Comparative Climate Politics:

Patterns of Climate Policy Performance

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Sebastian Sewerin, M.A.

aus

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Referent: Prof. Dr. André Kaiser, Universität zu Köln

Korreferent: Prof. Dr. Ingo Rohlfing, Universität Bremen

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Abstract

Although the comparative study of environmental politics and policy dates back well into the 1970s, it has never featured prominently within comparative politics generally. Against a background of mounting environmental pressures, most notably climate change, this low profile seems puzzling. As Steinberg and VanDeveer (2012) point out, building bridges between comparative environmental politics and the broader field of comparative politics is an important task for current research. This dissertation seeks to contribute to this linkage by revisiting the issue of cross-national environmental performance, focusing on climate performance. By addressing both the outcome and the output dimension of national climate performance, this thesis engages with two central issues of comparative politics: (i) the effect of political institutions on performance and (ii) policy change. Thus, it also contributes to broader research into the capacity of political systems to deal with complex long-term political problems. This dissertation attempts to make six major conceptual, methodological, and analytical contributions: 1) the thesis presents a conceptualization of general environmental performance based on the "planetary boundaries" approach; 2) it provides a theoretical framework for policy output and develops a measurement for its assessment; 3) it argues that actor constellations of specific environmental problems need to be considered to strengthen theoretical arguments about the effects of political institutions; 4) it argues that entire policy portfolios rather than (a set of) individual policy instruments need to be considered for assessing policy change; 5) it analyses the effect of political institutions on climate performance; 6) and it analyses policy change in climate mitigation and the role of policy innovations in altering policy portfolios.

I met a traveller from an antique land
Who said—"Two vast and trunkless legs of stone
Stand in the desert ... Near them, on the sand,
Half sunk, a shattered visage lies, whose frown,

And wrinkled lip, and sneer of cold command
Tell that its sculptor well those passions read
Which yet survive, stamp'd on these lifeless things,
The hand that mocked them, and the heart that fed;

And on the pedestal these words appear:
My name is Ozymandias, king of kings:
Look on my works, ye Mighty, and despair!

Nothing beside remains. Round the decay
Of that colossal wreck, boundless and bare
The lone and level sands stretch far away."

Percy Bysshe Shelley

Contents

Chapter 1

Einleitung

Der anthropogene Klimawandel ist eine der zentralen Herausforderungen unserer Zeit. Die überwiegende Mehrheit der Klimawissenschaftler, deren Forschung in regelmäßigen Abständen durch das *Intergovernmental Panel on Climate Change* (IPCC) ausgewertet und zusammengetragen wird, kommt zu dem Schluss, dass durch einen unkontrollierten Anstieg der globalen Temperaturen auf lange Sicht unsere gewohnte Lebensweise ernsthaft bedroht ist. Angesichts der zu erwartenden weitreichenden Folgen sind weitgehende Treibhausgasreduktionen notwendig um gefährliche Klimaveränderungen noch zu vermeiden. Bis zum Jahr 2050 muss der globale Ausstoß von Treibhausgasen um mindestens die Hälfte reduziert werden, um einen Temperaturanstieg über die als noch beherrschbar geltenden 2°C zu verhindern. Das IPCC (2007) hat berechnet, dass dafür in den westlichen Industrienationen 80 bis 95 Prozent aller Treibhausgasemissionen eingespart werden müssen.[1] In Anbetracht der Tatsache dass die CO_2-Emissionen im letzten Jahrhundert weltweit jährlich um durchschnittlich etwa drei Prozent gestiegen sind (vgl. Boden et al. 2009) würde jedoch bereits das Einfrieren der Emissionen gewaltige Anstrengungen erfordern. Die Notwendigkeit eines radikalen Umsteuerns in den

[1] Die westlichen Industrienationen (Europa, USA, Kanada, Australien, Japan) sind für zwei Drittel der kumulierten CO_2-Emissionen seit dem Beginn der Industrialisierung (1750-2006) verantwortlich (vgl. Monastersky 2009). Selbst bei den genannten Emissionszielen für die Industrienationen von 80 bis 95 Prozent gegenüber dem Stand von 1990 sind Reduktionen von 15 bis 30 Prozent in den sich entwickelnden Ländern notwendig um den Anstieg des globalen Klimas zu begrenzen (den Elzen und Höhne 2008). Die Größe der Herausforderung machen auch andere Berechnungen deutlich: Meinshausen et al. (2009) berechnen ein maximales Gesamtbudget zukünftiger Treibhausgasemissionen das nicht überschritten werden sollte. Die Autoren kommen zu dem Ergebnis, dass bis zum Jahr 2050 nicht mehr als insgesamt 1.000 Gigatonnen CO_2 emittiert werden dürfen, um die Wahrscheinlichkeit eines Anstiegs der globalen Mitteltemperatur über 2°C auf 25% zu begrenzen. Mithilfe eines *business-as-usual*-Szenarios auf der Basis der Emissionstrends der Jahre 2000 bis 2006 zeigen die Autoren, dass dieses Gesamtbudget bereits im Jahr 2027 überschritten werden könnte – wenn es nicht gelingen sollte, die Emissionen bis dahin drastisch zu senken (vgl. auch Allen et al. 2009).

nächsten zehn bis fünfzehn Jahren jedenfalls wird aus diesen Zahlen überdeutlich.[2] Das Verbrennen fossiler Energieträger verursacht weltweit insgesamt ca. 85 Prozent aller Treibhausgasemissionen[3] (IPCC 2007), wovon wiederum ca. 70 Prozent aus industrieller Strom- und Wärmeproduktion stammen (IEA 2012).[4] Im Kern ist der Klimawandel somit die Folge der Organisation unserer Wirtschaft, von Konsummustern und Lebensstilen. Um die notwendigen Reduktionen zu erreichen ist die vollständige Transformation des Energieerzeugungssystems zwingend erforderlich, was nur durch die Substitution fossiler durch erneuerbare Energieträger sowie durch Steigerung der Energieeffizienz zu erreichen ist (Diesendorf 2011). Die Organisation dieser Transformation ist eine Herkulesaufgabe: Energieinfrastrukturen sind überaus langlebig und mit langfristigen Investitionen und Interessen verbunden (Unruh 2000, 2002), gesellschaftliche und politische Konflikte sind angesichts der damit verbundenen Kosten unvermeidbar. Die Frage wie politische Systeme insgesamt oder spezifische Institutionen diese Herausforderung annehmen und zukunftssichere Lösungsansätze entwickeln ist daher von herausragender Bedeutung, sowohl in praktischer als auch in theoretischer Hinsicht.

Die Leistungs- oder Problemlösungsfähigkeit von Demokratietypen bzw. politischen Institutionen ist ein klassischer Gegenstand der Vergleichenden Politikwissenschaft (u.a. Eckstein 1971, Almond und Powell 1982, Weaver und Rockman 1993, Castles 1998, Lijphart 1999, Keman 2002, Roller 2005). Angesichts der gewaltigen Herausforderungen durch globale Umweltveränderungen ist diese Frage aktueller denn je – auch wenn umweltpolitische Themen durch die Finanzkrise seit 2008 in den Hintergrund gedrängt worden sind. Aus der Menge der Umweltprobleme sticht, wie eingangs beschrieben, der anthropogene Klimawandel heraus: er erscheint als besonders „teuflisches“ Problem (Steffen 2011), als das am schwierigsten zu lösende

[2] Vgl. Anderson et al. (2008) für eine konkrete Berechnung der Reduktionspfade am Beispiel Großbritanniens.
[3] Der überwiegende Rest der Emissionen entsteht durch Landnutzungsänderungen/Entwaldung.
[4] Auf den Verkehrssektor entfallen weitere ca. 20 Prozent (jeweils weltweiter Durchschnitt für 2010; IEA 2012).

Umweltproblem mit dem die Menschheit im 21. Jahrhundert konfrontiert ist. Gleichzeitig ist das politikwissenschaftliche Wissen um die Umweltperformanz allgemein und die Klimaschutzperformanz demokratischer Industriestaaten im Speziellen nach wie vor eher fragmentarisch, jedenfalls weit von allgemeingültigen Schlüssen entfernt (vgl. Saretziki 2007, Fioriono 2011; siehe auch Kapitel 2). Dies liegt zum Teil wohl auch daran, dass die Rolle der Umweltpolitikforschung in der Vergleichenden Politikwissenschaft insgesamt über die Jahre einflusslos (vgl. Munck und Snyder 2007, Steinberg und VanDeveer 2012a) und der Kreis derjenigen die sich mit Fragen der Umweltperformanz beschäftigen eher klein geblieben ist. Der geringe Austausch zwischen den Forschergruppen hat insgesamt dazu geführt, dass die Anschlussfähigkeit der Vergleichenden Umweltpolitikforschung an grundsätzliche Fragestellungen der Politikwissenschaft insgesamt wenig ausgeprägt ist.[5] Eine Überwindung der Kluft zwischen der Vergleichenden Umweltpolitikforschung und der Vergleichenden Politikwissenschaft erscheint also dringend geboten (Steinberg und VanDeveer 2012b).

Die vorliegende kumulative Dissertation versteht sich als Beitrag zur Überwindung dieser Kluft. Sie will dazu beitragen, das Verständnis der Leistungsfähigkeit von Demokratien bzw. politischen Institutionen insgesamt zu verbessern, indem sie Umwelt- bzw. Klimaschutz als politisches Problem konzipiert das es in seiner Komplexität mindestens mit langfristigen Herausforderungen wie der Organisation sozialer Sicherung aufnehmen kann. Ausgangspunkt des Vorhabens ist zunächst eine empirische Beobachtung: während im Zeitraum von 1990 bis 2008 die Treibhausgasemissionen beispielsweise in Deutschland um 24 Prozent, in Dänemark, Schweden und Großbritannien immerhin um 8 beziehungsweise 6 und 5 Prozent zurückgingen, stiegen die Emissionen in Japan um 12, den USA und Kanada um 17 und 25 Prozent; in Neuseeland und Spanien sogar um 35 und 51 Prozent (Boden et al. 2009). Diese Varianz auf der Outcome-Dimension ist durch umfangreiche Datensätze

[5] Andererseits ist es auch bemerkenswert, dass bspw. Gerring und Thackers (2008) Ansatz einer Theorie von „good democratic governance“ ohne weitere Diskussion auf jeden Umweltbezug verzichten kann.

sehr gut dokumentiert. Allerdings muss konstatiert werden, dass vorhandene „neo-institutionalistische“ Ansätze wie Lijpharts Demokratietypologie (1999, 2012) oder auch Tsebelis‘ Vetospielertheorie (2002) die empirische Varianz auf der Outcome-Dimension nicht erklären können (siehe Kapitel 2). Nach Lijphart, der der Konsensus- gegenüber der Mehrheitsdemokratie einen „kinder and gentler“ (1999, S. 294) Charakter zuweist und bessere materielle Ergebnisse u.a. in der Umweltpolitik zu bescheinigen sucht, sollte Großbritannien als klassische Mehrheitsdemokratie schlechte Klimaschutzleistungen in Form von steigenden Treibhausgasemissionen aufweisen; das Gegenteil ist der Fall. Vetospieleransätze wiederum haben Probleme zu erklären warum beispielsweise Deutschland, mit vielen Vetospielern ein klassisches Beispiel für große Hürden beim Politikwandel, so gute Klimaschutzleistungen erbracht hat.

Während die Varianz auf der Outcome-Dimension also gut beschrieben, aber nicht befriedigend erklärt ist, fehlen bislang überzeugende Daten zur Beschreibung der Output-Dimension von Klimaschutzperformanz. Zwar gibt es Datensätze welche Klimaschutzpolitiken auf den verschiedenen politischen Handlungsebenen zu erfassen und zu bewerten suchen – allerdings weisen diese Schwächen auf. So basiert die Wertung der Klimapolitiken im *Klimaschutz-Index* von Germanwatch[6] auf Expertenbeurteilungen während der *Climate Change Cooperation Index* von Bernauer und Böhmelt (2013) lediglich die Erfüllung internationaler Verpflichtungen des UNFCCC-Prozesses berücksichtigt (siehe auch Kapitel 4). Es fehlen also bislang systematisch vergleichbare Daten zur Stärke der national beschlossenen Policies und deren Veränderungen über Zeit. Im zweiten Teil dieser kumulativen Dissertation (Kapitel 4 und 5) soll diese Varianz auf der Output-Dimension beschrieben werden um ein vollständigeres Bild der bisherigen Klimaschutzleistungen westlicher Demokratien zu erhalten.

[6] Siehe http://germanwatch.org/de/ksi

Die beiden Teile dieser Dissertation sind somit zwar thematisch aufeinander bezogen, verfolgen angesichts der beiden unterschiedlichen Forschungslücken auf der Outcome- und der Output-Dimension von Klimaschutzperformanz aber unterschiedliche Ziele. Das erste Kapitelpaar (Kapitel 2 und 3) verfolgt zwei Ziele: Zum einen soll eine theoretisch fundierte Konzeptionalisierung von Umweltperformanz entwickelt werden um einen Untersuchungsrahmen für systematische Performanzforschung vorzuschlagen. Die unterschiedliche Messung und Konzeptionierung von Umweltperformanz in der vorhandenen Literatur wird dabei als Hauptursache für widersprüchliche Befunde über die Wirkung von Institutionen identifiziert (Kapitel 2). Zum anderen soll eine vergleichende explorative Untersuchung ein Erklärungsmodell für Unterschiede in der Klimaschutzperformanz westlicher Demokratien entwickeln um damit eine Basis für weitere Untersuchungen zu schaffen (Kapitel 3). Das zweite Kapitelpaar (Kapitel 4 und 5)[7] verfolgt ein anderes Ziel: Durch die Entwicklung eines Konzepts zur Messung von Politikwandel (Kapitel 4) wird die Varianz in den Klimaschutzleistungen westlicher Demokratien anhand von Fallstudien auch auf der Output-Dimension genauer beschrieben (Kapitel 5). Dabei wird mit einem Fokus auf Politikinnovationen ein weiterer Aspekt der Leistungsfähigkeit politischer Systeme analysiert, nämlich die Fähigkeit zur Modernisierung des politischen Instrumentariums (Weaver und Rockman 1993, Héritier 1997, Jordan und Huitema i.V.).

Angesichts dieser unterschiedlichen Zielsetzungen kann diese Einleitung keinen umfassenden Überblick über den jeweiligen Stand der Forschung bieten, stattdessen führen die beiden Kapitelpaare in die Literatur ein. Auch setzt sich diese Dissertation nicht zum Ziel, Klimaschutzperformanz abschließend zu erklären. Vielmehr geht es ihr darum, eine systematische Basis für weitere, größer angelegte Forschungsvorhaben zu entwickeln. Alle vier Artikel sind daher als Beitrag zur Weiterentwicklung dieser

[7] Kapitel 4 und 5 sind das Ergebnis einer Zusammenarbeit mit André Schaffrin und Sibylle Seubert. Während letztere v.a. zur Datenerhebung beigetragen hat, haben André Schaffrin und ich zu gleichen Teilen zur Erstellung der beiden Artikel beigetragen.

empirischen Forschungsrichtung zu verstehen und diskutieren jeweils explizit Ansatzpunkte für weitergehende Untersuchungen. Damit soll auch ein Beitrag dazu geleistet werden, die Vergleichende Umweltpolitikforschung stärker in der Vergleichenden Politikwissenschaft zu verankern. Über den Rahmen dieser Dissertation hinaus geht die Frage nach dem Zusammenhang zwischen den beiden Dimensionen, Outcome und Output. Eine empirische Analyse dieses Zusammenhangs ist erst möglich sobald umfassende Datensätze für die Output-Dimension vorhanden sind. Das für das zweite Kapitelpaar (Kapitel 4 und 5) entwickelte Messkonzept soll genau diese Lücke schließen, aber bislang konnte erst ein kleinerer Datensatz mit drei Ländern erstellt werden. Auch wenn diese Dissertation nicht alle Fragen in Zusammenhang mit Klimaschutzperformanz beantworten kann, tragen die einzelnen Kapitel dennoch dazu bei die politikwissenschaftliche Umwelt- und Klimaschutzperformanzforschung wiederzubeleben.

Im Folgenden werden die jeweiligen Kapitel kurz dargestellt, Ergebnisse zusammengefasst, ggf. Schwächen benannt und schließlich Ansatzpunkte für weitere Forschung beschrieben.

Kapitelübersicht

Kapitel 2 führt zunächst in die Literatur zur Umweltperformanz ein. Die wichtigsten systematisch vergleichenden Studien zum Einfluss von Demokratietypen bzw. politischen Institutionen werden dargestellt und diskutiert. Als Hauptgrund für widersprüchliche Ergebnisse wird das Fehlen einer einheitlichen Konzeptionalisierung von Umweltperformanz identifiziert (vgl. auch Saretzki 2007, Fiorino 2011). Die Bandbreite der in der Literatur herangezogenen Indikatoren reicht von lokalem Glas- und Papierrecycling über regionale Luft- und Wasserqualität hin zu Ozon- und Treibhausgasemissionen. Die Ansätze unterscheiden sich auch darin ob sie jeweils nur einen Indikator als abhängige Variable auswählen, verschiedene Indikatoren parallel untersuchen oder ob sie auf der Basis mehrerer Indikatoren einen Index berechnen.

Weil die Konzeptionalisierung von Umweltperformanz in der Regel nur kursorisch dargestellt wird, ist unklar ob Zusammenhänge generalisierbar (auf allgemeine Umweltperformanz) bzw. spezifizierbar (auf bestimmte Formen von Umweltperformanz, z.B. Klimaschutzperformanz) sind. Vor dem Hintergrund dieser Forschungsübersicht wird im Kapitel anschließend eine theoretisch fundierte Konzeptionalisierung von „general environmental performance“ entwickelt. Grundlage hierfür ist der Ansatz der „planetarischen Leitplanken“ von Rockström et al. (2009a,b) der die wichtigsten systemischen Umweltprozesse beschreibt die zur Stabilisierung des Erdsystems beitragen. Die auf dieser Basis identifizierten neun Indikatoren stellen daher eine Messung des Konzepts der „nachhaltigen Entwicklung“, des Ziels von Umweltpolitik, dar und können somit als Bezugsrahmen für ein Konzept von Umweltperformanz dienen. Desweiteren werden die Charakteristika von Umweltproblemen genauer untersucht. Es wird argumentiert, dass diese Charakteristika systematisch Akteurskonstellationen beeinflussen und damit die Konfliktintensität bestimmen.[8] Bei der Formulierung von Hypothesen zur Wirkung von Demokratietypen oder politischen Institutionen bleiben diese Charakteristika bislang jedoch oft unberücksichtigt. Schließlich wird auch angeregt, die Forschungsagenda unter dem Begriff „Comparative Transition Politics” zu erweitern und insbesondere die Fähigkeit von politischen Institutionen zur Lösung von komplexen Langfristproblemen stärker in den Fokus zu nehmen (Meadowcroft 2011, vgl. auch Grin et al. 2010).

