

## **UC Santa Cruz**

### **UC Santa Cruz Electronic Theses and Dissertations**

#### **Title**

Stakeholder Engagement in State-level Climate Change Policymaking

#### **Permalink**

<https://escholarship.org/uc/item/1rs3t89b>

#### **Author**

Fiack, Duran Anthony

#### **Publication Date**

2017

Peer reviewed|Thesis/dissertation

UNIVERSITY OF CALIFORNIA

SANTA CRUZ

**STAKEHOLDER ENGAGEMENT IN  
STATE-LEVEL CLIMATE CHANGE POLICYMAKING**

A dissertation submitted in partial satisfaction  
of the requirements for the degree of

DOCTOR OF PHILOSOPHY

in

ENVIRONMENTAL STUDIES

by

**Duran Anthony Fiack**

June 2017

The Dissertation of Duran Anthony Fiack is approved:

---

Professor Sheldon Kamieniecki, Chair

---

Professor Brent Haddad

---

Professor Lisa Sloan

---

Tyrus Miller  
Vice Provost and Dean of Graduate Studies

Copyright © by  
Duran Anthony Fiack  
2017

## Contents

Introduction.....	1
1. Climate Change Politics and Policy.....	37
2. Theoretical Framework.....	121
3. Study Methods.....	199
4. State-level Climate Change Policy in the U.S. ....	237
5. Emissions, Energy, and Climate Change.....	317
6. State Rankings in Climate Change Performance & Policy Adoption.....	415
7. Climate Change Policymaking in Four American States .....	510
Conclusions, Implications, and Future Research .....	595

## Figures

1	Atmospheric CO <sub>2</sub> concentration 1958-2014.....	11
2	Average temperature anomalies, last 1,000 years.....	12
3	American beliefs about global warming, 1998-2016.....	18
4	Top policy priorities according to the general public, 2013-2016.....	19
1.1	Total greenhouse gas emissions by economic sector, 2015.....	39
1.2	Interest group spending on inside lobbying, 2003-2016.....	51
1.3	Total campaign contributions by interest groups, 1990-2016 .....	70
1.4	Interest group campaign contributions by political party, 1990-2016 .....	71
1.5	Election cycle interest group campaign contributions, 1990-2016.....	75
1.6	Partisan views on global warming .....	88
2.1	Framework for collaborative climate change policymaking at the state level.....	144
2.2	Updated framework for collaborative climate change policymaking at the state level.....	146
3.1	Case study selection criteria.....	210
3.2	The temporal setting of the climate change policymaking process .....	220
4.1	State emissions reduction target adoption timeline .....	247
4.2	State greenhouse gas emissions reporting adoption timeline .....	250
4.3	State vehicle emissions standards adoption timeline .....	254
4.4	State zero emissions vehicle mandates adoption timeline .....	256
4.5	Electric power sector emissions performance standards adoption timeline ..	260

4.6	State net metering program adoption timeline.....	267
4.7	Renewable and alternative energy portfolio standards adoption timeline .....	270
4.8	State renewable fuel standards adoption timeline.....	275
4.9	State energy efficiency resource standards adoption timeline .....	288
5.1	U.S. greenhouse gas emissions by greenhouse gas, 1990 to 2013 .....	324
5.2	U.S. energy consumption (quadrillion Btu) by source, 1776 to 2012 .....	334
5.3	Renewable energy consumption by source, 1960 to 2013.....	336
5.4	U.S. fossil fuel consumption, 1960 to 2013.....	351
6.1	Conceptual framework for the SLCCPI.....	437
6.2	Conceptual framework for the SLCCPAII .....	448
6.3	Dimensions and indicators of the SLCCPI .....	467
6.4	Dimensions and indicators of the SLCCPAII.....	467
6.5	SLCCPI rankings and scores .....	486
6.6	SLCCPAII rankings and scores .....	491
7.1	Potential framework for collaborative climate change policymaking .....	512

## Tables

1.1	Positions on climate change in party platforms, 1988-2016.....	66
1.2	Top 10 recipients of campaign contributions by interest: House of Representatives, 2004-2014 .....	79
1.3	Top 10 recipients of campaign contributions by interest: Senate, 2004-2014.....	80
1.4	Top 10 lobbying clients by industry, 2003-2016 .....	84
1.5	State-level climate change policy adoption .....	98
1.6	State climate change policies by policy area .....	99
1.7	Climate change policy adoption by state .....	100
2.1	State climate policies and emissions growth, 1990-2007 .....	135
2.2	State climate policies and emissions growth, 1990-2013 .....	139
2.3	State Climate policies and emissions growth for states with climate legislative commissions and executive branch advisory groups.....	141
2.4	Variations of collaborative management institutions .....	152
2.5	IRC hypotheses, factors that affect formation of collaborative policy processes .....	170
2.6	SCF hypotheses, factors that affect collaborative partnership outputs .....	173
2.7	ACF hypotheses, factors that affect negotiated agreements .....	177
3.1	State-level climate change policy case selection .....	202
3.2	Components of the Climate Change Performance Index.....	207

3.3	Causal process observations and policy outputs.....	221
3.4	Causal process observations and climate change policymaking processes .....	222
3.5	Causal process observations and context.....	224
3.6	Causal process observations and civic community.....	226
3.7	Causal process observations and legitimacy.....	227
3.8	Causal process observations and climate change policy outcomes .....	229
3.9	Types of hypothesis tests and causal inference.....	230
4.1	Residential, commercial, and state building code standards.....	280
4.2	State smart growth and vehicle miles travelled policy adoption timeline .....	285
4.3	State multistate initiative participation .....	291
4.4	State-level climate change policy adoption by policy .....	295
4.5	State-level climate change policy adoption by state .....	298
5.1	100-year global warming potential for a selection of greenhouse gases .....	322
5.2	U.S. greenhouse gas by gas, million metric tons CO <sub>2</sub> Eq. ....	326
5.3	Renewable energy consumption by source.....	342
5.4	Carbon intensity by fuel type.....	349
5.5	State-level CO <sub>2</sub> emissions by fuel type, 2013.....	358
5.6	Emissions by fuel type and sector, 2013.....	360
5.7	Energy consumption by primary energy source, 2013 .....	363
5.8	Consumption by primary energy source and sector, 2013.....	366



5.9	Fossil fuel consumption by fuel type, 2013 .....	368
5.10	Fossil fuel consumption by fuel type and sector, 2013.....	370
5.11	Renewable energy consumption by source, 2013.....	376
5.12	Renewable energy consumption by source and sector, 2013 .....	378
6.1	Components of the Climate Change Performance Index .....	421
6.2	Dimensions of the State-Level Climate Change Policy Action Index.....	442
6.3	State multistate initiative participation .....	445
6.4	Potential indicators of state-level climate change performance .....	450
6.5	State climate change policies included in the SLCCPAII .....	457
6.6	Scoring criteria for the indicators included in the SLCCPAII.....	464
6.7	SLCCPI value summary .....	471
6.8	SLCCPAII emissions policy indicator value summary .....	474
6.9	SLCCPAII energy efficiency policy indicator value summary .....	475
6.10	SLCCPAII renewable energy policy indicator value summary.....	476
6.11	SLCCPAII summary of multistate agreements.....	477
6.12	SLCCPAII climate change policy planning indicator value summary.....	478
6.13	Components of the SLCCPI .....	479
6.14	Components of the SLCCPAII .....	480
6.15	SLCCPI rankings and scores .....	482
6.16	SLCCPAII rankings and scores .....	484
7.1	States considered for case study analysis.....	514
7.2	Climate change policy adoption and implementation in the four cases.....	516

7.3	Environmental conditions .....	525
7.4	Civic Community and socioeconomic conditions .....	528
7.5	Variations of collaborative management institutions .....	532
7.6	Delaware, collaborative engagement processes.....	534
7.7	Oregon, collaborative engagement processes .....	536
7.8	Delaware and Oregon, collaborative partnerships .....	540

## Appendices

1	SLCCPI indicator correlation matrix .....	624
2	Results of the SLCCPI .....	625
3	Results of the SLCCPAII.....	626

## **Abstract**

### **Stakeholder Engagement in State-level Climate Change Policymaking**

Duran Anthony Fiack

As a “wicked” environmental problem of the twenty-first century, the issue of anthropogenic global climate change will require mitigation efforts to occur across a diverse set of stakeholder groups in order to be addressed effectively. In the wake of the prevailing complexities associated with contemporary environmental issues, such as climate change, stakeholder engagement via collaborative policymaking processes has emerged as a potentially effective management model. This research contributes to the emerging scholarly discussion surrounding the dimensions of climate change communication by conducting a stakeholder-focused analysis concerning climate change policymaking at the state level. The major goal of this study is to explore the role of collaborative policymaking processes in the context of climate change policy adoption and implementation in the American states. Understanding the role of collaborative policymaking processes via stakeholder engagement is critical to building our understanding of the ability for policymakers to implement strategies that reduce emissions. Developing an effective stakeholder framework can help us to understand the multifaceted stakeholder dynamics around climate change communication and can be a critical contribution to theory and, subsequently, to policymaking by helping decision makers become aware and knowledgeable about constraints and opportunities in addressing climate change within the subnational context.

The study begins with an examination of the political barriers and policy challenges that have, thus far, successfully prevented the passage of federal legislation to regulate greenhouse gas emissions. The analysis applies theories of the policymaking process to provide a framework for understanding the motives, strategies, and access points that fossil fuel business and conservative interests have utilized to block successfully the climate change issue from the government agenda, and concludes that a federal policy to regulate emissions will not be achieved in the short to medium term.

The second chapter introduces a theoretical framework, developed by Sabatier et al. (2005) to analyze stakeholder involvement in collaborative watershed management, which can potentially be useful for understanding the process of stakeholder engagement in the development of state-level climate change policy. The chapter builds upon the work of Sabatier et al. (2005) and outlines a conceptual framework for understanding the possible variables influencing collaborative climate change policymaking in American states. The chapter includes a discussion of the theoretical foundations that support the conceptual relationships included in the framework, and the development of hypotheses regarding the causal mechanisms that drive the overall collaborative policymaking process.

The study continues with a review of state-level trends related to climate change mitigation and policy adoption, followed by the development of two composite indicators, the State-Level Climate Change Performance Index (SLCCPI) and State-Level Climate Change Policy Adoption and Implementation Index

(SLCCPAII), that are used rank the fifty American states based upon their relative climate change performance. The results of the CI analyses provide a large-n, comparative analysis of state-level experiences with respect to climate change mitigation and policy action that can be used to illuminate the various facets of climate change performance within individual states, as well as the shared and divergent trends amongst the states.

The study concludes with a case study investigation of the climate change policymaking experiences in four American states. The four state-level case studies are selected based upon the results of the SLCCPI and SLCCPAII using criteria developed from the hypothesized relationships between collaborative policymaking processes and climate change mitigation and policy outcomes. The analysis relies upon process tracing techniques to test hypotheses on how climate change policymaking has taken place, whether and how the process generates policy outcomes, and the role of stakeholder engagement in producing policy outcomes. The results of the case study analysis show that the proposed conceptual framework, and the associated theoretical perspectives, for collaborative climate change policy offer an informative approach for analyzing how climate change mitigation efforts transpire in the American states.

Dedicated to my mom, Linda.

## **Acknowledgements**

Many individuals have contributed to the completion of this work. I am most grateful to Sheldon Kamieniecki and Brent Haddad, both of whom relentlessly provided kind and supportive mentorship while guiding me through this process; and have had a profound impact on my academic, professional, and personal development. I am also grateful Lisa Sloan and Barry Rabe for providing valuable comments and intellectual support throughout the completion of this work.

I would also like to thank Greg Gilbert, Ingrid Parker, and Doris Ash, of the University of California, Santa Cruz (UCSC); Aaron Mamula and Cameron Speir, of the National Oceanic and Atmospheric Administration (NOAA), Southwest Fisheries Science Center; and Marc Mangel, of UCSC and the Center for Stock Assessment Research (CSTAR), for supporting the completion of this work by contributing their time and knowledge to support my academic development.

I am also deeply indebted to my parents, Linda and Jim Fiack, and friends, Raymond Adams, Max Myers, Woody Bell, Laura Clinton, and the Inner Circle MC, for walking me through this journey and providing invaluable spiritual, mental, and personal support.

Lastly, I would like to thank the University of California, Cota-Robles Fellowship Program, the NSF-Santa Cruz-Watsonville Inquiry-Based Learning in Environmental Sciences Program, the NOAA Southwest Fisheries Science Center, CSTAR, and the UCSC Department of Environmental Studies, for providing the funding and academic support that has made this research possible.



