems and conflicts in the principal–agent relationship can be addressed if a policy instrument comprises explicit rules for implementation and sanctioning (Hepburn 2010; Potoski 2002).

Monitoring as a key activity at the stage of policy evaluation is “intended to ensure that policies are accomplishing their expected goals” (Howlett, Ramesh, and Perl 2009, 185).

Policy-design literature shows that unintended consequences of policy implementation can lead to positive or negative feedback either supporting or undermining policy goals (Patashnik 2008; Pierson 1993; Weaver 2010). Highly committed political actors should have an interest in designing a policy instrument in such a way that it stimulates positive feedback mechanisms. This could entail increasing state capacities or larger groups of proponents (Jervis 1997; Pierson 2004) supporting the instrument in place in the long term (Jenkins and Patashnik 2012; Patashnik 2008; Pierson 2000). Positive feedback hardly provides immunity against policy failure; indeed, on the contrary, it can lead to major support for even malfunctioning policy instruments (Duit et al. 2010; Jenkins and Patashnik 2012). In the same vein, negative feedback can undermine policy goals, creating counter-activity and opposition to the policy instrument in place (Jervis 1997; Jones and Baumgartner 2012). Negative feedback can also trigger a process of policy learning to adapt policy instruments to changing environments and avoid malfunction in the long term, if the process of policy formulation intentionally designed monitoring for this purpose (Olsen 2009; Weaver 2010). Thus, administrative monitoring carried out by non-governmental entities according to formal rules provides governments with a feedback mechanism to refine instruments (Hepburn 2010; Howlett, Ramesh, and Perl 2009). Therefore, monitoring mechanisms laid down in the original policy instrument increase policy intensity.

Data and Operationalization

Database

We compiled data by undertaking a context-based analysis of national policy instruments in the energy-supply sector in Austria, Germany, and the UK from 1998 to 2010. In a first step, we collected information on policies and measures from two standardized sources, the Policies and Measures Databases on Global Renewable Energy, Climate Policy, and Energy Efficiency of the International Energy Agency (IEA, October 12, 2012), and the Climate Policies and Measures in Europe Database of the European Energy Agency (EEA, October 27, 2012). These databases cover the whole period of observation from 1998 to 2010 and include a variety of sectors (e.g., energy, transport, housing). The data are updated every six month by voluntary (IEA) and mandatory (EEA) reports of the member countries' public authorities. In a second step, we complemented additional policy instruments if not listed in the standardized datasets. We cross-verified the information on the policy design features (e.g., policy instruments' specific emission target or scope) given by the databases with non-standardized sources such as the UNFCCC National Communication, legal documents, and other governmental reports. Thus, we are confident that our dataset covers all policy instruments of the national portfolio for the energy-supply sector from 1998 to 2010.

In total, we analyze 175 policy instruments with varying numbers per country and per year (see 'density approach' in Figure 1). We choose the year 1998 where the Kyoto Protocol came into force and the EU's burden sharing agreement has been passed as point of reference for the starting point for national climate politics (Wurzel and Connelly 2012). 2010 is the most recent year where climate mitigation policies are completely available. We further restrict our analysis to the sector of energy production since it marks the basis of all greenhouse gas emissions and, thus, is most strongly addressed by political efforts to increase renewable energy production (Goldthau and Sovacool 2012).

The standardized databases we used allow to derive the five types of policy instruments (regulatory, soft, market-based instruments, framework policy and public investments) we discussed in the previous section. Appendix 1 gives detailed information about the content of these categories. We found this typology useful for our analysis because it covers the mainstream instruments discussed in the literature of climate politics (Bemelmans-Videc, Rist, and Vedung 1998; Hood 2007; Jordan et al. 2003; Macdonald 2001; Sager 2009; Steurer 2011).

Case Selection

The Index of Climate Policy Activity should reveal valid results, first comparing policy output for specific policy instruments within countries as well as, second, comparing policy output from national policy portfolios across countries. Therefore, we compare two pairs of EU countries in a most similar and most different cases research design. First, we choose Austria and Germany, where a similar highly regulatory policy style has led to a similar pattern of types of policy instruments (Wurzel, Brückner, et al. 2003; Wurzel, Jordan, et al. 2003), though the density of climate mitigation output is greater in Germany than in Austria (Burck, Bals, and Ackerman 2008; Jänicke 2011). Second, we compare Germany and the UK, where distinctive policy styles have led to different patterns of types of policy instruments. Germany combines regulatory and market-based instruments with soft measures such as voluntary agreements, whereas the UK adopts a mix of public regulation and market-based instruments (Bailey 2007; Lees 2007). Both countries have a similarly large policy portfolio (Burck, Bals, and Ackerman 2008; Jänicke 2011). The European Union's role remains limited to monitor national compliance with the targets laid down in the 2001 and 2009 energy directives (Haas et al. 2011; Kitzing, Mitchell, and Morthorst 2012) and more direct top-down harmonization by the Commission failed and has largely disappeared since 2005 (Haas et al. 2011; Toke and Lauber 2007).

Constructing the Index of Climate Policy Activity

Climate policy output is a function of density and intensity. Density equals the sum of policy instruments in a specific domain, which can be easily extracted from existing databases. To measure intensity, we applied a content-based coding procedure, conducted by three independent coders, to each policy instrument. The bases for the coding are the six design features: objectives, scope, integration, budget, implementation, and monitoring (see discussion in the theory section). Each of the three authors of this study coded one country each and evaluated the coding of the other two countries. If there were differences in the assessment of a policy between the coders, the value of the debated design feature of the respective policy was resolved in a group discussion following a consensus rule. Table 1 summarizes the coding question, possible coding values as well as the aggregation procedure for the six design features, which we derived from the theoretical discussion. Each policy instrument has been coded accordingly.

In order to compare our index with counting approaches, we standardized the coding of each policy instrument from a minimum of zero to a maximum of one on the six design features. This means that a policy instrument is weighted down on a value between zero and one if it does not reach full intensity. The scale of each policy design feature depends on the scale of the information available. For example, *objectives* reveal metric information on the emission targets for each policy instrument whereas other design features such as *monitoring* or scope consists of two or more dichotomous questions (yes/no) or distinct categories (e.g., demand, supply) which were, for reasons of simplicity, weighted equally. In the following, we briefly describe the coding criteria as summarized in Table 1.

Objectives are coded using two alternative indicators: emission reduction and renewable energy production.[1] The scores are calculated with the question of how the policy

instruments' objectives comply with the IPCC benchmark target of 80% emission reduction by 2050 compared to 1990 or 100% renewable energy production by 2050 (Metz et al. 2007). For example, the Voluntary Agreement between the German Government and German Industry in 2000 achieves an intensity of 0.66 which means that its objectives of annual reduction of 2000 tones in greenhouse gas emissions complies to 66% to the IPCC benchmark target.

The *scope* reflects the discussions of the IPCC regarding the need for an encompassing approach for climate mitigation. We distinguish between target groups and energy sources that are regulated by a policy instrument. Policy instruments reach a scope of 0.5 if both target groups on demand and supply sides are affected, and households as well as companies. The value of 0 is coded for policy instruments that target only one of these groups, and 0.16 for each additional group. Furthermore, value is added for the scope of a policy instrument if multiple energy sources are addressed. We divided the value 0.5 by the number of potential sources of energy (0.5 for each oil, gas, coal, wind, solar, biomass, hydro, combined heat and power) but allocated a larger value of 0.15 for energy efficiency due to its greater potential for greenhouse gas reduction (Metz et al. 2007). For each additional energy source, the value increases by 0.05 and by 0.15 for energy efficiency. An example of a scope value of 0.31 is the 2002 UK voluntary emission-trading scheme, which targets only industries (demand and supply = 0.16) and energy efficiency (0.15).

Table 1: Climate Policy Design Features, Coding Scheme, and Aggregation Rules

Design feature	Coding question	Coding values	Specific aggregation to final value	Range
Objectives	What is the policy objective with respect to policy performance?	0=no specific target given objective for absolute emission reduction objective for absolute increase in energy production from renewable sources	We calculated the share of the policy instruments' objective for absolute emission reduction or absolute increase in energy production from renewable energy sources on the benchmark of 80% emission reduction on the basis of 1990 levels or 100% energy production from renewable energy sources in 2050.	0–1
Scope	Does the policy include branches of both supply and demand side?	0=only one target group included 0.16=for each target group households/ companies demand/ supply 0.5=all groups targeted	additive aggregation	0–1
	Are all mitigation actions targeted?	0=only one mitigation action targeted 0.05=for each additional action out of oil, gas, coal, wind, solar, biomass, hydro,and combined heat and power 0.15=energy efficiency targeted		
Integration	Is the policy instrument integrated in a package or any reference to other policy instruments? Is framework policy included?	0=no 0.5=yes 1=yes, including framework policy	additive aggregation	0, 0.5, 1

Budget	What are the set expenditures/impositions of the policy instrument?	0=no fixed costs/impositions absolute annual costs/imposition of policy instrument	The values of intensity if calculated as the share of the public expenditure or imposition for the policy instrument on total public expenditure for energy and fuels or direct public revenue from the revenues of the value added tax (0-1)	0–1
Implemen-tation	Is there a statement about implementation procedures specifically allocating actors and rules? How is this implementation planned and is there sanctioning?	0=no statement about implementation procedures found 0.25=implementation is specifically allocated to actors and rules 0.25=only one specific actor coordinated implementation 0.25=implementation procedure is strict in the sense that it does not allow a range or change in standards or rules 0.25=there is sanctioning for actors not complying to the implementation procedure	additive aggregation	0, 0.25, 0.5, 0.75, 1
Monitoring	Is there a specific monitoring process for the policy instrument and by whom?	0=no monitoring 0.5=monitoring by the implementing agency 1=a special group/institution is established for monitoring	additive aggregation	0, 0.5, 1

Integration measures whether a policy instrument is part of a policy package including framework policy. We used three categories which reflect the arguments about consistency, coherence, and congruence in the previous section: no reference to other policy instruments (0); part of a package or reference to other policy instruments and thus consistent and coherent (0.5); policy instrument included in package in combination with framework policy and thus congruent with other policies (1). A fully integrated policy is, for example, the 2007 German "Combined Heat and Power Agreement", as it is part of and framed by the "Integrated Climate Change and Energy Programme".

The *budget* of a policy instrument refers to the annual expenditure or imposition costs of a policy instrument but depends on and varies between the countries' available resources and the more general spending patterns. In order to account for these between differences, we elaborate on how much public authorities are willing to spend on climate policy instruments as a percentage of total expenditure on energy and fuels taken from the Eurostat database (2012). It would be more accurate to follow the same approach for impositions but there is no data available on total public impositions from the sector of energy supply. Therefore, we used the value-added tax as an indicator of public taxing taken from the Eurostat database (2012) which is the most universal tax and widely applied for comparative research (e.g., Babiker, Metcalf, and Reilly 2003; Lockwood and Whalley 2010). Thus, we calculated the imposition costs of climate policy instruments as percentage of the value-added tax. An example of high budget policy instrument is the UK Carbon Trust with share of 36% of total expenditure on energy and fuels.

Implementation reveals two subcategories, number of implementing actors and implementation procedure. Reflecting the discussion in the theory section about the merit of

single implementation agencies and explicit rules for implementation and sanctioning, policy instruments that transfer the implementation process to one specific actor score the maximum of 0.5. An additional 0.5 is scored if the rules of implementation are pre-set and cannot be changed without political action, and if sanctioning procedures for noncompliance exists. The German Eco-Tax Reform is an example of a policy with a high implementation score. It details which actors are concerned and how much they have to pay for use of the various energy sources. Furthermore, the tax is part of national tax legislation with a standardized implementation and sanctioning process.

Monitoring reveals two equally weighted criteria for coding based on the two arguments presented in the theory section. If a monitoring procedure is set, the policy instrument scores 0.5. If there is an independent monitoring entity, distinct from the implementation actor, we add an additional score of 0.5. For example, the Austrian law on green electricity (Ökostromgesetz) reaches a score of one since there is a monitoring process set (0.5) and the monitoring agency (Energie-Control GmbH) operates independent from the executive authority (0.5).

Aggregation procedure: The score of a policy instrument's output equals the mean of the scores of all its design features. Naturally, not all design features can be applied to all policy instruments. For example, framework policies often lack a substantial budget and are in consequence not coded on this design feature. The scores of all policy instruments are then added to an annual score for the national policy portfolio.[2] A national score changes when policy instruments are enacted, abolished, or their design features change.

Alternative Measures of Policy Output

Attempts to operationalize alternative measures of policy output face the problem that no comparable data for climate policy instruments exist. We use our database to operationalize and compare alternative approaches to the Index of Climate Policy Activity.

Studies following the *density approach* operationalize policy output by simply counting policy instruments (e.g., Albrecht and Arts 2005; Knill, Debus, and Heichel 2010).[3] We apply this approach, counting all policy instruments in the climate policy portfolio. The *strictness approach* adds a set of standards or limit values as an indicator for intensity (e.g., Holzinger, Knill, and Sommerer 2011; Liefferink et al. 2009). However, limit values or standards can hardly be applied to, for example, voluntary agreements. Therefore, we operationalize strictness-weighting policy instruments by objectives for emission reduction (see Table 1). The *scope approach* adds the scope to the strictness measure (Knill, Schulze, and Tosun 2012). Following this, we weight policy *instruments* by their scope and objectives (see Table 1).

Results

Testing Validity of the Index of Climate Policy Activity

Empirical validation of the Index of Climate Policy Activity is a crucial step to establishing a comparable measure of policy output. We applied tests for convergent, discriminant, criterion, and construct validity (see Adcock and Collier 2001). The assumption that all indicators of the concept are empirically associated as demanded by *convergent validity* is supported by a principal component analysis (design features load on one factor) and tests with Cronbach's alpha (values above 0.92). As *discriminant validity* demands, the discrimination of the scores

of climate policy output for each design feature from the theoretically distinct discriminant indicator of “change in gross domestic product” reveals that the design features correlate higher with each other (above 0.7) than with change in gross domestic product (lower than 0.6). *Criterion validity* is not easy to test, as alternative measures for climate policy outputs are rare. To our knowledge, the only elaborated measurement of climate policy output of national climate policy portfolios is the Germanwatch Climate Change Performance Index (CCPI) (see Burk et al 2008 for a detailed description).[4] The CCPI is based exclusively on expert evaluations of whole countries' climate policy outputs and, thus, applies an analytically distinct measure of the same concept as the Index of Climate Policy Activity. Experts were asked to "list the most important national policies and measures (max three) for the reduction of CO_2 in the energy sector" and to "rate them according to their effectiveness" (Germanwatch 2012). Table 2 compares the expert evaluations with the scores of the Index of climate policy activity. Two findings indicate the validity of our index. First, those policy instruments that were considered “most important” in reducing greenhouse gas emissions also have high scores for climate policy output. Second, policy instruments rank very similarly using the expert evaluation of the CCPI and the Index of Climate Policy Activity.[5]

Table 2: Criterion Validity: Expert Policy Evaluation and the Index of Climate Policy Activity

Year	Policy instrument	Expert rating	Index scores
	Austria		
2007	National Allocation Plan (2008–2012)	2	0.63
	Quota/feed-in tariffs for electricity from renewables	3	0.63/0.66
2008	National Allocation Plan (2008–2012)	1	0.63
	Green Electricity Act	2	0.59
2009	National Allocation Plan (2008–2012)	4	0.63
	Feed-in tariffs renewable electricity	4	0.62
	Financial Incentives for Rural Biomass Energy	4	0.15
	Austrian Climate Change Strategy	5	0.52
2010	Energy Efficiency Action Plan	4	0.65
	Austrian Climate Change Strategy	4	0.52
	Green Electricity Act	5	0.59
	Germany		
2007	Renewable Energy Act	1,2	0.86
	Combined Heat and Power Act	3	0.61
	National Allocation Plan (2008–2012)	4	0.57
2008	Renewable Energy Act	1,1,2	0.68
	Combined Heat and Power Act	2,4	0.53
	National Allocation Plan (2008–2012)	2,5	0.57
	Ecological tax reform	3	0.49
2009	Renewable Energy Act Amendment	1	0.49
	National Allocation Plan (2008–2012)	2	0.57
	Combined Heat and Power Act	3	0.51
2010	National Allocation Plan (2008–2012)	2	0.57
	Combined Heat and Power Act	2	0.51
	Renewable Energy Act Amendment	3	0.49
	UK		
2007	Renewables Obligation	2,3	0.39
	Energy Efficiency Commitment	3,4	0.29
	National Allocation Plan (20052007)	3,4	0.28
2008	Climate Change Levy and Agreements	2	0.36
	National Allocation Plan (2008–2012)	3	0.48
	Renewables Obligation	4	0.38
2009	National Allocation Plan (2008–2012)	3	0.48
	Renewables Obligation	4	0.35
2010	Feed-in tariffs for renewables	2,3	0.45
	National Allocation Plan (2008–2012)	3,4	0.48
	Renewables Obligation	4	0.35

Note: Expert rating: 1 = very good, 2 = good, 3 = neutral, 4= poor, 5 = very poor; Index of Climate Policy Activity: 0 = least intensity, 1 = highest intensity;
Source: Burck, Bals and Ackerman 2008, authors' calculations.

In addition, findings from case-study literature on country-specific patterns of environmental policy instruments are used to test criterion validity. Figure 2 shows the pattern of the Index of Climate Policy Activity per type of policy instrument (black bar). In line with case-study literature (Bailey 2007; Lees 2007; Wurzel, Brückner, et al. 2003; Wurzel, Jordan, et al. 2003), levels of policy output for regulatory instruments, soft measures, and market-based instruments in Austria and Germany are fairly equal. German levels of framework policies and public investments exceed those in Austria. Furthermore, the UK shows a different pattern from Austria and Germany, with more output on regulatory instruments and framework policies but lower output in soft measures and public investments. Thus, the findings in Table 2 and Figure 2 support high criterion validity for the Index of Climate Policy Activity.

In order to demonstrate *construct validity,* we test the theoretical expectation that outputs and outcomes are somewhat but not strongly correlated. We compare all measures of policy output with annual emission reduction (in percentages since 1990). As demanded by construct validity, the correlation for the Index of Climate Policy Activity is substantially higher (0.34) than for the alternative measures of policy output (0.15–0.21).

Given these findings, we are confident that the Index of Climate Policy Activity is a valid and reliable measure of climate policy output and can be used to evaluate alternative quantitative approaches.

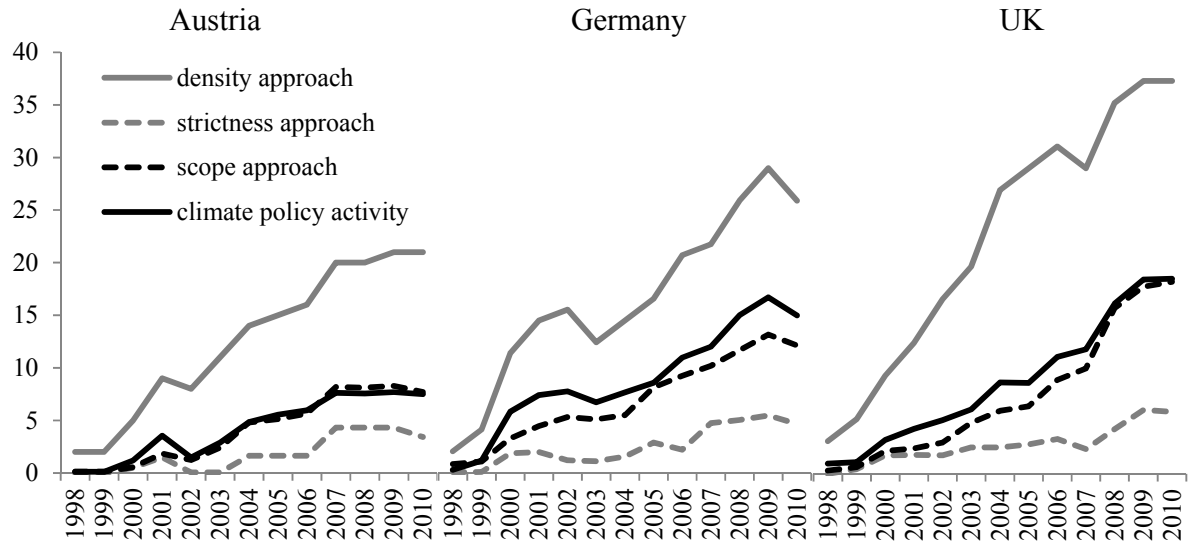
Evaluating Alternative Measures of Policy Output of the Policy Portfolio

We have demonstrated that the Index of Climate Policy Activity is a valid measurement of climate policy output. Given that, we may argue that alternative measures are potentially

biased if they reveal substantially different results. The analysis proceeds with a comparison of alternative measures of climate policy output with our index for Austria, Germany, and the UK 1998–2010. Figure 1 shows the Index of Climate Policy Activity (solid black line) and measures of the density (solid grey line), strictness (dashed grey line), and the scope approach (dashed black line) (see methods section above).

Figure 1 shows an increasing trend in the climate policy output of all measures over time. Policy output is lowest in Austria on all measures except for the strictness approach. Levels of policy output are higher in the UK than in Germany following the density and scope approach, but equally high for the strictness measure or the Index of Climate Policy Activity. In Austria, measures of the scope approach and the Index of Climate Policy Activity are nearly identical, whereas the strictness approach reveals much lower values. In contrast, there is an almost parallel development of policy density and the Index of Climate Policy Activity in Germany. Measures of the strictness and the scope approach reveal substantially lower values than the Index of Climate Policy Activity. In the UK, the difference between density and other measures of policy output is substantially larger than in Germany. Differences between the Index of Climate Policy Activity and the scope approach persist until 2007 but disappear thereafter.

Figure 1: Alternative Measures of Climate Policy Output



Source: IEA, UNFCCC communications, authors' calculations.

The major finding is that policy output varies by measurement and by country. In Austria, each of the measures reveals similar results, but the density approach overestimates the progress made in policy output in comparison to the Index of Climate Policy Activity. Thus, policy density needs weighting in order to establish accurate measures of policy output. In Germany, the Index of Climate Policy Activity shows a parallel pattern to the density approach whereas measures of the strictness and the scope approaches underestimate the intensity in policy output. One reason for this finding is the strong emphasis on implementation and monitoring in German policy making (Bailey 2007; Lees 2007), which is included as a design feature in the Index of Climate Policy Activity but not in the strictness or the scope approach. In fact, using strictness only, one would draw the conclusion that Germany, the UK, and Austria produce similar levels in climate policy output, contradicting the findings from expert evaluation (Burck, Bals, and Ackerman 2008). Another important finding concerns the lower

number of policy instruments but equal levels of policy output measured by the Index of Climate Policy Activity since 2002 in Germany compared to the UK. This indicates that output per policy instrument in Germany is higher than in the UK. Furthermore, the restricted focus of the scope (until 2007) and strictness approach underestimates progress in British climate policy output. In the UK, there has been a long phase of experimental policy adoption with less ambitious emission targets and scope to keep risks of policy failure to a minimum. However, objectives and scope substantially increased after 2007 when larger packages for climate mitigation such as the Energy Act or the Climate Change Act were adopted.

Evaluating Alternative Measures of Policy Output and Types of Policy Instruments

Independent from results on the national level, there might be differences when types of policy instruments are assessed. We demonstrated in the methods section that the Index of Climate Policy Activity accurately reproduces findings from case study literature on country patterns in the use of certain types of policy instruments (see Figure 2, black bars). Thus, our index is a valid benchmark to evaluate alternative approaches of climate policy output for certain types of policy instruments.