Kapitel 3 versucht ein Erklärungsmodell für Unterschiede in der Klimaschutzperformanz westlicher Demokratien zu entwickeln und zu testen. Mithilfe einer two-step fsQCA (Schneider und Wagemann 2012) wird die Outcome-Performanz von 16 Demokratien über den Zeitraum von 1993 bis 2008 verglichen. Erklärungsfaktoren werden auf der Basis der vorhandenen Literatur entwickelt und

[8] Der anthropogene Klimawandel erweist sich auch bei dieser systematischen Betrachtung als aufgrund seiner Konfliktintensität am schwierigsten zu lösendes Umweltproblem. Als „canary in the coal mine“ für globale Umweltveränderungen (Steffen 2011, S. 32) ist er daher ein besonders lohnender Gegenstand vergleichender Untersuchungen.

ihrer kausalen Distanz zum Ergebnis (gute bzw. schlechte Performanz) entsprechend in „nahe“ und „ferne“ Bedingungen unterteilt. Der Vorteil dieses Ansatzes ist es zunächst mehrere Pfade von „fernen“ Bedingungen zu identifizieren vor deren Hintergrund dann Kombinationen von notwendigen und hinreichenden „nahen“ Bedingungen für gute bzw. schlechte Performanz identifiziert werden können.[9] Die fsQCA zeigt u.a. dass der Einfluss linker Parteien Teil vieler Kausalkombinationen ist – ein Ergebnis das einem Teil der Literatur widerspricht und damit den Forschungsstand erweitert. Da die Untersuchung explorativer Natur ist, schließt das Kapitel mit einer Diskussion wie das Erklärungsmodel verbessert werden kann. Als eindeutige Schwachstelle erweist sich das Fehlen von vergleichbaren Daten zur Stärke von Klimaschutzpolitiken.

Kapitel 4 schließlich wendet sich genau dieser Output-Dimension von Klimaschutzperformanz zu. Einen Ansatz von Knill et al. (2010) aufgreifend, wird ein Maß für „policy output“ entwickelt welches systematisch die Regulierungsintensität von Politikportfolios erfassen kann. Es werden sechs Policy-Merkmale hergeleitet die zur Bestimmung der Intensität einer Policy genutzt werden können und die Erstellung eines „Index of Policy Activity“ erlauben. Drei Fallstudien dienen schließlich zur Demonstration der Vorteile des Messkonzepts: für das Politikfeld Energieproduktion in Deutschland, Großbritannien und Österreich (Zeitraum: 1998 bis 2010) wird ein „Index of Climate Policy Activity“ erstellt, der die Varianz über die Fälle systematisch beschreiben hilft. Zur Validierung des Konzepts werden die Ergebnisse mit konkurrierenden Messungen verglichen. Es erweist sich dass der neu entwickelte Index weniger anfällig für Verzerrungseffekte ist. Da das Konzept zur Messung von „policy output“ allgemeingültig ist, ergeben sich viele Anknüpfungspunkte an Forschungsstränge aus der Vergleichenden Policyforschung.

[9] Der explorative Charakter dieser Untersuchung und die explizite Unterscheidung zwischen „nahen“ und „fernen“ Faktoren sprechen in diesem Fall für eine fsQCA und gegen eine Regressionsanalyse – trotz der kürzlich von Hug (2012) geäußerten Kritik (vgl. auch Stockemer et al. 2012).

Kapitel 5 nutzt die zuvor erhobenen Daten um abschließend einen weiteren Aspekt von Klimaschutzperformanz, die Modernisierung des politischen Instrumentariums (vgl. Jordan et al. 2013, Jordan und Huitema i.V.), systematisch zu erfassen und zu beschreiben. Politikinnovationen werden vor dem Hintergrund des gesamten Politikportfolios identifiziert – wodurch ihre relative Bedeutung und auch die „Innovativität" des gesamten Portfolios genauer bestimmt werden kann. Diese Einbettung von Innovationen in ihren Kontext erlaubt zum einen zu bestimmen ob Innovationen lediglich symbolischer Natur oder doch radikaler Natur sind. Zum anderen können Entwicklungen über Zeit analysiert werden um festzustellen ob Innovationen zum „Kippen" des gesamten Politikportfolios hin zu einer neuen instrumentellen Logik, also zu einem neuen vorherrschenden Politikstil, führen. Die Analyse der Fallstudien zeigt unterschiedliche Entwicklungen in den untersuchten Ländern auf: während in Österreich die Bedeutung von Politikinnovationen insgesamt gering bleibt, zeichnen sich sowohl Deutschland als auch Großbritannien durch einen relativ konstanten Anteil von Innovationen am Politikportfolio aus. Zwar kann in keinem Fall ein „Kippen" der instrumentellen Logik beobachtet werden, jedoch unterscheiden sich die Innovationen in ihrer konkreten Ausgestaltung vom restlichen Politikportfolio. Das Kapitel geht lediglich kurz auf mögliche Erklärungsfaktoren ein, die verschiedenen Ansätze zu „policy change" könnten in einem nächsten Schritt herangezogen werden.

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None ever wished it longer than it is.

Samuel Johnson, a review

Chapter 2

Toward a New Research Agenda for Comparative Environmental Performance

Sebastian Sewerin

Abstract

This article revisits the research question of the effect of political institutions on environmental performance, advocating a substantiated conceptualization of general environmental performance based on the "planetary boundaries" approach. It reviews the existing literature on environmental performance and identifies research gaps and conceptual limitations. The article establishes a conceptual framework to assess the characteristics of specific environmental problems. It argues that considering the actor constellations of specific environmental problems will strengthen theoretical arguments about the effects of political institutions. The article aims to help building bridges between comparative politics and comparative environmental politics. Moreover, it suggests expanding research by specifically investigating the capacity of political systems to deal with complex long-term political problems.

Introduction

Although the comparative study of environmental politics and policy dates back well into the 1970s, it has never featured prominently within comparative politics generally. Against a background of mounting environmental pressures, most notably climate change, this low profile seems puzzling. Steinberg and VanDeveer (2012) point out that building bridges between comparative environmental politics and the broader field of comparative politics is not an easy task. They call for comparative environmental politics to pay more attention to theoretical debates in comparative politics, in order to strengthen comparative inquiry, to draw conclusions about cause-and-effect relationships, and to better understand causal processes. As I argue in this article, one major route to this linkage is to systematically address the effect of institutions on cross-national environmental performance. Because institutions structure the behavior of political actors, variations in the institutional arrangements of nation-states contribute to different political results – notwithstanding the fact that these causal relations are complex and, usually, indirect, long and contingent (March and Olsen 2006). Nonetheless, studying nation-states´ environmental performance with a specific focus on institutional arrangements is worth while from both a theoretical point of view and the perspective of policy advice. In comparative politics, established concepts and theories about the effectiveness of political systems in addressing political problems can be validated, and refined if necessary. From the perspective of scientific policy advice, it is important to achieve a better understanding of the persistent institutional constraints countries suffer, for these might affect both national policies and readiness to take an active role in international cooperation. Studying cross-national environmental performance is thus a good example of the "doubly-engaged", i.e. theoretically rigorous and practically relevant, comparative environmental research urged by Steinberg and VanDeveer (2012) and ideally suited to build the much-needed bridges between the comparative politics and the environmental politics communities.

A number of studies over the years have approached the issue of cross-national environmental performance and the effect of institutional characteristics, e.g. different forms of government, different types of interest representation, parties and party systems, different types of democracy (for a review, see below). However, and surprisingly, given the importance of environmental problems in our times, they have not produced conclusive evidence as to the effect of specific institutions on general environmental performance or specific environmental performance, e.g. climate mitigation. Synthesizing their findings is hampered by differing conceptualizations and measurements of performance (Fiorino 2011). In this paper, I set out to overcome this problem by proposing a conceptualization of general environmental performance and by discussing how the effects of institutions are related to the characteristics of specific environmental problems. I argue that the concept of "planetary boundaries" (Rockström et al. 2009 a,b) can help us identify the most pressing and challenging environmental problems societies face today and thus better conceptualize general environmental performance. I also argue that a systematic distinction between different types of environmental problems is needed to increase the leverage of studies on environmental performance. This article will show that the characteristics of environmental problems systematically influence the number of actors involved and the structures of their conflicts, i.e. the overall actor constellations. As the ability of political institutions to provide solutions to political problems is contingent on existing actor constellations, differences between environmental problems should be taken seriously when analysing the effect of institutions on environmental performance. Finally, I argue that better integration of sustainability transition research would help to establish a research agenda on environmental performance which recognizes the distinct challenges complex environmental problems pose for governance.

This article is structured as follows: Section 1 reviews the state of the art of research on environmental performance and discusses its inconsistencies. Section 2 presents a conceptualization of general environmental performance based on the "planetary

boundaries" approach. Section 3 discusses three characteristics of environmental problems that systematically influence the overall actor constellations and thus determine the effect of institutions. The article concludes with presenting a research agenda for systematically addressing environmental performance that can be further developed into a framework for Comparative Transition Politics.

1. Measuring Environmental Performance: Limitations of the State of the Art

Since the middle of the 1990s cross-national variations in environmental performance have been addressed by a growing number of studies. Yet, as Fiorino's (2011) review of the literature shows, the conceptualization of environmental performance differs considerably between studies, the most obvious distinction being whether they focus on *outcome* or *output*. The former approach focuses on material results of political and socio-economical action in the form of environmental impacts such as emissions of pollutants. The latter approach, on the other hand, is concerned with the results of the policy process in the form of policies adopted.[1] Causal relations between institutional characteristics and output are seen as more direct than those between institutional characteristics and outcome, which are characterized as long and contingent (March and Olsen 2006). The number of possible intervening factors is long; especially the influence of (socio-)economic factors (e.g. per capita income levels or economic growth) on environmental impacts is widely discussed (see Raymond 2004, Raupach et al. 2007, Goldthau and Sovacool 2012). Against this background it seems not surprising that recent cross-national comparative studies have focused more on output performance, covering a broad spectrum of research interests.

[1] Occasionally policy output in the form of institutionalization of environmental interests via environmental ministries and agencies (e.g. Jänicke and Weidner 1997) and government expenditures (e.g. Konisky and Woods 2012) is analyzed as well.

One major approach to studying environmental output performance is based on the distinction between *leader*[2] and *laggard* states in a comparison of policy approaches to environmental protection (Andersen and Liefferink 1997, Jordan and Lenschow 2000, Weidner and Jänicke 2002, Dryzek et al. 2002, Liefferink et al. 2009, Knill, Heichel and Arndt 2012). From a slightly different angle, studies of *policy diffusion* and *convergence* assess countries' early or rapid adoption of certain policies or international treaties, e.g. the Kyoto Protocol (Tews et al. 2003, Jordan et al. 2003, Holzinger and Knill 2005, Busch and Jörgens 2005, Harrison and McIntosh Sundstrom 2007, Holzinger et al. 2008, Holzinger et al. 2011; see Graham et al. 2012 for a review). However, as discussed by Schaffrin et al. 2013, output-centered approaches have two major shortcomings: (i) they lack a common conceptualization and measurement of policy output (cp. Green-Pedersen 2004, Kühner 2007, Howlett and Cashore 2009, Graham et al. 2012), and (ii) they do not assess policy portfolios (i.e. all national policy instruments) but a limited and pre-selected set of policies. Thus, most output-centered approaches not only risk biased conclusions but also fail to provide transparent and comparable assessments of national policy portfolios. Knill, Schulze and Tosun 2012 address these failings by suggesting a distinction between policy density (number of policy instruments) and intensity (content of policy instruments). On this basis, Schaffrin et al. (2013) propose a new measurement approach designed to provide a transparent and comparable assessment of policy output. Such an assessment provides a basis for systematic cross-national analyses of the strength of national policy portfolios which can then inform large(r)-n comparative research on environmental performance. Yet, until extensive datasets are created research from the output angle will, despite more direct causal claims between institutions and output, remain troubled with measurement problems.

The second approach to cross-national environmental performance is to study outcome performance, i.e. material results such as air pollution. Data availability and comparability present fewer problems here. Moreover, studying outcomes

[2] The terms *pioneer* state and *front-runner* are used in a similar vein.

circumvents the conceptually problematic equalization of policy output and material results which is often implicit in output-centered research (Scruggs 2003). Outcome-centered research relates more directly to theoretical debates in the broader field of comparative politics, where the issue of political systems' performance has become prominent since the 1990s in the context of 'new institutionalism' (e.g. Lijphart 1999, Roller 2005).[3] In her comparative study of the performance of democracies, Roller (2005) stresses the need to analyze the material outcomes of political systems as dependent variables. The conceptual argumentation of her study is straightforward: performance is defined as the degree to which political goals are achieved through political action. Therefore, studying performance requires the analysis of outcomes as dependent variables. A number of studies have followed this line in comparative environmental politics (see below) arguing that outcome performance is "the true test of environmental policy" (Scruggs 2003, p.6). However, drawing a synthesis from the studies' various findings is very difficult. Aside from the wide range of institutions considered, the most profound problem is that a conceptual discussion of what exactly constitutes environmental performance typically is missing. Whereas some studies concentrate on single measures of performance (e.g. greenhouse gas (GHG) emissions: Jensen and Spoon 2011), others investigate several measures (e.g. five measures of air pollutants: SO_x, NO_x, Volatile Organic Compounds (VOC), CO and CO_2; Crepaz 1995, Neumayer 2003), while a third group relies on composite indicators specifically designed for the purpose of their studies (e.g. Jahn 1998, Scruggs 2003). Consequently, comparing the analyses' findings is difficult because they examine different dependent variables. As a result of this scant attention to the conceptualization of environmental performance comparative research is confronted with inconclusive findings and thereby contested assumptions about the effect of institutions. The following review of existing research intends to illustrate this point further before proposing a framework to conceptualize environmental performance

[3] It also relates to discussions in political economy about the Environmental Kuznets Curve relating environmental degradation to economic output and growing incomes (e.g. Dasgupta et al. 2002, Stern 2004, Raymond 2004, Carson 2010).

in the next two sections. The studies discussed in this section have been chosen because they focus on various established strands of comparative public policy: their interest in institutions ranges from the system of interest representation, to parties and party systems, to parliamentary and presidential systems, to federalism, and to types of democracy. They are interested in analysing and explaining patterns of nations' environmental performance and belong to the growing field of "comparative environmental politics" (Steinberg and VanDeveer 2012). The most prominent of these are the large-n comparative analyses of Crepaz (1995), Jahn (1998) and Scruggs (2003), which consider a broad catalogue of environmental problems.

Interest Representation and Environmental Performance

All three of these studies share a particular interest in the effect of one specific institution: (neo-)corporatism as a type of interest representation. Crepaz (1995) puts forward the hypothesis that the type of interest representation (corporatism vs. pluralism) systematically affects air pollution levels. He argues that, independently of the policy field, the specific institutional arrangements of (neo-)corporatism explain better performance. He stresses, besides the goal-oriented character and accommodative style of corporatist systems, the importance of encompassing interest representation through peak associations: the more encompassing, the better the results. Crepaz tests his hypothesis by analyzing the effect of the type of interest representation in 18 industrialized democracies on five air pollutants, namely SO_x, NO_x, Volatile Organic Compounds (VOC), CO and CO_2. He treats the five pollutants as separate dependent variables and his findings reveal great variance between the different pollutant models: in the CO_2 model corporatism is found to have the hypothesized effect of reducing emissions. However, other models display more robust results. Crepaz (1995, 269) concludes that the more decentralized the sources of pollution, the less successful corporatist policy-making is. Jahn (1998), too, finds that corporatism is a major factor influencing environmental performance. However, by constructing a composite indicator comprised of a large number of measurements for various pollutants – combining CO_2 emissions with emissions of

SO_x, NO_x and CO – Jahn examines a different dependent variable. The broader study of Scruggs (2003) also discusses the effect of corporatism on environmental performance. He develops a further composite indicator – comprising measures for SO_x, NO_x, Waste and Treatment, Recycling, and Fertilizer Use – to measure performance. But although he states that the measures were "chosen on the basis of environmental importance and for their availability across countries and time" (2003, 29), Scruggs does not include measures for CO_2 or other GHG emissions in his indicator, which seems surprising given the growing importance of climate change on the political agenda.

Federalism and Environmental Performance

Jahn and Wälti (2007) discuss the connection between federal structures and environmental performance. They argue that federal structures act as an intervening variable that exerts positive influence on environmental performance in the context of neo-corporatist structures. Using an actor-centered approach, developed by Wälti (2004), they hold that federalism as a multi-level system offers multiple opportunities for environmental groups to influence decision making. Federalism, they argue, does not have a positive effect on environmental performance per se, but influences the constellation of actors and possible coalitions. Combined with neo-corporatist institutions, these distinct patterns of interaction exert a positive influence on environmental performance, whereas in unitary countries the connection between corporatism and good performance vanishes. To measure performance, Jahn and Wälti devise a composite indicator encompassing measurements of a wide range of environmental problems (SO_x, NO_x, CO, CO_2 and VOC emissions as outcome indicators, as well as a number of response indicators such as recycling rates).

Types of Democracy and Environmental Performance

Lijphart's (1999, 2012) study of political performance is well known, as is his statement that consensus democracies, due to their kinder and gentler nature, have a better record than majoritarian democracies on the protection of the environment.

In the first edition (1999) he tests the effect of type of democracy on environmental performance, with only one indicator, energy efficiency, which is described as a measure of overall environmental responsibility. Lijphart finds a strong correlation between consensus democracy and energy efficiency. His main argument is that consensus democracy is better at representing people and their interests more inclusively. In the second edition (2012) Lijphart replaced the indicator energy efficiency with a composite indicator, still finding a positive effect of consensus democracy. Elsewhere, Poloni-Staudinger (2008) finds that types of democracy do not have a good or bad effect on environmental performance per se, but that the effect varies depending on the problem. She distinguishes between "mundane", more regional, and national environmental problems and finds that consensus democracies appear to do better than majoritarian democracies in tackling the mundane (such as recycling and waste treatment), whereas her findings for more regional and national environmental problems are mixed.

Parliamentary/Presidential Systems and Environmental Performance

Gerring et al. (2009) make a strong case for reviving the question of whether presidential or parliamentary rule promote the better policy performance. They argue that in recent years relatively little scholarly attention has been devoted to the impact of different structures of the executive on policies and policy outcomes. What distinguishes parliamentarism from presidentialism, in their view, is its capacity to function as a coordination device. Actors in parliamentary systems generally have incentives to reach agreement (as a result of the product of political careers and electoral incentives aligning). On the other hand, the highly fragmented institutional sphere of presidential systems may impose higher transaction costs on actors and thus lead to lock-in situations. Until now, to my knowledge, the impact of parliamentary or presidential systems specifically on environmental performance has received very little attention as well. True, McBeath and Rosenberg (2006) are interested in the reasons for differences in nation-states´ general environmental policy performance, and they discuss the impact of parliamentary, semi-presidential

and presidential systems. Yet, their study lacks a clear comparative research design and draws its conclusions from various case studies. Bernauer and Kouby's study (2009) has a clear comparative framework. They are interested in the effects of the type of democratic government (parliamentary vs. presidential) on environmental performance; the dependent variable of their analysis is SO_2, a measure for air quality. Recalling the ambiguous theoretical arguments as to whether specific forms of democracy affect the provision of public goods in a positive or a negative way, Bernauer and Kouby hypothesize that presidential systems experience lower SO_2 concentrations than parliamentary systems. The results of their analysis support this claim. Interestingly, they check whether these results can be generalized to other pollutants. They find by additionally testing a CO_2 model that the effect of the type of democratic government on various forms of air pollutants is similar. Yet, they concede that the quality of the data used for their statistical analysis is quite diverse: the SO_2 dataset contains information for the time period 1971–1996, the CO_2 dataset for 1990–1996 – a fact that might influence the results.