## **Introduction**

Global climate change is the greatest environmental challenge of the 21<sup>st</sup> century. The consequences of increasing average global temperatures have important implications for the Earth's ecosystems and society. Despite a sharp increase in the scientific consensus regarding the occurrence of global climate change, and the significant role that human influences have contributed to its causes, the federal government has yet to enact comprehensive legislation to reduce greenhouse gas (GHG) emissions effectively. The absence of federal action to address the climate change issue by the Congress led the executive branch, under the administration of President Barak Obama, to initiate substantial and unprecedented efforts to reduce U.S. GHG emissions. Most notably, President Obama, in coordination with the U.S. Environmental Protection Agency (U.S. EPA), established a plan to reduce greenhouse gas (GHG) emissions from the nation's electric power sector and joined the most significant international climate change agreement to date, the Paris Agreement (see Chapter 1). The federal-level efforts established under the Obama administration to address the climate change issue, however, have proven to be short-lived. The inauguration of President Donald J. Trump, in 2017, combined with the reestablishment of a Republican majority in both chambers of the Congress immobilized, and reversed, the national climate change policy agenda that had been established under the previous administration. Within six months of taking office, President Trump, led a concerted effort to repeal the executive-level regulations related to climate change mitigation, and withdrew the U.S. from international efforts

to address anthropogenic climate change. The opposing policy agendas of President Obama and President Trump, with respect to climate change mitigation, is exemplary of the party politics that have persistently plagued climate change policy discussions in the U.S., and have stymied federal-level policy action to reduce GHG emissions (see Chapter 1).

The issue of global climate change poses a complex challenge for policymakers at all levels of governance, the causes and environmental consequences of which are characteristic of contemporary environmental issues of the third environmental epoch as described by Mazmanian and Kraft (2009). In comparison to the first and second epochs, in the third epoch such issues are characterized by a much greater combination of scientific and technical complexity, long-term timescales, involve large numbers of stakeholders with varying interests, and trans-jurisdictional and transnational impacts. The active role of fossil fuel and conservative interests in blocking the climate change issue from the political agenda, and the continuing political polarization of the Congress, has generated legislative gridlock on the regulation of GHG emissions. Achieving a legislative federal policy to address and stabilize GHG emissions to avoid the most severe consequences of climate change is unlikely to occur by the end of the 21<sup>st</sup> century.

In the absence of federal legislation to address anthropogenic climate change, as well as recent actions taken by the Trump administration to roll back nearly every federal effort to control GHG emissions, many states have taken action to reduce GHG emissions (Posner 2010; Rabe 2004, 2008). Exactly why some states have

developed climate change programs and others have is not clear and deserves in-depth research and analysis. Among other things, the nature of interactions between diverse stakeholders and the contexts in which they occur requires close examination.

This study contributes to the emerging scholarly discussion around the dimensions of climate change communication and policymaking by conducting a stakeholder-focused analysis concerning climate change at the state level. While the climate change problem presents a unique, intricate array of challenges for stakeholder engagement, such engagement is essential in order to bring together a variety of important policy interests to craft innovative solutions to serious environmental problems (Heikkila and Gerlak 2005; Sabatier et al. 2005). Generally speaking, too little research has been done specifically on collaborative climate change policymaking at the subnational level, and this study adds to this literature (Bernauer 2013). Much of the current research examines “issue framing” around climate change (Aklin and Urpelainen 2013; Guber and Bosso 2012; Kamieniecki 2006; Kraft and Kamieniecki 2007; Nisbet 2009). This study moves this scholarship forward by specifically linking the emergent role of social science analysis to an examination of critical stakeholder groups who are engaged, or not engaged, in the discourse around climate change.

This investigation draws upon a theoretical framework developed by Sabatier et al. (2005) to analyze stakeholder involvement in collaborative watershed management, and applies the framework to climate change policymaking in American states. A major goal of the study is to present and evaluate a possible

conceptual framework for analyzing the nature and extent of interactions between the major players involved in climate change mitigation at the state level. Developing an effective stakeholder framework can help us to understand the multifaceted stakeholder dynamics around climate change communication and can be a critical contribution to theory and, subsequently, to policymaking by helping decision makers become aware and knowledgeable about constraints and opportunities in addressing climate change within the subnational context.

While science has played a role in most environmental and natural resource policy debates, the progression of environmental politics and the transition of environmental issues from “point source” to “nonpoint source” problems has placed science at the forefront of environmental policymaking processes in the third environmental epoch (Mazmanian and Kraft 2009). Undeniably, science has become a dominant factor in the battle over the control of GHG emissions.

This chapter sets the stage for understanding the evolution of policy efforts, past and present, to address environmental problems in the U.S. and the emergent role of science in the climate change policymaking process. Following a brief history of federal environmental politics and policy, an overview of the history of the scientific understanding of global climate change and the emergent role of science in the climate change policymaking process is provided. The chapter concludes by tracing the general public’s understanding of anthropogenic global climate change and the significance that American’s place on addressing the climate change issue.

## **Congress and Environmental Policy During the Environmental Decade**

Early environmental policy in the U.S. was characterized by a centralized top-down approach (Mazmanian and Kraft 2009). Landmark federal legislation established beginning in the 1970s and in the two decades that followed was designed to control and remediate the impacts of industrial pollution that posed a risk to public health and resulted in environmental degradation. During the “environmental decade” of the 1970s the U.S. Congress commanded a central role in addressing the nation’s environmental issues. The environment had become a priority on the social and political agenda following the first Earth Day on April 22, 1970. New visibility of declining environmental conditions accompanied by direct exposure to the consequences of industrialization heightened public concern over environmental threats, and an increasingly affluent and educated American society began to place a high level of importance on quality of life that held a healthy environment in high regard (Andrews 2006; Kraft 2014). During this period, federal policymakers from both sides of the aisle saw politically attractive opportunities to enact new legislation to tackle existing environmental challenges related to water, air and hazardous waste pollution.

Beginning with the National Environmental Policy Act of 1969, the U.S. Congress enacted seven unprecedented and far-reaching legislative acts to improve environmental conditions and establish a national standard of environmental quality.<sup>1</sup>

---

<sup>1</sup> Clean Air Act of 1970, Federal Water Pollution Control Act Amendments of 1972, Safe Drinking Water Act of 1974, Resources Conservation and Recovery Act of 1976, Toxic Substances Control Act of 1976, Comprehensive Environmental Response, Compensation, and Liability Act of 1980.

These programs were administered at the federal level by the U.S. EPA, which was established in 1970 by President Nixon, and served as the primary bureaucratic body responsible for administering federal environmental law. For the most part, the bills transcended partisan lines and represented an era in which the Congress left a positive influence on environmental protection.

The legislative history of the Water Pollution Control Act Amendments (Clean Water Act) of 1972 provides an exceptional example of the era's high-level of bipartisan agreement to address environmental degradation. Following the bill's passage, President Nixon vetoed the law citing the financial costs and economic impacts on the nation's taxpayers. Upon the bill's "return without approval," veto override debates ensued within the Congress and the required two-thirds vote by both Chambers was quickly achieved.<sup>2</sup> Included in the Senate voting in favor of the veto override were 34 Democrats, 17 Republicans and 1 Conservative; in the House, 150 Democrats and 97 Republicans voted in favor of the override. The major environmental policy acts of the 1970s illustrate a unique time in federal environmental policymaking history during which members of Congress were willing to cooperate across party lines, despite ideological differences and economic interests, to address the nation's environmental challenges. Particularly telling is the willingness of Republican members of Congress to oppose a Republican President in order to override a presidential veto. Clearly, Republicans of this era felt that water

---

<sup>2</sup> The Senate and House voted 52-12 and 247-23, respectively, to override the President's veto. 31 Senators did not vote.

quality issues were serious and that something had to be done to reduce water pollution throughout the U.S. as soon as possible.

In addition to the broad liberal social movement and increasing affluence of American society during the mid-twentieth century the occurrence of dramatic focusing events pushed environmental quality issues to the top of the political agenda. A massive oil spill off the coast of Santa Barbara (1969), the combustion of the Cuyahoga river in Ohio (1969), and the Love Canal disaster (1978) were all extreme events that captured the attention of the public through extensive media coverage. In turn, this generated public concern leading to political support for the passage of the National Environmental Policy Act of 1969, the Clean Air Act of 1970, the Clean Water Act of 1972 and the Comprehensive Environmental Response, Compensation, and Liability Act of 1980.

The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 followed by the Clean Air Act Amendments of 1990 largely represent the end of federal action to address issues of environmental quality. The decline in federal environmental legislation began in 1981 when the Reagan Administration took control of the White House and executive agencies. The Reagan presidency's record on environmental policy was characterized by an aggressive campaign to reduce the U.S. EPA's capacity to implement effectively the environmental legislation of the previous decade. President Reagan appointed James Watt and Anne Gorsuch to head the Department of the Interior and the U.S. EPA, respectively, and they implemented dramatic cuts to federal funds earmarked for environmental

protection (Vig 2006, 2012). In addition to the war on existing environmental institutions being waged by the Reagan administration, for the first time in twenty-five years Republicans took control of the Senate in 1981, where the party remained in power for the next six years. The economic costs of policy implementation and executive agency expansion became apparent to business and industry interests and opposition to further regulation was supported by conservative policymakers.

The history of environmental policy making in the U.S. provides ample evidence that federal lawmakers are capable of reaching agreement on solutions to address environmental problems, however, in the last two and a half decades there has been an absence of significant environmental policy action from the federal legislative branch (Kraft 2012). National and international environmental issues have grown more pervasive and complex and the costs of mitigation, more diffuse, contributing to the legislative gridlock on Capitol Hill. The absence of federal legislation to address the issue of anthropogenic climate change and reduce GHG emissions can largely be attributed to the scientific complexity of the issue, the role of powerful and organized interest groups, and the increasing polarization of the Democratic and Republican members of the Congress.

### **Climate Change Science and Policymaking**

The role of scientists in providing technical information to advise environmental policy decisions has become increasingly critical to addressing environmental issues in the third environmental epoch (Mazmanian and Kraft 2009). Haas (1992) discusses how policy actors can learn new patterns of reasoning and



pursue new policy interests, and his concept of “epistemic community” lies at the heart of the climate change science and policy debate.<sup>3</sup> In his view, "epistemic communities" play a crucial role in "articulating the cause-and-effect relationships of complex problems, helping states identify their interests, framing the issues for collective debate, proposing specific policies, and identifying salient points for negotiation" (1992, 2). The climate change issue has been communicated by an epistemic community of scientists who study the physical processes that contribute to patterns of the Earth’s climate. Under Haas’ rational approach to policymaking, the findings of scientific experts would inform the regulatory process and produce new rules that improve environmental quality by reducing GHG emissions.

Climate scientists and scientific institutions were the primary drivers of early policy change efforts to address global climate change. Beginning with Joseph Fourier’s discovery of the heat trapping characteristics of GHGs in the 1820s, the scientific community has been laying the foundation for understanding anthropogenic climate change for nearly two centuries (Fourier 1827). The physical understanding of the role played by carbon dioxide (CO<sub>2</sub>) in the Earth’s energy balance has been of interest to scientists since the Industrial Revolution, when Swedish scientist Svante Arrhenius first proposed a link between atmospheric CO<sub>2</sub> levels and temperature (Arrhenius 1896).<sup>4</sup> At that time, humans had begun to burn fossil fuels such as coal, oil, and natural gas on a wide scale to produce energy (NRC 2010a). However,

---

<sup>3</sup> An epistemic community is a network of professionals with recognized expertise and competence in a given field and an authoritative claim to policy-relevant knowledge and information with that field or issue area. These experts share a set of normative and principled beliefs, causal beliefs, notions of validity, and a common policy enterprise.

<sup>4</sup> Arrhenius’ research showed that the doubling of CO<sub>2</sub> would raise global temperatures by 5-6<sup>0</sup> C.