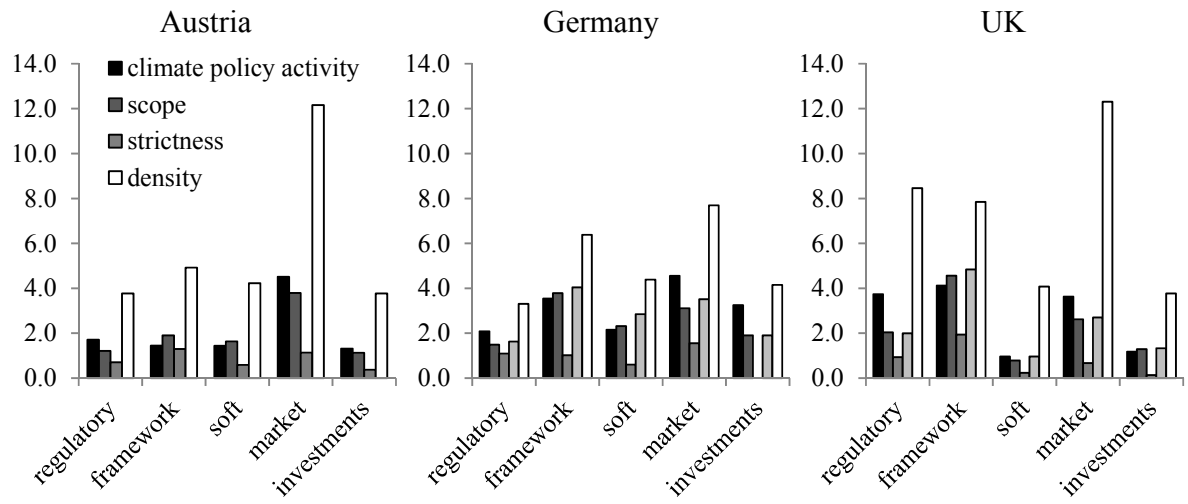
Figure 2 shows the Index of Climate Policy Activity and alternative measures of policy output calculated for five types of policy instruments in Austria, Germany and the UK as a mean value of 1998 to 2010. If the alternative measures are equally valid, the results should reveal similarity in the pattern for each measure of policy output with the Index of Climate Policy Activity within the countries.

First, alternative measures might overestimate the intensity of certain types of policy

instruments within the country cases. In Austria, values of the strictness approach reveal only about half the level of values of the Index of Climate Policy Activity in the category of soft measures, regulatory instruments, and public investments, and only one-third in the group of market-based instruments. The scope approach measures level of policy output nearly equal to that measured by the Index of Climate Policy Activity. The deviation of both measures from values of the density approach, however, varies across types of policy instruments. In Germany, there are larger differences between the values of the scope approach and the Index of Climate Policy Activity for public investments and market-based instruments. Values based on the strictness approach deviate markedly from the Index of Climate Policy Activity benchmark. In the UK, the values of the strictness approach vary across types of instruments from half the level of the Index of Climate Policy Activity in the category of framework policies to only a quarter for market-based instruments. Policy output measured by the scope approach reveals the same level as the Index of Climate Policy Activity for framework policies, soft measures, and public investments, but shows lower levels for regulatory and market-based instruments.

Second, comparing policy output of policy instruments across countries reveals substantial variation in the measurement. If the strictness approach is applied, differences in German and Austrian patterns of policy output disappear. The data reveal deviation of values of the density approach from the Index of Climate Policy Activity in Germany than in Austria or the UK. In the UK, the deviation of output per policy instrument measured by the Index of Climate Policy Activity is equal to the German values in the category of framework policies, but is different for market-based instruments and soft measures. Values of the index are even lower for market-based instruments in the UK than in Germany despite higher scores for policy density.

Figure 2: Mean of Policy Output Measures per Type of Policy Instrument



Source: IEA, UNFCCC communications, authors' calculations.

The results reveal substantial variation in the pattern for the alternative measures of policy output compared to the Index of Climate Policy Activity across types of policy instruments. As a consequence, studies using alternative measures of policy output risk potential bias on the importance of certain policy instruments within one country. Furthermore, differences between the Index of Climate Policy Activity and alternative measures vary across the cases, suggesting that the results of comparative analysis of types of policy instruments across countries are potentially biased when alternative measures are applied.

In sum, applying the density approach leads to substantial differences in results in comparison to the Index of Climate Policy Activity across and within countries whereas the strictness approach systematically underestimates policy output. Using the scope approach produces results most similar to the Index of Climate Policy Activity, for Austria even delivering identical levels of policy output. However, the scope approach underestimates

policy output for instruments in the UK and for market-based measures and public investments in Germany. Thus, while application of the scope approach might be adequate in specific circumstances or single countries, it does not provide sufficient robustness in the context of larger comparative studies.

Conclusion

Policy efforts at the national level continue to be the decisive arena for climate mitigation despite ongoing efforts at international collaboration. A wide range of policy instruments is used to curb greenhouse gas emissions, with marked differences but also similarities between nation states. The fact that policy adoption results from a unique national context renders international comparison a theoretical and empirical challenge. This article contributes to the public policy literature by providing the Index of Climate Policy Activity as an empirical tool, which allows the comparison of national policy portfolios.

The article addresses the theoretical and practical challenge of conceptualizing policy output with the focus on policy instruments. In a second step, we consider both elements of policy output, density and intensity, introduced by Knill, Schulze, and Tosun (2012). Using theoretical arguments from policy-design literature, we identify multiple design features of policy instruments, which reflect policy instruments' intensity throughout the policy process. In this way, the article improves attempts to conceptualize and operationalize policy output that has been missing in the literature so far. The Index of Policy Activity can be constructed on the basis of readily and publicly available sources such as policy databases and government documents what we consider to be a clear advantage of our approach compared to other

measurements that rely on proprietary data. The comparison of our Index of Climate Policy Activity with case-study literature and expert evaluation on policy output clearly demonstrated the validity of our case study findings. Furthermore, the analysis demonstrated the weaknesses of alternative measures of policy output using the concepts of density and intensity. It is important to note that counting procedures (density approach) or single-factor weighting (strictness and scope approach) can be highly appropriate in specific contexts. However, we demonstrated that they could carry potential for bias when applied to larger policy portfolios with various types of policy instruments.

This article was primarily concerned with presenting the Index of Climate Policy Activity. We did not attempt to explain how and why the policy portfolios came into existence or changed over time. Nor did we seek to evaluate the performance or effectiveness of these policy portfolios. Granted, this empirical application is limited to a period of observation of twelve years and the specific sector of energy production in the respective countries. However, the elaborate measurement concept that we developed in this article is intended to be generally applicable to assess any policy instrument's intensity in any institutional and political setting.

On this ground, we encourage both researchers and practitioners to apply the basic approach we used in comparative studies of policy output with a broader empirical basis (more policy sectors, more countries, longer time-spans). The analytical tool presented here provides sufficient flexibility to assess policies in any policy area due to its strong theoretical embedding in the policy-design literature. Minor modifications to the *objectives* and *scope* categories would allow applying the concept to further policy sectors such as education, health or environment. Also, the concept is applicable to policy making processes in any other national or sub-national context outside the European Union, e.g. in comparisons of US state

policies. Furthermore, the measurement concept developed in this article provides a basis for further statistical analyses of policy effectiveness or policy performance.

Notes

1. We were planning to includes measures on energy efficiency but had sufficient data available to calculate the intensity value via either targets for renewable energy or emission reduction.
2. For a discussion of aggregation, see Grant and Kelly (2008), Lapinski (2008), or Clinton and Lapinski (2006).
3. Albrecht and Arts (2005) analyze policies and measures for climate mitigation, which have been reported by national governments to the UNFCCC as having the "most significant impact" (p. 894). In a similar vein, Knill et al. (2010) use forty pre-selected environmental policy measures on the basis of expert surveys and national and international legal databases.
4. We thank Jan Burck from Germanwatch for providing the data.
5. Quite small differences exist, for example, for the German Combined Heat and Power Act (policy activity score = 0.53) and the National Allocation Plan 2008 to 2012 (policy activity score = 0.57) in 2008. The difference in the ranking of the German Renewable Energy Act Amendment in 2009–2010 is based on a delay in the expert evaluation taking major policy interactions with the German phase-out of nuclear power into account in 2010 but not in 2009. The Austrian Financial Incentives for Rural Biomass Energy is highly linked with the Feed-in tariff for which we calculated a separate score but which is evaluated as being highly similar by the experts. Due to the very different methods applied there is necessarily measurement error which becomes evident in the variation of expert evaluations for single policy instruments. Apart from these exceptions, the expert ratings revealed equal results.

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Appendix 1: Description of policy types.

Policy type	Description
Soft measures	Include education and outreach (policies designed to increase knowledge, awareness, and training among relevant stakeholders or users, including information campaigns, training programs, labeling schemes) and voluntary agreements (measures that are undertaking voluntarily by government agencies or industry bodies, based on a formalized agreement and often agreed to between a government and an industry body)
Market-based instruments	Include financial instruments (policies to encourage or stimulate certain activities or behaviors including tax incentives or credits on the purchase or installation), incentives and subsidies (policies to stimulate certain activities, behaviors or investments, e.g., feed-in tariffs, rebates, grants, and preferential loans), and tradable permits (GHG emissions trading schemes, white certificate systems stemming from energy efficiency or energy savings obligations, and green certificate systems based on obligations to produce or purchase renewable energy-sourced power).
Framework policy	Refers to the processes undertaken to develop and implement policies. This generally covers strategic planning documents and strategies that guide policy development. It can also include the creation of specific bodies to further policy aims, making strategic modifications, or developing specific programs.
Public investment	Include direct investments in government procurement programs (e.g. requirement to purchase energy efficient equipment and vehicles) and infrastructure investment (e.g. urban planning), and RD&D (investment in technology research, development, demonstration and deployment activities)
Regulatory instruments	Covers a wide range of instruments by which a government will oblige actors to undertake specific measures and/or report on specific information. Examples include energy performance standards for appliances, equipment, and buildings; obligations on companies to reduce energy consumption, produce or purchase a certain amount of renewable energy; mandatory energy audits of industrial facilities; requirements to report on GHG emissions or energy use.

Source: IEA, http://www.iea.org/textbase/pm/explanation.asp (October 12, 2012): EEA, http://www.eea.europa.eu/themes/climate/pam (October 27, 2012)

Chapter 3

The Innovativeness of National Policy Portfolios – Climate Policy Change in Austria, Germany, and the UK

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Abstract: This paper examines policy change in the area of climate mitigation and investigates the role of policy innovations in radically altering a policy portfolio. We analyze whether policy innovations are merely symbolic or truly radical and if they contribute to `tipping´ policy portfolios towards a new instrumental logic. We study policy innovations in the context of policy portfolios, distinguish between levels of policies at which innovations might occur, and analyze policy dynamics over time. Our analysis is facilitated by a new measurement for policy change in policy portfolios. This new encompassing approach sheds more light on the relative importance of policy innovations in complex policy portfolios. Thus, the paper can serve as a blueprint for further systematic comparative analyses. Empirically, we analyze policy innovations in the energy production policy portfolios of Austria, Germany and the UK between 1998 and 2010 and find high stability in the instrumental logic but substantial deviation in policy settings and calibrations.

Keywords: policy innovation, policy change, policy dynamics, policy measurement, policy portfolio, symbolic innovations

Introduction

After twenty years of debate on how to meet the challenges of climate change the major achievement at the latest 2012 UN Climate Change Conference in Doha was to set out a timetable to adopt a universal climate agreement by 2015. This incontrovertibly marks a dead end in international climate politics (Campbell 2013). By contrast to international failure, national policies are bound to be successful in providing effective and efficient solutions for domestic climate mitigation. Hence recent years have seen a resurgent interest by both scholars and practitioners in policy innovation – "a program or policy which is new to the states adopting it, no matter how old the program may be or how many other states may have adopted it" (Walker 1969, 881). This new wave of literature analyzes policy innovation from both a diffusion and evaluation perspective. Scholars studying policy diffusion explain international variation in countries' policy innovations as a result of endogenous and exogenous factors (Benson and Jordan 2011; Jordan and Lenschow 2008; Jordan et al. 2010). Other studies evaluate the process of innovation in policy output with the focus on post-adoption dynamics and its influence on the status quo (Bauer et al. 2012; Howlett and Joshi-Koop 2011; Schmitt and Tosun in preparation).

However, despite the large body of research, we have actually seen only pieces of the larger 'elephant in the room'. The majority of studies of innovation from both perspectives – diffusion and evaluation – have focused on individual instruments (e.g. Chandler 2009; Lyon and Yin 2010; Rabe 2006) or a specific set of pre-selected innovations (e.g. Busch et al. 2005; Holzinger et al. 2011; Liefferink et al. 2009) and rarely consider policy innovations in the more complex contexts of (1) the policy portfolio, (2) different levels of policies, and (3) policy dynamics over time. As a result, scholars and practitioners often assume that specific

policy instruments, such as feed-in tariffs, are highly innovative simply because they are newly adopted.

This attitude has two major pitfalls. First, without evaluating newly introduced policy instruments in the context of the policy portfolio, i.e. the entirety of all policies in a particular field, scholars and practitioners risk being misled by an impression of innovation that is exaggerated or merely symbolic (Strebel and Widmer 2012; Tömmel and Verdun 2009; Wurzel et al. 2013). Symbolic innovations result from a mismatch of different levels of policy where innovation might occur (van der Heiden and Strebel 2012; Makse and Volden 2011; Rogers 2003). Governmental action or 'cheap talk' on the level of policy goals might be perceived as innovative whereas actual instruments or other policy design features remain traditional (see Bauer et al. 2012; Krause 2011; McConnell 2010). Second, as discussed by Jordan and Huitema (this volume, citing Lynn 1997, 96), policy innovation is "an inherently disruptive process" with the potential to overcome interests defending the status quo. Even insignificant policy innovation might trigger policy dynamics within a process where cumulative changes lead to a 'tipping point' towards a regime with new policy instruments and new interests and coalitions formed around them (Black, Lodge, and Thatcher 2005; Shipan and Volden 2012). For example, the introduction of a support mechanism for renewable energies can be such a 'tipping point', changing a nation's energy policy regime from centralized non-renewable energy production to decentralized renewable energies and energy efficiency.

Therefore, for scholars and practitioners, it seems crucial to go beyond looking at innovations in isolation and to consider different levels of policy and a longer time frame. This article aims to provide insight by addressing two distinct questions: (1) Do policy innovations have largely symbolic goals or do they also include more radical innovation in their instruments or other policy design features? (2) Do policy innovations in their entirety

replicate the status quo or do they contribute to a momentum towards a 'tipping point' which changes the dominant style? We follow an evaluation perspective of policy output (see Jordan and Huitema, this volume; Beisheim and Campe 2012) and build on Walker's (1969) understanding of policy innovation as the first-time adoption of inventions in a new context via means of diffusion. We apply a distinction between different levels of policies introduced by Howlett and Cashore (2009) and adopt the Hogwood and Peters (1982, 1983) perspective on policy dynamics.

In order to illustrate the value of this encompassing approach, we conduct an empirical analysis of policy innovations in the sector of energy production in Austria, Germany, and the UK from 1998 to 2010. We use the Index of Policy Activity which has been developed to measure and compare policy output across countries and over time (Schaffrin et al. 2012). This approach allows individual policy innovations to be assessed in the context of the pre-existing policy portfolio while evaluating the effects of policy innovations on the policy portfolio. The statistical analysis supports the value of this approach by revealing distinct policy dynamics in the countries studied.

Innovation, policy dynamics and policy change

The complexity of policy innovation

After reviewing the environmental policy literature on innovation, Jordan and Huitema (2011, 2) come to the conclusion that:

> Contributions have largely been limited to particular aspects of the innovation process (namely policy diffusion) and/or case studies of specific inventions/ innovations. Crucially, a perspective that spans the whole policy cycle is still absent - post-adoption dynamics for example have largely been ignored […]. Arguably all these dimensions are needed to provide a full picture of climate policy innovation in the past and a firmer basis on which to speculate about the future.

We aim to contribute to this 'full picture' by considering the complexity of policy innovations with regard to (1) the policy portfolio, (2) different levels of policies, and (3) policy dynamics over time. In order to combine all three elements in an analysis of policy innovation, we take as our starting-point the mainstream literature of policy change (Cashore and Michael Howlett 2007; Hall 1993; van der Heijden 2013).

First, building on Hall (1993), Howlett and Cashore (2009) suggest a policy taxonomy grounded on levels of policy and the distinction between ends and means. On the highest level, more general goals define an instrumental logic of implementation preferences. The meso-level combines objectives and types of instruments. On the lowest level, settings define the specific on-the-ground requirements of policy instruments whereas calibrations describe the specific way in which instruments are used (see Howlett and Cashore 2009, Figure 1).

Second, scholarship has developed many analytical lenses for the study of policy change (e.g., Baumgartner and Jones 2002; Hall 1993; Mahoney and Thelen 2010; Pierson 2001). They widely agree upon Hall's (1993) distinction between two modes of policy change: incremental and radical (e.g., Capano 2003; Coleman et al. 1996). Hall argues that

first-order change in settings or calibrations and second-order changes of objectives and types of instruments are considered to be incremental, whereas third-order change is more paradigmatic and constitutes a radical shift in goals and the instrumental logic (see also Cashore and Michael Howlett 2007; Howlett and Cashore 2009).

Categorizing into different levels and distinguishing between modes of change lay the ground for an analysis of symbolic policies and tipping points. Symbolic policies have innovative goals and might even apply new instruments but lack innovation and intensity at the level of settings and calibrations (see Bauer et al. 2012; Krause 2011; McConnell 2010). For tipping points, the instrumental logic or policy styles play a more important role. Here, policy innovations that vary only minutely from the prevalent policy style in related policy fields might cumulate in a tipping point where the sum of all instruments add up to a completely new instrumental logic.

In the following, we briefly discuss three mainstream theories on policy change and their expectations for symbolic policy and tipping points before we turn to the dynamics of policy innovation in the context of the newly emerging field of climate mitigation.

Symbolic innovation, tipping points, and theories of policy change

Three dominant approaches seek to explain policy change in the literature and thus implicitly address the issue of symbolic policies and tipping points. First, the path dependency approach argues that early, rather stochastic events in a sequence have significant influence on the trajectory due to reinforcing mechanisms, whereas later events are inertial (Howlett and Rayner 2006; Mahoney 2000; Pierson 2000, 2001). Here, symbolic policies play a crucial role. While following a consistent policy path, they create a picture of activity but at the same time support the status quo in the dominant instrumental logic. Thus, symbolic policies serve as negative feedback in order to ensure increasing returns and policy stability (Capano 2003;

Howlett and Rayner 2006; Pierson 2000, 2001). Radical change in the instrumental logic is not a result of cumulative sequences reaching a final tipping point, but appears at critical junctures or during windows of opportunity, e.g. after an election (Kingdon 1995; Lindner 2003; Thelen 1999).

Second, the process sequencing approach follows the idea of cycles switching between incremental and more radical sequences of change (Howlett 2009). Its most prominent application is the punctuated equilibrium model (Baumgartner and Jones 2002; Baumgartner et al. 2009; Haydu 1998). While previous policies can create stable sequences accomplished by non-cumulative negative feedbacks (Bardach 2006; Mahoney 2000), they can also entail negative externalities that require more radical adjustments and transformation (Haydu 1998; de Vries 2000, 2005). Again, symbolic policies as a kind of negative feedback provide a useful means of buttressing existing interests. However, following this approach, cumulative sequences in negative externalities, for example significant public and media attention to catastrophic events, creates positive feedbacks and mobilizes new interests among stakeholders. If public pressure is strong and political actors have no capacity to react adequately, more radical policy change in the instrumental logic occurs (Baumgartner and Jones 2002; Baumgartner et al. 2009; Haydu 1998).

Third, cumulative incrementalism criticizes mainstream theory on policy change for its neglect of cumulative steps as a source of more radical change (Capano 2003; Cashore and Michael Howlett 2007; Lee and Strang 2006).[2] Here, processes of increasing returns and policy learning through incremental changes of policy instruments finally reach a tipping point for a more radical change in the instrumental logic (Coleman et al. 1996; Pierson 1993). Symbolic policies play no role since changes in the instrumental logic occur by the

[2] The most prominent applications are 'layering', 'conversion', 'drifting' and 'displacement' (Mahoney and Thelen 2010) and neo-/quasi homeostatic, or thermostatic approaches (Cashore and Howlett 2007).

incremental adoption of new 'layers' of innovative instruments with new settings and calibrations (Beland 2007; Mahoney and Thelen 2010; Streeck and Thelen 2005). The analytical problem is to define the point at which incremental changes tip the instrumental logic towards change (Capano 2009; van der Heijden 2011).

The dynamics of climate policy

The analysis of climate policies provides a very interesting case study for symbolic innovations and tipping points within the debate on policy dynamics and policy change since it is a rare example of a policy field that has come into existence only in the last twenty years.[3]

Hogwood and Peters (1983, 26) believe that innovations, i.e. "the entry of government into an activity in which it has not previously been involved" are rare. Instead, policy-making mostly deals with policy successions, which purposely adjust, transform, or replace existing policies (see Table 1). These successions nevertheless can include innovative elements such as new instruments. Hogwood and Peters (1982; 1983) predict a permanent need for policy adjustment, thus rendering successions the most likely next step once a policy is established. This distinction cuts to the main point of the Hogwood and Peters argument, that these categories are not "a static ordering on which individual issues can be ranked, but can be used to portray a *trend over time* whereby policies have increasingly incorporated greater elements of succession" (1983, 30, original italics).

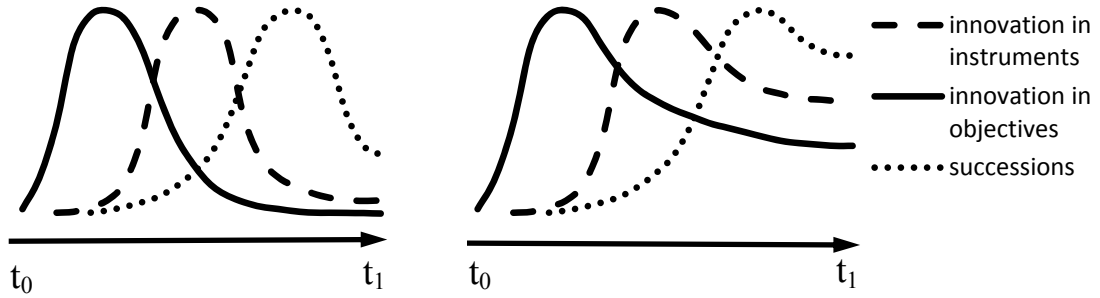
[3] This does not mean that the policy field was completely 'empty', since there are natural overlaps with other policy fields such as environmental policy. Some even argue that climate politics is merely the repackaging of existing policies from related policy fields such as environmental politics (Upham et al., this volume).

Table 1: Types of policy innovations

Innovation in *objectives*	new area of policy activity
Innovation in *instruments*	new type of policy instrument (or new technology, new institution) AND traditional area of policy activity
Succession	already established type of policy instrument AND traditional area of policy activity

Figure 1 illustrates different scenarios of policy dynamics in a newly emerging policy field. As the left panel shows, the relative importance of innovations is higher at the outset of a new policy field, but over time "the *relative* distribution of policy change" (Hogwood and Peters 1983, 30) moves from innovations in objectives to innovations in instruments and towards policy successions. This does not preclude innovations in later periods but decreases their relative importance. In this baseline scenario discussed by Hogwood and Peters (1982; 1983), policy change occurs during a critical juncture. Policy instruments might be randomly or purposely adopted in the initial phase of the emerging policy field but shape the succeeding trajectories significantly as predicted by path dependency theory or process sequencing (Howlett and Rayner 2006). This is why policy portfolios can quickly be 'locked in' to an equilibrium, applying mainly traditional, symbolic, and non-innovative policies (van der Heijden 2013; Howlett 2009; John and Margetts 2003; Tosun 2013).

Figure 1: The relative mix of innovation and successions over time



Note: y-axis = expected policy output

Source: Based on Hogwood and Peters (1982; 1983).