Parties/Party Systems and Environmental Performance

The question of partisan influence on environmental performance has received little systematic attention to date, although it is prominent in other fields of political science. Reviewing the debate on partisan influence, Schmidt (1996) declared that the role of political parties in shaping public policy is normally severely circumscribed by constitutional rules (i.e. institutions) and the relative immunity of social and economic life to political intervention. Within these limits, however, differences in the party composition of government do matter; they determine the choice of public policy instruments and the nature of policy outputs, such as legislation and policy on taxation and expenditure. Macro-economic outcomes, such as unemployment and inflation, can be attributed to left–right differences in the partisan complexion of governments and the different choices these governments make. Some of the studies discussed above consider partisan influence in one way or another, although not at length. Both Crepaz (1995) and Scruggs (2003) briefly comment on it, with the former

finding little effect and the latter no significant effect. Interestingly, Jahn (1998) finds left-wing parties have a negative effect on environmental performance. A more recent study by Jensen and Spoon (2011) directly addresses the "party matters" thesis. They seek to explore the ways in which parties influence policy outcomes. The outcome they are interested in is European Union Member States' progress toward Kyoto GHG emission targets. They find that governments that are more pro-environment make better progress toward these targets. To measure the differences in parties` policy preferences they rely on data from the Comparative Manifestos Project. However, these data only comprise one measure of parties' positions on environmental politics: the percentage of parties' platforms addressing nature protection and preservation in a very general way, e.g. statements related to the preservation of the countryside (cp. Klingemann et al. 2006). Consequently, Jensen and Spoon base their analysis on the assumption that parties' positions on climate change can be inferred from their positions on the very general issue of "environmental preservation". However, they fail to provide an explanation as to why they this can be made.[4] In another study, Neumayer (2003) analyzed the effect of the parliamentary presence of green/left-libertarian parties on the levels of several air pollutants represented by measures of SO_2, NO_2, CO, VOC and CO_2). He finds that the effect of increasing green/left-libertarian and traditional left-wing party strength on some measures (SO_2, NO_2, CO and VOC) is much higher than on others (CO_2) and concludes that the effect of party strength on pollution levels depends on the pollutant.

What becomes clear from this brief review is that, depending on the specific research question, environmental performance can mean anything to anybody. The absence of a common conceptualization of environmental performance combined with the use of different indicators produces inconclusive evidence regarding the effect of

[4] Similarly, Knill et al. 2009 use Comparative Manifesto Project data to determine the effect of parties' positions on environmental output performance.

institutions on environmental performance. Obvious questions arise regarding the generalizability of research results from these studies. For once, it is implicitly assumed that findings derived from analyzing specific air pollutants can be extrapolated either to air pollution or environmental performance in general and – vice versa – that findings from a composite indicator can be applied to specific environmental problems ranging from waste treatment to climate change. In my view, this specific approach of conflating a number of different environmental problems into one composite indicator is a major source of conceptually flawed assumptions about the effect of institutions on environmental performance. Moreover, in the existing literature the selection of environmental problems and (sets of) indicators is usually justified in passing by their being "important" (e.g. Scruggs 2003, 29). In what way they are important is not discussed in depth. One reason for this seems to be the understanding that performance indicators depicting environmental problems represent a kind of "political issue" (Jahn 1998, 107) and are "imbued with fundamentally normative judgments or assumptions" (Scruggs 2003, 21). However, I argue that a substantive conceptualization of environmental performance can be obtained by relating to the framework of "planetary boundaries" from the natural sciences. The framework provides arguments to identify a set of key indicators constituting the core of environmental challenges the world faces today. After presenting the framework in the next section, I discuss the systematic differences between environmental problems and the consequences for research into the effect of institutions on environmental performance.

2. The Great Transition and Performance

Summarizing decades of scientific research, Rockström et al. (2009 a,b) have described the challenges humankind faces today: The Earth System has entered a new era, the Anthropocence, in which human activities have become the main driver of environmental change. Burning fossil fuels, the exploitation of natural resources,

agriculture on an industrialized scale and other human activities related to the lifestyle of western, industrialized economies have reached a level potentially damaging to the natural systems keeping the earth in a state desirable for and conducive to human development. To define a "safe operating space for humanity", Rockström et al. (2009 a,b) propose a framework based on "planetary boundaries", identifiable threshold levels of nine key variables associated with nine essential earth-system processes: climate change, biodiversity loss, nitrogen and phosphorus cycles, stratospheric ozone depletion, ocean acidification, fresh-water use, land-use changes, chemical pollution, and atmospheric aerosol loading. Of these variables, three already surpass their threshold levels: climate change, biodiversity loss and variables related to the nitrogen cycle. The "planetary boundaries" framework succinctly captures the essence of what is understood as sustainable development[5] and provides comparative researchers with a list from which to select environmental problems. It should be noted that climate change is the most extreme of these cases: it is the condition sine qua non of sustainable development (WBGU 2011, 66) and thus serves as a "canary in the coal mine" for global change generally (Steffen 2011, 32). As will be discussed in the following section, climate change poses the greatest challenge for policy making and thus presents a unique object of investigation.

As a whole, the challenges to today´s societies identified by planetary boundaries offer a very promising reference framework for comparative research into environmental performance. Therefore I propose to use these indicators to measure general environmental performance. However, I do not advocate the construction of an indicator conflating all nine indicators. As I will discuss in the following section, there are good theoretical reasons to analyze these indicators separately: each indicator, or dimension of general environmental performance, has distinct characteristics influencing the patterns of political conflict evolving around it and thus influencing a political system's capacity to deal with it. A first step into assessing

[5] The framework is increasingly being used as a reference for scientific policy advice as well, e.g. by the German Advisory Council on Global Change and the German Advisory Council on the Environment (WBGU 2011, SRU 2012).

national patterns of general environmental performance based on planetary boundaries cross-nationally and over time could be to conduct an ideal-type analysis (see Vis et al. 2012 for a fuzzy-set ideal-type analysis of economic performance). The ideal type of best environmental performance comprises decreasing trends in all indicators, the ideal type of worst environmental performance increasing trends; with the other in-between models allowing to establish where a country is located empirically when not corresponding to the ideal types. Such an analysis could help establishing whether performance diverges or converges over time and between (groups of) countries.

Social scientists are only just beginning to investigate how the socio-economic systems of production and consumption underpinning the lifestyles of the western, industrialized world can be changed to abide by planetary boundaries. A growing scholarly community is addressing the issue of promoting and managing "transitions" toward sustainability (Markard et al. 2012). Sustainability transitions leading to socio-economic systems of production and consumption that reside within these boundaries clearly qualify as "great transformations" comparable to the neolithic and industrial revolutions (WBGU 2011). Given that three of the earth-system processes identified by Rockström et al. (2009a,b) – climate change, biodiversity loss and the nitrogen cycle –have already transgressed their boundaries, the urgency of changing course is apparent. Hence the emphatic calls for government intervention and active steering (e.g. Giddens 2009, Grin et al. 2010, Meadowcroft 2011, WBGU 2011, SRU 2012). As efforts to establish effective international regimes to mitigate environmental change have reached a dead end (Bernauer 2013), the (nation) state and its regulatory activities are beginning to attract greater attention. In other words, the question of the effect of institutions on environmental performance is a highly relevant research topic and should be at the top of the research agenda not only in comparative environmental politics but also in comparative politics as a whole.

To provide researchers with clear conceptual guidelines for undertaking research into the effect of institutions on environmental performance, the next section discusses characteristics of different environmental problems and proposes a systematic typology of these characteristics. These theoretical considerations provide for an explicit conceptualization of the respective problem structure and thus allow researchers to (re-)formulate their hypotheses regarding the effect of institutions on general environmental performance or specific dimensions of general environmental performance. It will become clear that this is not a mere scholarly exercise but especially valuable for research into climate policy performance, of which we know surprisingly little to date.

3. Differences between Environmental Problems

The notion that a problem's inherent characteristics influence the patterns of political conflict evolving around it is certainly not new to comparative politics. It has informed many policy analyses and comparative studies since Lowi (1972) established the premise that "policies determine politics" (p.299). In a broad discussion of American politics since the Civil War, Lowi developed a very neat taxonomy of policy problems, distinguishing between "distribute", "redistributive", "regulative" and "constituent" policies (1972, Table 1) that structure the conflict between political and societal actors. Similarly, Wilson (1973) argued that the means to distinguish policy problems is by whether the costs and benefits of government intervention were public or private. In environmental politics, the debate has been concerned less with the more theoretical aspects addressed by Lowi and Wilson than with underlining the importance of considering new policy instruments or governance approaches against the background of the "wickedness" (Rittel and Webber 1973) of environmental

problems.[6] The literature dealing with the characteristics of environmental problems is indeed broad.[7] However, a common feature is the lack of a systematic typology of these characteristics and explicit conceptualization of their problem structure. One prominent approach is that of Jänicke and Volkery (2001), who use the term "persistent" environmental problems[8] to classify those most pressing issues for which classical environmental policy instruments have found no solution (cp. also Jänicke and Jörgens 2006). They show how problems such as (local) air quality, ozone depletion and acid rain have been dealt with successfully because their problem structure – high saliency, easily identifiable polluters and availability of technical end-of-pipe solutions – made agenda setting relatively easy. In contrast, "persistent" problems have low saliency, cannot be resolved with end-of-pipe approaches, the distribution of costs and benefits is unclear, and they have a global dimension. Jänicke and Volkery (2001), and other researchers drawing on this concept, could only stress the need for new governance approaches such as "capacity building" and "policy integration" to engage more successfully with these "persistent" problems (e.g. Weidner and Jänicke 2002, Hogl et al. 2012).

Drawing on additional literature on collective action problems can help substantiate a more theoretically informed approach to categorizing the characteristics of environmental problems. Studies of European integration show that interactions between government actors at different levels become increasingly complex as the number of non-state actors trying to influence decision-making processes increases and actors' options for bargaining rise dramatically. Thus, multi-level governance can

[6] But see Nie (2003) for an analysis of conflicts stemming from "wicked" problems in US state natural resource policy.

[7] Characteristics of environmental problems are often discussed in the context of international relations studies (e.g. Mitchell 2010), analyzing the effect of these characteristics on regime effectiveness.

[8] The term had been established in the context of environmental reporting by the OECD and the European Environmental Agency (EEA) and has subsequently been used by the European Commission as well as national advisory institutions like the German Advisory Council on the Environment (SRU) and the German Advisory Council on Global Change (WBGU) (cp. Jänicke and Volkery 2001, Hogl et al. 2012).

produce high decision-making costs (Hooghe and Marks 2001). As noted above, the political dynamics of decision-making processes hinge on whether and how costs and benefits are (re-)distributed (Lowi 1972; Wilson 1973). More specifically, Wilson (1973) argued that private benefits were a strong incentive for political groups to form and exert their influence on the decision-making process, whereas public benefits regularly fall victim to the free-rider problem. Some years later, he pondered the apparent improbability of regulatory action addressing water and air quality being taken where the benefits of a proposed scheme were diffuse (in the form of less pollution eventually) but costs concentrated on a small group (of businesses) – as was the case with environmental policies in the 1960s and 1970s (Wilson 1980). More recently, Hovi et al. (2009) have discussed the implications of the cost–benefit distribution for climate policy. They argue that the logic of collective action favors small and well-organized groups responding to the possible costs of a policy proposal over large and more diffuse groups who respond to possible collective benefits some time in the future. They point out that the policies most easily adopted are those that offer tangible benefits to a specific sector of the economy or segment of society while costs are either widely dispersed or intermediate. Policies that concentrate costs on specific economic sectors or segments of society while benefits are widely dispersed are the hardest to adopt. As climate policies concentrate costs while benefits are widely dispersed, decision-making processes seldom produce effective policies (cp. also Bernauer 2013).

In theoretical terms, thus, climate change constitutes a distinct type of collective action problem – it is both a public goods problem and a redistribution problem. It is a public goods problem because individual maximization (via consumption, production and lifestyles) induces dysfunctional behavior (growing emission trends) which leads to collective irrationality. As the number of actors involved is very high, the costs for achieving outcomes rise exponentially (Scharpf 1997). As reducing emissions ultimately means limiting someone's (economic) activity (and prospects)

while others have to cope with rising costs (Peters 2005), elements of redistribution might be necessary in the future. The global and long-term nature of climate change increases these problems: on the global level, the problem of free-riding is immanent and those (countries, industries or individuals) going ahead may not obtain immediate benefits for themselves (Sprinz 2009). In contrast, the problem of acid rain was successfully dealt with: The benefits to a small number of identifiable polluters stood against the interests of the majority who had to suffer the effects of pollution. A (relatively) simple technological solution was available, the use of which could be regulated and controlled. Political action in this setting was (relatively) easy to organize. Scharpf (1997, 2000) argues that the impact of institutional conditions on the effectiveness of policy choices is contingent on the nature of the problems or challenges that the policy is supposed to address. Differences in the effectiveness of nations´ environmental policies can thus be attributed to differences in their institutional setups.

Thus, there are very good reasons to take the distinctions between environmental problems seriously when formulating hypotheses about an institution's or political system's capacity to deal with them. The purpose of the remainder of this section is to systematically discuss environmental problems' characteristics. I propose to distinguish between three characteristics (*complexity*, *policy approaches*, and *political dynamics*) and present six attributes intended to capture the problems' conflict structure. This is an important contribution to the literature as it provides the basis for a renewed research agenda into the effect of institutions on environmental performance.

The *complexity* of environmental problems is defined by the (1) time-frame, (2) scope, and (3) uncertainty, as well as the (4) character of their sources. The degree of complexity determines possible *policy approaches* which differ in their (5) level of intervention and (6) level of political coordination. All these characteristics

systematically influence the number of actors involved and the structure of their conflicts, i.e. the *political dynamics*. Different environmental problems thus pose different challenges for the ability of political systems to channel conflicting interests, preserve public goods and establish a long-term response strategy. Researchers interested in the effect of specific political institutions on nation-states' environmental performance should account for these differences when formulating their hypotheses.

Complexity

Time-frame: Environmental problems can either have a short, medium or long time-frame. The longer this time-frame, the harder it is for political actors to identify benefits and align possible action with their own time-frame, which is mainly determined by the length of election cycles. Climate change, for example, has been described as a "quintessential long-term policy problem" (Hovi et al. 2009, 20) marked by long time lags. Due to the underlying natural processes of the climate system itself, especially the longevity of carbon dioxide and other GHGs, today´s GHG emissions will still be present hundreds of years in the future (Dessler and Parson 2006, Solomon et al. 2009). Furthermore, changes in GHG concentrations exert only a slow influence on climate, mainly due to the large heat capacity of the ocean (Parson and Karwat 2011). Given these inertial effects, even extreme emission reductions in the near future may not have a measurable effect until the middle of this century (Steffen 2011). To limit global warming, today's social, political and economic actors have to reduce activities producing immediate benefits to preserve future generations' freedom of action (Sandler 1997). Thus, actors have to weigh short-term interests against undetermined future benefits, which is a great challenge for some of them, for example for political parties with their orientation on election cycles. Other environmental problems, e.g. stratospheric ozone depletion or local air quality, have a much smaller time-frame. The ozone layer is likely to be restored within a few decades, while local air quality improves fast if and when pollution is stopped (Victor

2011). As it takes less time to tackle these kinds of environmental problems, actors can easily identify short- or medium-term benefits (Carter 2007).

Scope: Environmental problems can have very different scope, ranging from local to regional and from national to global. The greater the scope, the larger the gap between the level of effective political decision-making – which is still the national level, the supra-national level of the EU being an exception – and international anarchy. For example, climate change is truly global as it is linked to both the atmosphere and the oceans, the "two great fluids" that transport material and energy around the planet (Steffen 2011, 22). Transcending national boundaries, climate change is marked by high spatial interdependence (Biermann 2007, Hogl et al. 2012). It does not matter where human activities cause the emission of GHGs; it is their increasing global average concentration that leads to rising surface temperature on a global scale (Dessler and Parson 2006). Most GHG emissions are (and were) produced in the global North, while the global South overall is more vulnerable to the consequences of climate change. The problem of free-riding is persistent, making it easy for actors to accuse others and delay decisions. In contrast, other environmental problems, such as air or water pollution caused by industry, agriculture or human settlements, have a more regional or even local scope (Schneider and Lane 2006).[9]

Uncertainty: Environmental problems pose different challenges for our scientific understanding of their causes and effects. The further environmental problems are related to fundamental earth systems, the greater scientific uncertainty. Although the basic science behind climate change is well understood, large quantitative uncertainties remain; the rate, magnitude, and specific consequences of future changes are extremely difficult to project (Parson and Karwat 2011). A further prominent feature of the climate system is its threshold behavior. Researchers have identified a number of "tipping elements", whereby small changes in one part of the

[9] Although they can have transnational implications, these problems lack a fully global dimension. For example, increasing water pollution in river systems in central Asia does not have immediate or direct effects on the environmental situation in Western Europe or North America.

system can trigger large, rapid and potentially irreversible change in the whole (Schellnhuber 2009, Steffen 2011). In short, we still know very little about the concrete dynamics even a "modest", now inadvertent, rise of global mean temperature will trigger. Other environmental problems are not troubled with such a high level of uncertainty, e.g. changing local air quality has very limited effect on earth system functions.

Character of their Sources: Environmental problems can be caused by either concentrated point sources, e.g. in the form of large industries, or by diffuse non-point sources. An example of the latter is climate change caused by GHG emissions, which themselves are the results of a plethora of human activities. All economic sectors from agriculture to service contribute to the growth of accumulated GHG concentrations, as do lifestyles (Dessler and Parson 2006). Thus, it is difficult to identify the main culprits. In contrast, environmental problems such as air and water quality or ozone depletion have easily identifiable, mainly industrial, point sources, which make dealing with these problems much easier (Jänicke and Volkery 2001, Victor 2011).

Policy Approaches

Intervention: Environmental problems with a low complexity, such as air and water quality, can be tackled by policy instruments dealing only with the control of pollutants and not interfering with the production process itself. The inherent logic of these instruments decouples production processes from the discharge of pollutants (Clark and Russel 2008). For example, relatively simple technological solutions in the form of filters limit point source emissions of SO_x which causes acid rain. These filters do not interfere with an industry's production process, as they are end-of-pipe technological solutions. Their use can be easily prescribed and controlled by straightforward regulatory instruments. Air and water pollution control along these lines has in the past been very successful (Ringquist 1995, Jänicke and Volkery 2001), indicating that the regulated entities (mainly large and medium-sized economic

actors) react “rationally” to fines and constraints (Clark and Russel 2008). On the other hand, a complex environmental problem like climate change is not amenable to reactive end-of-pipe technological solutions prescribed by regulation. Instead, the plethora of human activities producing GHG emissions need to be addressed by proactive complex and long-term societal and technological strategies involving the full spectrum of policy instruments. Climate mitigation policies have to address the very act of production or lifestyle decision.

Political coordination: Tackling different environmental problems requires different forms of political coordination, from industry- to sector-specific to cross-sectoral. Different environmental problems also require different levels of political coordination. These multiple scales of action pose serious challenges for governance (Steffen 2011).

Complex environmental problems like climate change call for policy integration and cross-sectoral approaches (Weidner and Jänicke 2002, Jordan and Lenschow 2010, Hogl et al. 2012). To limit GHG emissions it will not suffice to intervene in single sectors; only cross-sectoral solutions addressing virtually all patterns of production and consumption have the potential to achieve the emission reductions necessary to prevent further global warming (Pacala and Socolow 2004). On the other hand, less complex environmental problems caused by identifiable point sources can be addressed with sector- or even industry-specific regulations. Climate change also requires multiple levels of decision-making, from local to global, to be integrated into a common agenda. In contrast, less complex environmental problems, like air pollution caused by NO_x and $SO_{x,}$ require action mainly at a single decision-making level, e.g. setting a national standard (Ringquist 1995).