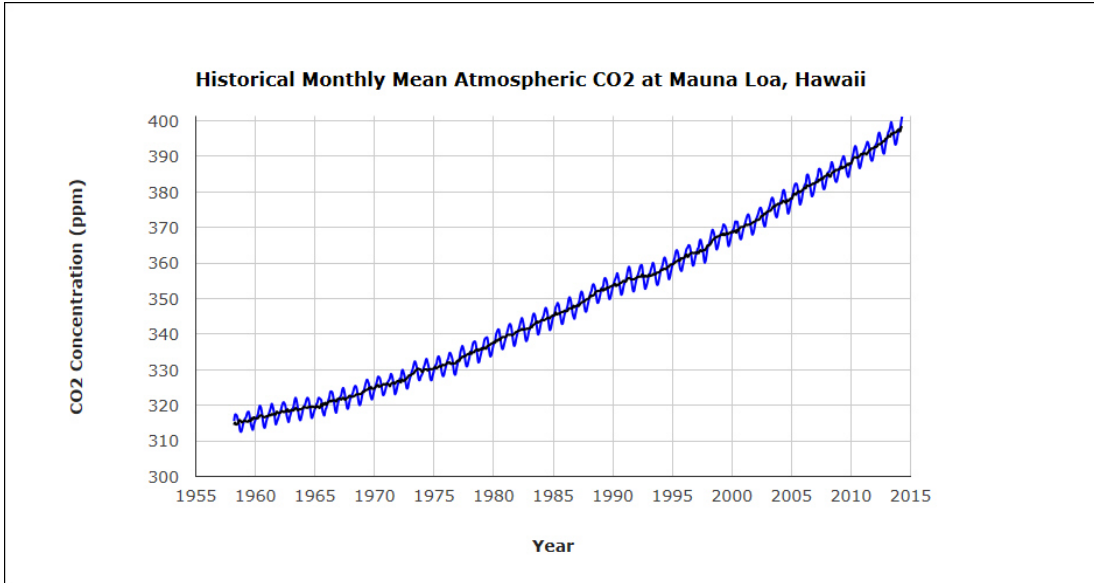
concern within the scientific community regarding the effect of increasing GHG emissions on global climate was largely placated by the belief that the world's oceans would absorb excess atmospheric CO<sub>2</sub> produced by human activities.

In 1957, research conducted by Revelle and Suess (1957) found that the oceans absorb excess atmospheric CO<sub>2</sub> at a much slower rate than had been previously thought, debunking the belief that the world's oceans would mitigate the consequences of growing GHG concentrations in the atmosphere. The following year Charles Keeling began to collect long-term measurements of atmospheric CO<sub>2</sub> levels at the Mauna Loa observatory in Hawaii. Keeling's work illustrated the trends of increasing atmospheric CO<sub>2</sub> levels, and his results became known as the Keeling curve (see Figure 1).

Yet it was not until the late 1980s when NASA scientist James Hansen testified before the U.S. Senate and stated that global climate change was already underway that the environmental issue of anthropogenic climate change received widespread public and political attention (McCright and Dunlap 2000; Shabecoff 1988). Following Hansen's testimony in 1988, the World Meteorological Association and the United Nations Environment Program created the Intergovernmental Panel on Climate Change (IPCC). The IPCC was established to "prepare, based on available scientific information, assessments on all aspects of climate change and its impacts, with a view of formulating realistic response strategies." The IPCC has been the most publicly visible scientific organization with respect to climate change, playing a critical role in establishing the scientific basis for understanding the causes of

anthropogenic climate change and developing projections of future environmental consequences (IPCC 2013).

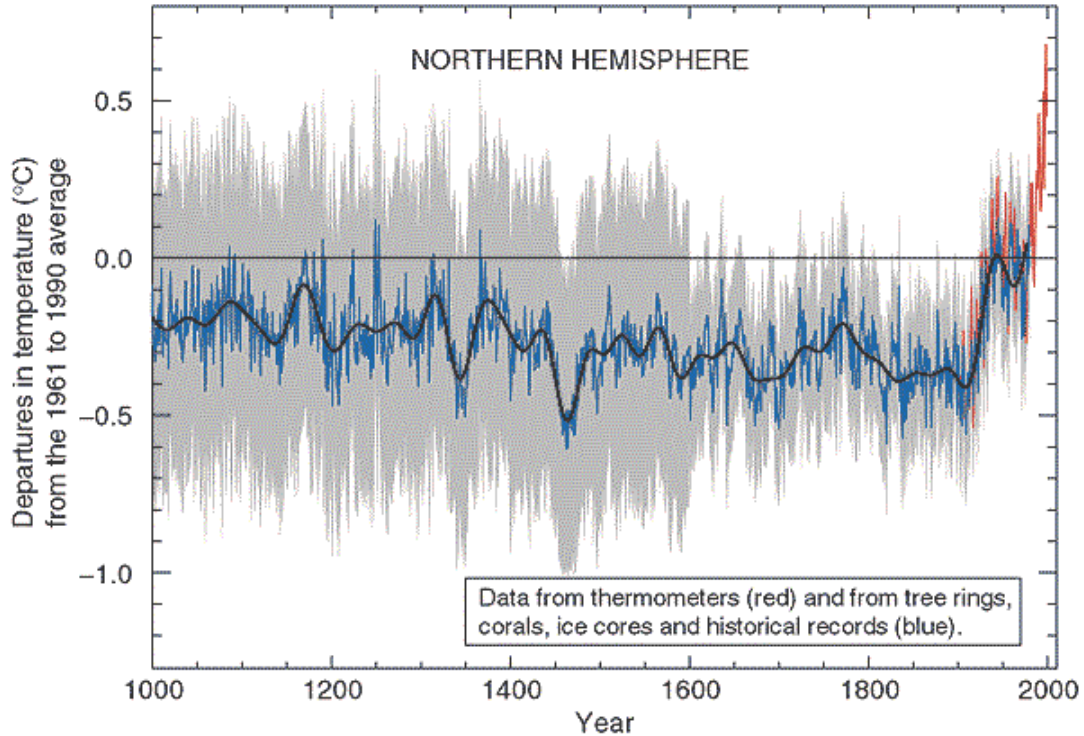
**Figure 1.** Atmospheric CO<sub>2</sub> concentration 1958-2014.



Source: NOAA Earth Systems Research Laboratory 2014.

Throughout the 1990s and into the new century the scientific community's understanding of climate change continued to improve. The IPCC had released two reports, the second of which echoed the testimony of Hansen, making the claim that anthropogenic climate change was occurring and that human activity was the primary cause (Santer et al. 1995). Independent scientists had produced compelling research that supported the IPCC's findings and made a strong case for the occurrence of anthropogenic climate change. In 1998, Mann, Bradley and Hughes (1998) published a detailed analysis of global average temperature over the last millennium. The study produced a compelling figure, which became known in the media as the "hockey stick graph," that illustrated the rapid increase in global average temperatures following the Industrial Revolution (see Figure 2).

**Figure 2.** Average temperature anomalies, last 1,000 years.



Source: Mann, Bradley and Hughes 1998.

The findings of the IPCC and other peer-reviewed scientific studies, particularly over the last twenty-five years, provide a telling story of the effect that human activities have had on atmospheric GHG concentrations. In situ measurements of CO<sub>2</sub> over the past several decades, ice core measurements, and detailed estimates of CO<sub>2</sub> sources and sinks have found that CO<sub>2</sub> levels consistently varied between 265 and 280 parts per million (ppm) for thousands of years before increasing sharply following the Industrial Revolution (NRC 2010a).<sup>5,6</sup> In 2013, CO<sub>2</sub> levels reached 400

<sup>5</sup> One part per million denotes one part per 1,000,000 parts.

<sup>6</sup> Since the middle of the 20<sup>th</sup> century, atmospheric CO<sub>2</sub> levels have risen by more than 25 percent, increasing at an average annual rate of more than 2.0 ppm per year over the last 10 years. The rate of

ppm, the highest they have been in more than one million years. Measurements of the isotopic abundances of CO<sub>2</sub> molecules in the atmosphere indicate that most of this excess atmospheric CO<sub>2</sub> is “fossil” carbon, originating from sources that are millions of years old, the only source of which are the combustion of coal, oil, and natural gas (Keeling et al. 2005). Furthermore, recent estimates of CO<sub>2</sub> uptake suggest that the rate at which CO<sub>2</sub> is removed from the atmosphere by ocean and land sinks may be waning (Canadell et al. 2007; Khatiwala, Primeau and Hall 2009; Le Quéré et al. 2013). If a decline in the rate of CO<sub>2</sub> uptake from carbon sinks continues, atmospheric CO<sub>2</sub> concentrations would rise more rapidly, even if global CO<sub>2</sub> emissions were stabilized.

The environmental consequences of anthropogenic alterations to the natural greenhouse effect have also become more apparent. Since 1895, the average temperature across the U.S. has increased by about 0.8° Celsius (C), most of which has taken place in the last 50 years, with the last ten years (2004-2014) being the warmest on record. It is widely accepted by the scientific community that in order to avoid the most severe and irreversible impacts of climate change the change in global average temperatures will have to remain below 2° C relative to pre-industrial levels (IPCC 2013). An increase in the average global temperature of 2° C would have significant negative impacts on human health and ecosystems, posing great challenges for environmental protection and society.

---

increase is twice as fast as it was during the first decade, of the record, and adds approximately 15.0 gigatons of CO<sub>2</sub> to the atmosphere each year (Blasing 2014; IPCC 2013; NRC 2010b; Tans 2014).

According to the IPCC's Fifth Assessment Report, it is likely that temperature change from anthropogenic GHG emissions can be kept below the 2° C threshold by stabilizing atmospheric CO<sub>2</sub> concentrations to less than 450 ppm by no later than 2100.<sup>7</sup> In order to remain below the 450 ppm threshold, global GHG emissions will have to be reduced 40 to 70 percent below 2010 levels by 2050, and 78 to 118 percent below 2010 levels by 2100 (IPCC 2013). Accounting for existing mitigation efforts, GHG emissions are predicted to continue increasing with global populations and economic development. Such baseline scenarios indicate that without additional mitigation efforts, average global temperatures in the Earth's lower atmosphere will increase to between 3.7° C and 4.8° C (atmospheric CO<sub>2</sub> concentrations of 750 to 1,300 ppm) relative to pre-industrial levels by 2100 (IPCC 2013). While such increases seem modest on the surface, they can have a major impact on climate change and the Earth's environment for many years to come.

The results of recent climate science research and the predicted consequences of global climate change have received broad support from the community of climate science experts. Nearly all climate scientists worldwide agree that global climate change is occurring. In the U.S. 94 percent of climate scientists agree that climate change is currently taking place, 88 percent agree that human activities have accelerated increases in global mean temperatures and 91 percent agreed that the uncertainty of future climate change projections do not justify the postponement of mitigation and adaption policy (Anderegg 2010; Bray 2010; Cook et al. 2013; Doran

---

<sup>7</sup> The likelihood of staying below the temperature change threshold decreases to about a 50 percent chance when atmospheric concentrations reach roughly 530 ppm.

and Zimmerman 2009; Rosenberg 2010). Given the overwhelming consensus amongst experts regarding the issue of climate change and the significant challenges that the issue poses for society, the rational approach to the integration of scientific information proposed by Haas would lead to dramatic policy change. Yet, thus far, such change has not occurred at the federal level, and the current Trump administration does not support any new policies to reduce GHG emissions.

### **Climate Change Science in Policymaking**

While science has played a role in most environmental and natural resource policy debates, it has become a dominant factor in the battle over the regulation of GHG emissions. In general, the public tends to invest a great deal of faith in the scientific community and often the default assumption is that a high degree of consensus exists within an epistemic community regarding a particular issue (Aklin and Urpelainen 2014; Ding et al. 2011; Gauchat, 2011, 2012; Lang and Hallman 2005; Leiserowitz et al. 2013; Lewandowsky, Gignac and Vaughan 2013). Under such conditions it seems that the accumulation of public support would produce widespread calls for the regulation of GHG emissions, and addressing climate change would be politically feasible. This rational process of environmental policymaking, in which concrete and objective scientific knowledge leads to policy change, was described by Benedick (1991) in his account of the Montreal Protocol agreement and the model of epistemic communities proposed by Haas (1992). However, according to Lipton's account of the Montreal Protocol, knowledge is often "deeply implicated in questions of framing and interpretation" and facts and ideas are often "framed in light

of specific interests and preexisting discourse,” reinterpreted and manipulated in the policymaking process (Lifitin 1994, 6; also, see Hoffman 2011; Ingold and Gschwend 2014; Pielke 2007; Sarewitz 2004).