Here, the policies' innovativeness is a result of the new policy field but does not entail new instruments or even a change from the instrumental logic that holds in other related but more traditional policy fields such as environmental politics. However, following the model of cumulative incrementalism, ambitious early innovations can lay a foundation stone for climate policy making, with a number of successions making only minor but cumulative calibrations towards a new instrumental logic. In an alternative scenario, innovations can have the character of small experiments and exert their main influence on outcomes through a number of successions increasing their intensity in the respective settings and calibrations. The main point here is that innovations remain dominant over a longer time period and might even reach a tipping point to achieve a new instrumental logic radically different from traditional policy fields. In the following, we analyze whether we find such developments in our empirical cases.

Operationalization, measurement, data

In our empirical analysis, we seek to illustrate the role of symbolic innovations and dynamics towards tipping points leading to a new instrumental logic. We conducted an empirical

analysis of national policy portfolios in the field of climate policy for three countries: Austria, Germany, and the UK for the period 1998 to 2010. 1998 is chosen as the reference year as the Kyoto Protocol officially came into force at that time. We restrict our analysis to the sector of domestic energy production as it is characterized by the highest emission levels of all economic sectors in our country cases.

Case Selection

The selection of Austria, Germany, and the UK results from theoretical considerations. As discussed in the previous section, policy innovation can occur on different levels of policy. We chose our cases in order to achieve similarity in goals but greater variation of the prevalent instrumental logic (macro level), objectives and instruments (meso level) as well as settings and calibrations (micro level). Austria and Germany are characterized as similar in terms of general environmental policy preferences and having a strong regulatory tradition (Liefferink et al. 2009; Wurzel, Brückner et al. 2003; Wurzel, Jordan et al. 2003). However, Germany has more ambition to meet national targets on greenhouse gas emissions, whereas Austria tends towards symbolic policies without real teeth. Comparing the two may answer the question whether Austria will soon be locked in to a traditional policy path while more radical changes emerge in Germany. Meanwhile, comparing Germany and the UK admits an assessment of the countries' differing potential to reach a tipping point to a new instrumental logic. Germany as a coordinated market economy with a strong emphasis on regulatory policy and the precautionary principle in environmental politics mainly adopts regulatory or financial instruments such as eco-taxes, and voluntary agreements. In contrast, UK environmental politics since 1997 has shifted away from strong regulation towards market-based instruments and voluntary agreements (Bailey 2007; Jordan, Wurzel, and Zito 2003; Jordan et al. 2003; Wurzel, Jordan et al. 2003).

Measuring policy output

In order to make national portfolios comparable, we apply a refined concept of policy output – the Climate Policy Activity Index (Schaffrin et al. 2012). It is based on the notion that a systematic comparison of policy instruments across countries requires not only identifying policy objectives and instruments but also a detailed and systematic assessment of settings and calibrations. As Grant and Kelly (2008) point out: "simply counting laws without accounting for their content is likely to produce measurement error when attempting to measure policy production" (p. 306).

For each policy, we evaluate specific settings and calibrations and code them accordingly (see Table 2 for a description). The first attribute considers whether the policy is integrated into a larger package where policy interaction is considered more systematically or whether the policy is adopted independently of others and thus less integrated (policy integration). Furthermore, the policy's scope is evaluated according to energy sources (oil, gas, coal, wind, solar, biomass, hydro power), energy efficiency, combined heat and power, and/or specific target groups (demand vs. supply, business vs. private sector). Another attribute focuses on policy targets (reduction of greenhouse gas emissions, percentage of renewable energy production, increase in energy efficiency, reduction of total energy consumption) in comparison to the benchmark target of 100% renewable energy production or 80% emission reduction in 2050. The budget covers all costs or imposts linked to the respective policy instrument, while implementation and monitoring focuses on whether strict rules are set, implementing/monitoring entities are clear, and the number of potential conflicting actors is low.

Table 2: Description and coding of *settings* and *calibrations* of climate policy output

Policy settings and calibrations	Description and Coding Range
Integration	Is policy integrated in a larger package and supplemented by an overarching policy process? (Coding: 0, 0.5, 1)
Scope	How many target groups and energy sources does the policy instrument address as a proportion of all possible target groups (households and companies/demand and supply) and energy sources (coal, gas, nuclear, wind, solar, geothermal, biomass, water, including energy efficiency and combined heat and power)? (Coding: 0-1)
Targets	How much does the policy instrument contribute to reach the benchmark target of 80% greenhouse gas reductions or 100% energy production from renewable sources by 2050 (base year 1990)? (Coding: 0-1)
Budget	How much is spent on the policy instrument as a proportion of the public expenditure on energy and fossil fuels in the country? How much is the revenue from the policy instrument as a proportion of public revenue from Value Added Tax in the country? (Coding: 0-1)
Implementation	Is not more than one implementing agency involved and are rules and procedures defined and strict? (Coding: 0, 0.25, 0.5, 1)
Monitoring	Do policy instruments include an automatic monitoring process and is monitoring implemented by an independent institution? (Coding: 0, 0.5, 1)

The resulting score of the weighted policy instrument is an indicator of the intensity of climate mitigation policy. Summing up the score (weighted number) of all policy instruments per country and per year provides the Climate Policy Activity Index. The bases for the data collection were the *Global Renewable Energy Policies and Measures,* the *Energy Efficiency,* and *Addressing Climate Change* databases of the International Energy Agency (IEA).[4] This data is supplemented by information from the *Climate Policies and Measures in Europe*

[4] The databases cover measures taken up in IEA member countries and are updated twice a year. Information is provided by the member countries, measures by provincial or regional governments are not included systematically.

Database from the European Energy Agency (EEA) as well as UNFCCC National Communications and other national documents such as governmental reports on specific climate policy instruments.

Operationalization of policy innovation in objectives and instruments

Our theoretical framework distinguishes between innovations in objectives, innovations in instruments, and successions. A policy is categorized as an innovation in objectives if it is the first policy in the policy portfolio for a specific energy source (out of oil, gas, coal, wind, solar, biomass, hydro power), energy efficiency, combined heat and power, or/and a specific target group (demand vs. supply, business vs. private sector). This applies regardless of the type of instrument which is applied. Policies are operationalized as innovation in instruments when they use tools which have not previously been applied in the field of climate policy, for example, a carbon tax. The third category, successions, consists of traditional instruments aimed at energy sources or target groups that had been addressed by other policies before. Appendix 2 presents a detailed list of innovative policy instruments identified in the analysis.

Following this systematic approach for assessing policy portfolios, we can calculate the score of climate policy output per type of innovation, which allows us to assess the relation in the numbers of innovations and successions on the overall policy portfolio. Furthermore, by assessing which types of instrument are preferred in our cases, we also get a general picture of the instrumental logic dominant in the climate policy portfolio. We can then compare our findings with existing research on national policy styles which has identified distinct national approaches to environmental problems. This allows us to analyze whether the climate policy portfolio is similar to their general environmental policy style or whether they constitute a new instrumental logic.

Results

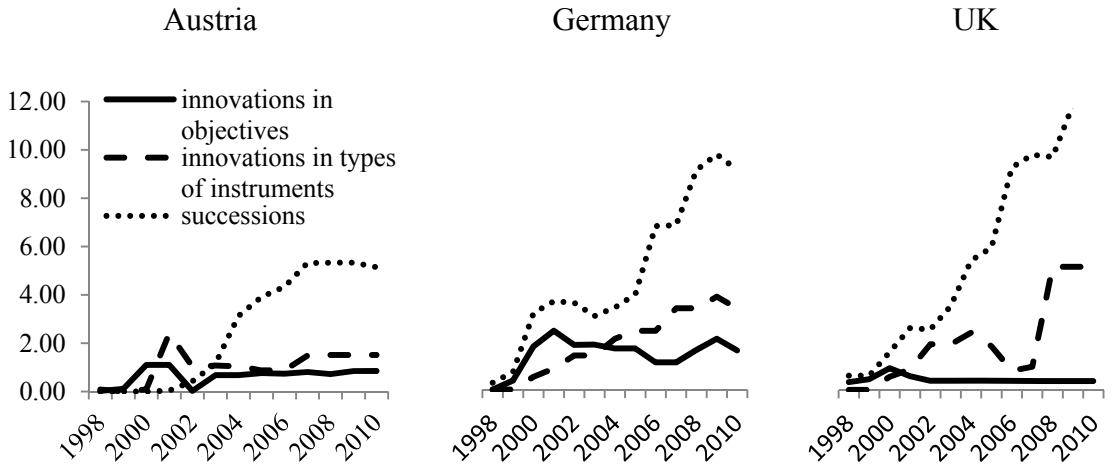
Dynamics of innovation in the climate policy portfolio

The paper proceeds with an analysis of domestic climate policy dynamics. We analyze the general development of climate policy instruments in Austria, Germany, and the UK from 1998 to 2010 to establish whether the portfolios fall into an early lock-in on a traditional policy path or whether policy innovations reach a tipping point in later times when the policy field is established.

Figure 2 shows the Index of Climate Policy Activity, distinguishing between innovations in objectives, innovations in instruments, and successions. We see that in all three cases policy output has substantially increased in the observation period. In Austria, policy output rose between 1998 and 2007 and has remained stable since then whereas both Germany and the UK show a substantially higher level and growth of policy output.

Over the whole observation period, successions dominate policy output in all countries. In Austria we see a pattern of innovations in objectives dominating in the early period until 2000, followed by a predominance of innovations in instruments which is then replaced after 2003 by non-innovative successions. Likewise in Germany and the UK we see that innovations in objectives are higher in numbers than innovations in instruments at the beginning of the observation period. In Germany a turning point is reached in 2004, while the UK passed this point in 2002. What is striking is that in both countries the highest levels of policy activity after 2000 are in successions, whereas in Austria policy innovations produce more policy activity than successions until 2002/3 – although on a smaller scale.

Figure 2 Index of Climate Policy Activity from 1998 to 2010



Note: y-axis: policy output of national portfolio climate mititgation taken from the Climate Policy Activity Index.

Source: IEA, UNFCCC Communications, own calculation.

Figure 2 indicates that innovations play a minor role in Austria but seem to cumulate in tipping the policy portfolio in Germany and the UK. In the case of Austria, with only moderate overall policy output, a lock-in on successions is reached as early as 2002 with only a minor (though relatively constant) part of policy output achieved through innovations. In both Germany and the UK, however, the policy activity of innovations continues to grow. Yet, in the British portfolio innovativeness is found mainly in instruments whereas in the German portfolio both innovations in objectives and innovations in instruments remain relatively strong. The British case also shows a very irregular pattern with a drop in innovations in instruments from 2005 to 2006 followed by a sudden spike of innovativeness around 2007/8. One reason for this is that between 1999 and 2006 a number of policy options were discussed by the British government in the form of various white papers, which ultimately formed the basis of the large Climate Change Act of 2008. In Germany, innovations in objectives occur step by step over time and thus go hand in hand with

innovations in new instruments. This development culminated in 2006 when a large number of policies were combined in the Integrated Climate Change and Energy Programme.

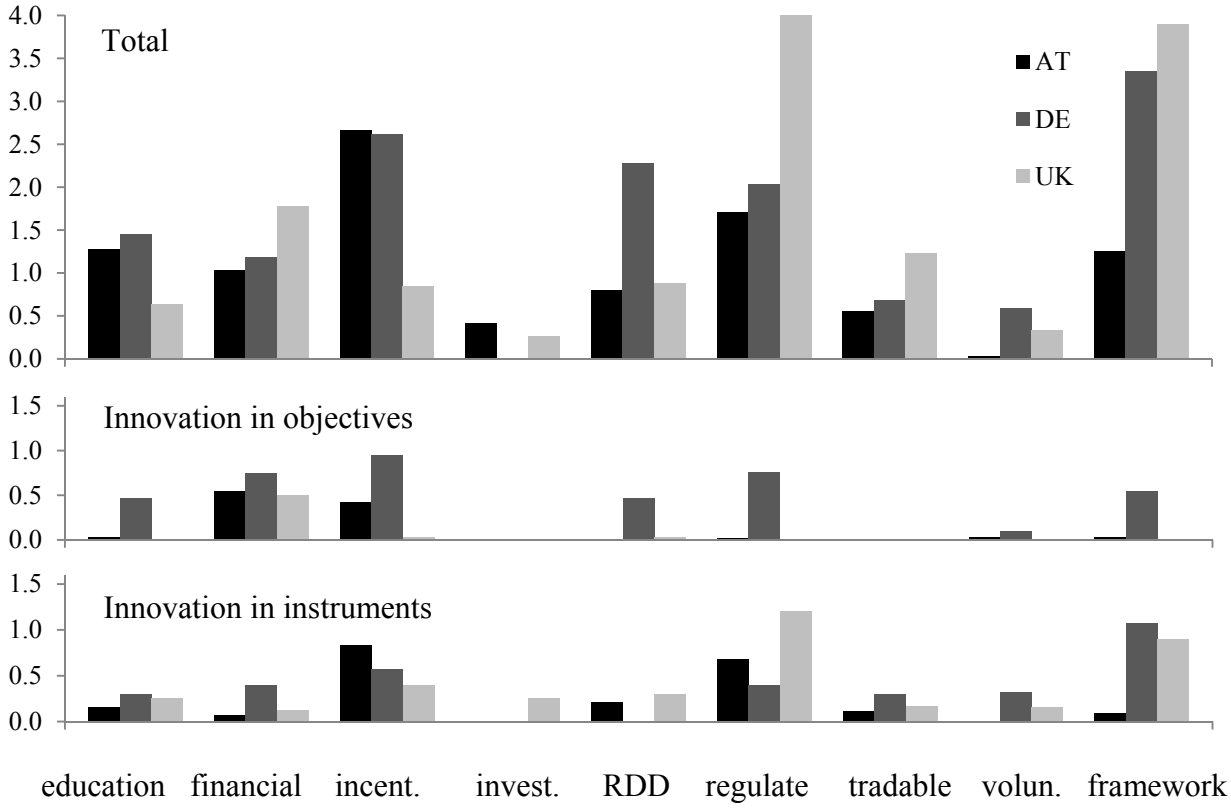
Symbolic innovation

The findings in Figure 2 give an impression of the dynamics of the national climate mitigation portfolios but do not reveal whether innovations are symbolic and whether they actually cumulate in a tipping point of a new instrumental logic.

In the next step, we analyze how innovations' settings and calibrations compare to the whole policy portfolio to demonstrate how much innovations alter the characteristics of the countries' climate mitigation policy (Figure 3). Innovations are symbolic if their settings and calibration indicate less policy intensity, i.e. less resources, time, or political commitment allocated than the average policy instruments in the policy portfolio (Schaffrin, Sewerin, and Seubert 2012). We measure six policy settings (scope, target) and calibrations (integration, budget, implementation, and monitoring) (see Table 2).

Figure 3 reveals that the Austrian climate policy portfolio is characterized by moderate policy integration and scope, and low targets, implementation, monitoring, and budget. In Germany, policies are highly integrated, have wider scope, and are very strict in implementation and monitoring, while targets and budget are low on average. In the UK's policy portfolio, integration, implementation, and monitoring are moderate, and policies have on average low scopes, targets, and budget.

Figure 3: Average climate policy output per type of instrument by innovation-type



Note: The exact labels of the types of policy instruments as provided by the IEA databases are Education and Outreach, Finciancial instruments, Incentives and Subsidies, Public Investments, Research, Development and Distribution,Regulatory Instruments, Tradable Permits, Voluntary Agreements, and Framework Policy. For a detailed description see Appendix 1.

Source: IEA, UNFCCC Communications, own calculation.

Austrian innovations in objectives seem to be more symbolic with marginally lower settings and calibrations but with a higher average budget. Innovations in instruments in Austria are also more symbolic with regard to integration and targets, but more ambitious in implementation. In Germany, innovations in objectives are more ambitious including greater scope and more detailed implementation procedures but less monitoring and integration than the total policy portfolio. German innovations in instruments are highly integrated with larger scope and targets, but marginally lower implementation. This can be attributed mainly to the Integrated Climate Change and Energy Programme of 2007 which comprised a large number

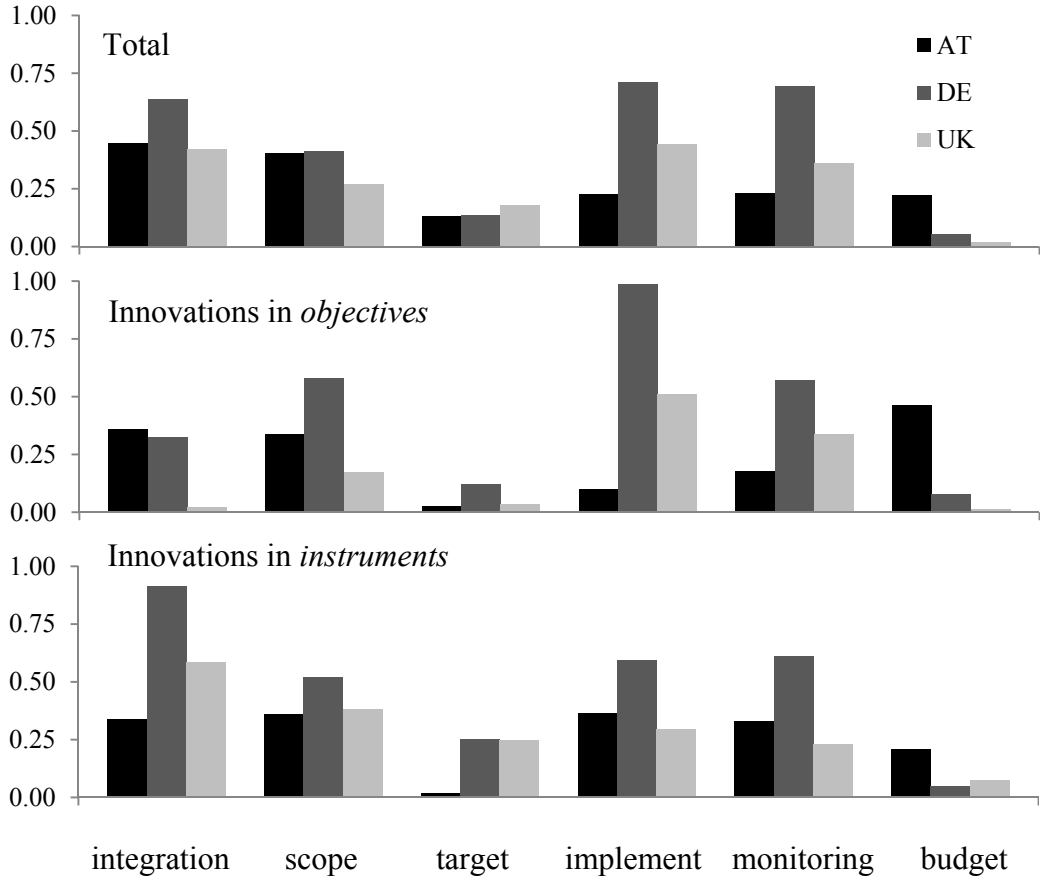
of policies under a common framework. British innovations in objectives seem to be much more symbolic when entering a new area where early policy experiments keep targets, scope and integration low in order to minimize risk and avoid negative consequences in the event of failure. In contrast, innovation in instruments contribute to the portfolio a higher level of integration, scope, target, and budget and only marginally lower levels in implementation and monitoring.

Tipping points in the instrumental logic of climate mitigation portfolios

In the last step of the analysis, we investigate whether a radical change in the instrumental logic of climate mitigation policy occurs, if at all, by cumulating in a tipping point over a longer time period. For this purpose, we compare the policy innovations' types of policy instruments with the policy portfolio to determine their contribution to the overall mix in types of policy instruments as an indicator for the instrumental logic. Furthermore, we compare the instrumental logic of the portfolio with policy styles in the related field of environmental politics in order to evaluate whether innovations really differ from the traditional policy style and thus contribute to tipping the instrumental logic.

Figure 4 shows the average policy output level per type of policy instrument for the total portfolio as well as specifically for innovations. In general, we see that regulatory instruments, framework policies and incentives and subsidies are the instruments with the highest level of output. These are followed by educational and financial measures, and Research, Development, and Distribution (RD&D). Tradable permits, voluntary agreements and public investment are least important for the countries' overall policy output.

Figure 4: Mean policy calibrations and settings per innovation type



Source: IEA, UNFCCC Communications, own calculation.

Austria's instrumental logic is characterized by high incentives and subsidies; moderate education and outreach, financial and regulatory instruments, and framework policies; and low public investments, tradable permits, and voluntary agreements. We find a similar pattern in the German policy portfolio with respect to education, financial instruments, incentives and subsidies, regulatory instruments and tradable permits. However, Germany shows a higher output in RD&D, voluntary agreements, and framework policies, with no output in public investments. The UK demonstrates a different choice of policy instruments. In contrast to Germany and Austria, policy output is clearly dominated by regulatory instruments followed by framework policies and financial instruments. Incentives and subsidies as well as education and outreach are of minor importance in the UK.

The second and third panels of Figure 4 examine how particular types of instruments are applied for innovations. Despite the variety of policy instrument in the Austrian policy portfolio, when entering a new area only incentives and subsidies and financial instruments are adopted and constitute innovations in objectives. In contrast, the instrumental logic of innovations in instruments in Austria is not substantially different from the rest of the portfolio with the exception of less public investments and framework policies. In Germany, innovations in objectives are distributed more widely while basically following the instrumental logic of the policy portfolio as shown in Panel 1 in Figure 4. Exceptions are higher levels in financial instruments and lower levels in RD&D and tradable permits. For German innovations in instruments, we find the same pattern with even lower levels of RD&D and education and outreach. In the UK, the results reveal only financial instruments to be characterized by substantially higher levels of policy output of innovations in objectives. British innovations in instruments also follow a very similar instrumental logic to the policy portfolio but with comparatively higher levels of policy output for public investments and voluntary agreements.

The findings are in line with what several authors consider the environmental policy style, i.e. the instrumental logic, dominant in these countries (Lees 2007; Richardson 1982). We find that Austria adopts policy instruments in conformity with its more regulative, corporatist, and consensual style in the field of environmental policy, which has been traditionally more resistant to market-based policy types and has only recently adopted environmental taxes (Jordan, Wurzel, and Zito 2003; Wurzel, Brückner et al. 2003). However, while still relying on regulation and framework policies, it expands its portfolio by incentives and subsidies. In Germany, the strong consensus-oriented stance of the government, based on the principle of the social market economy, a strong legalistic tradition, and corporatist design (Richardson 1982; Weale et al. 2000) resembles the Austrian policy style but also includes

further policy instruments such as education and outreach and voluntary agreements (Bailey 2007; Lees 2007; Wurzel, Jordan et al. 2003). It seems that Germany, due to its larger portfolio, also reveals a larger variation in climate mitigation policy than Austria. In the UK, the dominance of regulatory instruments and framework policies reflects the British tradition of accommodation and widespread consultation between political actors, experts, and interest groups. Yet, the relatively high importance of tradable permits in the British climate policy portfolio also points to a shift towards more market-based policy instruments (Jordan et al. 2003; Lees 2007).

Taken together these findings suggest that the countries' specific instrumental logic is substantially but not radically influenced by policy innovation. This finding is independent of high (as in the cases of Germany and the UK) or low (as in the case of Austria) levels of overall innovativeness and irrespective of policy styles in the countries.

Conclusion

Innovations in climate policies have been the subject of much research within the field of environmental policy studies. The aim of this article was to contribute to this field by investigating how innovations are situated within (1) the policy portfolio, (2) different levels of policies, and (3) policy dynamics over time. In our theoretical discussion and empirical analysis, we addressed the questions (1) Do policy innovations have largely symbolic goals or do they also include more radical innovation in their instruments or other policy design features? (2) Do policy innovations in their entirety replicate the status quo or do they contribute to a momentum towards a 'tipping point' which changes the dominant style?

The results demonstrated different dynamics in the development of the policy portfolio of climate mitigation policy in Austria, Germany, and the UK with innovations playing a

dominant role at the beginning when the policy field of climate mitigation was newly emerging. As in Austria, innovations were soon replaced by successions as predicted by the dynamics approach. In contrast, we found a dynamic in Germany and the UK where the policy portfolio continued to grow in policy output and innovations remained strong over a longer time period.