Political Dynamics

Number of actors involved and the structure of their conflicts: A complex problem like climate change, with a long time-frame, global scope and countless nonpoint sources, has to be addressed by a broad mix of cross-sectoral strategies seeking to

change the economic and social foundations of society which have to be coordinated in a multi-level framework. Additionally, given the inertia of the climate system and the uncertainties of climate projections, political conflicts over the timing and direction of policy interventions will be intense. Clearly, the political dynamics in this case are different from those in, say, regional air pollution from distinct industrial point sources which can be addressed on a sector- or industry-specific basis with technical end-of-pipe regulations.

TABLE 1 ABOUT HERE

Table 1 summarizes the arguments presented so far and describes the differences between environmental problems in a systematic way. Of course, many environmental problems involve difficult trade-offs and are laden with political conflicts, as solving them requires limiting some(one's) economic activity or influencing someone's way of living. Such changes are always costly and generate opposition. However, it turns out that climate change can be defined as being the most extreme of these problems, posing a distinct, almost extreme challenge for political systems' ability to find solutions. It is thus a good starting point for further analyses into the effect of institutions. Recalling the arguments made in favour of applying the nine indicators of the planetary boundaries framework to grasp general environmental performance, researchers should seek not to analyse specific environmental problems in isolation but to develop an integrated framework to investigate the effect of a set of institutions on a number of problems.

4. Discussion and Conclusion

The world today faces a daunting number of environmental problems. The ways in which political institutions deal with these challenges can give us valuable insight into

western democracies' future viability and potential for reform. Until now, the environmental performance of democratic governments has been mixed at best: the "low hanging fruits" of simple environmental problems have been picked, ambitious action to tackle complex environmental problems like climate change has been rare. A review of the literature makes it clear that our knowledge of the effect of institutions on environmental performance remains fragmentary. Although often blind to conceptual implications of their definition and measurement of environmental performance, the questions the literature raises can inform the research agenda for future studies of environmental performance. Existing hypotheses should be re-examined, keeping in mind the conceptual arguments presented in this article. With regard to the literature on corporatism, federalism, types of democracies, presidentialism and political parties discussed in section one this means that claims on the effect of each institution on general or specific environmental performance should be reviewed. For example, Lijphart´s (2012) conclusion that consensus democracies show better environmental performance could be re-evaluated by replacing his dependent variable (a composite indicator) with the nine indicators identified by the planetary boundaries approach. Doing this would allow to check whether the effect of either consensus or majoritarian democracy is constant over all models or whether effect is limited to only some models as the study of Poloni-Staudinger (2008) seems to suggest. Similarly, the debate on corporatism could be finally settled by conducting a study investigating its effect on the different planetary boundaries indicators.[10] At least, the arguments presented by Crepaz (1995) and Scruggs (2003) in support of corporatism should be reconsidered given the conceptual arguments made in this article: as actor constellations differ between environmental problems, the effect of corporatism should not be assumed to be uniform. Regarding the effect of presidentialism and federalism, a re-examination of Bernauer and Kouby's (2009) as well as Jahn and

[10] It seems somewhat surprising that corporatism is still seen as a key factor explaining environmental performance. Already a decade ago Neumayer (2003) questioned the relevance of corporatism concluding that "it is probably a myth to believe that corporatism is good for the environment" (p. 219).

Wälti's (2007) findings could also help to establish whether the effect of these institutions is uniform or differs between environmental problems. Unfortunately, the lack of data on party positions on different environmental problems makes it difficult to re-assess Jensen and Spoon's (2011) study. Further research on the influence of parties on environmental performance thus has to rely on the party family approach similar to Neumayer's (2003) study. Research along these lines could help building the bridges between comparative environmental politics and the broader field of comparative politics that Steinberg and VanDeveer (2012) have called for. Especially studies investigating the effect of a specific institution on a number of different environmental problems could provide a significant contribution to our understanding of the effect of institutions in general.

Also, research on environmental performance fits well with transition research, which currently lacks engagement with the political dimension of transitions to sustainability (Meadowcroft 2011).[11] However, as a research field, sustainability transitions are less visible in traditional political science journals and seem disconnected from political science debates dealing with related issues (Markard et al. 2012). Transition scholars seem reluctant to engage with the political dimensions of societal and socio-technical change. Yet, as Meadowcroft (2011) points out, the changes necessary for moving societies toward sustainable development are inherently political: decisions on policy change and the allocation of sparse resources have to be negotiated through political processes and legitimized and enforced by state institutions.[12] Against this background, Meadowcroft (2011, 73) has urged political scientists to develop a politically oriented literature on sustainability transitions, explicitly calling for their contributions in answering questions such as (i)

[11] Transitions are understood as processes of structural change in societal (sub-)systems which come about when existing economic and social structures are put under pressure by changes in society and/or social and technological innovations (Loorbach 2010). Transition research thrives in specialist journals, energy transition being the most developed area addressing the complexities of socio-technical change (e.g. Unruh 2000, 2002, Verbong and Loorbach 2012).

[12] Researchers have only recently begun to address actors and their strategies more systematically in the context of sustainability transitions (e.g. Farla et al. 2012).

what institutional contexts are favorable to sustainability transitions, and (ii) which reforms to democratic institutions can improve their capacity to negotiate sustainability transitions (see also Markard et al. 2012). Research on the effect of political institutions on environmental performance lends itself to systematic comparative studies as a means of answering these questions. Focusing on the effect of institutional setups on the direction and speed of social change and on policy change as well as the role of policy innovations (see Jordan and Lenschow 2008) would advance environmental performance research further, toward a framework of Comparative Transition Politics.

Finally, research on environmental performance could be integrated into broader research projects analyzing the capacity of political institutions to tackle complex political problems. The issue of environmental performance could be integrated into an encompassing systematic inquiry into the challenges of long-term governance. As has been argued in this article, a major characteristic of complex environmental problems is the long time-frame, in the case of climate change coupled with inertia. Policies that aim beyond the time-frame of political actors can induce specific coordination problems/dilemmas. The central problem for political actors then is to organize stable voter support for long-term policy approaches (Powell 2000, Franzese 2002, Jacobs 2008, 2011). This holds true for other political problems such as reforms to pensions, health care and social systems (Vis and van Kersbergen 2009) and for financial problems like the reduction of public debt. The capacity to deal with these different long-term problems might vary between certain types of democracies or between certain institutional setups.

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	Complexity				Policy Approaches		Political Dynamics
	(1) Time-frame: Short Term → Long Term	(2) Scope: Local → Global	(3) Uncertainty: Yes / No	(4) Sources: Point Sources / Non-Point Sources	(5) Level of Intervention: Non-Interference (End-of-Pipe) → Interference (Structural Change)	(6) Level of Political Coordination: (a) Single-Level → Multi-Level (b) Sectoral → Cross-Sectoral	Actor Constellations: No. of Actors and Structure of their Conflicts
Example: Climate Change	Long Term (and Inertia)	Global	Yes	Non-Point Sources	Interference	Multi-Level & Cross-Sectoral	Large No. of Actors, Intense Conflicts
Example: Ozone Depletion	Medium Term	Global	No	Point Sources	End-of-Pipe	Multi-Level & Sectoral	Medium No. of Actors, Low Conflict
Example: Air Quality	Short to MediumTerm	Local to Regional	No	Point Sources	End-of-Pipe	Single-Level & Sectoral	Small No. of Actors, Low Conflict

Table 1: Different Characteristics of Environmental Problems.

Chapter 3

Comparative Climate Politics – Patterns of Climate Policy Performance

Sebastian Sewerin

Abstract

This article presents an analysis of combinations of causal conditions leading to reductions or growth in greenhouse gas (GHG) emissions in fifteen western democracies. It develops an explanatory model that seeks to consider both the impact of long-term and stable "remote" conditions (such as institutional characteristics of political systems like bicameralism, federalism and presidentialism) and the impact of more short-term and actor-centered "proximate" conditions (such as governmental parties and policy instruments). A two-step fuzzy-set Qualitative Comparative Analysis (fsQCA) is applied to identify combinations of sufficient conditions for good and bad climate policy performance.

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1 Introduction

Climate change is, without doubt, one of the most complex long-term political problems the world faces today. From the mid-1990s climate change has become increasingly important on the political agenda, from the international level to national, regional, and local levels. Leading climate scientists stress that within this decade states in the global north have to begin a bold turn toward extensive reduction in greenhouse gases (GHG) to avoid the worst consequences of human-induced climate change (Schellnhuber and Cramer 2006). Indeed, since the 1990s most western democracies have recognized the importance of tackling climate change and devised numerous strategies and policies to reduce emissions. Yet, their efforts have yielded remarkably varied results: from 1990 to 2008 GHG emissions in Germany fell by 24 percent; emissions in Denmark, Sweden, and the United Kingdom fell by 8, 6, and 5 percent, respectively. On the other hand, emissions in Japan rose by 12 per cent, emissions in the United States and Canada by 17 and 25 percent, and emissions in New Zealand and Spain rose by an astonishing 35 and 51 percent (Boden et al. 2009). How can these huge differences be explained?

"Neo-institutionalist" research into democracies' ability to solve political problems has considerable difficulty in explaining the empirical patterns of climate policy performance, as the findings do not match prominent theoretical explanations. In *Patterns of Democracy,* Arend Lijphart (1999, 2012) addressed what effects polities (i.e. institutional configurations) have on politics (i.e. the political process) and on policies (i.e. macro-economic management). Lijphart concludes that the "kinder, gentler" characteristics of consensus democracies are likely to manifest themselves in four areas of government activity: social welfare, criminal justice, foreign aid – and protection of the environment (1999, p. 294). This should imply that consensus democracies are more likely to reduce their GHG emissions than majoritarian democracies; but this is not the

case. Other theories would posit that political systems with fewer institutional constraints (veto players) are more effective in addressing climate change (Tsebelis 2002). Again, the empirical patterns do not match these expectations.

In my view, the reason for this mismatch is a conceptual one: climate change mitigation is a distinct type of collective problem and as such is difficult to address. This conceptual issue is also the reason why assumptions from the body of research in comparative environmental politics need to be reconsidered (for a discussion see Sewerin 2013). For example, the cross-national large-n analysis of Scruggs (2003), building on earlier studies by Crepaz (1995) and Jahn (1998), aims to establish how the institutional structures of western, industrialized democracies affect environmental quality. All these studies cover a broad catalogue of environmental problems (or general environmental performance), ranging from water pollution and recycling rates to air pollutants like volatile organic compounds and sulphur dioxide. They do not focus on the issue of climate change; only Crepaz and Jahn include measurements of carbon dioxide (CO_2) among a number of others in their analyses. But the effects of institutions that these studies are trying to tease out may be quite different, depending on the character of the environmental problem. Perhaps certain institutional setups are effective in tackling "simpler" environmental problems (like water pollution and waste processing), but much less effective in addressing climate change. Although research on environmental policy performance is abundant, there are both empirical and theoretical reasons to engage in a systematic comparison of nation-states' climate policy performance.

This article presents an analysis of combinations of conditions leading to reductions or growth in GHG emissions in fifteen western democracies. It develops an explanatory model that seeks to consider both the impact of long-term and stable conditions (such

as institutional characteristics of political systems like bicameralism, federalism and presidentialism) and the impact of more short-term and actor-centered conditions (such as governmental parties and policy instruments). The article addresses the general issue of democracies' political and material performance, an issue that is characterized by contesting middle-range theoretical assumptions. More important, climate policy performance of western democracies specifically has not previously received systematic attention. Therefore, straightforward statistical variable-testing seems problematic. Instead, I apply a two-step fuzzy-set Qualitative Comparative Analysis (fsQCA), an alternative to standard statistical analyses, with considerable advantages in this context. As a case- and context-sensitive research approach, a fuzzy-set Qualitative Comparative Analysis allows us to refine and enrich the explanatory model with case-based knowledge in an iterative research process.

The article is organized as follows: the next section discusses the measurement of the outcome of interest and the selection of cases. Section 3 explains case selection and the method applied, a two-step fuzzy-set QCA. In Section 4, I discuss conditions influencing the outcome and present hypotheses. Section 5 describes the fsQCA and presents the findings of the analysis. Section 6 concludes with a discussion of the findings and their limitations and proposes routes for further research.

2 Outcome of Interest: Climate Policy Performance

There are different ways to conceptualize democracies' policy performance: by measuring policy output, by measuring the material outcome of political systems, or by a combination of both. Edeltraud Roller (2005) presents a strong case for capturing performance with outcome measures, stressing that the concept of performance (or

effectiveness) refers to the degree to which political goals are achieved through political action: only outcome indicators provide this information. Scruggs (2003) makes a similar point, arguing that outcome indicators are the "true test of environmental policy" (p. 6). Following this logic, I shall base my analysis on an outcome indicator based on GHG emissions. By measuring GHG emission trends, the impact of human behaviour over time is tracked, and by relying on percentage reductions (or growths) the effort of a given country can be compared to that of another (Scruggs 2003, pp. 27-28 and Bättig and Bernauer 2009, p. 292). In QCA terminology this outcome of interest is defined as the set "climate policy performance".

In fuzzy-set QCA it is important to establish how to operationalize sets by setting qualitative breakpoints (1, 0, 0.5)[i] and how to transform the raw data into fuzzy sets (Ragin 2000). Table 1 in the Appendix describes the calibration procedure for the conditions in more detail. Emission patterns are provided by Boden et al. (2009). Membership of the "climate policy performance" set is defined on the basis of scientific models describing emission reductions necessary to stabilize GHG emissions until 2050. To reach GHG concentration levels around 450ppm CO_2-equivalents and thus limiting global mean-temperature increase to 2°C, the so-called Annex 1 countries of the UNFCCC[ii] have to reduce their emissions by 25–40 percent by 2020 and by 80–95 percent by 2050 (Metz et al. 2007). Membership of the "climate policy performance" set is defined against this background, while bearing in mind that GHG emission data exist only until 2008, twelve years before the envisaged minimum 25 percent reduction in 2020. Therefore, full membership of the set (membership score 1) is defined as emission reductions greater than 10 percent, while the crossover point (0.5) is defined around 1 percent increase in emissions – the reason being that further increases drastically reduce the chances of a turnaround in emission trends in the years from 2008 to 2020. Full non-membership (membership score of 0) is defined as emission growth higher than 15

percent.[iii] Thus, to be clear at this point, this coding decision is based on a qualitative assessment, albeit one related to the objective reduction goals described in the IPCC scenarios.

3 Case Selection and Method

In this article, the outcome of interest is analyzed at the macro-level of political system, i.e. nation-states. However, considering that the characteristics of climate mitigation as a political problem pose distinct challenges to political actors (such as parties), actor constellations should be considered explicitly. It thus seems appropriate not to choose nation-states as analytical units but to disaggregate them into country-administrations and treat these as observed units.[iv] Because unit-homogeneity is necessary for meaningful comparisons across cases (Ragin and Becker 1992, Munck 2004) this article will only analyze established western industrialized democracies (of a minimum size, defined as a population of at least four million)[v]: Australia (AUS), Austria (AUT), Canada (CAN), Denmark (DK), Spain (ESP), France (F), Germany (GER), Ireland (IRL), Italy (ITA), Japan (JP), the Netherlands (NL), New Zealand (NZ), Sweden (SWE), the United Kingdom (UK), and the United States of America (USA). The units of analysis thus are not countries per se but the specific country-administrations, e.g. in the case of France the administrations from 1993-1996, 1997-2001, and 2002-2007. The analysis spans the years 1993 to 2008, thus comprising overall 63 units of analysis.[vi]

The growing methodological divide in comparative politics between the broad labels "quantitative"- and "qualitative"-oriented research often leads to different basic assumptions, understandings of "worthwhile" research questions and research goals. This tends to divide comparative political scientist into two distinct camps or "cultures",

as Mahoney and Goertz (2006) have observed. In a programmatic article Philippe Schmitter (2009) points to this growing methodological rift, and calls for what he labels a "complexification" of comparative politics: shifting attention from variable-oriented analysis to the analysis of patterns, to understand the effect(s) and the context of a set of variables rather than those of a single variable. He thus refers to the discussion about "causal complexity" that Charles Ragin stimulated with two important contributions (Ragin 1987, 2000). With his concept of *Qualitative Comparative Analysis* (QCA), Ragin tries to find middle ground between large-n statistical analysis and case studies, to capture the complexity of the different cases while still attempting to produce some level of generalization. Ragin's creed is best encapsulated in his caution against "net-effects thinking", meaning that in standard statistical analysis the case-specific context (and in many instances even the cases themselves) tends to move into the background as researchers are more interested in testing the relative explanatory power of different (independent) variables (Ragin 2006).

These methodological considerations are of some relevance in the context of this paper. As pointed out above, we still lack a comprehensive theoretical explanation of differences in nation-states' climate policy performance. Thus, a variable-centered statistical analysis does not appear very promising. Instead, an outcome-centered exploratory research design seems appropriate to develop comprehensive theoretical arguments. The *Two-step fsQCA Approach*, developed by Carsten Q. Schneider and Claudius Wagemann (Schneider and Wagemann 2006, 2007, 2012) seems particularly well suited to the analysis in this paper. It aims to improve fsQCA analyses by using the widespread (at least implicit) theoretical distinction between "remote" and "proximate" factors or conditions, making it possible to develop more differentiated theoretical assumptions. As will be discussed in the following paragraph, this distinction also makes practical sense.

4 Causal Conditions and Hypotheses

In this section, causal conditions affecting climate policy performance are discussed and corresponding hypotheses are presented. I draw both on established arguments about the general effects of institutions, such as institutional veto players and political parties, and on arguments developed in the field of climate policy, such as the effect of types of policy instruments. I also present data to calibrate the fuzzy membership scores.

Following Schneider and Wagemann (2006, 2007, 2012), all causal conditions can be distinguished according to their remoteness and proximity respectively to the outcome. Remote conditions are conceptualized as "relatively stable over time, they are remote in a spatiotemporal way, too, and they are out of the manipulative reach of the actors", whereas proximate conditions "display quite different features: they change easily over time, are spatially and temporally very close to the outcome and are subject to manipulations of actors" (Mannewitz 2011, p. 5). Applied to disaggregated country-administrations, this design also has the practical advantage that both cross-national and intra-national comparisons are possible. Most importantly, though, such a distinction makes sense in the context of climate policy performance as defined earlier: long-term and stable institutional arrangements may have a distinct effect on the effort a political system makes to solve the political problem of climate mitigation, just as more short-term and actor-centered conditions may also have a distinct effect.

In the remainder of this section, I discuss conditions influencing climate policy performance. I will argue that four conditions can be conceptualized as "remote" – their effect on the outcome is more indirect but stable over the long term: (1) institutional constraints, (2) corporatist policy making, (3) economic growth, and (4) EU membership.

These conditions "set the scene" for the struggle of political, economic and societal actors to prevail and see their interests met. Against this background, the following three conditions thus can be conceptualized as "proximate" conditions: (1) left-wing party dominance, (2) carbon lock-in, and (3) policy effort.