Despite the overwhelming scientific consensus regarding the effect that increased levels of GHGs will have on our global climate and the impacts that a changing climate will have on the environment and consequently society, addressing global climate change has maintained low saliency among the general public (Nisbet and Myers 2007). As of 2016, only 27 percent of Americans believed that scientists generally agree that global warming is occurring and is caused by human activity (Pew Research Center 2016). Although recent polls suggest that more than one-half (59 percent) of Americans believe that the effects of global warming have already begun, nearly one-third (31 percent) believe that climate change is not currently happening but will at some point in the future, and one-tenth (10 percent) of the population believes that global climate change will never happen (Saad and Jones 2016). The percentage of Americans who believe that climate change is happening is about the same as it was in 2008, when belief in the occurrence of climate change peaked at 61 percent before declining to a low of 49 percent in 2011 (see Figure 3). As of 2016, addressing climate change ranked 16<sup>th</sup> on a list of 18 top policy priority topics among the general public. Only 38 percent of survey participants claimed addressing GHG emissions to be a top priority for the president and Congress to address (see Figure 4). Although the issue has consistently ranked low on the public’s policy agenda, the proportion of the general public that places addressing global



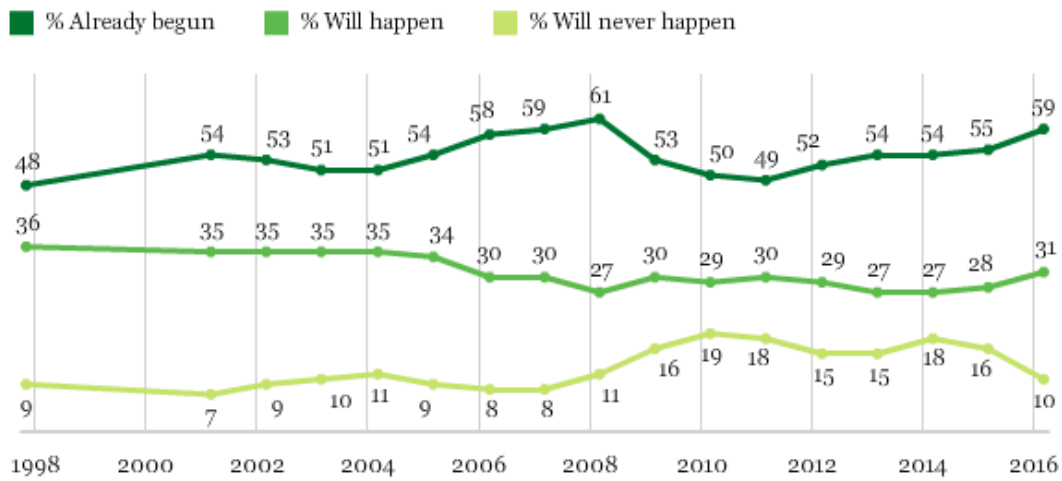
climate change as a top priority has increased by 10 percent since 2013, a reversal of a five-year decline since the issue initially peaked at 35 percent in 2008 (see Figure 4).

A number of factors are likely to be important contributors to the public's perception of the occurrence of global climate change and apparent contradictions in the positions citizens are taking on the issue. Among the most influential of these are the efforts of producers and consumers of fossil fuels, conservative interests, policymakers, and some media outlets to call into question the conclusions of climate science, which is complex and may be difficult for the general public to understand (Anderegg et al. 2014; Boykoff 2008, 2009, 2013; Dunlap and McCright 2008; Hmielowski 2014; Malka, Krosnick and Langer 2009; McCright and Dunlap 2011a, 2011b; McCright, Dunlap and Xiao 2014; Weber 2011). The low priority that Americans place on addressing the climate change issue is understandable for those who do not believe that climate change is happening. For those who believe that climate change is happening or will occur in their lifetime, addressing the issue on Capitol Hill may be a low priority where individuals believe that the impacts of climate change do not present an immediate threat to their way of life.

Understandably, many Americans are often more concerned with policy issues related to a healthy economy and national security, which are likely to hold a greater sense of urgency and personal impacts than those related to a changing climate. Additionally, the perception that the impacts of climate change do not present an immediate threat is likely to reduce American's willingness to accept the potential costs (e.g., an

increase in energy or fuel prices) of addressing the issue. Lastly, there is the belief that other nations must be held accountable to reduce GHG emissions. In the absence of a broad international effort to address anthropogenic global climate change, some Americans may be less likely to support a national effort given the potential consequences for national economic competitiveness on the global market.

**Figure 3.** U.S. views about climate change, 1998-2016.



Source: Saad and Jones 2016.

**Figure 4.** Top policy priorities according to the general public, 2013-2016.

	<b>Jan 2013</b>	<b>Jan 2014</b>	<b>Jan 2015</b>	<b>Jan 2016</b>	<b>'13-'16 change</b>
	%	%	%	%	
Strengthening the nation's economy	86	80	75	75	-11
Defending country from terrorism	71	73	76	75	+4
Improving the educational system	70	69	67	66	-4
Improving the job situation	79	74	67	64	-15
Making Social Security system sound	70	66	66	62	-8
Reducing health care costs	63	59	64	61	-2
Making Medicare system sound	65	61	61	58	-7
Reducing crime	55	55	57	58	+3
Reducing the budget deficit	72	63	64	56	-16
Dealing with problems of poor & needy	57	49	55	54	-3
Dealing with issue of immigration*	-	40	52	51	+11
Strengthening the U.S. military	41	43	52	49	+8
Protecting the environment	52	49	51	47	-5
Reforming the nation's tax system	52	55	48	45	-7
Reforming the criminal justice system	-	-	-	44	n/a
Dealing with global climate change	28	29	34	38	+10
Dealing with gun policy	-	-	-	37	n/a
Dealing with global trade issues	31	28	30	31	0

Source: Pew Research Center 2016.

A review of recent patterns in extreme weather events provides ample evidence of the probable consequences of a changing climate. Indeed, while extreme weather events are dependent upon multiple factors, and human-induced climate change is certainly one of them, the number of such events has been increasing overtime, and present real costs to the nation (Herring et al. 2014; Smith and Katz 2013; USGCRP 2014). In 2011, the U.S. experienced an unprecedented 14 extreme weather and climate events with costs exceeding \$1 billion in direct damages and total costs exceeding \$60 billion and the loss of 764 lives. This unprecedented year was followed by 11 such events in 2012, the second highest in more than 30 years,

with costs exceeding \$100 billion and 377 human lives.<sup>8</sup> The economic damages of 2012 are second only to the events of 2005 primarily from the damages caused by Hurricane Katrina (NCDC 2013). While many studies, particularly those from conservative organizations, have highlighted the potentially significant cost of taking action to reduce GHG emissions (for example, Dayaratna and Kreutzer 2014; Dayaratna, Loris and Kreutzer 2014) it is important to consider the costs of inaction, as the climate continues to change and extreme events such as hurricanes, tornadoes and droughts become more frequent and in some cases more severe, it is likely that the long-term costs to society will outweigh the costs of action (Bouwer 2011, 2013; CEC 2014; Gall et al. 2011; Nordhaus 2013; Tol 2014).

While some have found a positive association between abnormally warm and cool temperatures and vulnerability to climate change impacts and concern for climate change (Akerlof et al. 2013; Brooks et al. 2014; Donner and McDaniels 2013; Krosnick et al. 2006; Milfont et al. 2014; Myers et al. 2013; Zahran et al. 2006, 2008), perhaps the causal relationship between human-induced climate change and extreme events may be less clear to the general public. The complexity of the issue and the uncertainties of the risks it poses create challenges for laypersons to understand the causes of climate change, the impacts it may have, and the actions that can help alleviate the problem (Gifford 2011; Gifford, Kormos, and McIntyre 2011; Norgaard 2004, 2010; Pidgeon and Fischhoff 2011; Weber 2010). Some of the most severe impacts of global climate change, such as sea level rise and ecosystem

---

<sup>8</sup> Based on the 2013 Consumer Price Index, see Smith et al. 2014 for details.

alteration, will occur as gradual changes that are not expected to reach significant levels in the immediate future. Thus, the irreversible nature of such losses may be difficult for the general public to view as an issue to be addressed by current policymakers. Furthermore, the predictions of the physical impacts themselves rely upon complex, probabilistic models that cannot provide exact determinations of the long-term effects of human-induced climate change.

In the absence of dramatic “focusing events” science and, more recently, the economic costs of legislative action has taken on a central role in the policymaking arena and, in particular, the issue of global climate change. While the environmental consequences of climate change are already occurring, presenting real costs to ecosystems and society, the most severe and widespread consequences of climate change are expected to occur in the coming decades. Despite the substantial scientific evidence supporting the existence of anthropogenic climate change, the general public’s belief in the occurrence of global climate change and the severity of its likely impacts has remained relatively stable. Hence, addressing the issue remains low on the public’s issue agenda.

### **Overview of the Dissertation**

In addition to the complexities of climate change science, conservative interests and business and industry, especially firms that produce or consume fossil fuels, have thus far been successful in thwarting legislative efforts to control GHG emissions at the federal level. Chapter 1 examines these factors, and others, and concludes that the federal climate change legislative gridlock is likely to continue into

the foreseeable future. Given the dismal prospects of the federal regulation of GHG emissions, Chapter 2 shifts the focus of climate change policy to the subnational level, where much of the policy change has thus far been pursued and achieved, and establishes the theoretical framework for examining the process of stakeholder engagement in the development of state-level climate change policy. Chapter 3 introduces the methodological approach that will be applied to assess the role of stakeholder engagement and collaborative policy processes in the development of state-level climate change policy. Chapter 4 traces the emergence of state-level climate change policy in the U.S. and provides an up to date assessment of the current policy landscape. Chapter 5 introduces the key drivers of anthropogenic climate change within the U.S., energy consumption and CO<sub>2</sub> emissions, and an overview of state-level characteristics in these areas. Chapter 6 introduces a mixed-methods approach to rank objectively the states according to climate change policy action and mitigation. Based on the model presented in Chapter 6, four states are selected from four climate change policy categories (i.e., one state for each category), determined by their climate change policy achievements and climate change mitigation performance. Chapter 7 applies the theoretical approach developed in this study to present within and cross-comparison case studies of four states that have achieved climate change policy adoption and mitigation to varying degrees. The final chapter discusses the implications of the findings from the cases studied and revises the collaborative policy framework put forth in Chapter 2 to propose a new theory for collaborative climate change policymaking. The final chapter also reconsiders the

issue of global climate change and the role of stakeholder engagement in addressing the issue at the subnational level, and discusses opportunities for future research in this area.

## References

- Akerlof, K., Maibach, E. W., Fitzgerald, D., Ceden, A. Y., & Neuman, A. (2013). Do people "personally experience" global warming, and if so how, and does it matter? *Global Environmental Change-Human and Policy Dimensions*, 23(1), 81-91. doi: 10.1016/j.gloenvcha.2012.07.006
- Aklin, M., & Urpelainen, J. (2013). Debating clean energy: Frames, counter frames, and audiences. *Global Environmental Change-Human and Policy Dimensions*, 23(5), 1225-1232. doi: 10.1016/j.gloenvcha.2013.03.007
- Aklin, M., & Urpelainen, J. (2014). Perceptions of scientific dissent undermine public support for environmental policy. *Environmental Science & Policy*, 38, 173-177. doi: 10.1016/j.envsci.2013.10.006
- Anderegg, W. R. L. (2010). Moving beyond scientific agreement. *Climatic Change*, 101(3-4), 331-337. doi: 10.1007/s10584-010-9925-3
- Andrews, R.N. (2006). *Managing the Environment, Managing Ourselves: A History of American Environmental Policy*. 2nd ed. New Haven, Connecticut: Yale University Press.
- Arrhenius, S. (1896). XXXI. On the influence of carbonic acid in the air upon the temperature of the ground. *The London, Edinburgh, and Dublin Philosophical Magazine and Journal of Science*, 41(251), 237-276.
- Benedick, R.E. (1991). *Ozone Diplomacy: New Directions in Safeguarding the Planet*. New York, New York: Cambridge University Press.
- Bernauer, T. (2013). Climate Change Politics. *Annual Review of Political Science*, Vol 16,



16, 421-448. doi: 10.1146/annurev-polisci-062011-154926

- Blasing, T.J. (2014). *Recent Greenhouse Gas Concentrations*. Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory. Retrieved from [http://cdiac.ornl.gov/pns/current\\_ghg.html](http://cdiac.ornl.gov/pns/current_ghg.html)
- Bouwer, L. M. (2011). Have Disaster Losses Increased Due to Anthropogenic Climate Change? *Bulletin of the American Meteorological Society*, 92(1), 39-46. doi: 10.1175/2010bams3092.1
- Bouwer, L. M. (2013). Projections of Future Extreme Weather Losses Under Changes in Climate and Exposure. *Risk Analysis*, 33(5), 915-930. doi: 10.1111/j.1539-6924.2012.01880.x
- Boykoff, M. T. (2008). Media and scientific communication: a case of climate change. In D. G. E. Liverman, C. P. G. Pereira, & B. Marker (Eds.), *Communicating Environmental Geoscience*, 305,11-18.
- Boykoff, M. T. (2009). We Speak for the Trees: Media Reporting on the Environment. *Annual Review of Environment and Resources*, 34, 431-457. doi: 10.1146/annurev.environ.051308.084254
- Boykoff, M. T. (2013). Public Enemy No. 1?: Understanding Media Representations of Outlier Views on Climate Change. *American Behavioral Scientist*, 57(6), 796-817. doi: 10.1177/0002764213476846
- Bray, D. (2010). The scientific consensus of climate change revisited. *Environmental Science & Policy*, 13(5),340-350. doi: 10.1016/j.envsci.2010.04.001
- Brooks, J., Oxley, D., Vedlitz, A., Zahran, S., & Lindsey, C. (2014). Abnormal Daily