When comparing the specific calibrations and settings of innovations with the portfolio, we discovered that Austrian policy innovation is tentative symbolic but contributes a higher budget and implementation to the portfolio. However, as predicted by the path dependency and the process sequencing approach, the proportion of innovation on the portfolio was only marginal and their influence on changing the instrumental logic of the policy portfolio was rather low. In Germany, innovations were by no means symbolic but played a crucial role expanding the policy portfolio. We found innovations in objectives gradually addressing new policy areas using a variety of policy instruments with ambitious targets and scope being strongly implemented. The British strategy seemed to be more symbolic and experimental with regard to innovations in new objectives, for example, offshore wind power whereas innovative instruments have a larger scope and more resources.

By looking at complete policy portfolios we can show that despite the occurrence of innovations climate mitigation policy is more symbolic in one country but more substantial in others. As discussed by the cumulative incrementalism approach, policy innovation might tip the climate mitigation portfolio toward a new instrumental logic. In our empirical analysis, we observed that policy innovation expanded the portfolio by introducing new types of policy instruments. We found no evidence of a radical change in the instrumental logic in either country which is in line with what the path dependency and the process sequencing approach expect. However, the question remains when exactly such a tipping point is present. Given that the policy field of climate mitigation is still in flux and rapidly developing for the next

two decades, it is not clear to this point whether the current development which we see in the data is just the starting point for a more radical but cumulative change. We find indication for this development in Germany and the UK where experiences and knowledge from the increasing number of climate policy instrument in the early phase cumulated in a larger package in both countries.

Reviewing case-study literature on environmental politics suggests insights on whether symbolic policy innovations are in fact applied as a negative feedback mechanism to support the status quo interests as predicted by the path dependency and the process sequencing approach. For example, between 2000 and 2007, the Austrian federal government was dominated by the ÖVP, a pro-business conservative party mostly in favor of the status quo and no strong ambitions regarding climate politics (Klingemann et al. 2006; Wurzel, Brückner et al. 2003). In Germany, we find a typical scenario described by the process sequencing model where strong public pressure and media attention on climate change meets the opportunity to actually change the status quo with entering of the green party into government in 1998, the German presidency of the EU council in 2005, and the G8 summit in Heiligendamm in 2007 (Jänicke 2011; Schreurs and Tiberghien 2007). Important was also the antagonism of the green party and the large energy-production companies, breaking with traditional and more consensual policy style based on voluntary agreements, with industry in the "shadow" of strong regulation (Lees 2007). In the UK, a change in government - Third Way and New Labour – constituted a shift of British policy style from highly regulatory to more market-based approaches in cooperation with selected industries (Bailey 2007; Jordan et al. 2003). This supports the process sequencing approach but leaves the question unanswered why the UK applies different strategies for innovations in objectives and innovations.

The conclusions drawn from our analysis have to be interpreted in light of its

limitations. Our analysis is restricted to the limited period of observation. Even though we used the most recent data available the analysis is still truncated to 12 years while developments in the countries might continue for 20 or even 50 years. Still, the fact that the field is evolving renders it an interesting case for the analysis of policy change and innovations compared to many other policy fields which have a long history, such as financial, economic or social policy. However, the paper provides a blueprint for further and more detailed analyses of the impact of policy innovations on the overall policy portfolio, of the different levels of policy innovations, and of the policy dynamics resulting from the introduction of policy innovations to either a newly evolving or established policy field. Building on the conceptual outline and measurement approach presented in this article, researchers could address these aspects to conduct further large-N comparative studies. These studies could shed more light on the relative importance of policy innovations in complex policy portfolios and could help to identify cases of symbolic innovations more systematically. They also could provide systematic assessments of policy portfolios' range of innovativeness by taking up the distinction between innovation in objectives, innovation in instruments, and policy successions. This can facilitate a better understanding of the temporal patterns of policy innovations. Furthermore, with a clear focus on policy dynamics, future analyses can help us achieve a better understanding of the tipping points of policy portfolios which is, especially in light of the environmental challenges we face, important not only for academic debates but also for policymakers.

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Appendix 1: Description of policy types.

Policy type	Description
Education and outreach	Policies designed to increase knowledge, awareness, and training among relevant stakeholders or users, including information campaigns, training programs, labeling schemes.
Financial	Policies to encourage or stimulate certain activities or behaviors. These include tax incentives, such as tax exemptions, reductions or credits on the purchase or installation of certain goods and services.
Incentives and subsidies	Policies to stimulate certain activities, behaviors or investments. These include feed-in tariffs for renewable energy, rebates for the purchase of energy-efficient appliances, grants, and preferential loans and third-party financing.
Framework policy	Refers to the processes undertaken to develop and implement policies. This generally covers strategic planning documents and strategies that guide policy development. It can also include the creation of specific bodies to further policy aims, making strategic modifications, or developing specific programs.
Public investment	Policies guiding investment by public bodies. These include government procurement programs (e.g. requirement to purchase energy efficient equipment and vehicles) and infrastructure investment (e.g. urban planning).
RD&D	Policies and measures for the government to invest directly in or facilitate investment in technology research, development, demonstration and deployment activities.
Regulatory instruments	Covers a wide range of instruments by which a government will oblige actors to undertake specific measures and/or report on specific information. Examples include energy performance standards for appliances, equipment, and buildings; obligations on companies to reduce energy consumption, produce or purchase a certain amount of renewable energy; mandatory energy audits of industrial facilities; requirements to report on GHG emissions or energy use.
Tradable permits	Refers to three kinds of systems – GHG emissions trading schemes, white certificate systems stemming from energy efficiency or energy savings obligations, and green certificate systems based on obligations to produce or purchase renewable energy-sourced power (generally electricity). In GHG trading schemes, industries must hold permits to cover their GHG emissions; if they emit more than the amount of permits they hold, they must purchase permits to make up the shortfall. If they emit less, they may sell these. White certificate schemes create certificates for a certain quantity of energy saved, for example a MWh; regulated entities must submit enough certificates to show they have met energy saving obligations. Again, if they are short, this must be made-up through measures that reduce energy use, or through purchase of certificates. Green certificates refer to renewable energy certificates which represent the certified generation of one unit of renewable energy, generally one megawatt-hour. Certificates can be traded and used to meet renewable energy obligations among consumers and/or producers.
Voluntary agreements	Refers to measures that are undertaking voluntarily by government agencies or industry bodies, based on a formalized agreement. There are incentives and benefits to undertaking the action, but generally few legal penalties in case of non-compliance. The scope of the action tends to be agreed upon in concert with the relevant actors. These are often agreed to between a government and an industry body, with the latter agreeing to certain measures; for example, reporting information on energy use to the government, being subject to audits, and undertaking measures to reduce energy use

Source: IEA, http://www.iea.org/textbase/pm/explanation.asp (October 12, 2012)

Appendix 2: Innovation in objectives and in instrument.

Austria	
1995	Financial Incentives for Rural Biomass Energy Generation (innovation in objectives)
1996	Energy Taxes (innovation in instruments)
2000	Renewable Energy Targets/Quota System (innovation in objectives)
	Combined Heat and Power (CHP) (innovation in objectives)
2001	Eco-Plants Feed-In Tariffs (innovation in instruments)
	Green Certificates Trading for Small Hydro (innovation in instruments)
	Federal Environment Fund (innovation in instruments)
	AUT Labelling of Electricity Bills (innovation in instruments)
2002	Ökostromverordnung 2002 (feed-in tariffs for green electricity (innovation in instruments)
2003	Green Electricity Act: Promotion for combined heat and power (CHP): (Federal Law Gazette I No 45/2008) (innovation in instruments)
2007	Climate and Energy Fund (innovation in instruments)
Germany	
1999	Eco-Tax Reform - First Stage (innovation in objectives)
2000	Combined Heat and Power (CHP) Extra Law (Gesetz zum Schutz der Stromerzeugung aus Kraft-Wärme-Kopplung - Kraft-Wärme-Kopplungsgesetz) (innovation in objectives)
	Renewable Energy Act (innovation in objectives)
	Contracting und andere Energiedienstleistungen (innovation in instruments)
2001	National Energy Agency (dena) (innovation in objectives)
	CHP Agreements with Industry (innovation in instruments)
2002	Combined Heat and Power Law (Kraft-Wärme-Kopplungs Modernisierungsgesetz) (innovation in objectives)
2003	Law to Amend the Mineral Oil Tax Law and Renewable Energy Law (innovation in objectives)
2004	Renewable Energy Sources Act 2004 (innovation in objectives)
	Regional Testing Ground Agreement for Flexible Mechanisms, BASREC Testing Ground Facility (innovation in instruments)
2005	National Climate Protection Programme 2005 (innovation in instruments)
2006	Energy Taxes: Coal, Biodiesel, Natural Gas (innovation in objectives)
2007	Integrated Climate Change and Energy Programme (innovation in instruments)
	CHP Agreements with Industry (innovation in instruments)
	Smart Metering (innovation in instruments)
	Novellierung CHP-Law (innovation in instruments)
2008	Renewable Energy Heat Act (innovation in objectives)
2009	Renewable Energies Heat Act (EEWärmeG) (innovation in objectives)
	2009 Amendment of the Renewable Energy Sources Act (innovation in objectives)

UK	
1998	Reduced VAT for Energy Savings Material / The Value Added Tax (Reduced Rate) Order 1998 (innovation in objectives)
1999	10% Renewable Energy Target - Green Certificates (innovation in objectives)
	Emissions Trading Agreement (innovation in instruments)
2000	Reduced VAT for Energy Savings Material (innovation in objectives)
	UK Climate Change Programme (innovation in instruments)
	New Opportunities Fund - Financing Renewable Energy in the UK (innovation in objectives)
	Energy Crops Scheme - England (innovation in objectives)
2001	The Carbon Trust (innovation in instruments)
2002	Renewables Obligation Order 2002 No. 914 - IS regulatory, tradable permit, process (innovation in instruments)
	UK Emissions Trading Scheme (innovation in instruments)
	Climate Change Agreements (innovation in instruments)
2004	UK Energy Act 2004 Part 2 Sustainability and Renewable Energy Sources, Ch. 2 Offshore Production of Energy (innovation in instruments)
2007	Energy Technologies Institute (innovation in instruments)
2008	Energy Act 2008, Part 1, Ch. 2: Storage of Carbon Dioxide (innovation in instruments)
	Energy Act 2008, Part 2 Electricity from Renewable Sources, Feed-In Tariffs for Small-scale Generation of Electricity (innovation in instruments)
	Electricity Act 2008, Part 5 Misc., Smart Meters (innovation in instruments)
	Climate Change Act 2008, Part 1 Carbon Target and Budgeting: The Target for 2050 (innovation in instruments)
	Climate Change Act 2008, Part 1 Carbon Target and Budgeting: Carbon Budgets (innovation in instruments)
	Climate Change Act 2008, Part 1 Carbon Target and Budgeting: Other (innovation in instruments)
	Climate Change Act 2008, Part 2 The Committee on Climate Change (innovation in instruments)

Chapter 4

New Climate Governance and Policy Instruments -- A Comparative Analysis of the 'Government-to-Governance' Hypothesis

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Abstract: The changing role of the state in policy-making has been intensively discussed in public policy centering on the prominent hypothesis that modern states have moved from traditional hierarchical government to new forms of decentralized network governance. This contribution situates the shift in policy styles in the choice of policy instruments alongside two dimensions: (1) the number of actors involved (monocentrism/polycentrism) and (2) the degree of coercion. Using this extended conceptual framework we empirically test the government-to-governance hypothesis in the new field of climate mitigation policy. While case study literature has identified the rise of new modes of governments in this field, this study provides a new quantitative test of the hypothesis relying on complete policy portfolios rather than individual instruments for nineteen EU member states from 1990 to 2010. Results from hierarchical cluster analysis question a real shift towards governance. While some country clusters with wide portfolios make increasing use of new instruments such as voluntary agreements and tradable permits, traditional state-focused and coercive measures build the core of climate mitigation policy in the sample over the whole period.

Keywords: climate mitigation policy, cluster analysis, government-to-governance hypothesis, hybrid governance, policy instruments

Introduction

Policy change and the role of the state in policymaking are central themes in political science research. In interpreting and explaining policy change, political science scholarship, as well as work in legal studies and public administration, has observed a change in policymaking apparent since the early 1980s, with a rise of new partnerships and collaborations between public authorities and private actors (Bevir *et al.* 2003, Dent *et al.* 2007, Gunningham 2009, Kjaer 2005, Kooiman 2003, Rhodes 1997). These new modes of governance are identified as a trend in policymaking in modern states away from traditional hierarchical regulation of 'government' and towards new forms of decentralized network 'governance' (Bode 2006, Caporaso & Wittenbrinck 2006, Hysing 2009, Rhodes 2000, Tollefson *et al.* 2012, van Kersbergen & van Waarden 2004).

This 'government-to-governance' hypothesis has received much attention since it raises the question of how a changed role of the state affects policy output, public acceptance, and accountability relationships. For example, public authorities often face the problem of information-asymmetry and lack sufficient capacities to provide efficient regulation to ensure compliance (Enevoldsen & Brendstrup 2000). Public-private partnerships as a new mode of governance are seen as a way to achieve results more efficiently by creating less market disturbance than traditional forms of regulation (Alexeeva-Talebi *et al.* 2008, Bailey & Ditty 2009, Hentrich *et al.* 2009, Smale *et al.* 2006, van Asselt & Biermann 2007).

Given the importance of the 'government-to-governance' hypothesis for these questions, it seems crucial to test its basic claims empirically. According to Treib *et al.* (2007), governance includes at least three domains: polity, politics, and policy (see also

Driessen *et al.* 2012, Howlett 2009, Tollefson *et al.* 2012, Van Tatenhove & Leroy 2003). The majority of empirical research has focused on the influence of private actors on the political process (politics) and the change in modes of governance for political institutions (polity) (Duit 2007, Tompkins & Adger 2005, Treib *et al.* 2007). As Sager (2009, p. 537) states, 'there has been surprisingly little theorizing work based on empirical evidence concerning the question of the relationship between modes of governance [...] and instrument choice'. Within the last twenty years, 'more attention has been paid to emerging modes of environmental governance and to how they can increase the capacity of economic, social, and cultural systems to help humans mitigate and adapt to climatic change' (Lemos & Agrawal 2006, p. 314). In this realm, a number of studies have focused on **'**new**'** environmental policy instruments such as voluntary agreements or market-based instruments as devices to detect new modes of governance (Jordan *et al.* 2005, Jordan *et al.* 2003c). It is argued that these new tools of governance give more responsibility to private actors than hierarchical forms of government do.

However, a systematic quantitative test of the 'government-to-governance' hypothesis for a large number of national policy portfolios over a longer time period is still missing. The majority of studies on 'new' environmental policy instruments is on single or a selected number of cases, and their results bear the potential for bias. For example, we may not be able to tell whether the adoption of a number of 'new' environmental policy instruments constitutes a fundamental shift in the national mode of governance if they are analyzed in isolation of the whole policy portfolio. Thus, policy instruments might be simply 'layered' on top of the existing portfolio without changing its basic characteristics (Beland & Hacker 2004, Howlett & Rayner 2006).

Furthermore, environmental policy literature translates the 'government-to-governance' hypothesis into one dimension that deals only with the number of actors involved (polycentrism), where regulatory instruments are placed on one end and 'new' instruments on the other. As we know from the governance literature, this shift is more complex, including at least one additional dimension on the changing relationships between public authorities and private actors (coercion). This multi-dimensionality implies a larger variety in the modes of governance than suggested by the literature of 'new' environmental policy instruments.

Therefore, this article provides a systematic test of the 'government-to-governance' hypothesis, considering both dimensions of governance (polycentrism and coercion) based on complete national policy portfolios on climate mitigation for nineteen European Union (EU) member states. Climate mitigation policy has emerged as a new field of policymaking since the 1990s. It is a typical case for an environmentally, politically, economically, and technologically complex issue which is highly distinct from more traditional, single-media environmental problems such as acid rain (Durant *et al.* 2004). Because climate mitigation policy is a newly emerging policy field, it is less biased by traditional coalitions and interests than established policy fields. This allows policymakers to formulate a more evaluative and selective choice on the specific type or combination of policy instruments, which makes it an ideal case for studying new modes of governance (Doelle *et al.* 2012). Comparing complete policy portfolios on national climate mitigation cross-nationally and over time will allow us to improve our understanding of the relevance and timing of new modes of governance in climate policymaking and the degree to which this trend is shared across countries.

In the first section, the two dimensions of new modes of governance are discussed, and types of policy instruments are systematically categorized along these dimensions. The

following section describes data and methods used to perform a cluster analysis on the respective types of policy instruments in nineteen EU member states for the time periods of 1990 to 2005 and 2006 to 2010. The results section reveals substantial variation of the national policy portfolios on climate mitigation with respect to the 'government-to-governance' hypothesis. While in some countries (those with intense policymaking, e.g., Germany, Sweden, Denmark) we can observe a trend towards new modes of governance, other clusters arise that rely mainly on traditional forms of government such as regulation with varying degrees of financial investment (e.g., Spain, Slovakia).

1 Modes of Governance and Policy Instruments

1.1 Basic dimensions of governance

The 'government-to-governance' hypothesis is based in a broad discussion of a variety of disciplines on the concept of 'governance' (Dent *et al.* 2007, Radcliffe & Dent 2005). All of these are rooted historically in the traditional understanding of 'governance' consistent with the concept of hierarchy which is one of four distinct modes of social coordination and organization (Polanyi 1957), namely hierarchy, market, association, and community (Driessen *et al.* 2012, Gamble 2000, Steurer 2011). Thus, 'governance' describes any authoritative form of governmental steering that aims to provide public goods and correct market failures (Caporaso & Wittenbrinck 2006, Kooiman 2003, Poulsen 2009, Sorensen & Torfing 2007, Weale 2011). 'Governance' in this understanding is based on the hierarchical authority of the state as a unitary actor, whereas markets are polycentric and self-regulated through the mechanisms of prices and competition (Hanssen *et al.* 2009, Lemos & Agrawal 2006, Steurer 2011). Associations use symmetry, trust, and voluntary cooperation in order to

provide a common good for groups of actors such as trade unions or NGOs with a common interest (Hanssen *et al.* 2009). Community is built on 'the deployment of solidaristic relationships and time- and space-specific knowledge' (Lemos & Agrawal 2006) and describes the traditional understanding of family, social clubs, or local constituencies (Hanssen *et al.* 2009, Lemos & Agrawal 2006).

Two dominant but overlapping perspectives on the 'government-to-governance' hypothesis can be found in the literature which both apply a different understanding of 'governance' than the traditional interpretation. Both are focusing on two basic dimensions, as illustrated in Figure 1 (Caporaso & Wittenbrinck 2006, Dent *et al.* 2007, Hanssen *et al.* 2009, Radcliffe & Dent 2005, Steurer 2011, Weale 2011). Polycentrism, the first dimension, describes who the relevant actors are, ranging from a monocentric pole of public authority's dominance to a polycentric pole with multiple actors and sources of power (Gunningham 2009, Tollefson *et al.* 2012). The second dimension refers to the relationship between public and private actors, with the range from high coercion for traditional regulative and authoritative steering to low coercion with equal partnership between private and public actors (Bressers & O'Toode 2005).

The first perspective on the 'government-to-governance' hypothesis defines 'governance' in opposite terms to 'government', which is defined as the hierarchical regulation of public authorities. 'Governance', in contrast, is seen as the cooperation between public and private actors, linking traditional modes of social coordination and organization, namely hierarchy, market, associations, and community (Bevir & Rhodes 2004, Kjaer 2005, Marinetto 2003, Radcliffe & Dent 2005, Rhodes 1997). According to this definition, 'governance' is polycentric and less coercive, where the state is only one of several equally

powerful non-public actors in self-organizing, interdependent, and autonomous networks (Marinetto 2003, Rhodes 1997, Rhodes 2000). Examples of these network-based modes of coordination and organization are public-private partnerships or voluntary agreements (hierarchy-market) (Oikonomou *et al.* 2009, van der Heijden 2012), co-management such as social partnerships (state-association) (Hall & Kennedy 2008, Lemos & Agrawal 2006), and local citizenship (state-community) (Ostrom 1990, Ostrom 2009).

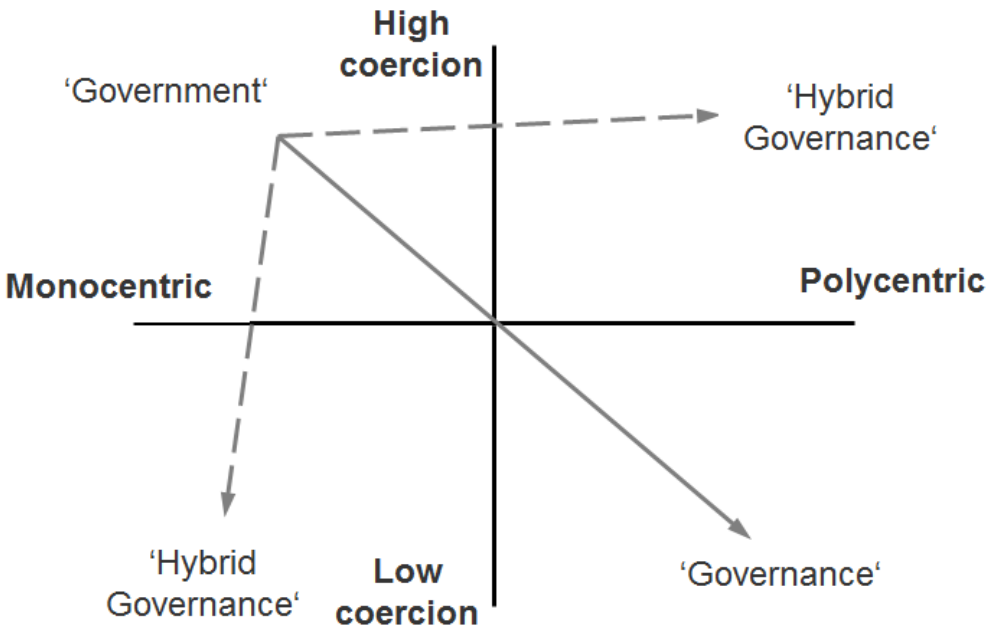

Figure 1. Dimensions and expectations of governance

Source: Adapted from Tollefson et al. (2012)

As illustrated in Figure 1 by the grey solid arrow, proponents of this perspective postulate a general trend from 'government-to-governance' in which the state increasingly endows private networks with major responsibilities for the provision of public goods. This eventually results in a process of 'hollowing out' the state so that public authority is restricted to framework policy and the provision of the very basic public goods such as crime protection

(Bode 2006, Caporaso & Wittenbrinck 2006, Driessen *et al.* 2012, Hysing 2009, Radcliffe & Dent 2005, Rhodes 1997, Rhodes 2000, Tollefson *et al.* 2012, van Kersbergen & van Waarden 2004, Weale 2011). Empirical evidence for this perspective comes, for example, from research on New Public Management reforms which sought to incorporate market mechanisms and stakeholder participation into public management and welfare policy in a number of Western European countries in the 1980s (Borghi & Van Berkel 2007, Dent *et al.* 2007).

The second perspective shares the definition of 'governance' but questions the assumption that monocentric and highly coercive forms of governance *give way* to polycentric and less coercive arrangements (e.g., Doelle *et al.* 2012). Instead it is argued that new modes of governance are complementing rather than replacing traditional 'government' (Jordan *et al.* 2013, Poulsen 2009). This issue is discussed with the hypothesis of the 'shadow-of-hierarchy', which states that new forms of 'governance' are most effective in combination with hierarchical instruments (Carrigan & Coglianese 2011, Driessen *et al.* 2012, Heritier & Eckert 2008, Heritier & Lehmkuhl 2008, Steurer 2011, Weale 2011). As a consequence, national governments rely more heavily on other organizations such as markets, associations, or communities for social coordination but the dominant steering role remains with their authority (Davies 2002, Gamble 2000, Kooiman 2003, Ling 2002, Marinetto 2003, Pierre & Peters 2000, Tollefson *et al.* 2012). It furthermore suggests a dominant role of other 'hybrid' modes of governance with different combinations of coercion and polycentrism, as illustrated by the dashed grey arrows in Figure 1.