Remote Condition 1: Institutional Constraints

To grasp the fundamental characteristics of governmental systems, typologies focus either on specific characteristics like presidentialism (Linz 1990) and party systems (Sartori 1976) or on more general patterns of majoritarian and consensus types of democracies (Lijphart 1999, 2012). An alternative to these is the veto-player approach associated with the work of Tsebelis (1995, 2002). Here, veto players are defined as individual or collective decision makers whose agreement is required for change in the legislative status quo. Veto-player indices are widely used in comparative studies, but there is no consensus on their conceptualization, measurement and aggregation (Jahn 2010a). Roller (2005) argues that researchers should specify whether they seek to apply a measure of the "governmental system" with the help of a constitutional veto-player index or whether they seek to capture the "relationship between governing and opposition parties" with the help of a partisan veto-player index (p. 108). In the context of this analysis a measure of constitutional veto players seems appropriate as a remote condition, given the long-term and stable character of these institutional arrangements. In line with Tsebelis (1995, 2002), and also Schmidt (1996), Colomer (1996) and Kaiser (1997), I assume that institutional constraints limit governments' action space and potentially obstruct decision making. As climate mitigation policies need to be introduced in a wide range of policy fields, they may be hindered by strong veto players. Against this background, a first general hypothesis can be derived:

H1: High institutional constraints potentially hinder or slow down governments' efforts to mitigate climate change. The absence of strong veto players is a sufficient condition for effective climate policy.

Existing constitutional veto-player indices differ as to whether they include characteristics other than fundamental, structural ones like bicameralism, federalism, and presidentialism. Roller (2005) points out that against a background of missing theoretical criteria for the selection (and weighting) of secondary characteristics, the most straightforward approach is to employ an index that only measures structural characteristics (p. 111). Taking this advice, I apply a simple additive institutional veto-player index including presidentialism, federalism and bicameralism. In order to allow for more differentiation between institutional settings, I consider whether federalism and bicameralism (if present) are strong or weak. Thus, the veto-player index ranges from 0 to 5. Cases with more than three veto players are coded as being fully in the "high institutional constraints" set (membership score of 1), while cases with no or only one veto player are coded as completely out of the set (see Table 1 in the Appendix for a detailed description of the coding procedures).

Remote Condition 2: System of Interest Representation

The most prominent cross-national quantitative studies conducted in the field of comparative environmental politics to date, those of Crepaz (1995), Jahn (1998) and Scruggs (2003), have concluded that the system of interest representation is the strongest explanatory factor for differences in countries' environmental performance. Crepaz (1995) argued that, independent of the policy field, corporatism as a distinct system of interest representation systematically affects political performance. He stresses the importance of encompassing interest representation through peak associations: the more encompassing they are (i.e. the higher the degree of

corporatism), the better the environmental performance (i.e. the lower the levels of the five air pollutants SO_X, NO_X, VOC, CO and CO_2). Although this reasoning draws heavily on findings regarding the role of corporatism in wage and price policies and in social policies in general (e.g. Crepaz 1992), a positive effect of corporatism is generally assumed – with the notable exception of Neumayer (2003), who holds that it is "probably a myth to believe that corporatism is good for the environment" (p. 219). However, the argumentation has significantly changed over time: as Scruggs (2003) convincingly argues, "approaches to environmental policy are the products of … prevailing conventions of policy making". It is to be expected therefore "that environmental policy making would look a lot like the prevailing style of policy making (i.e., that corporatist countries would have more corporatist environmental policy, and pluralist countries would tend to have more pluralist environmental policy)" (p. 133). (Neo-)corporatist policy-making institutions enjoy, according to Scruggs, three advantages: "1. They provide informational and efficiency gains in making policy. 2. They provide a regime where flexible, cost-effective implementation of high standards can occur. 3. They provide `built-in´ conditions that facilitate internalizing production and consumption externalities" (p. 152).

In the context of this study, these arguments remain convincing, especially when the importance of energy policy in dealing with climate change is considered. Given that the reorganization of the energy-production system is a cornerstone of successful climate policy, the ability to overcome collective action problems is a considerable advantage. Moreover, as Matthews (2001) concludes in her study of environmental and energy policies, the goal-oriented policy-making pattern in corporatist countries (contrasted to the process-oriented policy making of pluralist countries) encourages the shift to cleaner fuels in energy production. On this basis, the following hypothesis can be derived:

H2: (Neo-)Corporatist policy-making styles help overcome collective action problems, especially in the field of energy production. (Neo-)corporatism is a sufficient condition for effective climate policy.

I draw on Siaroff (1999) for the measurement of corporatism. Unlike most existing studies which rely on measurements relating to wage and price policies, I only consider the three indicators for general national policy-making patterns. The mean is calculated, leading to values between 0 and 5 against which membership scores for the "corporatist policy-making" set are calibrated (see Table 1 in the Appendix for detailed description).

Remote Condition 3: Economic Growth

The literature on possible effects of economic growth on environmental performance is abundant, but the jury on the (non-)existence of the so-called Environmental Kuznets Curve (EKC) is still out (Bernauer 2013). Proponents of the EKC hold that pollution increases in the early stages of economic development, but beyond a certain threshold it levels off, producing an inverted U-shaped curve. While research findings are at odds, there is a growing consensus that economic growth has no uniform effect on any kind of environmental pollution. The existence of an EKC for water and soil pollution, which potentially pose a direct threat to people's health, seems established: at some level of development, citizens demand pollution control and conservation policies, and the government has the means to deliver (Dasgupta et al. 2001).

However, the relationship between economic development and pollution whose effects are not immediately felt by citizens, such as GHG, is not very well established. A recent meta-analysis of econometric models of the relationship between economic growth and energy consumption (Chen et al. 2012) suggests stronger evidence in developed than in

developing countries for a nexus between economic growth and increasing GHG emissions. A study by Jahn (2010b) presented further evidence of this nexus: his statistical analysis reveals that GHG emissions follow not a U-shaped curve, but rather an N-shaped progression. Additionally, he finds a linear relation between increases in wealth and GHG emissions from road traffic. Against this background, the following hypothesis can be developed:

> H3: High levels of economic growth lead to increasing GHG emissions. Thus, low levels of economic growth are a sufficient condition for good climate policy performance.

To calibrate the fuzzy set "economic growth", mean OECD economic growth from 1990 to 2008 is calculated (data obtained from *World Bank's World Development Indicators*). Membership scores are assigned relative to positive or negative deviations from this mean (see Table 1).

Remote Condition 4: EU Membership

Schreurs and Tiberghien (2007) address the puzzle of why, despite complex decision-making processes and constant need for internal coordination, the European Union is seen as a leader in international climate politics. They identify a "dynamic process of competitive multi-level reinforcement among the different EU political poles within the context of decentralized governance" (p. 22). They show that the distinct institutional setup of the EU provides opportunities for policy entrepreneurs – such as individual member states, the European Parliament, or the European Commission – to introduce more far-reaching goals and policies into the decision-making process (see also Rayner and Jordan 2013). In addition, the EU burden-sharing agreement on GHG reduction targets under the Kyoto Protocol and the Emission Trading Scheme were important

steps toward a differentiated set of emission-reduction goals, leading to stronger national commitment (Soria and Saveyn 2010). Another strand of research, policy diffusion studies, similarly hints at a positive effect of the EU, as policy convergence leads to stricter environmental policies in the member states (Holzinger et al. 2008). Thus, a further hypothesis can be formulated:

> H4: EU membership facilitates dynamic processes of environmental policy convergence and reinforcement. EU membership is a sufficient condition for good climate policy performance.

Measuring EU membership and the assignment of membership scores are straightforward, as states are either fully in or fully out of the "EU member" set.[vii]

As indicated above, these first four conditions are conceptualized as more stable, long-term and difficult to manipulate by political actors. I turn now to more short-term and actor-centered proximate conditions.

Proximate Condition 1: Left-wing Party Dominance of Government

The role of political parties in shaping public policy is circumscribed by institutional features of the governmental system and the relative immunity of social and economic life to political intervention. Within these limits, however, differences in the party composition of governments do have an impact on the material results of policies (Schmidt 1996). The question of partisan influence on environmental policies has only received more systematic attention in the last decade, with a few earlier exceptions from the 1990s. What complicates matters is that the existing literature addresses quite diverse questions: some studies concentrate on the influence of parties on overall environmental performance (measured with highly aggregated outcome-indices) (Jahn

1998, Scruggs 2003), others on the influence of parties on a limited set of environmental pollutants (mostly air pollutants) (King and Borchard 1994, Neumayer 2003, Jensen and Spoon 2010); further studies investigate partisan influence on policy outputs, again with a focus either on a broad set of environmental problems (Knill et al. 2010) or a limited set of environmental problems (mostly air pollutants) (Bättig and Bernauer 2009).

To complicate matters still further, existing studies are divided by theoretical standpoint: some apply party family concepts while others rely on saliency theory. Choosing from this diverse menu should be backed by good arguments. Concepts of party families in the tradition of Hibbs (1977) ultimately assume that party electorates have distinct economic preferences and that conflict between them structures the party system (Schmidt 1996). On the other hand, Klingemann et al. (2006) start from the very different theoretical argument that (as a general pattern) a party's manifesto is a good predictor of its actions when in government. A party with a strong focus on environmental policy in its election manifesto will act on this program when in government. A recent study by Jensen and Spoon (2010) draws on saliency theory and the Comparative Manifestos Project (CMP) dataset to investigate the influence of parties on EU member states' progress toward Kyoto targets. As sound as their theoretical considerations are, their analysis reveals a serious empirical problem: the CMP dataset only codes environmental policy along a single category. This category relates to environmental policy only in a very broad understanding of environmental preservation and protection. The CMP coding scheme can thus only capture sentences in party manifestos relating to the preservation of the countryside and to national parks. It seems a very far-reaching assumption that parties strongly advocating policies to protect the countryside are equally eager to advocate climate policies. I suggest therefore that Jensen and Spoon (2010) cannot accurately identify the positions of parties on climate change – which might explain their ambiguous findings. Unfortunately, there is no

alternative long-term and comparable data source to the CMP dataset. Mainly for empirical reasons therefore, relying on party family concepts seems the better option in the context of this analysis. Following considerations of King and Borchard (1994), Jahn (1998) and Neumayer (2003), I argue that left-wing party dominance of governments leads to better environmental results, producing this hypothesis:

> H5: Left-wing party dominance of government is a sufficient condition for good climate policy performance.

To measure left-wing party dominance, I rely on data for cabinet composition from the Comparative Political Dataset and membership scores are calibrated accordingly (see Table 1 for detailed description of the coding procedure).

Proximate Condition 2: Carbon Lock-In

Energy production from renewable sources is, without doubt, a cornerstone of any ambitious climate policy strategy (Christoff and Eckersley 2011). Thus, for countries to reduce GHG emissions the substitution of fossil energy sources with renewable energy sources is imperative. However, industrial economies have been locked into energy systems dominated by fossil fuels through a process of technological and institutional co-evolution. This condition, for which Unruh (2000) coined the term “carbon lock-in", creates persistent market and policy failures inhibiting the diffusion of renewable energy technologies and investment. Energy scenarios (Hennicke 2004) predict that future sustainable energy production systems will be much more decentralized and rely on small-scale production facilities; renewable energy technologies are thus structurally disruptive to conventional electricity-generation technologies (Foxon et al. 2005). Consequently, market diffusion of renewable energy technologies is easier in electricity systems that are not dominated by large and centralized production facilities (Eikeland

and Saeverud 2007). In other words, current energy production structures can act as structural barriers to the diffusion of renewable energy technologies (Stenzel and Frenzel 2008). These structural barriers also have short-term implications in that they represent vested interests seeking to prevent or at least delay transition toward a sustainable energy production system. In a recent analysis Marques and Fuinhas (2011) suggest that the share of fossil fuels in energy production also captures to an extent the existence of lobbies for these fossil fuels. Exerting their influence politically, economically or through labour markets, these lobbies are powerful players in the policy-making subsystem of energy production. Against this background I argue that if the share of fossil fuels in energy production is decreasing, the political influence of the lobbies concerned is decreasing as well. The following hypothesis formalizes this reasoning:

> H6: Traditional fossil energy sources provide not only structural barriers to renewable energy but also lobby power against a transition to sustainable energy production. A decreasing share of fossil energy sources leads to decreasing political influence and thus is a sufficient condition for good climate policy performance.

To measure the strength of fossil fuels, it is common to add up the contributions of coal, oil, peat and nuclear power to electricity generation.[viii] For the country-specific share of traditional fossil energy I rely on data from the International Energy Agency's *Energy Policy Reviews* and calculate variation across time. A reduction in the share of fossil energy sources by more than 10 percent is defined as being fully out of the "carbon lock-in" set; a growing share (>5 percent) is defined as being fully in the set (see Table 1 for detailed description).

Proximate Condition 3: Policy Effort

Although a relationship between policy outputs and outcomes generally is assumed by public policy literature (see Howlett et al. 2009), empirical studies in the field of environmental politics are rare (see e.g. Liefferink et al. 2009, Holzinger et al. 2011). A major factor hindering research is the lack of comparative policy output data. Although databases on climate mitigation like the Policies and Measures Database of the International Energy Agency exist, they do not allow for accurate measurement of changes in policy output (see Schaffrin et al. 2013 for a discussion). Knill et al. (2012) argue that to conceptualize policy change, researchers have to distinguish between two dimensions: density change and intensity change. While the former explores how numbers of policy instruments change over time, the latter relates to the stringency of these instruments. As existing databases do not consider policy intensity, we need to find a plausible proxy in order to capture the mitigation efforts of governments.

In view of the importance of energy policies in reducing GHG emissions (Christoff and Eckersley 2011), it seems plausible to use governments' approaches to renewable energy policies as an indicator of their overall policy effort. Existing literature on policy instruments to foster renewable energy production distinguishes between two ideologically grounded approaches to governing: relying on state intervention in the energy market or trusting in market forces (Toke and Lauber 2007). Price-based policy instruments such as feed-in tariffs are the ideal type of the former; quantity-based instruments such as obligations/quota systems of the latter approach. Many empirical studies and comparisons show that price-based instruments are superior to quantity-based instruments in influencing market diffusion of renewable energy techniques: they trigger investments in all renewable energy techniques (wind, water, biomass and solar), whereas quantity-based instruments only trigger investments in already cost-effective

energy techniques, especially wind (e.g. Jacobssen et al. 2009, Bürer and Wüstenhagen 2009). Price-based systems provide long-term security of investment and thus reduce risk for electricity generators more effectively (Mitchell et al. 2006). Moreover, price-based instruments generally allow for technology-specific support (e.g. in the form of different levels of guaranteed feed-in tariffs for wind, solar, CHP etc.) and thus are more effective and efficient than technology-neutral schemes (Ragwitz and Steinhilber 2013). Finally, policy stability facilitates energy technology development and therefore contributes to the transition towards renewable energy supply (Liang and Fiorino 2013). Accordingly, I opt for assessing whether countries have adopted price-based policy instruments, to serve as a general indicator of their overall policy effort, and present the following hypothesis:

> H7 Renewable energy policies are an indicator for governments' overall climate mitigation efforts. A comprehensive and stable set of price-based policy instruments is a sufficient condition for good climate policy performance.

The Policies and Measures Database, the World Energy Outlook Database of the IEA (source: http://www.iea.org/textbase/pm) and the *Renewables Global Status Report 2007* (REN21 2007) have been used to assess governments' efforts. To allow for differentiation, the possibility of regional schemes in federal states is accounted for. Fuzzy membership of the "policy effort" set is calibrated according to whether price-based instruments are lacking (membership score of 0, fully out of the set), regional policies are isolated (0.2) or more widespread (0.4), nation-wide policy schemes aim only at specific (0.6) or at all renewable energy techniques, or whether nation-wide policy schemes are in effect over more than one legislative period (1, fully in the set) (see Table 1).

5 Two-Step Fuzzy-Set Qualitative Analysis

Having identified conditions influencing climate policy performance and having collected and coded data for the cases under consideration (see Table 2 in the appendix), the two-step fsQCA can now be carried out. The goal of this exploratory analysis is to investigate the conditions behind different patterns of western democracies' climate policy performance. Drawing on various approaches to comparative politics, I hypothesized that a set of conditions is sufficient for the occurrence of the outcome of interest – good (and bad) policy performance. As is standard in QCA, the occurrence of the outcome and the non-occurrence of the outcome are analyzed separately, allowing for causal asymmetry (Berg-Schlosser et al. 2009). Following the suggestion of Schneider and Wagemann (2006, 2007, 2012), I distinguish between conditions remote from and conditions proximate to the outcome (denomination in the analysis: **climateperform** for the occurrence, **~climateperform** for the non-occurrence of the outcome). The remote conditions and their denomination in the analysis are: (1) institutional constraints (**constitveto**), (2) the system of interest representation (**corporatism**), (3) economic growth (**growth**), and (4) EU membership (**eumember**). The proximate conditions and their denomination in the analysis are: (1) left-wing party dominance of government (**leftgovdom**), (2) carbon lock-in (**carbonlock**), and (3) policy effort (**policyportf**).

According to Schneider and Wagemann's two-step approach, the analysis is conducted in two subsequent steps. The first step considers only remote conditions and leads to the identification of different outcome-enabling pathways or contexts toward the outcome (and its negation). The second step aims at identifying combinations of proximate conditions that lead toward the outcome within the different contexts identified in the first step. In this second step the outcome-enabling pathways are analysed separately in conjunction with all proximate factors (Mannewitz 2011). The

fuzzy-set QCA is carried out with the help of the *fsQCA software*. Before beginning with the two-step analysis of sufficient conditions, following standards of good practice (Scheider and Wagemann 2010), the existence of necessary conditions is checked. In this case, no necessary condition can be identified by the software.

First Step: Outcome-enabling Pathways

The first step seeks to identify (combinations of) remote conditions that are sufficient for producing the outcome. According to the model, consistency values in this step are not very rigorous: a threshold of 0.7 is applied. Also, to find a more parsimonious solution, logical remainders are included by the software. The fsQCA finds two outcome-enabling conditions:

~gdpgrowth → climateperform (*context1*)

corporatism → climateperform (*context2*)

This finding indicates that there are broad contexts conducive to good climate policy performance: weak economic growth (**~growth**) and corporatism as system of interest representation (**corporatism**). Either of these contexts is sufficient, but not necessary for the occurrence of the outcome. Table 3 provides the detailed results of this first step of the analysis.

Solution term	**~growth** *(context 1)*	**corporatism** *(context 2)*
Consistency	0.729	0.654
Raw coverage	0.731	0.557
Unique coverage	0.295	0.121
Cases with membership >0.5 in path	JP 06-09, ITA 92-93, USA 05-08, USA 01-04, UK 05-09, SWE 92-94, NZ 06-08, NL 03-06, JP 97-00, JP 94-96, JP 04-05, JP 01-03, ITA 96-00, ITA 06-07, ITA 01-05, GER 99-02, GER 95-98, GER 91-94, GER 06-09, GER 03-05	SWE 99-02, SWE 95-98, SWE 92-94, SWE 03-06, NL 98-01, NL 94-97, NL 03-06, GER 99-02, GER 95-98, GER 91-94, GER 06-09, GER 03-05, DK 98-01, DK 95-97, DK 91-94, DK 05-07, DK 02-04, AUT 96-99, AUT 91-94, AUT 03-06

Solution consistency	0.852
Solution coverage	0.648

Table 3: Outcome-enabling conditions (**climateperform**)

For the non-occurrence of the outcome (**~climateperform**) the same procedure is applied. The fsQCA again finds two conditions:

~eumember → ~climateperform (*context3*)

~corporatism → ~climateperform (*context4*)

Again, either of these paths is sufficient, but not necessary, for the non-occurrence of the outcome. Table 4 provides the detailed results.