Temperature and Concern about Climate Change Across the United States. *Review of Policy Research*, 31(3), 199-217. doi: 10.1111/ropr.12067

Canadell, J. G., Le Quéré, C., Raupach, M. R., Field, C. B., Buitenhuis, E. T., Ciais, P., Conway, T.J., Gillet, N.P., Houghton, R.A., & Marland, G. (2007). Contributions to accelerating atmospheric CO<sub>2</sub> growth from economic activity, carbon intensity, and efficiency of natural sinks. *Proceedings of the National Academy of Sciences of the United States of America*, 104(47), 18866-18870. doi: 10.1073/pnas.0702737104

Cook, J., Nuccitelli, D., Green, S. A., Richardson, M., Winkler, B., Painting, R., Way, R., Jacobs, P., & Skuce, A. (2013). Quantifying the consensus on anthropogenic global warming in the scientific literature. *Environmental Research Letters*, 8(2). doi: 10.1088/1748-9326/8/2/024024

Council of Economic Advisers (CEC) (2014). *The Cost of Delaying Action to Stem Climate Change*. Washington, D.C. Retrieved from [http://www.whitehouse.gov/sites/default/files/docs/the\\_cost\\_of\\_delaying\\_action\\_to\\_stem\\_climate\\_change.pdf](http://www.whitehouse.gov/sites/default/files/docs/the_cost_of_delaying_action_to_stem_climate_change.pdf)

Dayaratna, K.D., & Kreutzer, D.W. (2014 April 29). “Unfounded FUND: Yet Another EPA Model Not Ready for the Big Game”. *Backgrounder*, 2897. Washington, D.C: The Heritage Foundation

Dayaratna, K.D., Loris, N.D., & Kreutzer, D.W. (2014 November 13). “The Obama Administration’ Climate Agenda: Underestimated Costs and Exaggerated Benefits”. *Backgrounder*, 2975. Washington, D.C: The Heritage Foundation

- Ding, D., Maibach, E. W., Zhao, X., Roser-Renouf, C., & Leiserowitz, A. (2011). Support for climate policy and societal action are linked to perceptions about scientific agreement. *Nature Climate Change*, *1*(9), 462-466. doi: 10.1038/nclimate1295
- Donner, S. D., & McDaniels, J. (2013). The influence of national temperature fluctuations on opinions about climate change in the US since 1990. *Climatic Change*, *118*(3-4), 537-550. doi: 10.1007/s10584-012-0690-3
- Doran P. & Zimmerman M. (2009). Examining the scientific consensus on climate change. *Eos, Transactions American Geophysical Union*, *90*(3), 22-23.
- Dunlap, R. E., & McCright, A. M. (2008). A widening gap - Republican and Democratic views on climate change. *Environment*, *50*(5), 26-35. doi: 10.3200/envt.50.5.26-35
- Fourier, M. (1827). Les températures du globe terrestre et des espaces planétaires. *Mémoires de l'Académie des sciences de l'Institut de France*, *7*, 569-604.
- Gall, M., Borden, K. A., Emrich, C. T., & Cutter, S. L. (2011). The Unsustainable Trend of Natural Hazard Losses in the United States. *Sustainability*, *3*(11), 2157-2181. doi: 10.3390/su3112157
- GaCHAT, G. (2011). The cultural authority of science: Public trust and acceptance of organized science. *Public Understanding of Science*, *20*(6), 751-770. doi: 10.1177/0963662510365246
- GaCHAT, G. (2012). Politicization of Science in the Public Sphere: A Study of Public Trust in

- the United States, 1974 to 2010. *American Sociological Review*, 77(2), 167-187. doi: 10.1177/0003122412438225
- Gifford, R. (2011). The Dragons of Inaction Psychological Barriers That Limit Climate Change Mitigation and Adaptation. *American Psychologist*, 66(4), 290-302. doi: 10.1037/a0023566
- Gifford, R., Kormos, C., & McIntyre, A. (2011). Behavioral dimensions of climate change: drivers, responses, barriers, and interventions. *Wiley Interdisciplinary Reviews-Climate Change*, 2(6), 801-827. doi: 10.1002/wcc.143
- Guber, D.L., & Bosso, C.I. (2012). "Issue Framing, Agenda Setting, and Environmental Discourse". In *The Oxford Handbook of US Environmental Policy*, ed. M.E. Kraft and S. Kamieniecki, 437-460. New York, New York: Oxford University Press.
- Haas, P. M. (1992). Introduction: epistemic communities and international policy coordination. *International Organization*, 46(1), 1-35.
- Heikkila, T., & Gerlak, A. K. (2005). The formation of large-scale collaborative resource management institutions: Clarifying the roles of stakeholders, science, and institutions. *Policy Studies Journal*, 33(4), 583-612. doi: 10.1111/j.1541-0072.2005.00134.x
- Herring, S.C., M.P. Hoerling, T.C. Peterson, & Stott P.A., eds, (2014) Explaining Extreme Events of 2013 from a Climate Perspective. *Bull. Amer. Meteor. Soc.*, 95 (9), S1–S96.
- Hmielowski, J. D., Feldman, L., Myers, T. A., Leiserowitz, A., & Maibach, E. (2014). An

- attack on science? Media use, trust in scientists, and perceptions of global warming. *Public Understanding of Science*, 23(7), 866-883. doi: 10.1177/0963662513480091
- Hoffman, A. J. (2011). Talking Past Each Other? Cultural Framing of Skeptical and Convinced Logics in the Climate Change Debate. *Organization & Environment*, 24(1), 3-33. doi: 10.1177/1086026611404336
- Ingold, K., & Gschwend, M. (2014). Science in Policy-Making: Neutral Experts or Strategic Policy-Makers? *West European Politics*, 37(5), 993-1018. doi: 10.1080/01402382.2014.920983
- Intergovernmental Panel on Climate Change (IPCC) (2013). *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. eds. T.F. Stocker, D. Qin, G.K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley. New York, New York: Cambridge University Press.
- Kamieniecki, S. (2006). *Corporate America and Environmental Policy: How Often Does Business Get Its Way?* Palo Alto, California: Stanford University Press.
- Keeling, C.D., Piper, S.C., Bacastow, R.B., Wahlen, M., Whorf, T.P., Heimann, M. & Meijer, H.A. (2005). *Atmospheric CO<sub>2</sub> and 13 CO<sub>2</sub> exchange with the terrestrial biosphere and oceans from 1978 to 2000: Observations and carbon cycle implications*. In *A History of Atmospheric CO<sub>2</sub> and Its Effects on Plants, Animals, and Ecosystems*, eds. J.R.Ehleringer, T.E.Cerling and M. D. Dearing, 83-113. New York, New York: Springer-Verlag.

- Khatiwala, S., Primeau, F., & Hall, T. (2009). Reconstruction of the history of anthropogenic CO<sub>2</sub> concentrations in the ocean. *Nature*, 462(7271), 346-U110. doi: 10.1038/nature08526
- Kraft, M.E. (2012). "Congress and Environmental Policy". In *Environmental Policy: New Directions for the Twenty-First Century*. ed. N.J. Vig and M.E. Kraft, 280-305, Thousand Oaks, California: CQ Press.
- Kraft, M. E. (2014). *Environmental Policy and Politics*. 6th ed. New York: Pearson.
- Kraft, M.E., & Kamieniecki, S. (2007). "Analyzing the Role of Business in Environmental Policy." In *Business and Environmental Policy: Corporate Interests in the American Political System*, ed. M. E. Kraft and S. Kamieniecki, 3–31. Cambridge, Massachusetts: MIT Press.
- Krosnick, J. A., Holbrook, A. L., Lowe, L., & Visser, P. S. (2006). The origins and consequences of democratic citizens' policy agendas: A study of popular concern about global warming. *Climatic Change*, 77(1-2), 7-43. doi: 10.1007/s10584-006-9068-8
- Lang, J. T., & Hallman, W. K. (2005). Who does the public trust? The case of genetically modified food in the United States. *Risk Analysis*, 25(5), 1241-1252. doi: 10.1111/j.1539-6924.2005.00668.x
- Le Quéré, C., Peters, G. P., Andres, R. J., Andrew, R. M., Boden, T., Ciais, P., Friedlingstein, P., Houghton, R. A., Marland, G., Moriarty, R., Sitch, S., Tans, P., Arneeth, A., Arvanitis, A., Bakker, D. C. E., Bopp, L., Canadell, J. G., Chini, L. P., Doney, S. C., Harper, A., Harris, I., House, J. I., Jain, A. K., Jones, S. D., Kato, E., Keeling, R. F.,

- Klein Goldewijk, K., Körtzinger, A., Koven, C., Lefèvre, N., Omar, A., Ono, T., Park, G.-H., Pfeil, B., Poulter, B., Raupach, M. R., Regnier, P., Rödenbeck, C., Saito, S., Schwinger, J., Segschneider, J., Stocker, B. D., Tilbrook, B., van Heuven, S., Viovy, N., Wanninkhof, R., Wiltshire, A., Zaehle, S., & Yue, C. (2013). Global carbon budget 2013. *Earth System Science Data Discuss*, 6, 689-760, doi:10.5194/essdd-6-689-2013
- Leiserowitz, A. A., Maibach, E. W., Roser-Renouf, C., Smith, N., & Dawson, E. (2013). Climategate, Public Opinion, and the Loss of Trust. *American Behavioral Scientist*, 57(6), 818-837. doi: 10.1177/0002764212458272
- Lewandowsky, S., Gignac, G. E., & Vaughan, S. (2013). The pivotal role of perceived scientific consensus in acceptance of science. *Nature Climate Change*, 3(4), 399-404. doi: 10.1038/nclimate1720
- Lifitin, K.T. (1994). *Ozone Discourse: Science and Politics in Global Environmental Cooperation*. New York, New York: Columbia University Press.
- Malka, A., Krosnick, J. A., & Langer, G. (2009). The Association of Knowledge with Concern About Global Warming: Trusted Information Sources Shape Public Thinking. *Risk Analysis*, 29(5), 633-647. doi: 10.1111/j.1539-6924.2009.01220.x
- Mann, M. E., Bradley, R. S., & Hughes, M. K. (1998). Global-scale temperature patterns and climate forcing over the past six centuries. *Nature*, 392(6678), 779-787.
- Mazmanian, D.A., & Kraft, M.E. (2009). "The Three Epochs of the Environmental Movement". In *Towards Sustainable Communities: Transition and*

- Transformation in Environmental Policy*, ed. D.A. Mazmanian and M.E. Kraft, 3-32. Cambridge, Massachusetts: MIT Press.
- McCright, A. M., & Dunlap, R. E. (2000). Challenging global warming as a social problem: An analysis of the conservative movement's counter-claims. *Social Problems*, 47(4), 499-522. doi: 10.1525/sp.2000.47.4.03x0305s
- McCright, A. M., & Dunlap, R. E. (2011a). Cool dudes: The denial of climate change among conservative white males in the United States. *Global Environmental Change-Human and Policy Dimensions*, 21(4), 1163-1172. doi: 10.1016/j.gloenvcha.2011.06.003
- McCright, A. M., & Dunlap, R. E. (2011b). The Politicization of Climate Change and Polarization in the American Public's Views of Global Warming, 2001-2010. *Sociological Quarterly*, 52(2), 155-194. doi: 10.1111/j.1533-8525.2011.01198.x
- McCright, A. M., Dunlap, R. E., & Xiao, C. Y. (2014). Increasing Influence of Party Identification on Perceived Scientific Agreement and Support for Government Action on Climate Change in the United States, 2006-12. *Weather Climate and Society*, 6(2), 194-201. doi: 10.1175/wcas-d-13-00058.1
- Milfont, T. L., Evans, L., Sibley, C. G., Ries, J., & Cunningham, A. (2014). Proximity to Coast Is Linked to Climate Change Belief. *Plos One*, 9(7). doi: 10.1371/journal.pone.0103180
- Myers, T. A., Maibach, E. W., Roser-Renouf, C., Akerlof, K., & Leiserowitz, A. A. (2013). The relationship between personal experience and belief in the reality of global warming. *Nature Climate Change*, 3(4), 343-347. doi: 10.1038/nclimate1754
- National Research Council (NRC) (2010a). *Advancing the Science of Climate Change*.