Findings from comparative case study analysis on 'new' environmental policy instruments support these arguments and cast doubt on the more general trend from

‘government-to-governance’ as postulated by the first perspective (e.g., Jordan *et al.* 2011, Jordan *et al.* 2005, Jordan *et al.* 2003c). It is demonstrated that ‘governance’ complements rather than replaces traditional ‘government’ (Hysing 2009, Jordan *et al.* 2011, Jordan *et al.* 2005, Jordan *et al.* 2003b, Jordan *et al.* 2013, Poulsen 2009). Furthermore, the number and diversity of policy instruments increases over time (Jordan *et al.* 2011) and 'new governance arrangements tend to be much more diverse, unpredictable and plain “messy” than a simple ‘government-to-governance’ thesis would suggest' (Doelle *et al.* 2012, p. 52).

1.2 Policy instruments, coercion, and polycentrism

Having discussed the basic dimensions of ‘governance’, the challenge for an empirical analysis on the ‘government-to-governance’ hypothesis is how to evaluate specific types of policy instruments on the level of polycentrism and coercion. A policy instrument is defined along these dimensions as a 'set of techniques by which governmental authorities wield their power in attempting to ensure support and effect social change' (Bemelmans-Videc *et al.* 1998, p. 50). It is characterized by 'the generic purpose of carrying a concrete concept of the politics/society relationship and sustained by a concept of regulation' (Lascoumes & Le Gales 2007, p. 4) (see also Howlett 2009, Jordan *et al.* 2011, Sager 2009, Steurer 2011).

Two typologies are discussed in the literature on policy instruments but have not yet been transferred to the dimensions of coercion and polycentrism. The ‘tools of government’ approach focuses on the resources available to public authorities to either influence behavior – nodality, authority, treasure – or to detect information – organization (Hood 2007).

> Nodality denotes the capacity of government to operate as a node in information networks—a central point of contact. Authority denotes government’s legal power and other sources of legitimacy. Treasure denotes government’s assets or fungible resources, and organization denotes its capacity for direct action, for instance, through armies, police, or bureaucracy. (Hood 2007, p. 129)

The second approach suggested by Bemelmans-Videc *et al.* (1998) – ‘sticks’, ‘carrots’, and ‘sermon’ – more explicitly refers to the level of coercion exerted by public authorities on private actors. ‘Sticks’ describes highly coercive, hierarchical, and regulatory ‘command-and-control’ legislation taken up by public authorities to influence people to act in accordance with formulated rules. ‘Carrots’ are economic instruments such as incentives and subsidies which try to influence behavior in a less coercive way, as the addressees are not obliged to react. ‘Sermon’ is the least coercive and aims to provide sufficient information for actors to make a reasonable or desired choice (Bemelmans-Videc *et al.* 1998, Jordan *et al.* 2003a, Sager 2009, Steurer 2011).

As Hood (2007, p. 139) notes, 'there are some basic aspects of control and surveillance [...] that are not easily classified under the headings of "carrots, sticks, and sermons"'. For example, market-based instruments such as emission trading schemes include both elements of more coercive regulation (cap on emissions) and less coercive incentives (market price for certificates). Furthermore, the categorization lacks ‘detecting’ elements as suggested by the

'tools of government' approach (Hood 2007) and information on polycentrism as the second dimension of governance (Howlett 2009, Tollefson *et al.* 2012, Treib *et al.* 2007). For this reason, Steurer (2011) extends this typology by adding 'ties', such as voluntary agreements, and 'adhesives', which are framework policies that combine different measures under a policy package or political process (see also Lodge & Wegrich 2005). Both are indicators for high polycentrism independent from levels of coercion.

The 'tools of government' (Hood 2007), levels of coercion (Bemelmans-Videc *et al.* 1998), and polycentrism (Steurer 2011) form the basis for a standard set of policy instruments apparent in the environmental policy literature. We identified regulatory instruments ('authority', 'stick'), public investments ('treasures', 'sermon'), information policy ('nodality', 'sermon'), market-based instruments ('treasure', 'carrot'), voluntary agreements ('organization', 'ties'), and political processes ('organization', 'adhesives) (Jordan *et al.* 2011, Jordan *et al.* 2005, Jordan *et al.* 2013, Macdonald 2001, Sager 2009). Figure 2 gives an overview on how these types of policy instruments ideally can be sorted along the two dimensions of coercion and polycentrism. The exact placement of single policy instruments, however, depends on the concrete mode of implementation.

Regulatory instruments are the strongest example of traditional 'government', which is characterized by a highly coercive and monocentric principal-agent relationship. Public authorities, or the principal, steer the behavior of private actors, or the agents (e.g., individual households, communities, companies), by using means of 'command-and-control' such as laws or directives (Bannink & Ossewaarde 2012, Lascoumes & Le Gales 2007, Sager 2009, Steurer 2011).

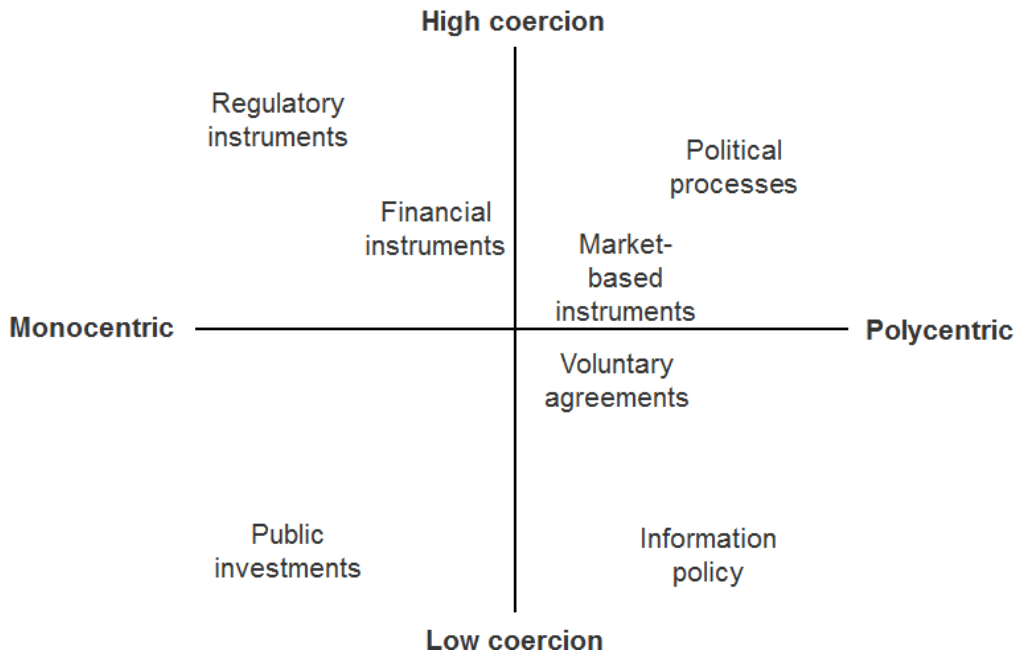

Figure 2. Types of policy instruments and the dimensions of governance

Source: Adapted from Tollefson et al. (2012)

Information policy is the strongest example of a form a 'governance' that is clearly distinct from 'government'. It has a low degree of coercion and is highly polycentric. Under specific circumstances, 'regulation by information' is considered to be an effective tool of social coordination that provides knowledge and information. It relies not only on moral persuasion but can also create public or market pressures through increased transparency (Mol 2006, Sager 2009, Steurer 2011).

On the diagonal between regulatory instruments of 'government' and information policy of 'governance', we find financial instruments with elements of both ideal types of coordination and organization. Examples of financial instruments are any kinds of taxes which impose a coercive form of incentive in order to stimulate certain behavior (Lascoumes

& Le Gales 2007). These are clearly monocentric instruments managed by public authorities even though policy processes to change the tax rate or amend tax abatement might include a number of stakeholder groups.

Market-based instruments such as subsidy schemes or tradable permits more clearly address public authorities and market actors and thus are situated on the polycentric side of the first dimension. They are less coercive than regulatory or financial instruments since 'addressees are not obliged to take the measures involved', just incentivized to do so (Sager 2009). Incentives and subsidies are a more coercive sub-type of market-based instruments, as public authorities directly manipulate prices to steer market behavior (Lascoumes & Le Gales 2007, Steurer 2011). Tradable permits are described as regulated self-regulation in which the state sets the framework but allows markets to find the most efficient solution (Lemos & Agrawal 2006, Steurer 2011).

Voluntary agreements include more elements of ‘governance’ than financial or market-based instruments do. Here, private actors are not passive recipients of governance but play an active and equal role in the governance process (Steurer 2011). Thus, voluntary agreements are clearly polycentric -- the degree can vary depending on the sectoral scope of the instruments. Coercion is generally seen as lower than for regulatory instruments but can vary depending on the way the agreements are specified (Carrigan & Coglianese 2011, Lascoumes & Le Gales 2007).

Public investments in, for example, research, development, and distribution (RD&D) or public ownership are an example of a hybrid form of governance. For these highly monocentric instruments, the state is the dominant actor providing public goods where market

mechanisms would fail (Macdonald 2001). Instead of using legal force, governments provide information and try to 'lead by example' by 'applying respective principles and practices in their own domain' (Lodge & Wegrich 2005, Steurer 2011).

Policy processes are a second example of a hybrid mode of governance with a high degree of coercion and polycentrism. These organizational instruments and operational policies include the 'organization, administration and delivery of policies and services' and strongly relate to polity, i.e. the organization of political institutions, rules, and procedures (Borghi & Van Berkel 2007, Carmel & Papadopoulos 2003, see also Steurer 2011). These instruments integrate a variety of political actors, expert groups, stakeholders, and lobbyists within the process of policy formulation and strategy building.

The framework presented in Figure 1 and Figure 2 is an important theoretical tool that allows us to empirically test the 'government-to-governance' hypothesis. If the hypothesis holds, we should find a high number of informational instruments, market-based instruments, and voluntary agreements as typical examples of ‘governance’. Higher numbers of regulatory instruments and financial instruments, which present traditional forms of ‘government’, or policy processes and public investments, which are hybrid modes of governance, would shed doubt on the ‘government-to-governance’ hypothesis.

2 Data and Methods

The analysis is based on aggregate data on the annual numbers of domestic policy instruments for nineteen EU member states which were active within the time period of 1990 to 2010. We use data from the three databases ‘Policies and Measures Databases on Global Renewable

Energy', 'Energy Efficiency', and 'Addressing Climate Change' from the International Energy Agency (http://www.iea.org/textbase/pm/explanation.asp, accessed June 28, 2012). The databases cover the whole period of observation from 1990 to 2010 and include a variety of sectors (e.g., energy supply, transport, housing). The data contain voluntary reports on climate mitigation measures which are updated every six months by national agencies of the IEA member states.

The datasets distinguish between nine categories of policy instruments: information policy, financial instruments, incentives and subsidies, policy processes, public investments, RD&D, regulatory instruments, tradable permits, and voluntary agreements. These are consistent with the seven ideal types of policy instruments discussed in the previous section (regulatory instruments, information policy, financial instruments, market-based instruments, voluntary agreements, policy processes and public investments), except that the IEA categorization further distinguishes between incentives/subsidies and tradable permits and between public investments for infrastructural projects and for RD&D. Appendix 1 shows a detailed description of these policy types. As discussed above, tradable permits as well as incentives and subsidies follow very different market logics, which suggests the need to analyze both policy types separately. Furthermore, it seems reasonable to distinguish between investments for RD&D, which include mainly non-governmental actors such as companies, universities, or other epistemic communities, and public investments in public infrastructure projects, where public authorities are the only relevant actors involved.

In line with what we know from the literature (Hood 2007, Lascoumes & Le Gales 2007, Sager 2009), the instruments discussed are seldom found in pure form but, rather, combine different elements from the nine IEA categories. For example, a feed-in tariff for

electricity from renewable energy includes characteristics of both regulatory instruments and incentives and subsidies. This is clearly an advantage for this analysis since it allows us to consider each element individually as well as in combination with other elements. If an instrument includes elements of multiple categories, we divide 1 by the number of the categories. For example, the feed-in tariff would be counted 0.5 for regulatory instruments and 0.5 for incentives and subsidies.

In order to observe variation in climate policy instruments across countries, we use hierarchical cluster analyses based on the cumulated number of policies and measures in the respective policy categories for climate policy instruments. We estimated two cluster models for policy instruments adopted in the time periods 1990 to 2005 and separately for all additionally added policy instruments from 2006 to 2010. The overall number of adopted climate policies is about equally high between 1990 and 2005 (268 policies) and the following 5-year period until 2010 (343 policies). The cluster analysis encompasses only countries with at least one climate policy instrument in each time period. This reduces the sample from twenty-seven EU member state to nineteen countries (excluding Bulgaria, Cyprus, Estonia, Latvia, Lithuania, Malta, Romania, and Slovenia). The years 1990 and 2005 were both chosen as reference years in which major climate programs came into force. 1990 is the reference year for the national targets of emission reduction of the Kyoto-Protocol. In 2005, the EU Emission Trading Scheme and the Second European Climate Program (ECCP II) marked the starting point for the wider coordination of EU climate politics. 2010 is the latest year for which we have complete data available for our sample countries.

Climate policy harmonization efforts in Europe have been intensified within the last decade, resulting in the formulation of binding greenhouse gas emission targets under the EU

Effort Sharing Decision (No. 406/2009/EC). However, the majority of sectors such as transport or housing are not regulated by strict EU directives but fall under the responsibility of domestic regulation. Numbers of and variation in climate policy instruments strongly increase among the member states after 1998. This is why we find policy instruments on climate mitigation of all categories in the countries.

Cluster analysis is the standard procedure for identifying distinct country groups with similar characteristics (e.g., Gough 2001). We used hierarchical cluster analysis with Euclidian Distance as a similarity measure and the Wards linkage procedure (Everitt *et al.* 2001, Wagschal 1999). In order to ensure robustness of the results, other linkage procedures have been tested and revealed similar results. The number of policy instruments per category is z-standardized in order to provide comparable results across the types of policy instruments. The cluster analysis groups cases by simultaneously taking a number of selected characteristics into account and by maximizing homogeneity within and heterogeneity between clusters. Ideally, countries within clusters should be more similar to each other than to any country of another cluster, across all characteristics. We performed two separate cluster analyses for 1990 to 2005 and 2006 to 2010. Applying both recommended stopping rules of Calinski/Harabasz pseudo-F index (Calinski and Harabasz 1974) and Duda/Hart Je(2)/Je(1) index (Duda *et al.* 2001), the analysis revealed six country clusters (see Appendix 2-3).

3 National Variation in Climate Policy Instruments

3.1 National characteristics of climate policy instruments

The first step of the analysis is an aggregate comparison of the types of instruments that were applied in all EU countries in the two time periods. If the 'government-to-governance' hypothesis is correct, we should observe a dominance, or at least an increase, in incentives and subsidies, tradable permits, voluntary agreements, and information policy after 2005.

Figure 3 shows the cumulative number of climate policy instruments as an average for the period 1990 to 2005 and 2006 to 2010 across the nineteen EU member states. Regulatory instruments, incentives and subsidies, and policy processes are adopted most widely before 2006. These are followed by financial instruments and measures on RD&D or information policy, with fifty percent of the countries with less than two policies (median). Voluntary agreements, tradable permits, and public investments are less often applied. After 2005, we find an increasing median adoption rate for all categories except for regulatory instruments. Policy processes replace regulatory instruments as the second most widely applied policy instruments. Information policy, financial instruments, and tradable permits have been more often adopted since 2005 according to the median. However, overall variation within the types of policy instruments increases for regulatory instruments, financial instruments, policy processes, and incentives and subsidies, which means that a few countries adopted a high number of these instruments.

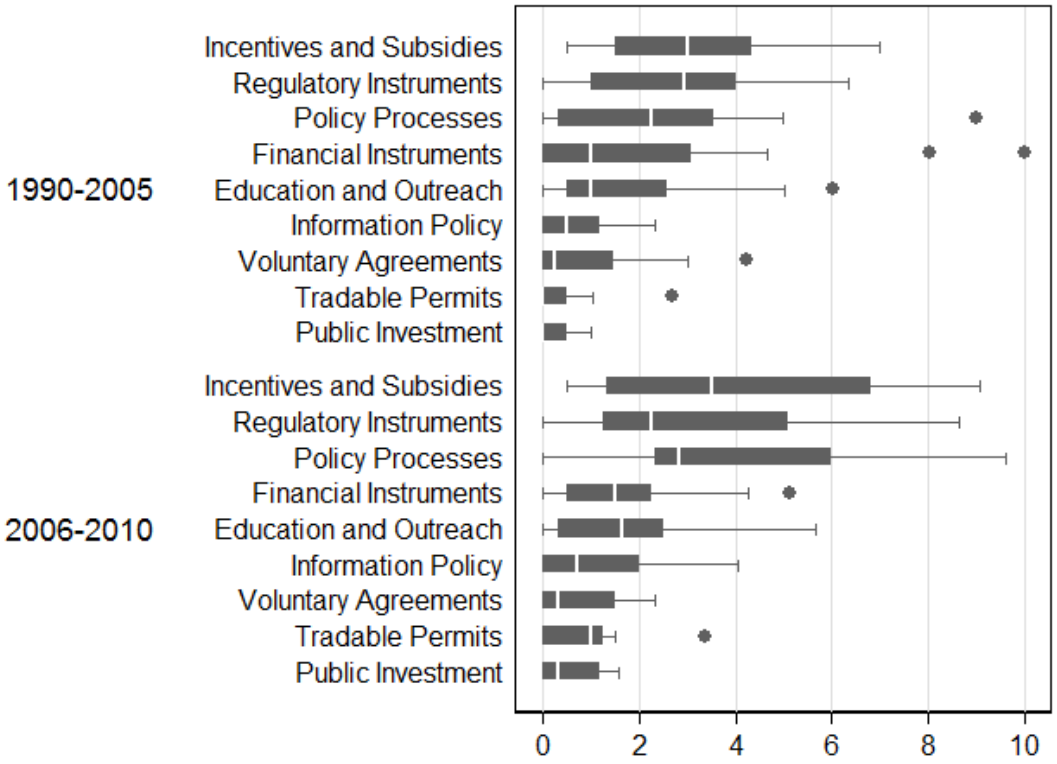

Figure 3. Cumulated number of adopted climate policy instruments

Note: Median = white bar, left end of the box = 25th percentile, right end of the box = 75th percentile.

Source: IEA Policies and Measures Database on Global Renewable Energy, Energy Efficiency, and Addressing Climate Change; own depiction.

What we can read from the results is that traditional forms of 'government' such as regulatory policy instruments and policy processes, but also hybrid forms of 'governance' such as incentives and subsidies dominate national policy portfolios from 1990 to 2005. Types of policy instruments typical for 'governance' are found in the moderate field (information policy) or play a minor role (voluntary agreements, tradable permits) in the earlier period. After 2005, forms of 'governance' increase, whereas types of policy instruments typical for 'government' – regulatory instruments and policy processes – are still applied rather frequently.

3.2 National climate mitigation from 1990 to 2005

Apart from this general trend, there is substantial variation between the countries and across the time periods in the combination of the policy instruments. We performed two separate cluster analyses for 1990 to 2005 and 2006 to 2010. Table 1 gives a descriptive overview of the content of the clusters by comparing the average number of policies across the countries of a specific cluster in each category. The clusters are named according to the specific combination of the country groups' dominant policy instruments.

(Cluster 1) The 'innovative leader' cluster which encompasses Sweden and the UK is characterized by a strong engagement in all policy categories except for public investment and voluntary agreements.

(Cluster 2) A second 'traditional I' cluster includes three Southern European countries (Greece, Portugal, and Spain) and three Eastern European member states (Hungary, Poland, and Slovakia). This group of countries combines a medium number of traditional regulatory instruments as typical instruments of 'government', forms of 'hybrid governance' such as public investments and policy processes, and incentives/subsidies as examples of 'governance'.

(Cluster 3) A 'traditional II' cluster includes Austria, the Czech Republic, France, Ireland, and Luxembourg. Those member states share the same policy types as countries of the 'traditional' Cluster 2 except for their low engagement in public investment. Moreover,

they apply more ‘hybrid governance’ and ‘governance’ by sharing higher numbers of policy instruments in the categories of RD&D and information policy.

(Cluster 4) Even the ‘incentives’ cluster including Belgium, Germany, and Italy builds on a high number of regulatory and financial instruments as typical tools of ‘government’. However, this cluster has complemented these traditional strategies with forms of ‘governance’ (tradable permits, incentives and subsidies, and information policy) and ‘hybrid governance’ (RD&D).

(Cluster 5) Denmark constitutes a single ‘knowledge’ cluster characterized by a combination of forms of ‘government’ (regulatory and financial instruments) and ‘hybrid governance’ (policy processes, public investments) without any instruments of ‘governance’.

(Cluster 6) Finland and the Netherlands form a sixth, ‘voluntary’ cluster that has a strong emphasis on voluntary agreements between the public and the business sector, which are considered a type of ‘governance’ replacing policy processes. Additionally, these countries add a combination of forms of ‘government’, ‘governance’, and ‘hybrid governance’ on financial instruments, RD&D, and information policy to the national portfolio in order to provide resources and knowledge for companies to fulfill their part of the agreement.

Table 1. Cluster mean in the number of climate policy instruments across 19 EU member states

	Government - to - Governance						Hybrid governance		
1990-2005	Regulatory	Financial	Incentives/ subsidies	Tradable permits	Voluntary agreements	Information policy	Policy processes	Public investments	RD&D
Cluster 1: 'innovative leaders' (UK, SE)	high	high	high	high	moderate	high	moderate	high	high
Cluster 2: 'traditional I' (ES, GR, HU, PL, PT, SK)	moderate	low	moderate	low	low	low	moderate	moderate	low
Cluster 3: 'traditional II' (AT, CZ, FR, IR, LU)	moderate	low	moderate	low	low	moderate	moderate	low	moderate
Cluster 4: 'incentives' (BE, DE, IT)	high	moderate	high	moderate	low	high	moderate	high	moderate
Cluster 5: 'knowledge' (DK)	high	moderate	low	low	low	high	high	moderate	low
Cluster 6: 'voluntary' (FI, NL)	moderate	moderate	low	low	high	high	low	moderate	moderate
2006-2010	Regulatory	Financial	Incentives/ subsidies	Tradable permits	Voluntary agreements	Information policy	Policy processes	Public investments	RD&D
Cluster 1: 'innovative leaders' (UK)	high	moderate	high	high	high	high	high	moderate	high
Cluster 2: 'laggards' (CZ, GR, HU, LU, PL)	low	low	low	low	low	low	low	low	low
Cluster 3: 'traditional' (ES, IR,IT,SK)	high	high	high	low	low	low	high	low	low
Cluster 4: 'incentives' (BE, PT, SE)	moderate	high	high	low	low	low	low	high	low
Cluster 5: 'knowledge' (AT, DE, NL)	low	moderate	moderate	low	low	moderate	low	low	moderate
Cluster 6: 'voluntary' (DK, FI, FR)	moderate	moderate	moderate	moderate	high	moderate	low	high	moderate

Source: International Energy Agency 2010, own calculations.

Note: Scaling between 0=min and 1=max for each policy type where 0 means that the cluster has no policy instruments of this category and 1 means the cluster has the maximum country-mean of the respective policy type across all clusters. On this scale: 0-0.33=low, 0.33>0.66=moderate, 0.66>1=high. For example, in 1990-2005, voluntary agreements are most often adopted by the countries of Cluster 6 (cluster mean = 5.6) and least often by the countries of Cluster 2 (cluster mean = 0.3). The value for voluntary agreements of Cluster 1 is then calculated as follows: $(mean_{cluster\ 1} - mean_{min})/(mean_{max} - mean_{min}) = (2.4 - 0.3)/5.6\text{-}0.3) = 0.4$ (moderate).