Solution term	**~ eumember** *(context 3)*	**~corporatism** *(context 4)*
Consistency	0.606	0.635
Raw coverage	0.44	0.723
Unique coverage	0.052	0.335
Cases with membership >0.5 in path	USA 97-00, USA 93-96, USA 05-08, USA 01-04, NZ 97-99, NZ 94-96, NZ 06-08, NZ 03-05, NZ 00-02, JP 97-00, JP 94-96, JP 06-09, JP 04-05, JP 01-03, CAN 98-00, CAN 94-97, CAN 06-09, CAN 01-04, AUS 99-01, AUS 96-98	USA 97-00, USA 93-96, USA 05-08, USA 01-04, UK 97-00, UK 92-96, UK 05-09, UK 01-04, NZ 97-99, NZ 94-96, NZ 06-08, NZ 03-05, NZ 00-02, IRL 97-01, IRL 93-96, IRL 02-06, AUS 02-04, AUS 05-07, AUS 93-95, AUS 96-98
Solution consistency	0.775	
Solution coverage	0.613	

Table 4: Outcome-enabling conditions (**~climateperform**)

Second Step: Proximate Conditions

The second step seeks to identify (combinations of) remote and proximate conditions that are sufficient for producing the outcome in the four identified contexts. In order to achieve more consistent results, higher requirements are applied in setting the

consistency thresholds: a threshold of 0.85 is applied in all following analyses. As this study is exploratory, seeking to improve possible models to explain climate policy performance and inform further research endeavours, I do not seek to produce complex solution terms. Instead, the results presented here are intermediate solution terms. Logical remainders are included, but are prevented from implying the remote context be used as a counterfactual (Schneider and Wagemann 2012, 253f.). Table 5 presents an overview of the findings for the occurrence of the outcome in the outcome-enabling context 1 (**~growth)**, Table 6 for the outcome-enabling context 2 (**corporatism**).

Solution term	**leftgovdom*policyportf**	**leftgovdom*context1*~carbonlock**
Consistency	0.803	0.91
Raw coverage	0.161	0.233
Unique coverage	0.05	0.121
Cases with membership >0.5 in path	ESP 04-07, GER 03-05, DK 95-97, DK 98-01, GER 99-02, F 97-01, ITA 06-07	AUT 91-94, DK 98-01, GER 03-05, ITA 06-07, NZ 06-08, UK 05-09
Solution consistency	0.819	
Solution coverage	0.282	

Table 5: Intermediate solution terms, **climateperform** (context1: ~growth)

Solution Term	**leftgovdom*policyportf* carbonlock**	**leftgovdom*policyportf*context2***
Consistency	0.889	0.81
Raw Coverage	0.077	0.111
Unique Coverage	0.02	0.053
Cases with membership >0.5 in path	GER 99-02, F 97-01	GER 03-05, DK 95-97, DK 98-01, GER 99-02
Solution Consistency	0.833	
Solution Coverage	0.131	

Table 6: Intermediate solution terms, **climateperform** (context2: corporatism)

These solution terms are logically equally true and describe combinations of sufficient conditions leading toward the occurrence of the outcome. They have, though, different

empirical weight as they cover a different number of cases. The value for coverage shows what percentage of the cases is covered by the solution term. Thus, the empirically most relevant combination of sufficient conditions for the occurrence of the outcome is **leftgovdom*context1*~carbonlock**, covering 23 percent of the cases that show the outcome. Verbalized, this term means: the combination of the conditions left-wing party dominance of government AND weak economic growth AND decreasing carbon lock-in is sufficient for membership of the "climate policy performance" set, the outcome of interest. Figure 3 also lists the cases with a membership score of >0.5 in this path: AUT 91-94, DK 98-01, GER 03-05, ITA 06-07, NZ 06-08, UK 05-09.

Regarding the non-occurrence of the outcome, Table 7 presents the findings for the outcome-enabling context 3 (**~eumember)**, Table 8 for the outcome-enabling context 4 (~**corporatism**).

Solution term	**leftgovdom*~policyportf* carbonlock*context3**	**~leftgovdom*policyportf* carbonlock*context3**
Consistency	1	1
Raw coverage	0.031	0.037
Unique coverage	0.031	0.037
Cases with membership >0.5 in path	AUS 93-95	CAN 01-04, CAN 06-09
Solution consistency	1	
Solution coverage	0.068	

Table 7: Intermediate solution terms, **~climateperform** (context3: ~eumember)

Solution term	**~leftgovdom*~carbonlock *context4**	**~leftgovdom*policyportf *context4**	**leftgovdom*~policyportf*carbonlock*context4**
Consistency	0.9	0.875	0.886
Raw coverage	0.314	0.129	0.095
Unique coverage	0.234	0.058	0.086
Cases with membership >0.5 in path	ESP 00-03, IRL 02-06, IRL 97-01, NZ 94-96, NZ 97-99, ITA 01-05	ESP 00-03, ESP 96-99, F 02-07, CAN 01-04, CAN 06-09, ITA 92-93, ITA 94-95	ESP 93-95, AUS 93-95, ITA 96-00, UK 97-00

Solution consistency	0.871
SolutioncCoverage	0.46

Table 8: Intermediate solution terms, **~climateperform** (context4: ~corporatism)

These five solution terms represent combinations of sufficient conditions leading to the non-occurrence of the outcome. The solution term with the broadest coverage is **~leftgovdom*~carbonlock*context4** which covers 31 percent of the cases not showing the outcome (cases with a membership score of >0.5: ESP 00-03, IRL 02-06, IRL 97-01, NZ 94-96, NZ 97-99, ITA 01-05). Verbalized, this term means: the combination of the conditions absence of left-wing party domination of government AND decreasing carbon lock-in AND the absence of corporatism leads to the non-occurrence of the outcome, i.e. bad climate policy performance.

These findings clearly demonstrate that the relationship between climate policy performance and influencing conditions is complex and that further research is needed. The analysis has identified four solution terms for good performance and five solution terms for bad performance, each with a different coverage ranging from only 3 to 31 percent. The overall solution coverage for bad performance in the outcome-enabling context **~corporatism** is broadest with 46 percent, while the overall solution coverage for good performance in the contexts of **corporatism** and **~growth** is relatively low with 13 and 28 percent respectively. The solution terms for good performance support the hypotheses regarding the positive or negative effect of conditions, with the exception of the solution term **leftgovdom*policyportf*carbonlock**, where growing carbon lock-in in combination with the other two conditions contribute to good performance in the cases GER 99-02 and F 97-01. This specific finding could be interpreted to underline the importance of environmental policy initiatives from the new social democratic/ socialist and green governmental coalitions under Gerhard Schröder in Germany and Lionel Jospin in France. Regarding the solution terms for bad performance, the terms

leftgovdom*~policyportf*carbonlock*context4 and **~leftgovdom*policyportf *context4** at first glance seem to contradict the hypotheses presented in this article. However, both terms can be interpreted as specifications of the hypotheses, with the first terms specifying that left-wing government, in the absence of a strong policy portfolio and corporatist decision-making style, and confronting strong lobby interests, cannot implement its policy preferences. The second term can be interpreted as hinting that right-wing party governments implement ineffective climate mitigation policies.

The solution terms with the greatest coverage deserve closer inspection. Explaining good climate policy performance, the term **leftgovdom*context1*~carbonlock** supports the hypotheses presented in this article: a combination of left-wing party dominance of government, low economic growth and declining carbon lock-in contributes to countries' good performance. Interestingly, the term covers cases from six countries with a membership score of >0.5, Austria, Denmark, Germany, Italy, New Zealand, and the United Kingdom – but only for a specific legislative period. A possible interpretation is that in these particular periods economic growth in these countries was exceptionally weak, thus contributing strongly to good performance. With the exception of the UK from 2005–7, all of these cases have a low membership score of 0.3 in the "economic growth" set. Further in-case analyses could shed more light on this finding. The solution term with the greatest coverage for bad performance, **~leftgovdom*~carbonlock*context4**, seems partly to contradict the hypotheses presented in this article as it comprises decreasing carbon lock-in as part of the combination of conditions. As the term covers cases representing consecutive legislative periods (IRL 1997–2001 and 2002–6, NZ 1997–2001 and 2002–6) further case-specific analyses could help interpret this finding. A common feature of both solution terms for good and bad climate policy performance is the prominent role of the condition **leftgovdom**, left-wing party dominance of government, in them. This finding clearly

indicates that “party matters”, not only for general environmental performance (see Jahn 1998, Neumayer 2003, 2004, Jensen and Spoon 2010) but for climate policy performance in particular.

6 Discussion and Conclusion

In this paper, I contribute to the scholarly debate on the relationship between institutions and climate policy performance by evolving hypotheses about the effect of specific conditions. I argue that, against the background of contesting middle-range assumptions regarding the effect of institutions on policy performance in general and limited knowledge specifically about nations’ climate policy performance, standard statistical variable testing seems problematic. Instead, a fuzzy-set Qualitative Comparative Analysis (fsQCA) provides a case- and context-sensitive approach based on the notion of causal complexity. As explanatory factors are perhaps best conceptualized as “remote” from and “proximate” to the outcome of interest, the two-step fsQCA approach of Schneider and Wagemann (2006, 2007, 2012) may be the best option for research seeking to explain variation in climate policy performance.

However, the conclusions drawn from the results have to be interpreted in light of the limitations of the study. The low coverage of the solution terms and the fact that cases from four countries, Japan, the Netherlands, Sweden, and the USA, are not found in any solution term with a membership score of >0.5 suggest that the explanatory model needs to be improved, either by including further possible conditions or by improving the data basis for conditions presented here. Unfortunately, in the absence of better data two conditions rely on arguably weak proxies, namely overall governmental policy effort and party influence on climate mitigation. As has been argued in Section 4, existing policy databases only indicate the regulatory density and not the regulatory intensity of countries’ policy portfolios. Consequently, the data collected for the condition **policyportf** are driven only by the presence of policies and not their respective

strength. An alternative approach could be to create a dataset also measuring policy strength, or to rely on policy evaluation based on expert interviews. I discussed above in relation to the condition **leftgovdom** the lack of data from the Party Manifesto network establishing party position on climate mitigation. Another approach might be to consider the influence of green parties, e.g. by assessing green party strength in parliaments and thus evaluating their power in agenda setting (Neumayer 2003, 2004) or by considering the party affiliation of the environmental, energy or climate minister.

A further way to improve the leverage of this study would be to conduct separate analyses for climate policy performance in the three most relevant sectors – energy production, transport and housing – for which we have data on their GHG emissions. The model could be improved by combining a stable set of remote conditions relevant to all sectors with more sector-specific proximate conditions in the form of specific policy portfolios or distinctive features of the respective sector.

Nonetheless, being a first exploratory study of the relationship between institutional characteristics and climate policy performance, the findings lay the groundwork for further research into combinations of conditions fostering good or bad performance. We can increase our understanding either by improving the model as described above or by further within-case analyses based on post-QCA case selection (Schneider and Wagemann 2012). In face of the global challenge of climate change further analyses along the lines of this study should be high on the agenda of both comparative politics and comparative environmental politics.

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Appendix

Table 1: Coding Procedures for Remote and Proximate Conditions

Condition (set name)	Indicators and Coding Procedures	Values	Source
Remote Conditions			
constitveto (high institutional constraints)	simple additive veto player index: Presidentialism: 0 = no (=Parliamentary), 1 = yes Federalism: 0 = no, 1 = weak, 2 = strong Bicameralism: 0 = no, 1 = weak, 2 = strong	0 = no institutional constraints (0-1 veto player) 0.3 = few institutional constraints (2 veto player) 0.7 = relevant institutional constraints (3 veto player) 1 = high institutional constraints (> 3 veto player)	*Comparative Political Dataset I* (Armingeon et al. 2008)
corporatism (corporatist policy-making)	Siaroff's measure of (neo-)corporatism: mean of indicators for `overall national policy-making patterns`, late 1990s (value between 0 and 5): a) nature of (conflict resolution in) national industrial adjustment and wage setting b) extent of `generalized	0 = no corporatist policy making (mean between 0 and 2.63) 0.3 = weak corporatist policy making (mean between 2.65 and 3.33) 0.7 = medium corporatist policy making (mean between 3.34 and 3.98)	Siaroff 1999

	political exchange´ in industrial relations and national policy making c) general nature of public–private interaction	1 = strong corporatist policy making (mean above 3.99)	
growth (strong economic growth)	mean economic growth (percent) per government period compared to mean economic growth of all OECD countries	0 = negative economic growth (mean < 0) 0.3 = below average economic growth (mean between 0 and 2.35) 0.7 = above average economic growth (mean between 2.35 and 5) 1 = strong economic growth (mean > 5)	World Bank: World Development Indicators (http://data.worldbank.org/data-catalog/world-development-indicators)
eumember (EU membership)	EU membership candidate: yes or no; EU membership decision by European Council: yes or no; EU membership: yes or no;	0 = not member of EU 0.3 = EU candidate 0.7 = EU membership decided 1 = full EU member	
Proximate Conditions			
leftgovdom (left-wing party dominance)	cabinet composition: relative number of left-wing party ministers compared to ministers of other party families; in cases of left–right coalitions: party membership of PM	0 = no left-wing party members of cabinet 0.3 = right-wing party dominance of cabinet (in cases of left–right coalition: PM from right-wing party) 0.7 = strong position of left-wing party in cabinet (in cases of left–right coalition: PM from left-wing party) 1 = left-wing party dominance of cabinet	*Comparative Political Dataset I* (Armingeon et al. 2008)
carbonlock (carbon lock-in of energy system)	share of traditional fossil fuels (without natural gas) in electricity generation: changes of share compared	0 = diminishing carbon lock-in (growth share of renewables >10%)	*Energy Policies of IEA Countries – Country Reviews*

	to previous period (1973–90)	0.3 = carbon lock-in under attack (growth share of renewables between 5 and 10%) 0.7 = stable carbon lock-in (growth share of renewables <5 to -5%) 1 = strong carbon lock-in (growth share of traditional energy sources >5%)	(http://www.iea.org/publications/countryreviews/)
policyportf (policy effort)	assessment of renewable energy portfolio: instruments aiming at market intervention (feed-in tariffs and similar instruments) at regional and national level	0 = no policy effort (no policies at regional and national level) 0.2 = weak policy effort (isolated regional policies) 0.4 = medium policy effort, regional basis (widespread regional schemes) 0.6 = medium policy effort, national basis (national schemes aiming only at specific renewables) 0.8 = good national policy effort (national schemes aiming at all renewables) 1 = strong national policy effort (established national schemes for renewables; stable conditions over government periods)	*Policies and Measures Database*, the *World Energy Outlook Database* of the IEA (http://www.iea.org/textbase/pm) and the *Renewables Global Status Report 2007* (REN21 2007)

Table 2: Fuzzy Membership Scores

caseid	constitveto	corporatism	growth	eumember	leftgovdom	carbonlock	policyportf	outcome
AUS 02-04	0,7	0	0,7	0	0	0,7	0	0,2
AUS 05-07	0,7	0	0,7	0	0	0,7	0	0,8
AUS 93-95	0,7	0	0,7	0	1	0,7	0	0,2
AUS 96-98	0,7	0	0,7	0	0	0,7	0	0,6
AUS 99-01	0,7	0	0,7	0	0	0,7	0	0,4
AUT 00-02	0	1	0,3	1	0	0,7	0,4	0,1
AUT 03-06	0	1	0,3	1	0	0,7	0,8	0,6
AUT 91-94	0	1	0,3	0,7	0,7	0,3	0	0,6
AUT 96-99	0	1	0,7	1	0,7	0,3	0,2	0,4
CAN 01-04	0,3	0	0,7	0	0	0,7	0,6	0,2
CAN 06-09	0,3	0	0,3	0	0	0,7	0,6	0,4
CAN 94-97	0,3	0	0,7	0	0	1	0	0,2
CAN 98-00	0,3	0	0,7	0	0	1	0	0,1
DK 02-04	0	1	0,3	1	0	0	0,8	0,8
DK 05-07	0	1	0,7	1	0	0	0,8	0,6
DK 91-94	0	1	0,3	1	0	0,3	0,8	0,1
DK 95-97	0	1	0,7	1	1	0,3	0,8	0,6
DK 98-01	0	1	0,3	1	1	0,3	0,8	1
ESP 00-03	0,7	0	0,7	1	0	0	0,8	0
ESP 04-07	0,7	0	0,7	1	1	0	1	0,6
ESP 93-95	0,7	0	0,3	1	1	1	0	0,1
ESP 96-99	0,7	0	0,7	1	0	1	0,8	0
F 02-07	0	0	0,3	1	0	0,7	0,8	0,6
F 93-96	0	0	0,3	1	0	1	0	0,6
F 97-01	0	0	0,7	1	1	1	0,6	0,6
GER 03-05	1	1	0,3	1	1	0,3	1	0,8
GER 06-09	1	1	0,3	1	0,3	0,3	1	0,8
GER 91-94	1	1	0,3	1	0	0,7	0,6	1
GER 95-98	1	1	0,3	1	0	0,7	0,6	0,9
GER 99-02	1	1	0,3	1	1	0,7	0,8	0,4
IRL 02-06	0	0	1	1	0	0	0	0,6
IRL 93-96	0	0	1	1	0,7	0	0	0
IRL 97-01	0	0	1	1	0	0	0	0
ITA 01-05	0	0,3	0,3	1	0	0	0	0,2
ITA 06-07	0	0,3	0,3	1	1	0	0,6	0,8
ITA 92-93	0	0,3	0	1	0	0,7	0,6	0,6
ITA 94-95	0	0,3	0,7	1	0	0,7	0,6	0,4
ITA 96-00	0	0,3	0,3	1	0,7	0,7	0	0,2
JP 01-03	0	0,7	0,3	0	0	0,7	0	0,2
JP 04-05	0	0,7	0,3	0	0	0,7	0	0,6

JP 06-09	0	0,7	0	0	0	0,7	0	0,4
JP 94-96	0	0,7	0,3	0	0	0	0	0,4
JP 97-00	0	0,7	0,3	0	0	0	0	0,8
NL 03-06	0	1	0,3	1	0	0	0,8	0,9
NL 94-97	0	1	0,7	1	0,7	1	0	0,4
NL 98-01	0	1	0,7	1	0,7	1	0	0,6
NZ 00-02	0	0	0,7	0	1	0	0	0,6
NZ 03-05	0	0	0,7	0	1	0	0	0,8
NZ 06-08	0	0	0,3	0	1	0	0	0,4
NZ 94-96	0	0	0,7	0	0	0	0	0
NZ 97-99	0	0	0,7	0	0	0	0	0,2
SWE 03-06	0	1	0,7	1	1	0,7	0	1
SWE 92-94	0	1	0,3	0,7	0	1	0	0,8
SWE 95-98	0	1	0,7	1	1	1	0	0,8
SWE 99-02	0	1	0,7	1	1	1	0	0,2
UK 01-04	0	0	0,7	1	1	0	0	0,6
UK 05-09	0	0	0,3	1	1	0	0	0,6
UK 92-96	0	0	0,7	1	0	0,7	0	0,8
UK 97-00	0	0	0,7	1	1	0,7	0	0,6
USA 01-04	1	0	0,3	0	0	0,7	0	0,4
USA 05-08	1	0	0,3	0	0	0,7	0	0,8
USA 93-96	1	0	0,7	0	0	1	0	0,1
USA 97-00	1	0	0,7	0	0	1	0	0,4

Notes

[i] 0.5 is called the "crossover point" (see Schneider and Wagemann 2012).

[ii] Basically, these are the OECD member states.

[iii] The membership scores are set as follows: >15% emission change: 0; 10-15%: 0.1; 4,5-10%: 0.2; 1-4.5%: 0.4; -2.5 to 1%: 0.6; -2.5% to -6%: 0.8; -6% to -10%: 0.9; >-10%: 1.

[iv] Caretaker and short-term governments lasting under twelve months are excluded.

[v] This is, in fact, what Przeworski and Teune (1970) have labeled a "most similar systems design".