- Washington, DC: The National Academies Press
- National Research Council (NRC). (2010b). *Advancing the Science of Climate Change*.  
Washington, DC: The National Academies Press.
- National Climatic Data Center (NCDC) (2013) Billion-Dollar Weather/Climate Events.  
Retrieved from <http://www.ncdc.noaa.gov/billions>
- Nisbet, M. C. (2009). Communicating Climate Change Why Frames Matter for Public Engagement. *Environment*, 51(2), 12-23.
- Nisbet, M. C., & Myers, T. (2007). The polls - Trends - Twenty years of public opinion about global warming. *Public Opinion Quarterly*, 71(3), 444-470. doi: 10.1093/poq/nfm031
- Norgaard, R. B. (2004). Learning and knowing collectively. *Ecological Economics*, 49(2), 231-241. doi: 10.1016/j.ecolecon.2004.03.021
- Norgaard, R. B. (2010). Ecosystem services: From eye-opening metaphor to complexity blinder. *Ecological Economics*, 69(6), 1219-1227. doi: 10.1016/j.ecolecon.2009.11.009
- Nordhaus, W.D. (2013). *The Climate Casino: Risk, Uncertainty, and Economics for a Warming World*. New Haven, Connecticut: Yale University
- Pew Research Center. (2016 January). *Budget Deficit Slips as Public Priority*. Retrieved from: <http://www.people-press.org/files/2016/01/1-21-2016-Priorities-Release.pdf>
- Pidgeon, N., & Fischhoff, B. (2011). The role of social and decision sciences in communicating uncertain climate risks. *Nature Climate Change*, 1(1), 35-41. doi: 10.1038/nclimate1080
- Pielke, R., Jr. (2007). Mistreatment of the economic impacts of extreme events in the Stern

Review Report on the Economics of Climate Change. *Global Environmental Change-Human and Policy Dimensions*, 17(3-4), 302-310. doi:

10.1016/j.gloenvcha.2007.05.004

Posner, P.L. (2010). *Greenhouse Governance: Addressing Climate Change in America*. ed. B.G. Rabe, 73-100. Washington, D.C.: Brookings Institution Press.

Rabe, B.G. (2004). *Statehouse and Greenhouse: The Emerging Politics of American Climate Change Policy*. Washington, D.C.: Brookings Institution Press.

Rabe, B. G. (2008). States on Steroids: The Intergovernmental Odyssey of American Climate Policy. *Review of Policy Research*, 25(2), 105-128. doi:

10.1111/j.1541-1338.2007.00314.x

Revelle, R., & Suess, H. E. (1957). Carbon dioxide exchange between atmosphere and ocean and the question of an increase of atmospheric CO<sub>2</sub> during the past decades. *Tellus*, 9(1), 18-27.

Rosenberg, S., Vedlitz, A., Cowman, D. F., & Zahran, S. (2010). Climate change: a profile of US climate scientists' perspectives. *Climatic Change*, 101(3-4), 311-329. doi:

10.1007/s10584-009-9709-9

Saad, L., & Jones, J.M. (2016 March 16). U.S. Concern About Global Warming at Eight-Year High. *Gallup*. Retrieved from:

<http://www.gallup.com/poll/190010/concern-global-warming-eight-year-high.aspx>

- Sabatier, P., Focht, W., Lubell, M., Trachtenberg, Z., Vedlitz, A., & Matlock, M. (2005). "Collaborative Approaches to Watershed Management". In *Swimming Upstream: Collaborative Approaches to Watershed Management*. ed. P. Sabatier, W. Focht, M. Lubell, Z. Trachtenberg, A. Vedlitz and M. Matlock, 3-22, Cambridge, Massachusetts: MIT Press.
- Santer, B.D., Wigley, T.M.L., Barnett, T.P., & Anyamba, E. (1995). "Detection of Climate Change and Attribution of Causes". In *Climate Change 1995: The Science of Climate Change*. eds. J.T. Houghton, L.G. Meira Filho, B.A. Callander, N. Harris, A. Kattenberg and K. Maskell. New York, New York: Cambridge University Press.
- Sarewitz, D. (2004). How science makes environmental controversies worse. *Environmental Science & Policy*, 7(5), 385-403. doi: 10.1016/j.envsci.2004.06.001
- Shabecoff, P. (1988 June 24). Global Warming Has Begun, Expert Tells Senate. *New York Times*. Retrieved from <http://www.nytimes.com/1988/06/24/us/global-warming-has-begun-expert-tells-senate.html>
- Smith, A.B. & Katz, R.W (2013). US billion-dollar weather and climate disasters: data sources, trends, accuracy and biases. *Natural Hazards*, 67(2), 387-410. doi: 10.1007/s11069-013-0566-5
- Tans, P. (2014). NOAA/ESRL (NOAA Earth System Research Laboratory). *Trends in Atmospheric Carbon Dioxide*. Retrieved from: [http://www.esrl.noaa.gov/gmd/ccgg/trends/#mlo\\_growth](http://www.esrl.noaa.gov/gmd/ccgg/trends/#mlo_growth)
- Tol, R.S.J. (2014). Correction and Update: The Economic Effects of Climate Change. *Journal of Economic Perspectives*, 28, 2, 221-226.

- U.S. Global Change Research Program (USGCRP) (2014). *Global Climate Change Impacts in the United States*. New York, New York: Cambridge University Press.
- Vig, N.J. (2012). "Presidential Powers and Environmental Policy". In *Environmental Policy: New Directions for the Twenty-First Century*. ed. N.J. Vig and M.E. Kraft, 84-108, Thousand Oaks, California: CQ Press.
- Vig, N.J. (2012). "The American Presidency and Environmental Policy". In *The Oxford Handbook of US Environmental Policy*, ed. M.E. Kraft and S. Kamieniecki, 306-328. New York, New York: Oxford University Press.
- Weber, E. U. (2010). What shapes perceptions of climate change? *Wiley Interdisciplinary Reviews-Climate Change*, 1(3), 332-342. doi: 10.1002/wcc.41
- Weber, E. U., & Stern, P. C. (2011). Public Understanding of Climate Change in the United States. *American Psychologist*, 66(4), 315-328. doi: 10.1037/a0023253
- Zahran, S., Brody, S. D., Grover, H., & Vedlitz, A. (2006). Climate change vulnerability and policy support. *Society & Natural Resources*, 19(9), 771-789. doi: 10.1080/08941920600835528
- Zahran, S., Brody, S. D., Vedlitz, A., Grover, H., & Miller, C. (2008). Vulnerability and capacity: explaining local commitment to climate-change policy. *Environment and Planning C-Government and Policy*, 26(3), 544-562. doi: 10.1068/c2g

## Chapter 1 - Climate Change Politics and Policy

The U.S. has often been at the forefront of addressing domestic environmental problems and has, at times, played a critical role in bringing together members of the international community to form multilateral environmental agreements to address pervasive environmental problems. Achieving the dramatic GHG emissions reductions called for by the IPCC is not only an important issue for the U.S. to address from a domestic policy perspective, but also to maintain the nation's reputation as an international steward of the environment. As noted in the previous chapter, however, the U.S. has yet to enact a legislative federal policy to address the causes of anthropogenic climate change and reduce GHG emissions to the levels called upon by the IPCC. As of 2015, U.S. GHG emissions totaled 6,587 million metric tons, of carbon dioxide equivalents (CO<sub>2</sub>e), a 3.5 percent increase from 1990 emissions and a 2.27 percent decrease from 2014 emissions, at which time the U.S. accounted for 15 percent of global GHG emissions from fossil fuel combustion (Boden, Marland and Andres 2017; USEPA 2017).<sup>9</sup> In order to achieve the GHG stabilization called for in the IPCC's Fifth assessment report, U.S. emissions would have to be reduced to at least 4,124 million metric tons of CO<sub>2</sub>e by 2050, and 1,512 million metric tons of CO<sub>2</sub>e by 2100. In 2014, the U.S. EPA released a proposed rule to decrease GHG emissions from power plants by 32 percent from 2005 levels by 2030. The proposed rule would amount to a reduction of 733 million metric tons of

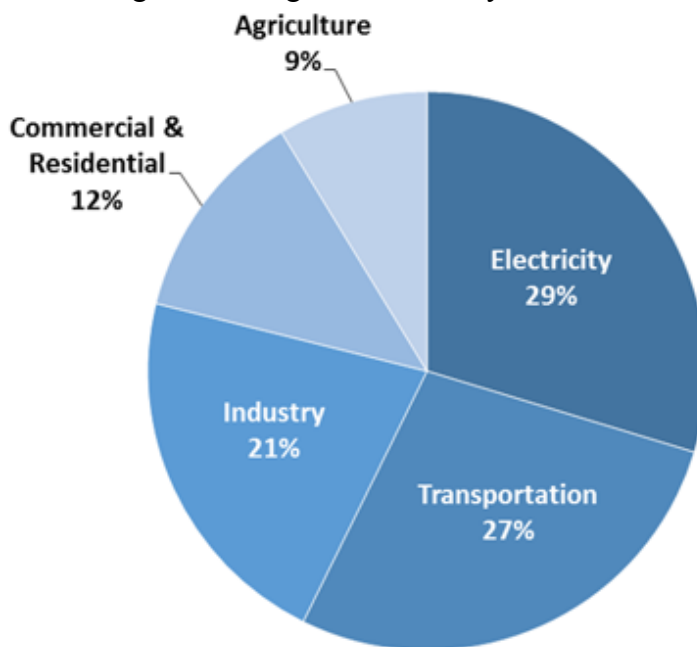
---

<sup>9</sup> The carbon dioxide equivalent is a metric measure used to compare the emissions from various GHGs based upon their global warming potential (GWP). The carbon dioxide equivalent for a gas is derived by multiplying the tons of the gas by the associated GWP.

CO<sub>2</sub>e, a 10 percent reduction from 2010 GHG emission levels, and a far cry from the 40-70 percent 2050 benchmark set forth by the IPCC (IPCC 2013; USEPA 2017).

Despite recent declines in national GHG emissions, dramatic reductions will be required across economic sectors in order to contribute to a global effort to avoid the most dramatic consequences of climate change. As an environmental issue of the third environmental epoch, the origins of anthropogenic GHG emissions are diffuse and distributed across a number of economic sectors. In the U.S., GHG emissions originate from five primary sources including: electricity generation, transportation, industrial operations, commercial and residential sources, and agriculture production (see Figure 1.1). As the largest producers of GHG emissions in the U.S., business and industry interests, especially firms that produce or consume fossil fuels, have been the most vocal opponents of policy efforts to regulate GHG emissions at the national level. Given the nation's economic dependence on fossil fuel, conservative interest groups and elected officials have also been critical of government intervention to address climate change, often citing the economic consequences of policy action. Thus far, the opponents of climate change have been successful at thwarting government efforts to control GHG emissions.

**Figure 1.1** Total greenhouse gas emissions by economic sector, 2015.



Source: U.S. Environmental Protection Agency 2017.

This chapter describes the political barriers and policy challenges that have, thus far, been promulgated by climate change policy opponents to prevent supporters from reaching a “tipping point” on Capitol Hill and achieving GHG regulation. In general, research on the level of influence that business and industry interests have on environmental policymaking in the U.S. has provided mixed results. While some studies have found that business interests do not dominate the legislative policymaking process, relative to the general interest group population (e.g., Baumgartner and Leech 1998; Baumgartner et al. 2009; Berry 1999; Kamieniecki 2006; Kraft and Kamieniecki 2007; Smith 2000; Vogel 1989), others have found business to dominate numerous aspects of American politics (e.g., Korten 1995; Lehne 2001; Libby 1998; Schlozman and Tierney 1986; Nounes 2002). This chapter applies theories of the policymaking process as described by Kingdon (1995) and

Baumgartner and Jones (1993) to provide a framework for understanding the motives, strategies, and access points that fossil fuel business and conservative interests have utilized to block successfully the climate change issue from the government agenda. Following a review of past and present efforts by climate change policy opponents to prevent policy change, the discussion concludes that a federal policy to regulate GHG emissions will not be achieved in the short to medium term.

Making predictions regarding the future of federal climate change policy is no simple task. However, given the ongoing trend of strong partisan division regarding environmental issues and the powerful electoral incentives that members have to act in the interest of constituents and organized interests, a reasonable calculation can be made based on predictions regarding the number of Republican seats that will be held on Capitol Hill in the coming years. The founders of the U.S. Constitution designed the House of Representatives to represent the people of the U.S., rather than the individual states. Article I, Section II of the Constitution provides that each state shall have at least one U.S. Representative seated in the House, and that the size of a state's delegation will depend on its total population. Thus, the apportionment of seats in the house dedicated to each state is determined by the state's aggregate share of the national population. The distribution of Representatives is updated every ten years according to the national census, at which time states may gain, sustain or lose the number of seats held in the House based on the proportion of the national population within their boundaries. Perhaps even more critical to this process, is how the redistricting process within a state, occurs following the reapportionment process. In



many states, the establishment of electoral district boundaries is left up to the legislature, which, in states where one political party holds a strong majority, may result in new boundaries that favor the party in power.