Following the ‘government-to-governance’ hypothesis, we would expect to find a dominance of typical instruments for ‘governance’ such as information policy, voluntary agreements, and incentives and subsidies starting already in 1990. As the cluster analysis for 1990 to 2005 shows, these types of instruments provide a substantial share of the national policy portfolios. However, hierarchical forms of regulatory 'government' along with ‘hybrid governance’ of policy processes are more dominant and have formed the basis of climate mitigation in this period. This finding suggests that there is much more variation in national pathways towards policy change in a newly emerging policy field than the ‘government-to-governance’ hypothesis postulates.

Yet, the findings reveal remarkable differences in the combination of single-policy instruments in order to provide different but equivalent strategies. For example, resources-intensive policy processes that are mainly located in the public sector are ‘outsourced’ towards private actors by means of voluntary agreements, information policy, or RD&D. In fact, patterns of national climate mitigation found in the countries are very similar to those reported in case study literature on environmental policies. For example, the results clearly confirm literature describing the change in German policy traditions from a regulative dominance towards the more open and innovative character of new environmental policies (Bailey 2007, Jänicke 2011, Wurzel 2010, Wurzel *et al.* 2003b), the leadership role of Sweden and the UK in European climate politics (Andersen & Liefferink 1997, Rayner & Jordan 2011), and the reluctance of Austrian (Wurzel *et al.* 2003a), French (Szarka 2003, Szarka 2006), and Irish politics to adopt market-based instruments (Flynn 2003, Leonard 2008). The question remains

whether the data reveal a trend of increasing polycentrism and less coercion towards new modes of ‘governance’ that clearly replace regulatory instruments of hierarchical 'government'.

3.3 Developments in national climate policy from 2006 to 2010

A second cluster analysis was performed for the period 2006 to 2010 for all policy instruments that were additionally added to the national policy portfolios or had been changed during that time. Again, six country clusters are identified. Table 1 shows that typical forms of ‘government’ (regulatory instruments) and ‘hybrid governance’ (policy processes, public investments) are more selectively adopted by specific clusters in 2006 to 2010. Types of policy instruments that increase across all clusters are based on both ‘government’ (financial instruments) and ‘governance’ (incentives and subsidies, voluntary agreements, and tradable permits). Furthermore, ‘hybrid governance’ by RD&D and ‘governance’ by information policy are more concentrated in three clusters after 2006 than between 1990 to 2005. Irrespective of the distribution of policy instruments, we find substantial differences between the clusters.

(Cluster 1) In the ‘innovative leaders’ cluster, the UK is still using a wide range of policy types and all forms of ‘government’, ‘hybrid governance’, and ‘governance’ except for public investments and financial instruments in 2006 to 2010.

(Cluster 2) The former ‘traditional-investment’ cluster in 1990 to 2005 (also Cluster 2) contributes most of its countries to the new Cluster 2 the ‘laggard’ countries, which all share a low overall number of policies, including Greece, Hungary, and Poland. In addition, the

‘traditional-knowledge’ cluster in 1990 to 2005 (Cluster 3), including the Czech Republic and Luxembourg, is incorporated into the new Cluster 2 .

(Cluster 3) Countries in this cluster intensified their ‘traditional’ policy record by increasing forms of ‘government’ (regulatory and financial instruments), and ‘hybrid governance’ (mainly policy processes). This approach is well known from the ‘traditional-knowledge’ cluster in 1990 to 2005. In fact, next to Italy, Spain, and Slovakia, we find Ireland as a former ‘traditional-knowledge’ member in the ‘traditional’ cluster. Thus, it seems that this cluster is a pool of countries with strong emphasis on traditional forms of ‘government’.

(Cluster 4) Belgium, Portugal, and Sweden form the fourth ‘incentives’ cluster. Traditional forms of ‘government’ (regulatory and financial instruments) are joined with tools of ‘hybrid governance’ (public investments) and ‘governance’ (incentives and subsidies). These countries even intensified their portfolios along the ‘government’ approach by increasing financial instruments.

(Cluster 5) Even though the ‘knowledge’ cluster includes a different set of countries from those it contained from 1990 to 2005, this group shares a rather similar combination of climate policy instruments in 2006 to 2010 to those of Denmark between 1990 and 2005. These countries shift their portfolio from highly monocentric types of policy instruments (regulatory policy and policy processes), towards a larger polycentric mix of ‘government’ (financial instruments), ‘hybrid governance’ (RD&D), and ‘governance’ (information policy).

(Cluster 6) The ‘voluntary’ cluster remains strong with voluntary agreements as a typical polycentric form of ‘governance’ complementing traditional, monocentric forms of ‘government’ (regulatory instruments) and ‘hybrid governance’ (public investments). Additionally, this cluster adds other forms of ‘governance’ such as incentives and subsidies and tradable permits after 2005.

Summing up, the results demonstrate a high variation in the respective modes of governance across countries. We find Cluster 1 to adopt high numbers of policy instruments for all types, while Cluster 2 countries make only minor efforts to increase their policy portfolios. Cluster 5 and Cluster 6 increasingly add more typical instruments of ‘governance’, whereas Cluster 3 and Cluster 4 intensify their portfolios with monocentric and more coercive forms of ‘government’ and ‘hybrid governance’. Notably, we find in Cluster 2 that countries with very small policy portfolios in 1990 to 2005 predominantly adopt more coercive and monocentric forms of ‘government’ when substantially increasing their number of policy instruments in 2006 to 2010. In contrast, forms of ‘governance’ are applied foremost in country clusters where the existing portfolios already include a large stock of regulatory instruments of hierarchical 'government'. For example, voluntary agreements and information policy -- two typical types of ‘governance’ -- have been dominantly applied in addition to strong regulation and tax policy in Germany, Austria, the Netherlands, and Denmark. This development is based more on traditional policy styles (Liefferink & Birkel 2011, Wurzel *et al.* 2003b, Zito *et al.* 2003) and the institutional corporatist setting (Andersen 1997, Andersen 2004, Pedersen 2007) than on a general trend from ‘government’ to ‘governance’. The question of how these patterns

and shifts can be explained is beyond the scope of this paper and needs to be answered in more detailed analyses.

Conclusion

This paper provides an empirical application of the ‘government-to-governance’ hypothesis in the newly emerging field of climate mitigation policy from 1990 to 2010 across nineteen EU member states. It identifies the two basic dimensions of social coordination and organization – low coercion/high coercion and monocentrism/polycentrism – and systematically categorizes types of policy instruments as discussed in the literature on ‘new’ environmental policy instruments and climate politics. Following the ‘government-to-governance’ hypothesis, we expect that policy instruments which are characterized by low levels of coercion and high levels of polycentrism clearly would replace traditional forms of hierarchical 'government'.

The empirical part of the paper provides detailed insights into the development of climate policies between 1990 and 2010. Respective modes of governance of climate mitigation differ markedly across countries. In the analysis, we find less support for the 'government-to-governance' hypothesis. First, hierarchical 'government' is the dominant mode applied by public authority to mitigate climate change within all of the countries, independent of the respective timing of the policy adoption. Second, in the context of the novel and presumably unbiased policy field of climate mitigation, new modes of governance only complement rather than replace traditional forms of hierarchical 'government'. These findings are in line with the hypothesis of the 'shadow-of-hierarchy' discussed in the literature, which

states that new modes of governance are most effective in combination with hierarchical instruments (Carrigan & Coglianese 2011, Driessen *et al.* 2012, Heritier & Eckert 2008, Heritier & Lehmkuhl 2008, Steurer 2011, Weale 2011). Furthermore, national climate mitigation substantially varies in the adoption of policy instruments with traditional forms of 'government' along with new forms of 'governance' and 'hybrid governance'. It seems that countries choose a specific combination of these types of instruments in orientation to their national characteristics. More detailed analyses of the clusters would shed more light on the respective mechanisms and explanations of the country patterns we found.

While interpreting the results, the reader should acknowledge certain limitations of this study. Development of national climate mitigation policy in some member states such as the UK or Spain after 2005 is impressive. Yet, it is still an ongoing process of policymaking, and the selected time frame provides only a small snapshot of the overall development. Furthermore, the number of domestic instruments is only a proxy for certain forms of 'government' and 'governance' and does not consider the policies' content or specific calibration. The same instrument adopted in two countries might reveal different forms of 'government' or 'governance' when studied in detail. For example, voluntary agreements in the pluralist UK are less coercive than in the corporatist Netherlands (van der Heijden 2012).

Despite these limitations, using policy portfolios instead of individual policies provides a more systematic test of the 'government-to-governance' hypothesis. For the field of climate mitigation policy, it reveals that, despite the widespread use of new forms of 'governance', 'government' and 'hybrid governance' still dominate instrument choice in the light of whole

portfolios. This bears implications for the wider governance literature as well in particular for the selection of research designs: While case studies have strongly improved our understanding of new governance forms and their development, incorporating large N analysis will achieve the needed assessment of the relative importance and timing of this phenomenon.

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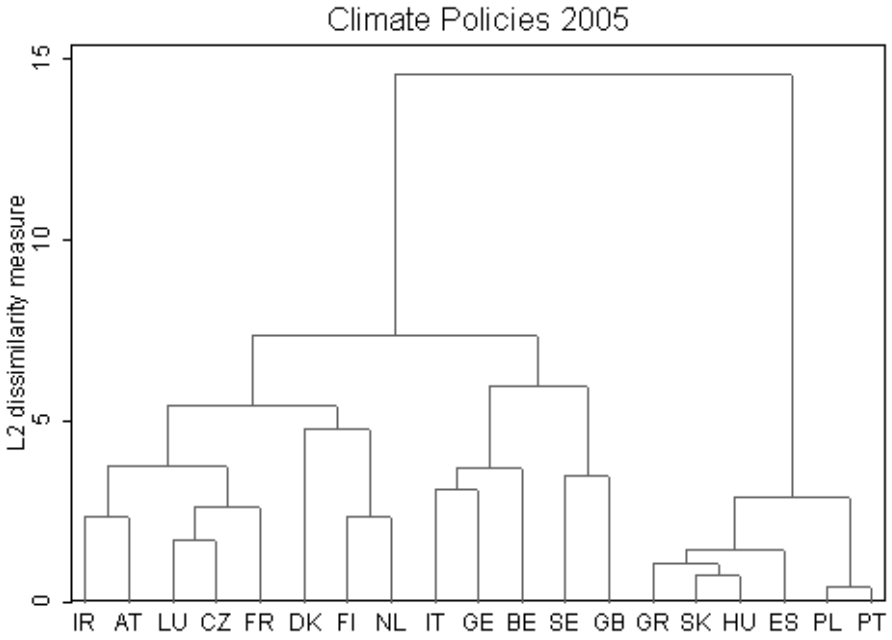
Appendix 1. IEA-description of policy categories

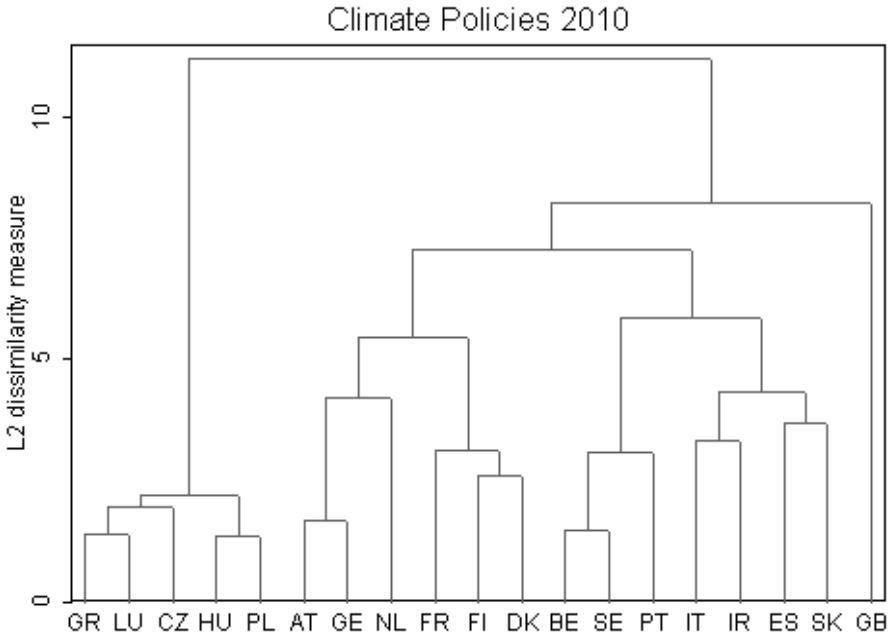
Policy category	Description
Information policy	Policies and measures designed to increase knowledge, awareness, and training among relevant stakeholders or users. This can include general information campaigns, targeted training programs, labeling schemes that provide the user information on a product's energy usage or emissions.
Financial	Policies and measures that encourage or stimulate certain activities or behaviors. These include tax incentives, such as tax exemptions, reductions or credits on the purchase or installation of certain goods and services.
Incentives and subsidies	Policies and measures that encourage or stimulate certain activities, behaviors or investments. These include feed-in tariffs for renewable energy, rebates for the purchase of energy-efficient appliances, grants, and preferential loans and third party financing.
Policy processes:	Refers to the processes undertaken to develop and implement policies. This generally covers strategic planning documents and strategies that guide policy development. It can also include the creation of specific bodies to further policy aims, making strategic modifications to existing policy, or developing specific programs.
Public investment	Policies and measures guiding investment by public bodies. These include government procurement programs (e.g. requirement to purchase energy efficient equipment and vehicles, or to source a certain percentage of energy use from renewable sources) and infrastructure investment (e.g. urban planning and transport infrastructure).
RD&D	Policies and measures for the government to invest directly in or facilitate investment in technology research, development, demonstration and deployment activities.
Regulatory instruments	Covers a wide range of instruments by which a government will oblige actors to undertake specific measures and/or report on specific information. Examples include energy performance standards for appliances, equipment, and buildings; obligations on companies to reduce energy consumption, produce or purchase a certain amount of renewable energy; mandatory energy audits of industrial facilities; requirements to report on GHG emissions or energy use.
Tradable permits:	Refers to three kinds of systems – GHG emissions trading schemes, white certificate systems stemming from energy efficiency or energy savings obligations, and green certificate systems based on obligations to produce or purchase renewable energy-sourced power (generally electricity).
Voluntary agreements	Refers to measures that are undertaking voluntarily by government agencies or industry bodies, based on a formalized agreement. There are incentives and benefits to undertaking the action, but generally few legal penalties in case of non-compliance. The scope of the action tends to be agreed upon in concert with the relevant actors. These are often agreed to between a government and an industry body, with the latter agreeing to certain measures; for example, reporting information on energy use to the government, being subject to audits, and undertaking measures to reduce energy use

Source: IEA, http://www.iea.org/textbase/pm/explanation.asp, accessed June 28, 2013

Appendix 2. Cluster Solution Climate Policies 1990-2005



Appendix 3. Cluster Solution Climate Policies 2006-2010



CHAPTER 5

BREAKS OR ENGINES? THE ROLE OF VETO PLAYERS AND LEADERS IN THE NEW FIELD OF CLIMATE MITIGATION POLICY

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Abstract

Veto player theory is undoubtedly one of the most prominent approaches for explaining policy stability and change. While some studies have corroborated the influence of veto players and their preferences, other empirical work has provided mixed evidence. Three critical points are discussed: the identification of veto players, the measurement of policy preferences and the assumption of equivalence of veto players. This article aims to shed new light on the theoretical debate and empirical influence of veto players by applying the model to a newly emerging policy field. While most empirical studies have tested veto player theory in established fields such as social or economic policy, the new field of climate mitigation provides a different context for political decision-making. In this situation with a status quo outside the median preferences, a lack of policy baggage and newly forming actors and interests, the absolute anchoring of preferences and the identification of leaders seems to be an important extension of the veto player perspective. Using a mixed-methods approach, this article combines a large-N pooled time-series cross-section analysis of national policies on energy efficiency in 25 EU member states from 1998 to 2010 with a case-study analysis of the renewable electricity laws in Poland (2005) and Germany (2000). The findings demonstrate that climate leaders play a crucial role in stimulating climate mitigation policy. The case study suggests that political actors other than official veto players such as ministers or the EU strongly influence the process of agenda setting and decision making. The findings underscore the importance of including a measure of the internal cohesion of veto players, the presence of leaders, and the consideration of motives other than policy preferences in future analyses.

Introduction

Explaining why decision-makers adopt (or do not adopt) new policies is one of the primary interests of political science. Institutions and actors have naturally been central theoretical access points for such explanations. One of the most prominent theoretical models has synthesized their influence in the concept of veto players, political actors or parties in institutionally defined positions with veto power over legislation (Jahn, 2010, Tsebelis, 2002, Andrews and Montinola, 2004, Kaiser, 2007). Veto player theory's central hypothesis – more veto players, larger differences in their policy preferences, and lower internal coherence decrease the likelihood of policy change – has been subject to numerous empirical studies (Kaiser, 2002, Swank, 2002, Kittel and Obinger, 2003). These empirical evaluations have been focused on traditional policy fields, such as economic or labor market policy, where the status quo is established and defended by strong interests (MacIntyre, 2002, Allan and Scruggs, 2004, Andrews and Montinola, 2004).

However, we lack an understanding of the explanatory power of veto player theory in newly emerging policy fields such as climate change mitigation (see Jensen and Spoon, 2011, Knill et al., 2009). New policy fields provide a different context for decision-making which may challenge some of the theoretical mechanisms underlying the veto player approach. (1) While in established policy fields the status quo is close to the median preferences of all veto players, in new fields the status quo may be in a different position. Thus, even with a wide range of preferences, preferences of all actors may be towards expansion and thus policy change. In the context of climate change mitigation, this may be likely with EU emission sharing targets

influencing those preferences. (2) Preferences, lobby groups, political cleavages and informal coalitions have to be newly formed in these fields. This dynamic situation can create veto players' policy preferences to be more vulnerable towards attempts to influence them through processes of framing or bargaining at the time of decision-making (Weaver, 1986, Pierson, 2001). (3) In established fields most "new" policies constitute policy successions, maintenance, and terminations rather than innovations (Hogwood and Peters, 1982, Hogwood and Peters, 1983). In new fields, where existing policies do not need adjustments, policy change requires mobilization of new issues. Thus, the role of political key actors "pushing" for climate mitigation rather than on veto players "blocking" legislation has been the major focus of climate policy analyses (Wurzel and Connelly, 2011, Schreurs and Tiberghien, 2007, Albrecht and Arts, 2005).

Therefore, this study examines theoretically and empirically how veto player theory can be applied and adapted for the field of climate mitigation and newly emerging policy fields more generally. The central focus will be on the role of the mobilizing political actors where we draw on the concept of climate leaders (Schreurs and Tiberghien, 2007, Liefferink et al., 2009, Wurzel and Connelly, 2011). We use a mixed-methods approach, combining a quantitative analysis of all policies on energy efficiency adopted in the EU between 1998 and 2010 and a case analysis of renewable energy laws in Poland and Germany. This allows us both to test veto player and climate leader influence and to examine the nature and mechanisms of this influence in two concrete policy decisions in a mixed-methods design (Curry et al., 2009, Lieberman, 2005, Rohlfing, 2008).

The article begins with a brief overview of veto player theory and its critiques. It then examines arguments from the literature on environmental leadership relating to whether and how climate leaders influence climate mitigation policy. The methods section describes our mixed-methods research design. The basic statistical and analytical findings demonstrate that climate leaders play a key role in changing the status quo towards more climate mitigation policy. Furthermore, the analysis demonstrates that new coalitions are formed. It shows that the internal coherence of veto players is a crucial element which had been overlooked in most empirical research. The article concludes by discussing the implications of these results for veto player theory and climate mitigation policy.

1. Theoretical Considerations

1.1 Veto player theory

Veto player theory defines veto players as individual or collective actors whose agreement is needed to change the legislative status quo (Becher, 2010, Tsebelis, 2002, Ganghof, 2003). The main focus has been on constitutionally defined veto players – actors who have a formal role in the legislative process (Bassinger and Hallerberg, 2004, Keefer and Stasavage, 2003). They can be institutional such as the president or partisan like the two political parties of a minimum winning coalition government (Schmidt, 2002, Crepaz, 2001, Kastner and Rector, 2003).

The traditional veto player approach assumes that political decision making is based on rational choices following defined policy preferences from which the winset, i.e. the set of policies that

can change the status quo, can be calculated (Wagschal, 1999, Crepaz, 2001, Schmidt, 2002). *The basic prediction is that with an increasing number of veto players this winset is reduced and thus policy stability is likely to increase* (Tsebelis, 1995, 2002). Empirical studies following this approach thus use the number of veto players as a predictor for policy change (Kastner and Rector, 2003, Schmidt, 2002, Crepaz, 2001). For example, in a single-party majority government in a unicameral parliamentary system like the UK until 2010, there is only one party and therefore one veto player. In Germany, since the 1950s the number of veto players has been three, given the two parties of the coalition government and the veto power of the second chamber.

The veto player theory developed by George Tsebelis (1995, 1999, 2002) additionally considers the policy preferences of the veto players. Policy preferences are the ideological beliefs which determine the ideal point of a political party for a policy in a one-dimensional policy space. The basic argument is that it is not the number of veto players but the range of their policy preferences that affects policy stability. In France, for example, we would count the president, the first and the second chamber as separate veto players; but after 2007 all were held by one party and thus their disagreement on a policy, measured by the range of policy preferences, is de facto zero. If veto players belong to different political parties, the question is how much these parties differ in their policy preferences. The wider the range of policy preferences, the smaller becomes the winset of those veto players who favor policy change. *As a consequence, policy stability is more likely as the range of policy preferences increases* (see also Merkel, 2003, Ganghof and Bräuninger, 2006, Jahn, 2010). The majority of studies following this approach use the salience of single-policy issues such as environmental

protection from, for example, the party manifestos to measure the parties' policy preferences (Knill et al., 2009, Jensen and Spoon, 2011, Tsebelis, 1999, Jahn, 2010).

1.2 Empirical evidence and critique

Evidence from empirical studies on the traditional veto player approach (number) and the Tsebelis account (range) in various fields of policy making is mixed. A number of studies find higher stability in economic policy (Hallerberg and Basinger, 1998, MacIntyre, 2002), welfare state reforms (Korpi and Palme, 2003), and public expenditure (Bawn, 1999). No or even a positive effect of the number of veto players is found on retrenchment or expansion of labor market or policy reform (Allan and Scruggs, 2004, Andrews and Montinola, 2004). Furthermore, research on labor law production (Tsebelis, 1999), public budgets (Tsebelis and Chang, 2004), or legislative output (Kreppel, 1997) generally support the claim that with a larger range of policy preferences policy stability increases. For environmental legislation, the studies from Knill et al. (2009) and Jensen and Spoon (2011) support the veto player approach.

These findings concur with theoretical critiques of veto player theory along three major lines (Merkel, 2003, Ganghof and Bräuninger, 2006, Ganghof, 2003). First, the problem of *identification* describes how difficult it is "to distinguish real veto players from other potentially influential actors" (Ganghof, 2003, p. 3). Political decision making takes place in different political arenas, for example, the parliament and the cabinet, where different sets of actors, such as parliamentary factions or ministers, are involved (Merkel, 2003, Ganghof and Bräuninger, 2006, Becher, 2010). Veto player theory suggests that internal cohesion of

collective veto players addresses this issue. An example is when the conflicting interests and preferences of ministers weaken the position of the government (Tsebelis, 1995). However, internal cohesion is introduced theoretically but rarely used in empirical applications (Knill et al., 2009, Jensen and Spoon, 2011).

Second, scholars have raised concerns about the *measurement of preferences* (Ganghof, 2003, Jahn, 2010, Merkel, 2003, Kaiser, 2007). They argue that policies usually reflect more than one dimension, for example, environmental protection *and* economic growth, which leaves more alternatives for political bargaining (e.g., Becher, 2010). Besides, preferences are not constant at the time of decision-making as suggested by Tsebelis (1995, 2002), but might change over time depending on other motives such as office-, rent- , or vote-seeking (Müller and Strom, 1999). These motives introduce substantial side-payments into the actual winset (Andrews and Montinola, 2004, Ganghof, 2003, Ganghof and Bräuninger, 2006).