[vi] The denomination of the units of analysis follows from the governments' years in office, starting with the governments in office in 1993.

[vii] Yet, there are two governments, AUT 91-94 and SWE 92-94, who are assigned a membership score of 0,7 because their formal accession to the community was only in 1995. Still, in the years before accession, candidates have to transfer the acquis communautaire into national laws, including environmental regulations, the cases are assumed to be more in than out of the set (see Table 1).

[viii] Occasionally, researchers include the contribution of natural gas as well. Natural gas, though, is a far better partner for renewable energy than the coal, oil or nuclear (Hennicke 2004) and is therefore not considered a barrier in this analysis.

Chapter 4

Toward a Comparative Measure of Climate Policy Output

André Schaffrin, Sebastian Sewerin, Sibylle Seubert

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.

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 Bemelsman-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 extent this typology adding 'ties' such as voluntary agreements and 'adhesives' which is framework policy that combines 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

actors in 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) whereas 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 on 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 set in a group discussion. 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.

*** Table 1 about here ***

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).

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 imposition costs are provisions of the UK Climate Change Levy on energy.

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 rankings of "the most important national policies and measures (max three) for the reduction of CO_2 in the

energy sector" (Germanwatch 2012). This means that experts select policies and only evaluate the relative impact of these "most important" national policies while the Index of Climate Policy Activity compares all existent policies. Thus, the CCPI has a different frame of reference (compared to other most important policies in a given year) than the Index of Climate Policy Activity who applies absolute standards for comparison. For this reason and because the experts chosen for the CCPI vary between the years, a validity assessment allows only to assess the ranking of the most important climate mitigation policies in a particular year and not across years or countries. In contrast to the values of the Index of Climate Policy Activity which describe constant characteristics of the policy instruments, the CCPI-ranking changes over the years depending on the rank of other policies. For example, a carbon tax might rank highest in the policy portfolio as long as a feed-in tariff for renewable energy with a higher rank is adopted. Nevertheless, the values of the Index of Climate Policy Activity should reflect the ranking order of the policy instruments mentioned in the CCPI measure within one particular year.

Table 2 compares the expert ranking with the scores of the Index of climate policy activity. Given that the Index of Climate Policy Activity and the CCPI are measured on two strongly different methodological approaches, there is necessarily measurement errors involved. Nevertheless, there are two findings indicating 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, if we compare both indices per, policy instruments with high ranking on the CCPI are also characterized by higher values on the Index of Climate Policy Activity as shown in Table 2. Exceptions are explained in a footnote.[5]

*** Table 2 about here***

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 about here ***

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 greater 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 about here ***

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 challenge of developing a systematic and holistic conceptualization of policy output with the focus on policy instruments.

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 described in Austria, Germany, and the UK 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-span). 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 an ideal basis for further statistical analyses of policy effectiveness or policy performance.

Notes

1. Energy efficiency has been considered but was not applicable since either targets for renewable energy, emission reduction, or no target was given for all policy instruments.
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 the 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. In Austria, exceptions are the Austrian Financial Incentives for Rural Biomass Energy in 2009 which is highly linked with the Feed-in tariff for which we calculated a separate score. Expert ratings are highly similar for both policies indicating that the experts combine their effect and do not evaluate them separately. Differences between the values of the Germanwatch CCPI and the Index of Climate Policy Activity exist for the German Renewable Energy Act Amendment in 2009–2010. The CCPI ranking in 2009 has been done before it has been decided upon the German phase-out of nuclear power whereas the Index of Climate Policy Activity already takes major policy interactions with this decision into account.

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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

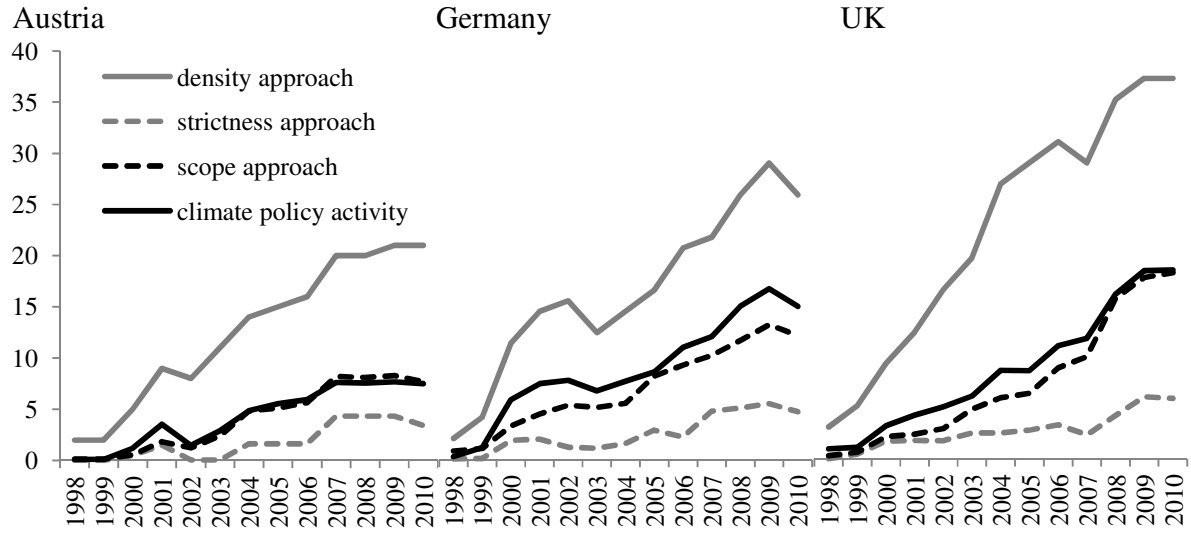
Budget	What are the set expenditures/impositions of the policy instrument?	0=no fixed costs/impositions absolute annual costs/imposition of policy instrument	The values of intensity if calculated as the share of the public expenditure or imposition for the policy instrument on total public expenditure 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?	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	additive aggregation	0, 0.25, 0.5, 0.75, 1
	How is this implementation planned and is there sanctioning?	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		
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

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

Year	Policy instrument	Expert ranking	Index scores
	Austria		
2007	National Allocation Plan (2008–2012)	1	0.63
	Quota for electricity from renewables	2	0.63
2008	National Allocation Plan (2008–2012)	1	0.63
	Green Electricity Act	2	0.51
2009	National Allocation Plan (2008–2012)	1	0.63
	Feed-in tariffs renewable electricity	1	0.62
	Financial Incentives for Rural Biomass Energy	1	0.14
	Austrian Climate Change Strategy	2	0.52
2010	Energy Efficiency Action Plan	1	0.65
	Austrian Climate Change Strategy	1	0.52
	Green Electricity Act	2	0.51
	Germany		
2007	Renewable Energy Act	1	0.68
	Combined Heat and Power Act	2	0.61
	National Allocation Plan (2008–2012)	3	0.57
2008	Renewable Energy Act	1	0.68
	Combined Heat and Power Act	2	0.61
	National Allocation Plan (2008–2012)	3	0.57
	Ecological tax reform	4	0.49
2009	Renewable Energy Act Amendment	1	0.50
	National Allocation Plan (2008–2012)	2	0.57
	Combined Heat and Power Act	3	0.61
2010	National Allocation Plan (2008–2012)	1	0.57
	Combined Heat and Power Act	1	0.61
	Renewable Energy Act Amendment	2	0.50
	United Kingdom		
2007	Renewables Obligation	1	0.39
	Energy Efficiency Commitment	2	0.29
	National Allocation Plan (2005-2007)	2	0.28
2008	Climate Change Levy and Agreements	1	0.50
	National Allocation Plan (2008–2012)	2	0.48
	Renewables Obligation	3	0.38
2009	National Allocation Plan (2008–2012)	1	0.48
	Renewables Obligation	2	0.35
2010	Feed-in tariffs for renewables	1	0.57
	National Allocation Plan (2008–2012)	2	0.48
	Renewables Obligation	3	0.35

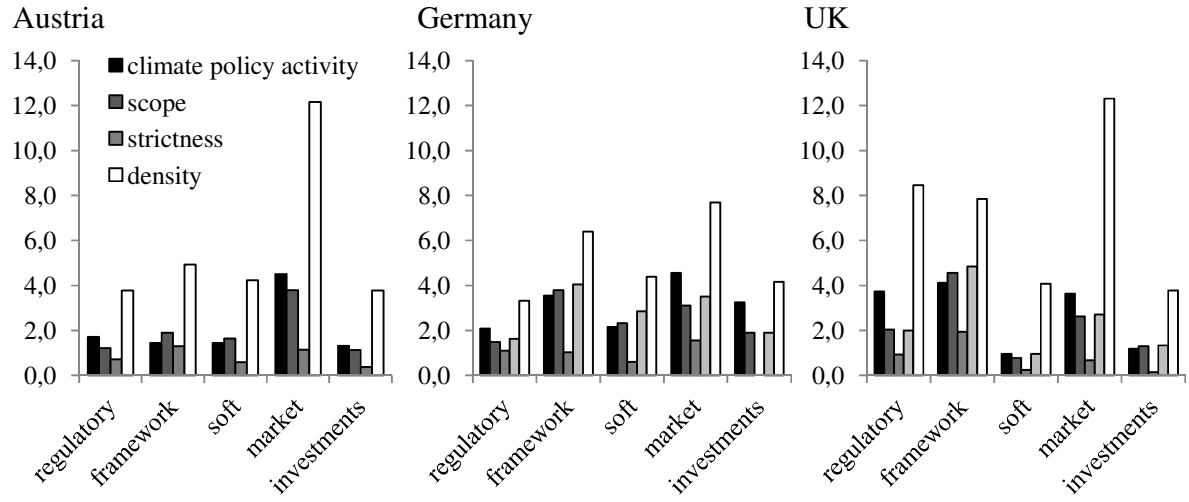
Note: Expert ranking: 1 = highest rank; Index of Climate Policy Activity: 1 = highest intensity, 0 = least intensity; Source: Burck, Bals and Ackerman 2008, authors' calculations.

Figure 1: Alternative Measures of Climate Policy Output



Source: IEA, UNFCCC communications, authors' calculations.

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



Source: IEA, UNFCCC communications, authors' calculations.

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 5

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

André Schaffrin, Sebastian Sewerin and Sibylle Seubert

Abstract

This paper examines policy change in 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 as part 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 of policy output. This new approach sheds 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 within the policy portfolios of electricity and heat production in 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.

Introduction

After twenty years of debate on how to meet the challenges of climate change the latest 2012 UN Climate Change Conference in Doha incontrovertibly marks a dead end in international climate politics (Campbell 2013). By contrast, recent years have seen a resurgent development and interest in policy innovation on the level of national climate mitigation. What is still puzzling is whether national policy innovation measures up to the expectations to provide a major contribution for global climate mitigation. Two issues are crucial but have been rarely considered in the literature to answer this question.

(1) Scholars and practitioners are challenged to identify tipping points where policy innovation as 'an inherently disruptive process' overcomes interests defending the status quo (Jordan and Huitema, this volume, citing Lynn 1997, p. 96). If layered on top of a process of cumulative changes, even insignificant policy innovation might trigger radical changes in the political trajectory towards new policy instruments with new interests and coalitions (Black, Lodge, and Thatcher 2005; Shipan and Volden 2012; Pelling and Dill 2010).

(2) Governmental action or 'cheap talk' might be perceived as innovative even if actual instruments remain traditional and symbolic (Bauer et al. 2012; Krause 2011; McConnell 2010). Without evaluating policy innovations 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).

However, despite a large body of policy innovation research, we have actually seen only pieces of the larger 'elephant in the room' to describe tipping points and symbolic policies. The majority of studies of policy innovation 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., Holzinger et al. 2011; Liefferink et al. 2009). What has been rarely considered but what is crucial for both scholars and practitioners for investigating tipping points and symbolic policy innovations is to apply a holistic perspective with the focus on (1) different levels of policies, (2) the policy portfolio, and (3) policy dynamics over time.

Therefore, we follow an evaluation perspective of policy output (see Jordan and Huitema, this volume; Beisheim and Campe 2012). The article provides an empirical example on how to study the issues: (1) 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 instrumental logic? (2) Do policy innovations have largely symbolic goals or do they also include more radical innovation in the settings and calibrations of their instruments?

We conduct an empirical analysis of policy innovations in the sector of electricity and heat production in Austria, Germany, and the UK from 1998 to 2010. Going beyond a perspective on innovations in isolation, we provide a holistic approach to study tipping points and symbolic innovations.

Policy innovation and policy change

We follow Walker's (1969) definition of policy innovation 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' (p. 881). We aim to contribute to the literature on policy innovation when analyzing tipping points and symbolic innovations by considering the complexity of policy innovations with regard to (1) different levels of policies, (2) the policy portfolio, 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 Howlett 2007; Hall 1993; van der Heijden 2013).

The levels of policy innovation

Building on Hall (1993), Howlett and Cashore (2009) suggest a taxonomy grounded on levels of policy and the distinction between ends and means. On the highest level, 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). This categorization builds on Hall's (1993) distinction between

incremental and radical policy change. 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 Howlett 2007; Howlett and Cashore 2009).

Categorizing into different levels and distinguishing between modes of change lays the ground for an analysis of tipping points and symbolic innovations. Symbolic innovations are discussed in the literature rather straightforward as resulting from a mismatch of different levels of policy (van der Heiden and Strebel 2012; Makse and Volden 2011; Rogers 2003). We argue that symbolic innovations have innovative goals and might even apply new instruments but lack innovation and intensity at the level of settings and calibrations (see also Bauer et al. 2012; Krause 2011; McConnell 2010).

The concept of tipping points originates in the Natural Sciences studying complex eco-system change or other wide scale transitions. Pelling (2010) discusses tipping points in the political context and defines them as 'critical historical moments or broader influences on systems (internal and external) that determine the direction and significance of change' (p. 22). Duit and Galaz (2008) state that even 'small events might trigger changes that are difficult or even impossible to reverse' and 'seemingly stable systems can suddenly undergo comprehensive transformations into something entirely new' (p. 313; see also Gunderson and Holling 2002; Kinzig et al. 2006). In the following, we discuss three approaches' expectations for tipping points and symbolic policy before we turn to the dynamics of policy innovation in the context of the newly emerging field of climate mitigation.

Theories of policy change and the policy portfolio

Three dominant approaches seeking to explain policy change in the policy portfolio come to different conclusions on which levels these changes occur and what role tipping points and symbolic innovations play within that process (for a review see Capano 2009; Howlett and Rayner 2006, Van der Heijden 2013). 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 (Hall 1993; Hacker 2004; Mahoney 2000). Here, radical change in the instrumental logic appears at critical junctures or during windows of opportunity (Kingdon 1995; Lindner 2003; Thelen 1999). While following a consistent policy path, symbolic innovations create a picture of activity but in fact support the status quo. Thus, symbolic innovations serve as negative feedback in order to ensure increasing returns and policy stability (Capano 2003; Howlett and Rayner 2006; Pierson 2000).

Second, the process sequencing approach with its application of the punctuated equilibrium model (Baumgartner et al. 2009; Haydu 1998) follows the idea of cycles switching between incremental and more radical sequences of change (Howlett 2009). 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 innovations 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, create positive feedbacks and mobilize 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 et al. 2009; Haydu 1998).

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, p. 231; see also Genschel 1997; Pierson 2004) but rather as a result of cumulative adaption (Capano 2003; Cashore and Howlett 2007; Coleman et al. 1996; Lee and Strang 2006). Here, 'bottom-up' processes of increasing returns and policy learning through incremental changes of the meso-level of policy instruments finally reach a tipping point for a more radical change in the instrumental logic at the highest policy level (Coleman et al. 1996; Daugbjerg and Sonderskov 2012; Howlett and Cashore 2009; Pierson 1993). Symbolic innovations play no role since changes in the instrumental logic occur by the incremental adoption of new 'layers' of innovative instruments (Beland 2007; Streeck and Thelen 2005).

Two issues are relevant when considering the three approaches of policy change. (1) The fact that the accumulation of policy instruments is one central mechanism for policy change supports the position that we need to analyze policy portfolios instead of single (types of) policy instruments (Tosun 2013; Hacker 2004; Pierson 2004; Huitema and Meijerink 2010). (2) As discussed above, the approaches come to different conclusions on the role of tipping points. We argue that policy innovations that vary only minutely from the prevalent policy style on the level of policy instruments might cumulate in a tipping point where the sum of all instruments add up to a completely new instrumental logic.

The dynamics of climate policy innovation

The approaches of policy change discussed above focus on traditional areas of public policy, for example, health care or national defense. They rarely describe the dynamics that arise in newly emerging policy fields such as climate mitigation. In order to contribute to the debate on the role of tipping points and symbolic innovation, the analysis of climate policies provides a very interesting case. Climate mitigation is a policy field that came into existence only in the last twenty years.[1] For this purpose, we argue, Hogwood and Peters' (1982, 1983) perspective on the dynamics of different types of policy innovations in the context of a newly emerging policy field adds valuable thoughts to the literature on policy change.

+++ Table 1 about here +++

As shown in Table 1, Hogwood and Peters (1982, 1983) describe policy change as policy dynamics between different types of policy innovations. The authors argue that innovations are rare. Instead, policy-making mostly deals with policy successions, which purposely adjust, transform, or replace existing policies. Hogwood and Peters (1982; 1983) predict a permanent need for policy adjustment, thus rendering successions the most likely next step once a policy field is established. Hogwood and Peters argue 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, p. 30, original italics).

Figure 1 illustrates this point. As shown in the left panel, Hogwood and Peters assume a cyclical development of 'the *relative* distribution of policy change' (Hogwood and Peters 1983, p. 30) that moves from innovations in objectives to innovations in instruments and towards policy successions. In this baseline, the adoption frequency of policy innovations in objectives and instruments is highest at critical junctures in the outset of a new policy field where policy instruments might be randomly or purposely adopted in new policy areas. Policy innovations then shape the succeeding trajectories significantly which results in a rising adoption frequency of policy successions. It does not preclude innovations in later periods but decreases their relative adoption frequency.

+++ Figure 1 about here +++

Hogwood and Peters (1982; 1983) see the left panel in Figure 2 as a standard development of policy innovation to describe policy change (Howlett and Rayner 2006). As predicted by path dependency theory or process sequencing, when a critical juncture occurs, a new policy field is politically addressed for the very first time but policy innovation is only temporarily dominant and can quickly be 'locked in' to an new equilibrium (van der Heijden 2013; Howlett 2009; John and Margetts 2003; Tosun 2013). Thus, the policies' innovativeness is a result of the new policy field, for example, climate mitigation. On the one hand, these innovations might only entail traditional instruments and an instrumental logic similar to other related and established policy fields such as environmental politics. In this scenario, the potential for the adoption of symbolic policy innovations is rather high and tipping points towards a new instrumental logic are not considered. On the other hand, ambitious, non-symbolic, and radically new innovations at the outset of the newly emerging policy field can lay a foundation stone for proceeding climate policy making. Here, a new 'lock-in' on an equilibrium with a different instrumental logic than those in established and related policy fields is reached.

However, following the model of cumulative incrementalism, there is an alternative scenario for newly emerging policy fields different to what Hogwood and Peters (1982, 1983) suggest (right panel of Figure 1). We argue for a scenario with a similarly typical development of a high frequency of policy innovations in objective and instruments at the outset of the policy field followed by rising frequencies of policy successions. In contrast to the first scenario, innovations remain dominant over a longer time period and might even cumulate towards a tipping point. In this scenario, the cumulative process of innovative incrementalism might lead to a new, radically different equilibrium in the instrumental logic independent from traditional policy fields and the outset of the newly emerging policy field.