Following the 2010 Census, Republican states gained a net total of six seats in the House. Predictions of the 2020 reapportionment based on population have found similar trends to continue, as populations decrease in the Northeast and increase in the Southwest (Burmilla 2009). A Republican majority in the House through 2030 has significant implications for the possibility of forging a federal climate change policy. Furthermore, an increasing divergence on ideological principles by members of the Congress will create additional challenges to reaching policy compromise on the issue. House majority leader Eric Cantor's primary election defeat by Tea Party-backed candidate David Brat in the 2014 primary election signified a continued push toward increasingly conservative leadership by voters and a growing divide between political party ideologies. Furthermore, in the 2014 midterm election, the Republican party won control of both the House and the Senate, and maintained control following the 2016 Presidential election. The conservative takeover of the 114<sup>th</sup> and 115<sup>th</sup> Congress has had important implications concerning the prospect of forging federal climate change legislation during the final two years of the Obama presidency, and the first half of the Trump administration.

### **Climate Change and Environmental Policymaking**

Kingdon (1995) posits that dramatic policy change occurs when, "Solutions become joined to problems, and both of them are joined to favorable political forces"

(1995, 20). He identifies three independent process streams flowing through the policy system –streams of problems, policy alternatives, and politics. The three streams are largely independent of one another, and each evolves according to its own dynamics and rules. According to Kingdon, “the greatest policy changes grow out of the coupling of problems, policy proposals, and politics” (1995, 19). Baumgartner and Jones (1993) build upon Kingdon’s work, describing the process of policy change in terms of the cascading effect of positive feedbacks, characterized by the “simultaneous combinations of several independent streams: policy images, technical evidence, political leadership, a consensus among reluctant interest groups, a window of opportunity” (Baumgartner 2006, 38).

In general, the public policy arena is characterized by relative stability where fluctuations occur incrementally and with little dramatic change (Baumgartner 2006; Baumgartner and Jones 1993). Such policy “lock-in” is generally maintained by the interaction of positive and negative feedbacks, driven by entities with an interest in either moving a policy initiative forward (positive feedbacks) or maintaining or reversing the status quo (negative feedbacks). Thus, the faces of power in the policymaking process are characterized by two distinct groups, those that effectively initiate a policy proposal and those who seek to limit decision making by preventing policy issues from being considered for adoption (Bachrach and Bratz 1962).

The endogenous factors that contribute to stability in the policymaking process (e.g., interest group lobbying, congressional committee hearings, and public speeches) are often complemented by exogenous disturbances that also affect the

policy process by potentially pushing a problem forward, towards a critical “tipping point,” or backwards, decreasing the issue’s importance on the political agenda (Brock 2006; Frankel and Young 2000). Such shifts are often characterized by new scientific information, a shift in underlying economic fundamentals, a technological change, new information available to the public, a change in the “macro-political” environment, or an “act of God” (i.e., an unforeseen event such as an oil spill or nuclear meltdown). Occasionally, under the right conditions, “punctuations” occur, policy issues rise to the forefront of the political agenda and rapid policy change takes place (Baumgartner 2006; Baumgartner and Jones 1993).

Environmental organizations and the scientific community have been the key initiators of positive feedback contributing to placing global climate change on the political agenda. Climate scientists and scientific institutions were the primary drivers of early policy change efforts to address global climate change by defining the policy problem, while environmental organizations have contributed to the process by organizing public support for policy change and lobbying officials within the legislative and executive branch to enact environmental rules and regulations.

The negative feedbacks to policy change generated by business and industry interests may be the most important factors contributing to the twenty-five year federal environmental legislative “lock-in.” In the environmental policy arena, business and industry interests are often the initiators of negative feedbacks. In general, the goal of these organizations is to prevent new environmental initiatives from being enacted to protect economic interests by avoiding the costs of regulation.

Often such interests frame the policy image as one of uncertain scientific information and, more recently, economic costs to society (Jacques 2006; Jacques, Dunlap and Freeman 2008).

### **Early Climate Change Policy Efforts**

The formation of the IPCC was instigated by groundbreaking scientific research that revealed the effect that human activities were having on the Earth's climate system. The emergence of scientific research that linked national environmental issues, such as the drought of 1988, motivated the executive and legislative branch to take a closer look at the effects of increased GHG emissions in the atmosphere, and the potential implications that human-induced climate change may have for society. Following the creation of the IPCC in 1988, President George H.W. Bush established the U.S. Global Change Research Program (U.S. GCRP), which was codified by Congress through the Global Change Research Act of 1990 (P.L. 101-606). Composed of scientists from thirteen federal departments and agencies that carry out research and develop and maintain capabilities that support the nation's response to global change, the charge of the organization was to develop a comprehensive research program to "assist the nation and the world to understand, assess, predict and respond to human-induced and natural processes of global change" (Global Change Research Act of 1990).

By the early 1990s, the national environmental community, composed of members of the environmental movement, climate scientists, and environmental policymakers, had successfully identified human-induced climate change as a

legitimate social problem (McCright and Dunlap 2003). The issue had clearly been placed on the political agenda, and public awareness of global climate change developed with an increase in media coverage. However, the prospect of a national policy to mitigate the causes of anthropogenic climate change motivated the mainstream conservative movement, spearheaded by conservative think tanks (CTTs) and foundations, to coordinate a national effort led by the fossil fuel industry to block the regulation of GHG emissions (Dunlap and McCright 2011; Gelbspan 1997; Goodell 2007; McCright and Dunlap 2003).

Shortly after the IPCC first met in 1989, the Global Climate Coalition (GCC) was created. The GCC, a partnership of individual corporations from the fossil fuel industry as well as industry associations, conservative organizations such as the United States Chamber of Commerce, and other resource-based corporations and related associations sought to stymie any national effort to enact restrictions on the burning of fossil fuels (Dunlap and McCright 2011; Layzer 2007). In 1991, the National Coal Association, the Western Fuels Association, and Edison Electric Institute established the Information Council on the Environment (ICE). While the primary strategy of ICE was to discredit the scientific consensus on global warming, the GCC initiated a two-pronged campaign to prevent public concern and shift the focus of mitigation efforts to the economic costs of policy alternatives (Gelbspan 1997; Layzer 2007). The coalition financed the publication and distribution of various books, pamphlets, and articles prepared by credible skeptics who challenged the scientific understanding of anthropogenic climate change and disseminated a number

of economic studies that projected dramatic costs associated with a global energy transition (Gelbspan 1997; Fisher, Waggle and Leifeld 2013; Layzer 2014).

The early efforts of climate change policy opponents to block the regulation of GHG emissions produced effective results. While initial media coverage of the climate change issue was focused on the anthropogenic nature of global climate change, by 1990, journalists began referencing climate skeptics in an effort to provide “balanced” reporting (Boykoff and Boykoff 2004). Public concern regarding the issue of climate change had declined since the issue was initially covered, and a poll conducted in 1994 found that only 28 percent of respondents perceived a scientific consensus that global warming is taking place and could have potentially significant impacts, while 58 percent believed that scientists were divided on the issue (Program on International Policy Attitudes 1994). Furthermore, the 1994 Congressional elections produced Republican majorities in both the House and the Senate providing a critical political platform for climate change policy opponents. Conservative political leaders were able to leverage the issue of scientific uncertainty and the prevailing public opinion to minimize the urgency of GHG emissions reductions, while aligning the economic costs of action with conventional Republican ideologies to prevent the opportunity for legislation to reduce GHG emissions from reaching the President’s desk.

By the mid-1990s a growing worldwide concern regarding the seriousness of global warming led to an international effort to address anthropogenic climate change by committing to GHG emissions reductions. The release of the IPCC’s second

assessment report called for a 60 to 80 percent reduction in global CO<sub>2</sub> emissions to stabilize atmospheric concentrations of GHGs (IPCC 1995). In December 1997, more than 160 nations met in Kyoto, Japan to develop the Kyoto Protocol, a formal agreement by developed countries to reduce CO<sub>2</sub> emissions by 7 percent between 2008 and 2012. In response to a favorable shift in public opinion regarding the issue of global climate change, the Clinton administration signed the Kyoto Protocol in November 1998 (PIPA1998).

The resurgence in positive feedback from the scientific community and policy change initiated by the international community was met with an aggressive campaign from industry opponents who continued to attack the scientific basis for anthropogenic climate change and emphasize the economic consequences of policy action. Industry arguments against the international agreement were supplemented by efforts to reach the general American public via a heavy media campaign leading up to the 1997 meeting in Kyoto. The GCC spent \$13 million on an advertising campaign that warned the public of the catastrophic economic consequences of regulated reductions in GHG emissions that would “pose a threat to the American way of life” (Layzer 2007). In addition to the efforts of industry groups, a number of CTTs held press conferences to reinforce the advertising efforts and broaden the range of the movement (McCright and Dunlap 2000).

Consequently, the President’s move on climate change policy was preempted by the passage of Senate Resolution 98, commonly referred to as the Hagel-Byrd Resolution. The stipulations that the Congress set forth in the resolution echoed the

claims of climate change policy opponents. To frame opposition to the Kyoto Protocol, in addition to attacks on the scientific certainty and consensus regarding climate change, industry interests opposed the exemption of developing countries from the agreement and the potential competitive disadvantage for U.S. business that would result from a commitment to CO<sub>2</sub> emission reductions. The Resolution, which received a unanimous vote, notified the Clinton administration that the Senate would not ratify any treaty that would: 1) impose mandatory GHG emissions reductions for the U.S. without imposing such reductions for developing nations, or 2) result in serious harm to the nation's economy. Thus, U.S. ratification of the international effort to reduce GHG emissions was significantly constrained by the demands set in place by the 105<sup>th</sup> Senate. The opportunity to enact such federal legislation was reduced even further when George W. Bush took office in 2001 and abandoned any plans to reduce carbon emissions from U.S. power plants despite a pledge during his campaign to do so. During the presidential campaign, President Bush had acknowledged the climate change issue as one that required federal legislative action. Once in office, however, the President reversed his opinion on the issue and announced that he had no intention of abiding by the Kyoto Protocol.

### **Recent Climate Change Policy Efforts**

Perhaps the widest climate change policy window was opened following the 2008 presidential and Congressional elections. President Obama, a staunch supporter of reducing GHG emissions, had expressed concern over the climate change issue during his election campaign and continued to push for national regulation following



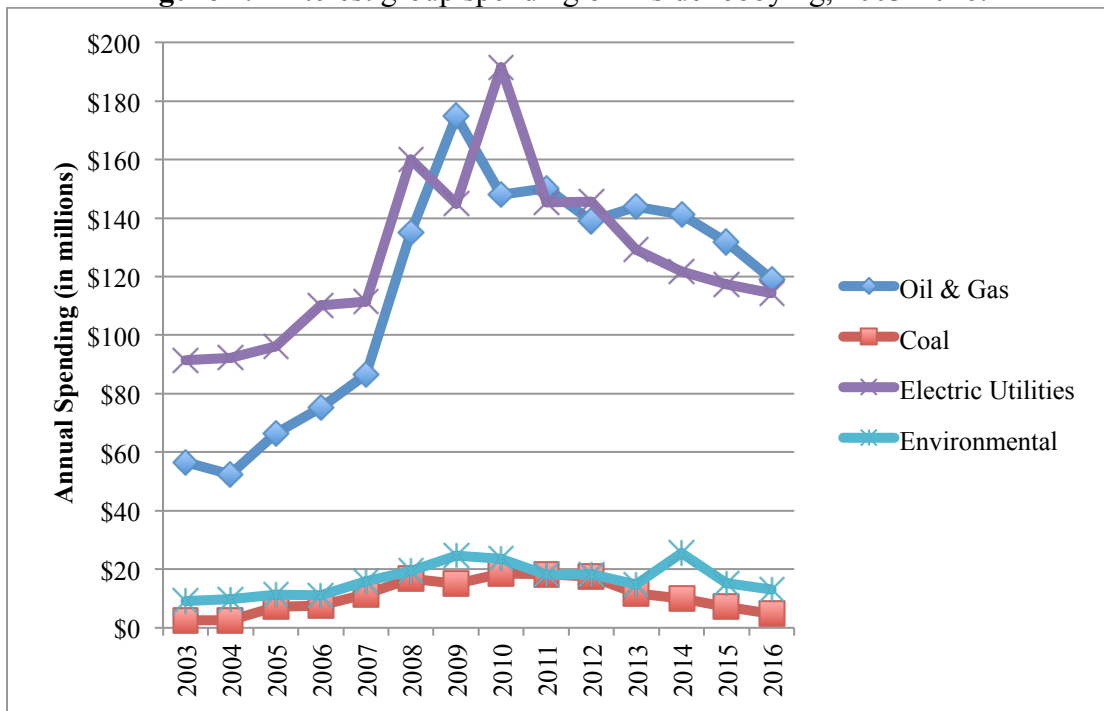
his inauguration. The president's call to congressional leaders to address the climate change issue via federal legislation was heard, and Democratic party leaders in the House and the Senate pledged to act. Policy entrepreneurs in the Congressional and advocacy arenas had already begun to prepare for the opportunity to push climate legislation forward following the 2006 midterm elections, when the Democratic party took control of both Congressional chambers (Skocpol 2013). As George W. Bush left office and Obama entered, a Democratic majority took their seats during the 111<sup>th</sup> Congress and a favorable political opportunity presented itself for proponents to take action on climate change legislation.