Third, several authors doubt the *equivalence* of veto players. Veto player theory focuses primarily on competitive veto players (e.g., government and oppositional majority in the second chamber) but leaves less room for cooperative relationships which enable rather than block legislation (e.g., parties in a coalition government) (Merkel, 2003, Crepaz, 2001, Ganghof, 2003). As we will see in the following section, in the field of climate mitigation debate focuses more on cooperative leadership (Schreurs and Tiberghien, 2007, Wurzel and Connelly, 2011).

1.3 Climate leaders and the mechanisms for changing policy preferences

Leaders are defined as entrepreneurs pursuing "policy ideas that can lead to a revision of policy goals, in turn causing a redefinition of actor interests" (Schreurs and Tiberghien, 2007, p. 24). This definition addresses the critical issues of veto player theory. With regard to *identification*, it stresses that leaders can be a variety of policy entrepreneurs: for example, businesses, environmental NGOs, or political parties (Schreurs and Tiberghien, 2007, Wurzel and Connelly, 2011, Harrison, 2010). Studies show that political parties such as the Social Democrats (Korpi and Palme, 2003) or the Greens actively serve as leaders pushing for environmental or social legislation on the national and EU level (Müller-Rommel and Poguntke, 2002, Karapin, 2012, Wurzel and Connelly, 2011). The definition of leadership concerns the measurement of preferences, pointing out that leadership is not only based on actual policy but also on political ideas (Knill et al., 2012, Liefferink et al., 2009, Schreurs and Tiberghien, 2007). Furthermore, the definition states that leaders are not equivalent to competitive veto players but are highly cooperative, influencing other political actors to follow their lead (Liefferink et al., 2009, Knill et al., 2012).

Given the definition of leadership, we may now try to integrate both approaches within the case of climate mitigation policy. Figure 1 illustrates the different predictions made by each account, based on two hypothetical countries with varying numbers of veto players and range of preferences.

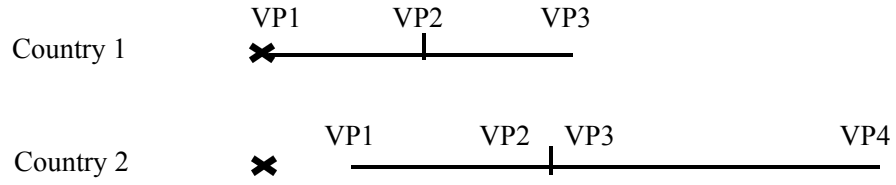
First, climate mitigation is a new policy field where policy change occurs in only one direction: the adoption of climate mitigation policies, as illustrated in Figure 1. Veto player theory argues that, independent of the direction of change, more veto players or a wider range of policy preferences trigger policy stability around the status quo, i.e. no climate mitigation policy (Tsebelis, 1999, 2002, Kastner and Rector, 2003).

Second, the leadership concept gives rise to the argument that the preference range or the number of veto players may be a necessary but not sufficient determinant of policy change. Veto player theory focuses on the relative position of veto players but neglects to anchor their absolute preferences in the policy space. Taking the definition of veto players as actors who are necessary for policy making, we could argue that policy has to conform with the actor's preference which is closest to the status quo (VP1 in both countries). However, as illustrated by the example, we would expect that Country 2 would adopt more ambitious climate policy measures than Country 1 despite its larger preference range and higher number of veto players.

Third, in contrast to the scenario where climate mitigation policy necessarily ends up at the minimum, we argue that climate leaders can play a substantial role in changing policy preferences and, thus, in "pulling" the result of climate mitigation policy further to the median or even the maximum. Only veto players with preferences that exceed a certain absolute threshold (e.g., the 75%-quintile across all countries) are defined as climate leaders (Knill et al., 2012, Liefferink et al., 2009). We argue that higher numbers of climate leaders enable higher legislative output in climate mitigation policy because they increase the winset of all

veto players. In our example of Figure 1, VP4 in Country 2 but not VP3 in Country 1 would be a climate leader as defined above.

Figure 1: Theoretical approaches to veto players and climate leaders



Note: VP = veto player, ✖ = status quo, —— = range, | = median

The expectations of both theories are not necessarily competing. In countries with the same number of climate leaders, we might still find variation in climate mitigation policy according to the number of veto players and their range in preferences. The reason is that climate leaders find it more difficult to convince other veto players the larger the number of veto players and the higher their distance in policy preferences is. These hypotheses will be tested in the following.

2 A Mixed Methods Design

The goal of our research is to test veto player theory and the climate leaders approach. We apply a mixed methods design in which qualitative and quantitative methods are combined in a single program of inquiry to allow a certain degree of triangulation of the findings (Bryman,

2006, Creswell and Plano, 2011, Tashakkori and Teddlie, 2010). Here, the complementary strengths of quantitative components examining the magnitude and frequency of veto player or climate leader influence and qualitative components examining the nature and understanding of this influence can yield greater insight than either approach alone (Curry et al., 2009, Lieberman, 2005, Rohlfing, 2008). To develop our explanation, we follow Lieberman's (2005) suggestion of a nested approach starting with a quantitative analysis and, if the model results are robust, proceeding to a qualitative small-N analysis.

2.1 Quantitative analysis

The quantitative analysis seeks to demonstrate that, next to veto players and policy preferences, climate leaders are an important factor influencing climate mitigation policy. We analyzed a longitudinal sample of countries over a 12-year period using a cross-sectional time-series approach.

Data Our sample consists of observations for 25 EU member states from 1998 to 2010 (excluding Malta and Cyprus due to lack of data). 1998 marks the starting point of the Kyoto Protocol and the year in which the EU's burden-sharing agreement was made (Wurzel and Connelly, 2011); 2010 is the most recent year for which climate mitigation policies are fully available.

Dependent variable Our dependent variable is the annual adoption rate of policies and measures on energy efficiency, compiled from the *MURE-Database*

(www.isisrome.com/mure/index.htm). We chose the field of energy efficiency since it has been designated a key for successful climate mitigation (IEA, 2013). We constructed a metric variable counting the number of climate policies adopted per year and per country. The MURE database provides semi-quantitative expert evaluations of the policy's performance on emission reduction (low, medium, high) which we apply as weights for the policies (for a similar approach see Albrecht and Arts, 2005, Knill et al., 2009, Tsebelis, 1999).

Independent variables Our analysis focuses on how the number of veto players, the range of policy preferences, and the presence of climate leaders affect climate policy adoption. We use information from the *Comparative Political Dataset III* in order to derive the number of veto players (Armingeon et al., 2010, see also Jahn, 2010, Tsebelis, 2002, Ganghof and Bräuninger, 2006). We only count veto players belonging to different parties (Tsebelis, 1995, 2002). First, the type of government (single party, multi-party minority or majority cabinet) determines how many parties count as veto players in the executive. For minority governments, we additionally added non-governmental parties in parliament with the policy preferences closest to the government *and* sufficient seats to enable a majority vote. Second, we counted the president as one additional veto player if the position brings a veto right and is occupied by a non-governmental party. Third, the second chamber is counted as a veto player if it is not controlled by a government majority and it holds a veto right.

Furthermore, following Tsebelis (2002, 1995), we calculated the range of policy preferences of all veto players using the *Comparative Manifesto Project Data* (Klingemann et al., 2006). To our knowledge, this is the only dataset available covering all EU member state for the period

1998 to 2010. It counts the number of quasi-sentences (issue-salience scores) in party manifestos on two environmental issues. Per416 measures anti-growth politics and steady-state economy; ecology; Green Politics; and sustainable development. Per501 includes sub-sentences on preservation of the countryside, etc; general protection of natural resources against selfish interests; proper use of national parks, soil banks, etc; and environmental improvement (Klingemann et al., 2006). We assume that parties with a high proportion of these quasi-sentences in their manifestos (high salience scores) also consider climate change an important problem. The range is calculated for all veto players per country and per year. For example, in countries with multi-party majority governments but no veto rights for the second chamber or president, the range is calculated by subtracting the salience scores of the most extreme cabinet parties. For minority governments, we extended the range by the salience score of the parties which are closest to the government's range of policy preferences *and* which hold sufficient seats to enable a majority vote. The same procedure was applied if the second chamber has veto power and is controlled by opposition parties. Furthermore, presidents with veto rights from non-government parties were included in the calculation of the range.

For the third independent variable, we follow the approach applied by Knill et al. (2012) using a fixed percentage threshold of the 75-quintile of all veto players per year across countries as a benchmark to identify climate leaders. In addition, we calculate the share of climate leaders on veto players in order to account for country differences in the absolute number of veto players across countries.

Control variables Clearly the national targets for emission reduction under the EU burden-sharing agreement are a driving force behind climate policy making in the EU (Wurzel and Connelly, 2011). Since these targets are constant over time, they cannot be included as a control variable in a pooled time-series cross-section model. Instead we introduced two factors that constitute the basis for the calculation of the targets and their achievement over time: the annual percentage growth in gross domestic product, taken from the World Bank World Development Indicators database; and carbon dioxide emissions in kilograms per $1 of gross domestic product in purchasing power parities, provided by the United Nations Framework Convention on Climate Change Millennium Development Goals Database. Both variables account for changes in the energy intensity of national industries and economic circumstances in the respective member states. Finally, we included a dummy variable for EU membership to assess if being part of the burden-sharing agreement stimulated national policy making.

Method We used unit root tests to assess if our variable is stationary. Since unit root tests are often criticized for lack of power, we compared results from three different tests: the Levin-Lin test, the Im-Pesaran-Shin test, and the Hadri LM stationarity tests (Baltagi, 2001). All three tests indicate that our dependent variable, weighted climate policies, is stationary ($p < .05$).

We estimate the following model:

$$Climate_{it} = \beta_1 Number\ of\ Veto\ Player_{it} + \beta_2 Preference\ Range_{it} + \beta_3 Climate\ Leader_{it} + \beta_4 GDP\ Growth_{it-1} + \beta_4 Emission\ Change_{it-1} + \beta_5 EU\ Member_{it} + \beta_6 Climate_{it-1} + \gamma_i Country_i + \delta_t Year_t + \varepsilon_{it}.$$

where *i* represents country, *t* stands for year and ε_{it} for the error term. The model includes a linear time trend, since the Bayesian Information Criterion prefers a linear time trend to dummies for each year. We use country dummies to correct for time-constant unobserved heterogeneity. Both a Wald test of the country dummies and a Hausman test underscore the necessity of fixed effects.

Since we look at the policies and measures adopted in a given year, one would expect that policies adopted in previous periods form an explanatory factor in themselves. This dynamic relationship is modeled with a lagged dependent variable (LDV). Panel-corrected standard errors are used to correct for panel heteroscedasticity and contemporaneous correlation of errors (Beck and Katz, 1995). All variables are entered in logarithmized form to adjust for skewedness in their distribution and to enable interpretation as constant percentage changes. We introduce a one-year lag for the control variables since changes in gross domestic product and carbon emissions of the preceding year are generally used as a benchmark for actual political decision making.

2.2 Qualitative analysis

The quantitative approach seeks to demonstrate that climate leaders play a role in climate mitigation policy, whereas our qualitative analysis focuses on the within-case processes, demonstrating *how* climate leaders accomplish wider support for climate mitigation policy. For this we employ a small-N qualitative analysis to assess the plausibility of the observed statistical relationships and to illuminate the potential causal mechanisms (Lieberman, 2005, Curry et al., 2009).

In this in-depth qualitative study, we selected two cases on theoretical grounds, Poland and Germany, which differ in one of the central areas of climate policy: renewable energy regulation. The countries' strategies to replace fossil fuels by renewable energies are opposite in design and effect (Jacobsson and Lauber, 2006). The Polish quota model with tradable green certificates failed to meet its obligation (under EU directive 2001/77/EC) to reach a share of 7.5 percent of renewable energy in gross electricity consumption; whereas in Germany this share had been successfully increased to 25 percent by the feed-in tariff (Mendonça et al., 2010). These differences are puzzling: veto player theory would expect the opposite results, given the number of veto players and the range of preferences in these countries. The number of veto players was less (two) and the range of policy preferences smaller (0.85) in Poland than in Germany (three; 9.81). This constellation of veto players and the outcome in climate mitigation adoption is ideal for studying the potential influence of climate leaders on climate policy.

Data The basis of the case study is a systematic review of primary and secondary material. Primary sources included documentation, official and archival records, and media records, such as the German Renewable Energy Act, the Polish Energy Law and the Polish renewable energy industry journal *Czysta Energia*. Secondary materials included books, journal articles, and other scholarly documents on the history of renewable energy in Poland and Germany.

Analyzing strategy We used content analysis of documents and statements by public authorities as well as media records, and consulted secondary sources to develop analytical narratives for the policy-making process. Process tracing was applied in order to identify the intervening casual process between veto players, policy preferences and climate leaders on the one hand, and the adoption of climate mitigation policy on the other hand.

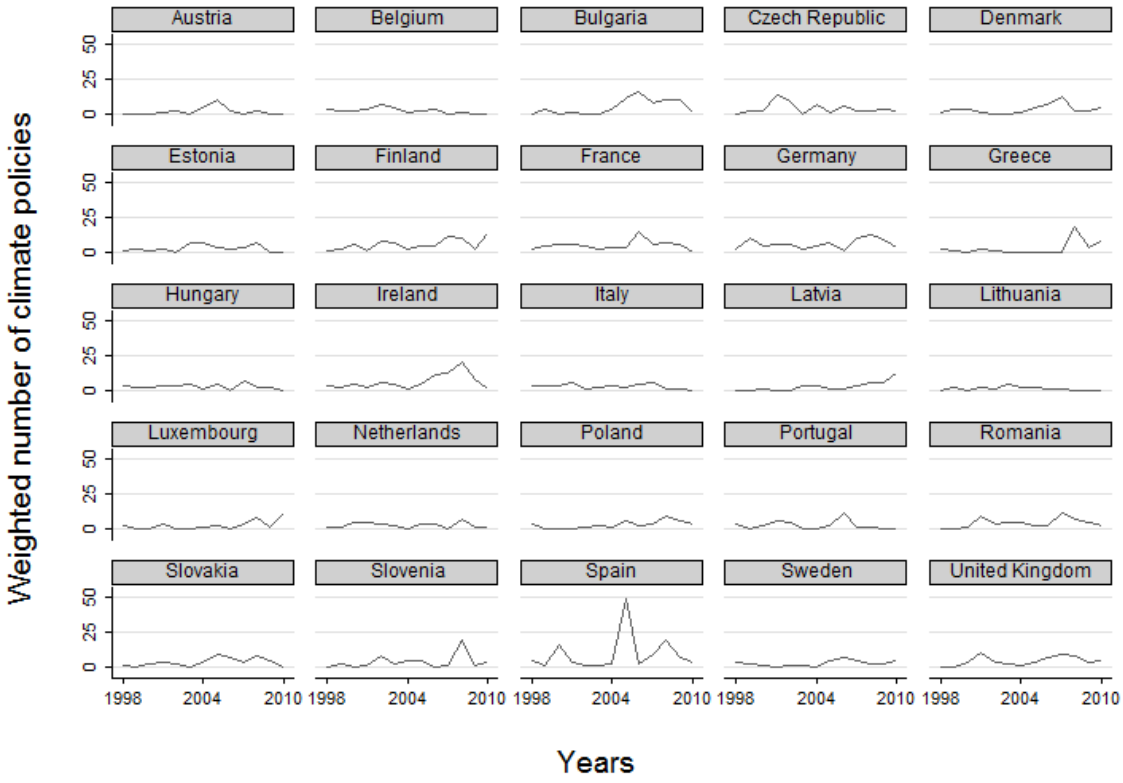
3 Results

3.1 Quantitative analysis

Figure 2 plots the weighted number of climate policies for 25 EU countries from 1998 to 2010. First, we note no clear trend in climate policy adoption except that in the late 1990s there seems to be less activity than subsequently. Second, climate policymaking we can see that for most countries in most years, the weighted number of policies does not exceed ten. Exceptions are larger packages such as the Spanish Action Plan 2005–2007. Finally, we see strong inter-country differences in the degree and timing of climate policy adoption. Countries like Bulgaria, Denmark, France, Greece, Ireland, Slovenia, and Spain are characterized by larger

peaks which stand out from the common country pattern of a relatively low rate of policy adoption across time. However, even in countries without strong spikes, such as Belgium, Germany, Hungary, or Sweden, we still see substantial variation in climate policy-making across time.

Figure 2: Number of climate policies per country over time weighted by expert evaluation



Source: MURE Database, authors' calculation.

Table 1 shows the results from the regression models. Both GDP and emissions are positively associated with more climate policy activity, while we find no significant effect of EU membership. Model 2 introduces the veto player index which is positive and significant,

indicating that a higher number of veto players is associated with more climate policy making. Adding the preference range of the veto players renders the effect of the veto player index insignificant.

However, both veto player variables are positive and thus in contrast to their expected direction of influence. Models 4 and 5 test the implications of the climate leader account. Both the number and the proportion of climate leaders increase national climate policy. Under the climate leaders control, the coefficient of the preference range is negative but still not significant. The findings clearly support the argument that climate leaders play a significant role in climate mitigation policy independent of the number of veto players or the range of policy preferences.

Table 1: Estimation results for the adoption of climate policies in 25 EU member states between 1998 and 2010

	Model 1	Model 2	Model3	Model4	Model5
Veto player index		1.034*	0.685	0.493	0.653
		(0.450)	(0.515)	(0.504)	(0.509)
Preference range			0.124	-0.039	-0.057
			(0.089)	(0.101)	(0.100)
Number of climate Leaders				0.248***	
				(0.059)	
Proportion of climate leaders					0.330***
					(0.077)
GDP growth$_{t-1}$	3.834***	3.694***	3.746***	3.353**	3.347**
	(1.062)	(1.044)	(1.051)	(1.047)	(1.046)
Emission change$_{t-1}$	4.871+	4.561+	4.650+	4.862*	4.903*
	(2.563)	(2.491)	(2.499)	(2.398)	(2.396)
EU membership	0.545	0.540	0.545	0.164	0.194
	(0.446)	(0.424)	(0.425)	(0.397)	(0.399)
Year	0.054	0.054	0.051	0.068	0.067
	(0.066)	(0.065)	(0.064)	(0.062)	(0.062)
LDV	0.147	0.134	0.134	0.111	0.113
	(0.109)	(0.108)	(0.107)	(0.105)	(0.105)
Country dummies	Yes	Yes	Yes	Yes	Yes
Constant	-2.102*	-1.795+	-1.905+	-1.720+	-1.764+
	(0.959)	(0.971)	(0.983)	(0.959)	(0.955)
N	275	275	275	275	275
Wald χ^2	77.38	65.58	69.07	55.81	112.28
Prob > χ^2	0.000	0.000	0.000	0.000	0.000
R^2	0.257	0.270	0.273	0.303	0.304
LM χ^2	0.58	0.90	0.80	0.72	0.86
Prob > χ^2	0.747	0.637	0.670	0.698	0.652

Note: + $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$; panel-corrected standard errors in parentheses; all variables are in logarithmic form; LDV = lagged dependent variable; fixed effects are not shown.

Sensitivity tests Correlation matrices and variance-inflation factors show no multicollinearity issues. Lagrange Multiplier Tests find no evidence for serial correlation for the final models. Furthermore, a RESET for the full model report no evidence for omitted variable bias ($F(3) = 0.71$; $F(3) = 0.67$). Using differences instead of levels (see online appendix) leads to similar results, except for the veto player index which is negative albeit not significant when change scores are used. Combining fixed effects and a lagged dependent variable (LDV) can create the so-called Nickell bias (Nickell, 1981). Since the results are very similar when we drop the LDV or use random effects, Nickell bias if present should not affect our substantive conclusions despite our small T.

We recalculated the full model using a 20-year span starting in 1990 as a reference year and the un-weighted adoption rate of climate policies and measures. All regression models deliver highly similar results of the political variables. The results are stable when applying the mean and the median instead of the 75-quintile as a threshold to operationalize climate leaders. Different controls have been included in the models (population density, percentage of energy production from renewables, energy intensity of industry, primary energy consumption, net energy imports, percentage of trade on gross domestic product). They do not affect the estimates for the political variables but were excluded from to achieve a parsimonious model. Furthermore, we applied different lags for the dependent variable, the political indicators and controls and found no substantial deviation of the results from our base model. Finally, an extended outlier analysis, including a reanalysis of all models excluding one country, one year, or one observation at a time, indicates that the results are not driven by influential cases.

3.2 Qualitative results

The contextual analysis compares the renewable electricity laws in Poland and Germany. The foundation for a renewable electricity law in Poland in 2005 was the 'Development Strategy for Renewable Energy Sector', which was adopted in 2001 by the former cabinet of the Freedom Union (UW) and Electoral Action 'Solidarity' (AWS). This strategy obliged the government of the following legislation period to adopt a separate renewable energy law. Furthermore, when Poland joined the EU in 2004, it agreed to increase the share of renewable electricity in gross energy consumption to 7.5 percent by 2010 (Directive 2001/77/EC) (Jankowska, 2012). In Germany, the basis for the renewable electricity law (EEG) was the Electricity Feed-in Law (StrEG) of 1990, which introduced national feed-in rates for renewables based on electricity retail rates (Hirschl, 2008, Jänicke, 2011).

Table 2 shows veto players and climate leaders as identified by the quantitative operationalization. In Poland, veto players consist of the coalition government of the Democratic Left Alliance (SLD) and the Union of Labor (UP) with a majority in the second chamber and the position of the president (SLD). The German veto players are two governing parties (the Social Democrats and the Green Party), both identified as climate leaders, and a second chamber controlled by the opposition of Christian Democrats (CDU) and Free Democratic Party (FDP).

Table 2: Veto players and climate leaders

	Poland (2005)	**Germany (2000)**
Veto players	SLD and UP cabinet Second chamber controlled by SLD and UP coalition President, SLD	SPD and Green Party cabinet Second chamber controlled by opposition of CDU and FDP
Climate leaders		Both cabinet parties

In Poland, the environmental minister (Czesław Śleziak, SLD) in the newly elected government coalition of the SLD and the UP in 2001 commissioned the renewable energy institute EC BREC/IBMER to prepare a draft to meet the 'Development Strategy for Renewable Energy Sector' and the EU obligation in early 2004 (Wojciechowska, 2004, Jankowska, 2012). The draft included the introduction of tradable green certificates besides the already existing quota scheme (Jankowska, 2012). After a change in government in May 2004, the former governmental parties remained in power but with a new environmental minister (Jerzy Swatoń, independent). The EC BREC/IBMER was strongly criticized and sidelined by the 'Instruments for Environmental Protection' division and its new director Wojciech Jaworski (independent) within the environmental ministry (Grużewski, 2004, Podrygała, 2008). The division prepared a proposal intended to limit support for renewable energy technologies (Grużewski, 2004, Podrygała, 2008). For example, representatives of the conventional energy industry (e.g., Bio-energia SP) were invited to participate in the process of policy formulation, whereas business groups representing the renewable energy sector (e.g., the Polish Economic Chamber of Renewable Energy) were not (Grużewski, 2004). Consequently, the final version

of the draft clearly favored the conventional energy sector. For example, it proposed to shift the responsibility for issuing green certificates from the Energy Regulatory Office to the state-owned conventional power supply company PSA SA (Grużewski, 2004, Podrygała, 2008).

This draft was rejected by the cabinet in early 2005, as it clearly failed to meet the 'Development Strategy for Renewable Energy Sector' and the EU obligation (Grużewski, 2004). Since the EU Directive was a formal criterion within the accession treaty for Polish EU membership, political pressure to pass a renewable energy law was high. As a compromise to achieve a quick solution, the environmental minister, Swantoń, proposed an idea originally brought forward by his predecessor, Śleziak, to amend the existing energy law (Wojciechowska, 2004). During several rounds of consultation, the ministers agreed in 2005 to amend the existing energy law by major elements taken from the more ambitious EC BREC/IBMER draft (Podrygała, 2008, Jankowska, 2012). This included tradable green certificates without different prices for different technologies where only the bottom certificate price was fixed (Podrygała, 2008, Jankowska, 2012). The proposal passed the second chamber and was finally signed by the president in March 2005.