In the following, we provide an exemplary comparative case study on how to analyze the role of tipping points and symbolic innovations in the two scenarios.

Operationalization, measurement, data

In our empirical analysis, we seek to illustrate dynamics towards tipping points and the role of symbolic innovations. 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.

The analysis is based on several data sources including the *Global Renewable Energy Policies and Measures,* the *Energy Efficiency,* and *Addressing Climate Change* databases of the International Energy Agency (IEA).[2] We also used information from the *Climate Policies and Measures in Europe* Database from the European Energy Agency as well as UNFCCC National Communications and other national documents such as governmental reports.

We restrict our analysis to the sector of domestic electricity and heat production as energy use is by far the largest source of greenhouse gas emissions (IPCC 2007). The transformation of the energy system of electricity and heat production takes center stage in countries' political efforts to mitigate climate change (e.g. Christoff and Eckersley 2011). Energy policy is the point of concretion for abstract emission reduction goals that countries pledge to fulfill (IPCC 2007).

Case Selection

This being an explanatory study, we selected Austria, Germany, and the UK as diverse cases based on the likely distribution of our concept of interest, the tipping points and symbolic innovations (for a discussion on case-selection of diverse cases see Rohlfing 2012). Tipping points result from an accumulation of innovations in types of policy instruments from the meso-level whereas symbolic policy innovation is measured on the lowest policy level of calibrations and settings. We used information from case study literature on environmental policy to determine similarities and differences in goals, objectives and types of instruments, and calibrations and settings. We use a systematic comparison of three cases in order to elaborate on one dependent variable while holding the other constant as shown in Table 2.

+++ Table 2 about here +++

We choose three European countries with similar but highly ambitious *goals* as reflected by the national emission targets (European Effort Sharing Decision, No. 406/2009/EC). For this cases, external pressures and domestic efforts to establish national portfolios for the mitigation of climate change are much higher than, for example, the US or Japan given the EU's ambition for environmental leadership (Wurzel and Connelly 2011).

On the level of objectives and types of instruments, case study literature on environmental policy describes Austria and Germany as similar but equally different extremes to the UK in terms of their policy styles. Austria and Germany follow a strong regulatory tradition of environmental policy making and mainly rely on regulatory and financial instruments combined with voluntary agreements (Liefferink et al. 2009; Wurzel, Brückner et al. 2003; Wurzel, Jordan et al. 2003). In contrast, the UK's policy style relies on financial instruments but since 1997 has shifted away from strong regulation towards other market based instruments such as tradable permits (Bailey 2007; Lees 2007; Jordan et al. 2003).

On the level of settings and calibrations and with regard to the question of symbolic policy innovation, Germany and the UK were chosen as widely recognized leaders in climate policy more likely providing ambitious policy innovations (Christoff and Eckersley 2011). In contrast, Austria tends towards symbolic policy innovations without 'real teeth' (Burck et al. 2008; Jänicke 2011).

Measuring policy output

Comparative analyses apply counting techniques of policy instruments in a respective policy portfolio (density approach) (e.g., Jahn and Kuitto 2011; Knill, Debus, et al. 2010). 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). Several scholars address this issue and combine counting techniques with weighting methods in order to account for differences in the resources, time, or political commitment manifested in the settings and calibrations of the instruments (intensity approach) (Holzinger et al. 2011; Knill, Schulze, et al. 2012; Liefferink et al. 2009; Schaffrin et al. in preparation). We take advantage of this development and apply a refined concept of policy output – the Climate Policy Activity Index – which has been tested and validated by a recent study (Schaffrin et al. in preparation).

Following Schaffrin et al. (in preparation), we evaluate specific instruments' settings and calibrations and code them accordingly (see Table 3). The guiding idea for deriving these six attributes is to evaluate whether the actual policy formulation considers aspects from all stages of the policy process from agenda-setting to implementation and monitoring. We do not consider the actual implementation or monitoring of the policy instruments but account for how political actors anticipate obstacles for successful implementation and monitoring by means of precautionary rules or institutions already established in the process of policy formulation and adoption.

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 (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 or percentage of electricity and heat production from renewable sources) 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 established, and the number of potential conflicting actors is low.

+++ Table 3 about here +++

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 Index is valid and reliable as comparisons with other existing measurement approaches based on expert ratings (e.g, Burck et al., 2008) show (see Schaffrin et al. in preparation).

These databases allow for distinguishing between nine types of policy instrument as described in Appendix 1, each revealing a distinct theorization of the relationship between the governing and the governed (Lascoumes and Le Gales 2007; Hood 2007; Bemelmans-Videc et al. 1998). We used this more detailed categorization in order to allow for a refined distinction between national instrumental logics.[3] We included all information that was available to account for different elements of policy types for policy instruments with multiple elements of policy types (e.g., feed-in tariffs for electricity from renewable energy sources combine regulatory instruments and incentives and subsidies).

Operationalization of policy innovation

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 the policy output for different types of instrument, 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. This allows us to analyze whether the climate policy portfolio is similar to the country's general environmental policy style or whether it constitutes a new instrumental logic.

Results

Dynamics of innovation

The paper proceeds with an analysis of the domestic development of climate policy portfolio in Austria, Germany, and the UK from 1998 to 2010. 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 about here +++

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.

Tipping points in the instrumental logic

The findings in Figure 2 give an impression of the dynamics of the national climate mitigation portfolios. In the next step, 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 3 about here +++

Figure 3 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.

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. In contrast to Germany and Austria, policy output in the UK 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.

The second and third panels of Figure 3 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 3. 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 (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.

Symbolic innovation

In the last 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 4). 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 et al. in preparation). We measure six policy settings (scope, target) and calibrations (integration, budget, implementation, and monitoring) (see Table 3).

+++ Figure 4 about here

Figure 4 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.

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.

Conclusion

Innovation studies on climate mitigation are challenged by the task to identify tipping points where policy innovations contribute to a new instrumental logic, and to determine whether policy innovations are merely symbolic without real potential to alter the status quo. The aim of this article was to contribute to this literature by providing an analytical and holistic example on how to consider (1) the policy portfolio, (2) different levels of policies, and (3) policy dynamics over time.

The results confirmed the general pattern proposed by Hogwood and Peters (1982, 1983) with innovations playing a dominant role at the outset of the field of climate mitigation. In Austria, innovations were soon replaced by successions whereas the German and the British policy portfolio remained highly innovative over a longer time period. With regard to tipping points, we observed that policy innovation expanded the portfolio by introducing new types of policy instruments but found no evidence of a radical change in the instrumental logic in either country. However, given that the policy field of climate mitigation is still in flux and rapidly developing, current developments observed in the data might still be the starting point for a more radical but cumulative change. We find some indication for this in Germany and the UK where the increasing number of climate policy innovations in the early phase cumulated in a larger policy package in both countries. As concerning the symbolic policy innovations, we found that the contribution of innovation to the portfolio was only marginal. In Germany, innovations played a crucial role expanding the policy portfolio and

contributing ambitious targets, scope, and implementation. The British innovations seemed to be more symbolic and experimental but contribute a larger scope and more resources to the policy portfolio.

The conclusions drawn from the results have to be interpreted in light of a number of limitations. 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 traditional policy fields. Using the Index of Climate Policy Activity restricts our analysis to national policy instruments and leaves sub-national efforts unobserved. Furthermore, the sector of electricity and heat supply is a rather positive example where climate mitigation is more ambitious. Symbolic innovation might be more frequent in, for example, the residential sector due to the difficulty to address more fragmented consumers.

However, we argue that this methodological example provides substantial insight on how to study tipping points and symbolic innovations considering different policy levels, the policy portfolio, and dynamics over time. Even though the Index of Climate Policy Activity is a valid and reliable measure of policy output, the findings are still descriptive and should be used as an inspiration for further research. The results suggest further analysis on whether political parties such as the pro-business conservative party ÖVP in Austria (2000 – 2007) predominantly adopt symbolic policy innovations to support the status quo interests (Wurzel, Brückner et al. 2003). Hence, the question is whether the early adoption strategy of the German portfolio can directly be linked with national politics such as the green party entering into government in 1998 or the German presidency of the EU council in 2005 (Jänicke 2011; Schreurs and Tiberghien 2007). Similarly, the question is whether the change in government in the UK - Third Way and New Labour – constituted the shift from a more experimental policy style (Bailey 2007; Jordan et al. 2003) towards an more encompassing policy package after 2007.

Building on the conceptual outline and measurement approach presented in this article, we encourage both researchers and practitioners to apply our approach to other climate-related policy fields, such as transport or residential heating and cooling.

With small modifications to the assessment of settings and calibrations, further analyses could investigate the full spectrum of countries' climate policy portfolios.

Notes

1 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).

2 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.

3 The distinction between financial instruments and incentives and subsidies may be counterintuitive at first sight. However, the logic behind them is different: the former primarily relates to tax-based instruments which is in the hand of public authorities whereas the latter refers to a banking-approach with instruments that follow a much stronger market logic such as grants, preferential loans and feed-in tariffs.

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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): EEA, http://www.eea.europa.eu/themes/climate/pam (October 27, 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 (Erneuerbare-Energien-Gesetz EEG) 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)

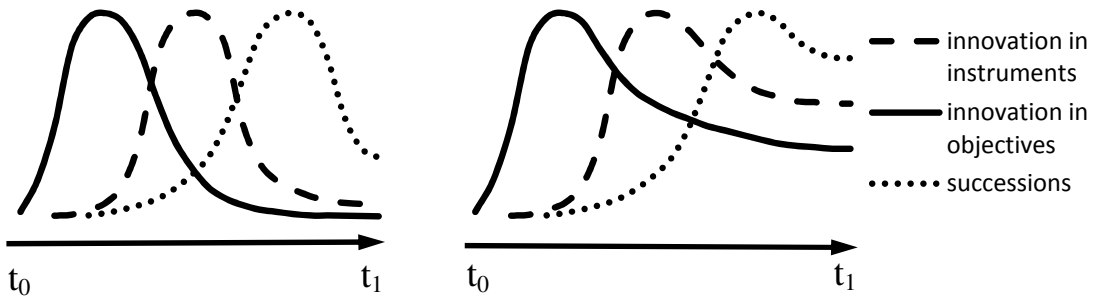
UK	
1998	Reduced VAT for Energy Savings Material / The Value Added Tax (Reduced Rate) Order 1998 (innovation in objectives)
1999	10% Renewable Energy Target - Green Certificates (innovation in objectives)
	Emissions Trading Agreement (innovation in instruments)
2000	Reduced VAT for Energy Savings Material (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)

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

Note: Based on Hogwood and Peters (1983) with the additional distinction between innovation in objectives and innovation in instruments.

Figure 1: Hypothetical policy adoption frequency by type of innovation in a newly emerging policy field over time



Note: y-axis = frequency of policy adoption, t = time.

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

Table 2: Comparative approach using a distribution-based diverse case study

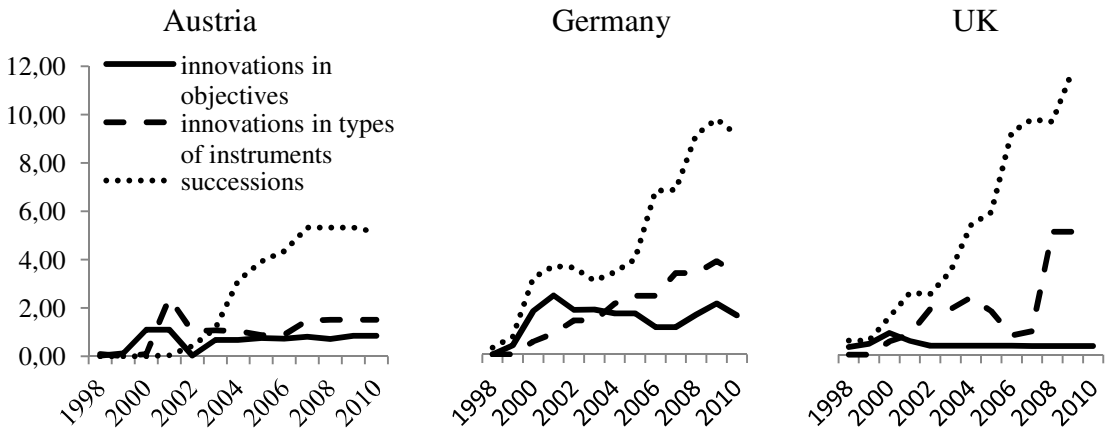
	Austria	Germany	UK
Goals	Similar	Similar	Similar
Objectives and Instruments	Similar	Similar	Different
Calibrations and Settings	Different	Similar	Similar

Table 3: 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% electricity and heat 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)

Source: Schaffrin et al., in preparation

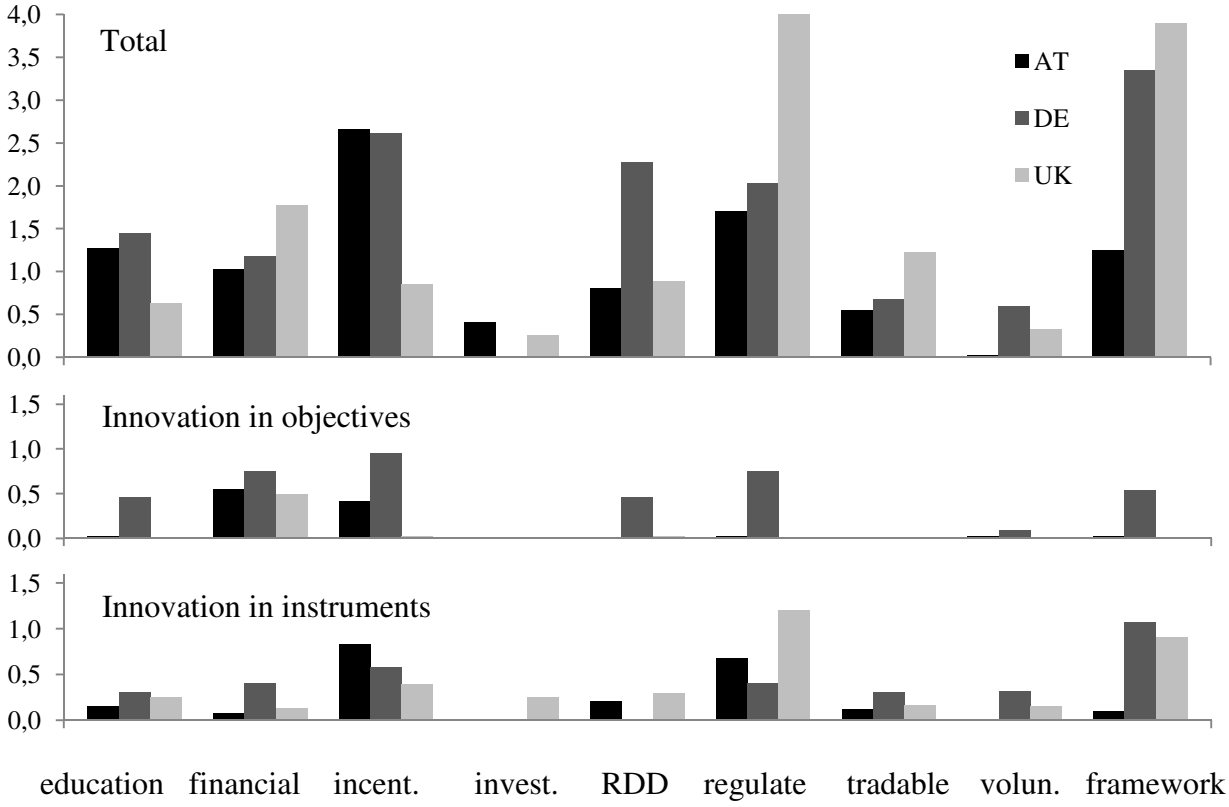
Figure 2 Index of Climate Policy Activity from 1998 to 2010



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

Source: IEA, UNFCCC Communications, own calculation.

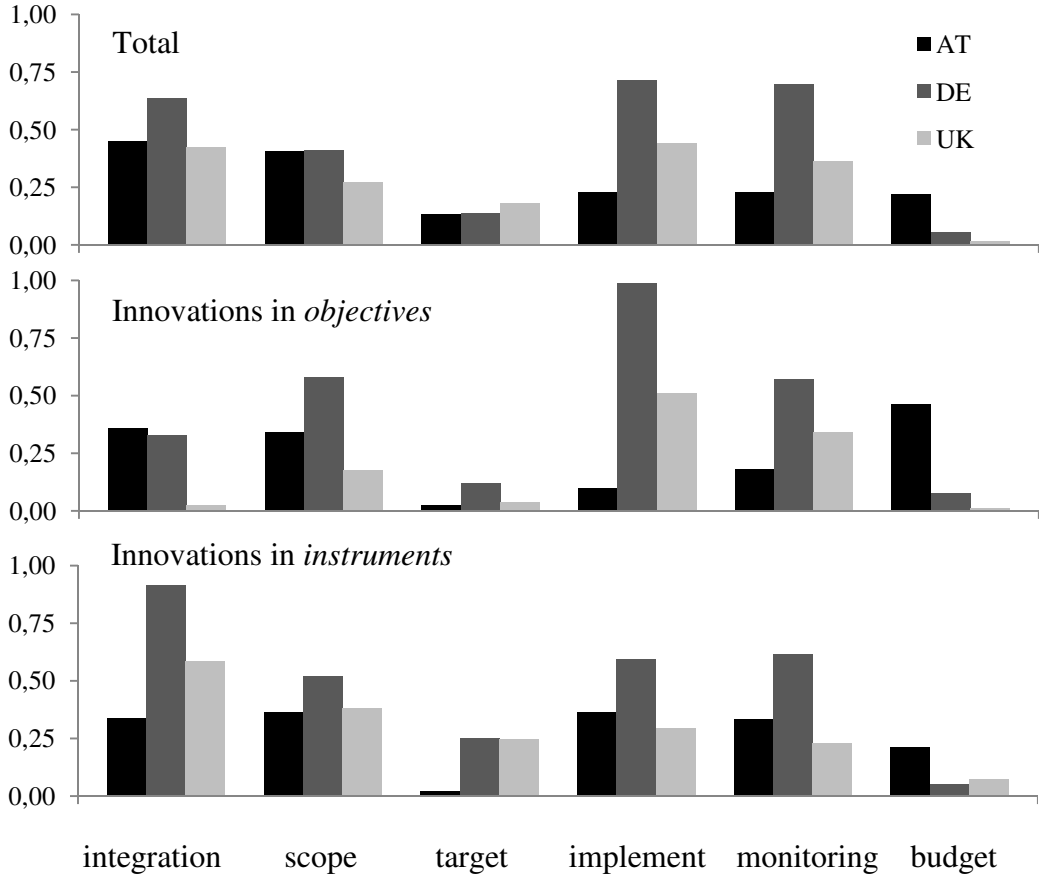
Figure 4: Average climate policy output per type of instrument by innovation-type



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.

Figure 4: Mean policy calibrations and settings per innovation type



Source: IEA, UNFCCC Communications, own calculation.

Say not the struggle nought availeth,
The labour and the wounds are vain,
The enemy faints not, nor faileth,
And as things have been they remain.

If hopes were dupes, fears may be liars;
It may be, in yon smoke concealed,
Your comrades chase e'en now the fliers,
And, but for you, possess the field.

For while the tired waves, vainly breaking
Seem here no painful inch to gain,
Far back through creeks and inlets making,
Comes, silent, flooding in, the main.

And not by eastern windows only,
When daylight comes, comes in the light,
In front the sun climbs slow, how slowly,
But westward, look, the land is bright.

Arthur Hugh Clough