In Germany, due to decreasing prices following the liberalization of the EU energy market in 1998, the StrEG failed to produce sufficient dividend from the feed-in rate for renewable energy technologies to compete with conventional energies (Jacobsson and Lauber, 2006, Hirschl, 2008). At the same time, negotiations to phase out nuclear power in Germany placed more pressure on policy makers to improve the competitiveness of renewable energy sources (Jankowska et al., 2008). This situation demanded a revision of the StrEG feed-in tariff,

decoupling it from the retail electricity rate (Hirschl, 2008, DB Climate Change Advisors, 2011). However, responsibility for the renewable energy law fell within the competence of the minister for the economy (Werner Müller, SPD) who, at that time, appeared to have no intention of changing the status quo (Jacobsson and Lauber, 2006, Hirschl, 2008). The initiative for a revision of the StrEG came from the Green Party's parliamentary group in the government coalition (Eckpunktepapier von der bündnisgrünen Fraktion, 1999) in the first chamber of the German parliament (Bundestag) (Hirschl 2008). The major step forward was the proposal of fixed feed-in rates that approximated the generation costs of renewable technology systems independent from retail electricity rates (Jänicke, 2011).

The minister for the economy initially supported the proposed amendment of the StrEG in cabinet, but soon prepared a separate, less ambitious proposal for a quota system, which was perceived as breaking the earlier agreement with the coalition partner (Jacobsson and Lauber, 2006, Hirschl, 2008). Some members of parliament, therefore – Hans-Josef Fell, Michaele Hustedt (both Green Party), and Hermann Scheer (SPD) – seized the initiative and submitted a draft law based on the Eckpunktepapier (Deutscher Bundestag, 1999). They managed both to convince the majority of both cabinet parties in the Bundestag and to build a broad coalition of associations (e.g., VDMA, IG Metall), solar cell producers (e.g., Qcells), large energy suppliers (e.g., Preussen Elektra) and state-level politicians (Jacobsson and Lauber, 2006, Hirschl, 2008). It was their successful framing of the issue as a chance to put German industry and employment on a more sustainable economic basis which led to the approval of the EEG on 13 December 1999 (Jacobsson and Lauber, 2006). With this coalition of support, the EEG was adopted in the German parliament on 25 February 2000 (Deutscher Bundestag, 2000) and on

17 March 2000 even passed the opposition-dominated second chamber of state representatives (Deutscher Bundesrat, 2000).

This analysis of the renewable electricity laws in Poland and Germany enables us to demonstrate the problems of identification, preference measurement, and internal coherence. In Poland, the minister of the environment (Czesław Śleziak, SLD) had been a strong climate leader but had to resign in the early phase of the process. This enabled advocates for the conventional energy industry such as Wojciech Jaworski to act like a veto player without veto power actually preventing the more ambitious EC BREC/IBMER draft becoming part of the political agenda. This finding points to the issue of identification and internal cohesion of collective veto players, where single actors influence the policy preferences of collective veto players. Furthermore, we find the EU to be a powerful veto player, because it linked support for renewable energy with the accession treaty and thus provided a crucial side payment in the winset. In this case, the Polish government could not risk its membership status through lack of compliance with the directive.

In Germany, we find a situation that challenges traditional veto player theory. The agenda-setting power of crucial climate leaders, the government parties (SPD and the Green Party), was blocked by the minister for the economy's support for conventional industries. Agenda-setting power was wielded to considerable effect by parliamentary groups in order to push for a renewable energy law. These climate leaders managed to frame renewable energy as a chance for economically sustainable development and to manoeuver even members of the opposition parties in the second chamber into supporting the draft law. This finding, too, underlines the

issue of identification and internal cohesion of collective veto players.

Conclusion

The aim of our study was to elaborate veto player theory in the context of the newly emerging policy field of climate mitigation. We discuss the role and integrate the concept of climate leaders into veto player theory as a crucial component in understanding policy change (Schreurs and Tiberghien, 2007, Wurzel and Connelly, 2011). We hypothesized that the number of climate leaders and their proportion in the absolute number of veto players in the political system positively influence climate mitigation policy independent of the number of veto players and the range of policy preferences.

We investigate this hypothesis by a mixed-methods design combining a pooled times-series cross section analysis of domestic climate policy adoption in 25 EU member states from 1998 to 2010 with a qualitative in-depth case-study comparison of two renewable energy laws in Poland (2005) and Germany (2000). The results of the quantitative analysis reveal a robust positive effect of the number of climate leaders and their proportion among veto players. In contrast, we find no statistical support for the claim that the range of policy preferences explains policy stability in the field of climate mitigation. In the qualitative analysis, we find the renewable energy law to be more successful in Germany than in Poland, despite the higher number of veto players and wider range of policy preferences in Germany. However, as the analysis reveals, it is the higher numbers of climate leaders in Germany that enabled the adoption of the renewable energy law.

The findings underscore our critique that veto player theory focuses too much on the relative position of veto players within the policy space and leaves absolute measures aside. They also demonstrate that the issues of internal cohesion and identification as well as substantial side payments increasing the winset play a more important role than assumed by traditional veto player theory. In the Polish case, the EU played a substantial role in triggering policy change. In Germany, it was not the government parties in cabinet or the second chamber but members of parliament who actively sought an ambitious renewable energy law. Our analysis makes a compelling case that *engines* rather than *breaks* influence policy-making in new fields. Future research could build on this insight by systematically investigating the relative importance of veto players and leaders for different policy fields (new versus established) and at different periods in time (newly emerging, on-going crisis, etc.).

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Online Appendix

Appendix 1: Estimation results for the adoption of climate policies in 25 EU member states between 1998 and 2010 based on first differences

	Model 1	Model 2	Model3	Model4	Model5
Veto player index		-0.318	-0.643	-1.004	-0.835
		(0.526)	(0.633)	(0.639)	(0.623)
Preference range			0.129	0.018	-0.002
			(0.125)	(0.117)	(0.116)
Number of climate leaders				0.264**	
				(0.096)	
Proportion of climate leaders					0.371**
					(0.127)
GDP growth$_{t-1}$	4.729**	4.720**	4.477**	4.490**	4.490**
	(1.492)	(1.488)	(1.596)	(1.611)	(1.607)
Emission change$_{t-1}$	5.336+	5.348+	4.986	4.917	4.885
	(3.094)	(3.100)	(3.198)	(3.096)	(3.093)
EU membership	0.714	0.701	0.713	0.464	0.484
	(0.612)	(0.623)	(0.654)	(0.633)	(0.630)
Year	-0.053	-0.054	-0.064	-0.054	-0.052
	(0.072)	(0.071)	(0.078)	(0.077)	(0.077)
LDV	-0.402***	-0.402***	-0.396***	-0.400***	-0.399***
	(0.098)	(0.098)	(0.099)	(0.098)	(0.098)
Country dummies	Yes	Yes	Yes	Yes	Yes
Constant	0.617	0.626	0.699	0.720	0.724
	(1.159)	(1.157)	(1.225)	(1.214)	(1.214)
N	275	275	275	275	275
R^2	0.226	0.227	0.219	0.239	0.242

Note: + $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$; panel-corrected standard errors in parentheses; all variables are in logarithmic form and first differenced; LDV = lagged dependent variable; fixed effects are not shown.

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WISSENSCHAFTLICHER WERDEGANG

10/2009 – 07/2013	**Doktorand** Graduiertenkolleg Soclife – Universität zu Köln Titel der Doktorarbeit: *Policy Change: Concept, Measurement, and Causes – An Empirical Analysis of Climate Mitigation Policy*. Betreuer: Prof André Kaiser, Universität zu Köln
10/2004 – 06/2009	**Diplom Sozialwissenschaften** Fakultät für Sozialwissenschaften, Universität Mannheim Titel der Diplomarbeit: *Klimapolitik und Wohlfahrtsregime im internationalen Vergleich* Betreuer: Prof Bernhard Ebbinghaus, Universität Mannheim
08/1993 – 07/2002	**Abitur** Melanchthon Gymnasium, Wittenberg

ARBEITS- UND LEHRERFAHRUNG

Seit 07/2013	**Wissenschaftlicher Mitarbeiter (Projektkoordinator)** Europäische Akademie zur Erforschung von Folgen wissenschaftlich-technischer Entwicklungen Bad Neuenahr-Ahrweiler gGmbH (Prof Ahrweiler) Projekt: *Nachhaltige Gestaltung der Landnutzung und Energieversorgung auf kommunaler Ebene (EnAHRgie)* Koordination des Verbundprojekts
04/2011 – 08/2012	**Geprüfte wissenschaftliche Hilfskraft** Institut für Datenanalyse und Datenarchivierung, Universität zu Köln (Prof Jagodzinski) Statistische Analyse von internationalen Umfragedaten
10/2010 – 03/2011	**Tutor** Lehrstuhl für empirische Sozial- und Wirtschaftsforschung, Universität zu Köln (Prof Andreß) Tutorium zur Vorlesung *Linear Models*
05/2008 – 09/2008	**Praktikant** Deutsche Gesellschaft für internationale Zusammenarbeit (GIZ) *Projekt:* Energising Africa Monitoring von Klimaschutzprojekten im Senegal und Kenia Organisation und Unterstützung der BMU CDM/JI Initiative

ARBEITS- UND LEHRERFAHRUNG

09/2005 – 06/2009 **Studentische Hilfskraft**
Mannheimer Zentrum für Europäische Sozialforschung (MZES)
(Prof Ebbinghaus)
Projekt *Governance of Supplementary Pensions in Europe*
Durchführung multivariater Analysen von internationalen Umfragedaten

10/2006 – 12/2006 **Berater**
Staatliche Universität Omsk (Russische Föderation)
- Evaluation des Bologna Prozesses in Europa

05/2006 – 10/2006 **Studentische Hilfskraft**
Mannheimer Zentrum für Europäische Sozialforschung (MZES)
(Prof van Deth)
Projekt *Demokratie leben lernen*
- Durchführung multivariater Analysen von internationalen Umfragedaten

09/2005 - 10/2006 **Studentische Hilfskraft**
Lehrstuhl für Makrosoziologie, Universität Mannheim (Prof Ebbinghaus)
- Sammlung und Analyse von Daten der BA und OECD zu Erwerbstätigkeit

06/2005 – 08/2005 **Studentische Hilfskraft**
Sonderforschungsbereich 504, Universität Mannheim (Prof Esser)
Projekt *Bildungsaspiration und Referenzgruppen*
- Durchführung von standardisierten Tests an Grundschulen
- Datenkodierung und -analyse

INTERNATIONALE ERFAHRUNG

09/2012 – 09/2013 **USA: Gastwissenschaftler**
Fachbereich Soziologie, Harvard Universität, Cambridge, MA

03/2011 – 04/2011 **Niederlande: Gastwissenschaftler**
Fachbereich Politikwissenschaften, Freie Universität Amsterdam

02/2007 – 07/2007 **Australien: Austauschstudent**
Fachbereich Sozialwissenschaften, Flinders Universität, Adelaide

10/2006 – 12/2006 **Russische Föderation: Praktikum**
Fachbereich Ökonomie, Staatliche Universität Omsk

06/2003 – 09/2003 **Südafrika: Freiwilligenarbeit**
TravelWorks, Kapstadt

FORSCHUNGSINTERESSEN

Vergleichende Politikwissenschaften	Nationale Klimapolitikentwicklungen, politische Parteien, Vetospielertheorie
Policyanalyse und Governance	Design von Politikinstrumenten, Politikinnovationen, Diffusionsprozesse, politischer Wandel, neue Formen von Governance
Umweltgerechtigkeit	Nachhaltigkeit, Energie und Gesellschaft, Energiearmut
Umweltsoziologie	Umweltbewusstsein, Umweltverhalten und Energiekonsum
Methoden	quantitativ und qualitative

VERÖFFENTLICHUNGEN

Schaffrin, A. im Erscheinen. "The New Social Risks and Opportunities of Climate Change" In: Fitzpatrick, T. (Hrsg). *International Handbook on Social Policy & the Environment.* Edward Elgar.

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Schaffrin, A. 2011. "No Measure Without Concept. A Critical Review on the Conceptualization and Measurement of Environmental Concern" *International Review of Social Research* 1 (3) 11-31.

Schaffrin, A. 2011. "Environmental Concern for Climate Change - A Welfare State Perspective" *Soclife Working Paper Series* 8/2011.

Schaffrin, A. 2011. "The capacities to fight climate change? An empirical investigation on the influence of economic, institutional, structural and cultural capacities on national climate policy efforts and strategies" Schriftenreihe *Marie Curie Training Course on Human Dimensions of Global Environmental Change, Freie Universität Berlin,* edocs.fu-berlin.de/docs/receive/FUDOCS_document_000000010254

LAUFENDE PUBLIKATIONSPROJEKTE

Schaffrin, A. "Who Cares for Climate Mitigation? - A Welfare State Perspective on Individual Concern for Climate Change"

Schaffrin, A. und N. Reibling. "Household Energy and Climate Mitigation Policies: Investigating Energy Practices in the Housing Sector"

Schaffrin, A., S. Sewerin, und S. Seubert. "Toward a Comparative Measure of Climate Policy Output"

Schaffrin, A., S. Sewerin, und S. Seubert. "The innovativeness of national policy portfolios: innovation dynamics in Austria, Germany and the United Kingdom"

Schaffrin, A. und K. Jankowska. "Explaining National Differences in Domestic Climate Policy Adoption - Political Institutions and Preferences"

Schaffrin, A. "New Modes of Regulation? - A Comparative Analysis on Instrument Choices and National Climate Policy Developments"

Jagodzinski, W., A. Schaffrin, H. Dülmer, und M. Voicu. "Positive and Negative Consequences of National Pride - An Empirical Analysis of ISSP Data"

GASTVORTRÄGE

02/2013	Schaffrin, A., S. Sewerin, und S. Seubert. "How to Pick the Real Champions of Climate Change Mitigation? Measuring and Assessing Climate Policy Output in Austria, Germany, and the UK." *NUS Workshop: Designing Optimal Policy Mixes: Principles and Methods*, Nationale Universität Singapur, 28. Feb – 1. März
05/2012	Schaffrin, A., S. Seubert, und S. Sewerin. "Measuring Domestic Climate Policy Activity in a Cross-National Comparison – Policy Attributes and Policy Innovation." Forschungsgruppe Energie-, Verkehrs- und Klimapolitik, Wuppertal Institut für Klima, Umwelt und Energie, 16. Mai
02/2011	Schaffrin, A. "Who Pays for Climate Mitigation? An Empirical Investigation on the Social Impact of Climate Policy." Doktorandenkolloquium, Wuppertal Institut für Klima, Umwelt und Energie, 23. Feb

KONFERENZBEITRÄGE

09/2013	Schaffrin, A., S. Sewerin, und S. Seubert "The Innovativeness of National Policy Portfolios: Innovation Dynamics in Austria, Germany and the United Kingdom" *4th ECPR General Conference*, 5.-7. Sept, Bordeaux
08/2013	Schaffrin, A. und N. Reibling "Household energy and climate mitigation policies: Investigating energy practices in the housing sector" *108th Annual Meeting American Sociologiological Association*, 10.-13. Aug, New York

KONFERENZBEITRÄGE

06/2013	Schaffrin, A., S. Sewerin, und S. Seubert "Policy Dynamics and Policy Innovation – Climate Policy Change in Austria, Germany, and the United Kingdom" *1st International Conference on Public Policy*, 25.-28. Juni, Grenoble
05/2013	Schaffrin, A. "New Modes of Regulation? - A Comparative Analysis on Instrument Choices and National Climate Policy Developments" *Annual Meeting Law and Society Association*, 30. Mai – 02. Juni, Boston
04/2013	Schaffrin, A., S. Sewerin, und S. Seubert "How to Pick the Real Champions of Climate Change Mitigation?" *71st Annual Conference Midwest Political Science Association*, 11.-14. April, Chicago
07/2012	Schaffrin, A. "Living Green but Poor? - Investigating Inequality in Household Energy Costs" *4th ECPR Graduate Conference*, 4.-6. Juli, Bremen
06/2012	Schaffrin, A. "New Modes of Regulation? - A Comparative Analysis of National Climate Policy Developments" *4th ECPR Standing Group on Regulation and Governance Biennial Conference*, 27.-29. Juni, University of Exeter
06/2012	Schaffrin, A., S. Seubert, und S. Sewerin "Measuring Domestic Climate Policy Activity in a Cross-National Comparison" *2nd Workshop on Climate Policy Innovation*, 27.-29. Juni, Universität Cambridge
03/2012	Schaffrin, A. "Living Green but Poor? - Investigating Inequality in Household Energy Costs among Income Groups" *Energy and Society Conference*, 25.-27. März, Universität Lissabon
02/2012	Schaffrin, A., S. Seubert, und S. Sewerin "Measuring Domestic Climate Policy Activity in a Cross-National Comparison" *1st Workshop on Climate Policy Innovation*, 23.-24. Feb, Freie Universität Amsterdam
11/2011	Schaffrin, A. "Living Green but Poor? - Investigating Inequality in Household Energy Costs among Income Groups" *3rd German Environmental Sociology Summit,* 16.-18. Nov, Goethe University Frankfurt
08/2011	Schaffrin, A. und K. Jankowska "Explaining National Differences in Domestic Climate Policy Adoption" *6th ECPR General Conference*, 25.-27. Aug, Universität Island
08/2011	Schaffrin, A. "Political and Economic Capacities in National Climate Policies " *6th ECPR General Conference*, 25.-27. Aug, Universität Island
08/2011	Schaffrin, A. "Who Pays for Climate Mitigation? An Empirical Investigation on the Social Impact of Climate Policy" *Annual Meeting of the American Sociological Association*, 20.-23. Aug, Las Vegas (aus persönlichen Gründen abgelehnt).

KONFERENZBEITRÄGE

06/2011	Schaffrin, A. "Living Green but Poor? - Investigating Inequality in Household Energy Costs" *Council for European Studies*, 20.-22. Juni, Barcelona
03/2011	Schaffrin, A. "Who Pays for Climate Mitigation? An Empirical Investigation on the Social Impact of Climate Policy" *Housing in Hard Times: Class, Poverty and Social Exclusion*, 13.-15. März, Housing Studies Association, Universität York
10/2010	Schaffrin, A. "Who Pays for Climate Mitigation? An Empirical Investigation on the Social Impact of Climate Policy" *34. Kongress der Deutschen Gesellschaft für Soziologie*, 11.-15. Okt, Goethe Universität Frankfurt
10/2010	Schaffrin, A. "Who Pays for Climate Mitigation? An Empirical Investigation on the Social Impact of Climate Policy"*Berlin Conference on the Human Dimensions of Global Environmental Change*, 8.-9. Okt, Freie Universität Berlin
09/2010	Schaffrin, A. "Who Pays for Climate Mitigation? An Empirical Investigation on the Social Impact of Climate Policy" *3rd Workshop on Adaptation Research in Social Science*, 27.-28. Sept, Bonn
08/2010	Schaffrin, A.. "The Climate Friendly Welfare State? " *3rd ECPR Graduate Conference*, 30. Aug – 1. Sep, Dublin City Universität
07/2010	Schaffrin, A. "Who Pays for Climate Mitigation? An Empirical Investigation on the Social Impact of Climate Policy" *XVI World Congress of Sociology*, 11.-17. Juli, Universität Göteburg
09/2009	Schaffrin, A. "Who is Harmed by Climate Change?" *9th European Sociological Association Conference*, 2.-5. Sep, Lissabon

STIPENDIEN

2010	*Marie-Curie Forschungsstipendium, Schulung zu* Human Dimension of Global Environmental Change*, 4.-13. Okt, Berlin*
2010	Reisestipendium des Deutschen Akademischen Austausch Dienst (DAAD), *Essex Summer School*, 9.-20. Aug, Universität Essex
seit 2009	Doktorandenstipendium der Deutsche Forschungsgemeinschaft (für vier Jahre), Graduiertenkolleg Soclife, Universität zu Köln
2009	*Doktorandenstipendium, Fachbereich Politikwissenschaften (für vier Jahre), Freie Universität Amsterdam (aus persönlichen Gründen abgelehnt)*
2006	*Reisestipendium des Deutschen Akademischen Austausch Dienst (DAAD),* Aiesec *Praktikum, 15. Okt - 25. Dez, Staatliche Universität Omsk*

WEITERBILDUNG

08/2010	*Essex Summer School in Social Science Data Analysis*, 09.-20. Aug, Universität Essex
06/2010	*Soclife & Sess.EuroPhD/ BGSS Workshop on Multi-Level-Analysis*, 28.-30. Juni, Humboldt Universität Berlin
02/2010	*Multi-level approaches to the analysis of work, care and welfare: An introductory workshop to theory, data, and analyses*, 22.-25. Feb, Universität Tilburg
01/2010	Mannheim Winter School *Analysis of Cross-Section Time-Series Data*, 13.-16. Jan, Universität Mannheim
02/2008	BASF-Workshop *Projektmanagement*, 18.-21. Feb, Ludwigshafen
12/2007	GESIS Workshop: *Analysis of ESS- and ISSP Data*, 04. – 05. Dez, GESIS Mannheim
08/2006	ECPR Summerschool in Methods and Techniques, 7.-18. Aug, Universität Ljubljana
10/2012	*IGA-410* Energy Policy: Technologies, Systems, and Markets*, Okt - Dez, Kennedy School of Governance, Harvard Universität, Cambridge, MA*
11/2011	InCluESEV Konferenz *Energy Justice in a Changing Climate: Defining an Agenda*, 10. – 11. Nov, King's College, London
11/2011	Internationales Forum *Greening Real Estate Markets - A Multi-Stakeholder Perspective,* 29. – 30. Nov, Umweltbundesamt/UNECE, Dessau
10/2010	*Marie Curie Training Course* Human Dimension of Global Environmental Change: Architectures for Earth System Governance*, 4.-13. Okt, Freie Universität Berlin*
09/2010	*LLP-ERASMUS-Intensive Program* Energy Security in the Baltic Sea Region in the 21. Century*, 1.-12. Sep, Humboldt Universität Berlin*

ORGANISATORISCHE AKTIVITÄTEN

Konferenzen	*Energy and Society*, 25.-27. März 2012, Universität Lissabon (Portugal) (Mitglied des Organisationskomitees)
	1st Soclife Workshop on the Analysis of Time in Context and Time as Context, 12.-14. Sep 2011, Universität zu Köln (Mitglied des Organisationskomitees)
	Болонский процесс в Германии и в Европе. Проблемы и перспективы для России (Der Bolognia Process in Deutschland und Europa. Herausforderungen und Perspektiven für Russland), 04. Dez 2006, Staatliche Universitäten Omsk, Barnaul und Novosibirsk (Organisation und Präsentation)
Panel	"The Distributive Effects of Environmental Politics: National and International Perspectives." *4th ECPR Graduate Conference*, 4.-6. Juli 2012, Universität Bremen (zusammen mit Ina Lehmann)
	"Technologies and Social Change" *Energy and Society Conference*, 25.-27. März 2012, Universität Lissabon (Portugal)
	"European Politics of Climate Change – Evaluating Policy Instruments and National Strategies." *6th ECPR General Conference*, 25.-27. Aug 2011, Universität Island (zusammen mit Miranda Schreurs)
Mitgliedschaften	Energy and Society Network (Gründungsmitglied, Organisationskomitee) Earth System Governance Network Climate Policy Innovation Network European Consortium of Political Research (ECPR) International Sociological Association American Sociological Association Midwest Political Science Association
Gutachter	International Review of Social Research Energy and Buildings Environmental Politics

FREMDSPACHEN

Englisch (fließend), Russisch (gut)

SOFTWARE

Statistik	STATA (hervorragend), SPSS (gut), AMOS (gut), HLM (gut)
Andere	MS Office (hervorragend), LATEX (gut)