The U.S. Climate Action Partnership (U.S. CAP), a coalition of more than two dozen big business CEOs and environmental organizations, including the Environmental Defense Fund, the National Resources Defense Council, and the Nature Conservancy, formed in 2007 to draft collaboratively a CO<sub>2</sub> cap and trade legislation that could be marketed to legislators as policy that both environmental and business interests supported. The U.S. CAP effort was largely a response to the continued incremental changes occurring at the national level regarding climate change policy and to the role that negative feedback from organized interests played in preventing previous efforts to establish a national GHG emissions policy. The U.S. CAP's cap and trade system was designed after the Clean Air Act Amendments of 1990 that were implemented to reduce industrial emissions of sulfur dioxide and address the issue of acid rain. The Acid Rain Program was recognized as a least cost

solution to industry, and by-and-large an environmental and economic success, which made the model an ideal framework to address GHG emissions.

In January 2009, USCAP leaders released the negotiated blueprint for the GHG cap and trade system, followed by an unprecedented lobbying campaign to sell the policy to members of the House and Senate. During 2009, environmental organizations spent an unprecedented \$24.7 million on Congressional lobbying, more than 25 percent of which was contributed by members of U.S. CAP (See Figure 1.2). The groups' efforts contributed to the attempt by House Representatives Henry Waxman (D-CA) and Ed Markey (D-MA) to establish a federal cap and trade program for GHG emissions via the American Clean Energy and Security Act of 2009, which was introduced and passed by the House of Representatives in 2009 (American Clean Energy and Security Act of 2009). However, the victory was short-lived as oppositional lobbying, media campaigns and Tea Party-led protests quickly responded to the positive momentum towards GHG regulation. The oil and gas industry spent more than \$174 million on lobbying in 2009 (see Figure 1.2), and by July 2010, Senate leaders pulled the plug on the cap and trade legislation as Republican Senators unanimously refused to support any form of cap and trade legislation and the prospect of gaining the 60 votes required to overcome the chamber's filibuster became dismal. Leiserowitz (2013) found that the significant declines in public belief in global warming after 2008 is largely the result of the spread of debate and contention over anthropogenic climate change (Anderegg 2014).

**Figure 1.2** Interest group spending on inside lobbying, 2003-2016.



Source: Center for Responsive Politics 2017.

### **Agenda Blocking**

Schattschneider (1960) was one of the first scholars to argue that the ability to deny an issue from reaching the government agenda is an indication of power. As he observes, "A conclusive way of checking the rise of conflict is simply to provide no arena for it or to create no public agency with power to do anything about it" (1960, 71). Edelman (1985) presents ways in which conflict expansion is sometimes achieved and other times thwarted. He discusses how political leaders and interest groups provide symbolic benefits to unorganized interests while securing tangible paybacks for themselves. In Edelman's (1985) view, this is accomplished through symbolic manipulation, which is used to define priorities as well as direct attention toward or away from specific problems and issues.

During the 1970s, an American conservatism began to strategically organize a counter-offensive to combat the number of progressive causes that had been publicized and placed upon the political agenda during the 1960s (Stefancic and Delgado 1996). Conservative efforts to counter-mobilize against the environmental movement accelerated in the early 1990s as global concern with issues such as biodiversity and climate change began to grow, both of which presented potential threats to the international capitalism regime established during the previous decade (McCright and Dunlap 2010). The general strategy of the conservative movement has been to link issue campaigns with important conservative ideologies while simultaneously making contrary claims to those supported by their opponents in order to block efforts for policy change.

Cobb and Ross (1997a) highlight the significance of cultural and symbolic strategies intended to define a problem in such a manner that a stakeholder group can block an issue, such as climate change mitigation or adaptation, from attaining agenda status and achieving success in the long run. They divide strategies that interest groups can use to keep new issues off the formal agenda into four categories based on the resources they must expend (e.g., time, effort, and money). Low-cost strategies include non-recognition of the problem, denial that a problem exists, and refusal to recognize the groups that are promoting an issue. Medium-cost strategies involve two different types of issue avoidance. An attempt is first made to discredit the issue position of the stakeholder group. Such an effort might include, for example, the reversal of roles by claiming victim status, use of deception by releasing false data

and information, disputing the facts of the case, stating the issue is not a legitimate public concern, and claiming that concerns are isolated incidents and the problem is not that serious. If this fails to derail the initiators, an effort is then made to show symbolic concern in addressing the problem. This approach can include invoking community norms, such as loyalty, engaging in showcasing or tokenism by narrowly defining the problem and indicating something is being done to address it, co-opting leaders or the stakeholder group's symbols, creating a commission to study the problem, or postponing a decision. High-cost strategies normally involve economic threats, threats to withhold electoral support, and legal threats or actions (for example, lawsuits and injunctions). Cobb and Ross (1997b) argue that if initial low-cost approaches fail, opposing stakeholder groups will pursue increasingly costlier and aggressive strategies.

Opponents of policies to regulate GHG emissions have consistently sought to block the issue from gaining momentum on the political agenda by establishing counter-claims that question the scientific validity of anthropogenic climate change and emphasizing the potential economic implications of policy action on American's way of life (McCright and Dunlap 2000). The strategy, what Jacques, Dunlap and Freeman (2008) calls "environmental skepticism," challenges the evidence put forth by scientific institutions and environmentalists of environmental degradation, and disputes the seriousness of environmental problems in order to downplay the need for environmental regulation. According to Jacques, Dunlap and Freeman (2008), "the most fundamental theme of environmental skepticism is a rejection of scientific

literature on environmental problems.” The strategy is an attempt by climate change policy opponents to constrict the “scope of conflict.” In recent years, the debate seems to be shifting away from one centered around science, given the proliferation of research on anthropogenic climate change, to economics and the costs of action to reduce GHG emissions (Lutzenhiser 2001; McCright 2011).

The use of “environmental skepticism” became a preferred strategy of business and industry interest groups during the Regan administration, when anti-environmental protection campaigns were not well received by the general public (Dunlap 1987). These groups found that framing an issue as one of scientific uncertainty was more effective in swaying public opinion and policymakers than outright condemnation of environmental protection. Beginning with the GCC, climate change policy opponents began to invest in “low-cost” strategies to dispute the scientific evidence presented by scientists and “manufacture uncertainty” regarding the occurrence of anthropogenic climate change. The climate denial strategies applied by industry and conservative interests was reminiscent of those used by tobacco companies when the industry led public relations campaigns to prevent the general public from understanding the negative health effects of smoking (Oreskes and Conway, 2010; Powell 2012).

During the onset of the climate change skepticism efforts, the evidence supporting climate change was more uncertain and could still be considered a “frontier” science. Even modest dissension regarding the scientific findings of an epistemic community can have dramatic effects on the public’s perception of

scientific consensus on a particular issue (Aklin and Urpelainen 2013; Ding et al. 2011; Gauchat 2011; Leiserowitz et al. 2013). Indeed, many studies in the early 1990s sought to deconstruct the notion of global warming, thereby allowing the fossil fuel industry to protect its interests by publicly scrutinizing the claims of scientists and scientific organizations and consequently the economic costs associated with policy change (Boehmer-Christiansen 1994; Cole 1992; Dunlap and Catton 1994; Ross 1991; Taylor and Buttel 1992). Early efforts to generate skepticism targeted the IPCC's second assessment report and the "hockey stick graph," (see Figure 2) both of which received widespread public and political attention and sought to establish the effects that increased combustion of fossil fuels have had on the global climate. Attacking the science behind climate change to block the political agenda of environmentalists and policy entrepreneurs was an effective strategy given that confidence in climate science and trust in climate scientists are key factors influencing the public's views of anthropogenic climate change (Ding et al. 2011; McCright, Dunlap and Xiao 2013).

However, as the scientific consensus on climate change progressed into the new millennium, and the issue became a "core" finding, efforts to block the issue by the fossil fuel industry became less credible and more risky due to backlash. The progression of the scientific consensus during the final decade of the 20<sup>th</sup> century had a powerful effect on the organized industry and conservative interests that opposed a national commitment to reduce GHG emissions. Members of the GCC began to exit the coalition beginning in 1997, largely to avoid public scrutiny. In 2001, triggered by

a mass exodus of its remaining partners following the release of the IPCC's 4<sup>th</sup> Assessment Report, the GCC disbanded. In light of the building body of scientific evidence supporting anthropogenic climate change, a number of members of the business community began to shift their opinion on climate change and move towards more sustainable practices. To many, it seemed that the writing was on the wall and federal regulations to reduce GHG emissions were soon to follow (Layzer 2007). A number of corporations even joined the ranks of environmental organizations and built coalitions (e.g., U.S. CAP) in the movement towards a federal policy to reduce GHG emissions.

With the growing scientific consensus on climate change, developing a business model that reduced the carbon footprint of daily operations and transitioned away from reliance on fossil fuels seemed to be the next logical approach for a couple of reasons. First, denying the existence of climate change and questioning the scientific consensus became a less credible approach to achieving policy demands. In the absence of federal mandates to reduce emissions, environmental organizations began to publicly scrutinize corporations and even lead boycott campaigns to shame corporations into more sustainable practices. First mover companies would potentially avoid public scrutiny and even capitalize from efforts to reduce the carbon footprint of their company by gaining support from the general public. In addition, a company that had made the transition to more sustainable practices may gain a competitive advantage in the event that a federal regulation on GHG emissions became reality. Second, in light of the scientific consensus that had developed around



climate change, a shift from opposition to support of climate change policy would provide business interests the opportunity to influence the policymaking process by working with environmental organizations and the Congress to formulate a least cost policy for industry interests.

A number of corporations and climate policy opponents began to invest more financial resources into CTTs to block the climate change issue. The increased dependence on CTTs at the beginning of the 21<sup>st</sup> century signifies a movement towards the use of “medium-cost” strategies to create an organized “disinformation” campaign to prevent the regulation of GHG emissions (Dunlap and McCright 2011). While a number of actors have played important roles in national efforts to block climate change legislation, CTTs have been a central component of the climate change counter-mobilization movement by serving as spokespersons and facilitators for conservative causes (Dunlap and McCright 2011).<sup>10</sup> The strategies used by CTTs have integrated the ideological norms of conservatives with the complexities of climate change science to continue producing skepticism and denial (Dunlap and McCright 2011; McCright and Dunlap 2003).

CTTs provide an institutional basis for contrarians, hosting “climate skeptic” conferences, orchestrating front groups and “Astroturf” operations, sponsoring “educational events” for policymakers and producing and circulating anti-climate change material (e.g., reports, press releases, interviews, etc.) to the media and the general public (Dunlap and McCright 2011; Oreskes and Conway 2010; Powell

---

<sup>10</sup> For a comprehensive discussion of this topic see Dunlap and McCright (2011).

2012). The ability for these organizations to convey themselves as objective and neutral sources of information provides the opportunity for fossil fuel corporations and philanthropists with ties to the fossil fuel industry to avoid public scrutiny by investing financial resources into CTTs (Brulle 2014; Greenpeace 2010, 2012; Union of Concerned Scientists 2007). The systematic organization of climate change skeptics and the production of economic studies that emphasize the costs of addressing climate change have played a pivotal role in keeping skepticism alive among the general public and on Capitol Hill (Dunlap and McCright 2011).

In addition to questioning the scientific basis of anthropogenic climate change, the conservative movement has successfully aligned public concerns with conventional conservative political ideology by emphasizing the potential economic implications of federal climate change policy. The second theme of environmental skepticism, according to Jacques, Dunlap and Freeman (2008), is “the prioritization of economic, social and environmental problems.” By rejecting the science of climate change and, consequently, the environmental impacts of the phenomenon, the issue becomes less important to address relative to existing policy problems. Thus, the first and second themes of environmental skepticism provide the foundation for policymakers to oppose government regulation and protect economic prosperity, the third and fourth themes of environmental skepticism (Jacques, Dunlap and Freeman 2008).

## **Congress and Climate Change Policy**

Under the U.S. Constitution, Congress shares authority with the president for federal policy making on the environment. To become law, all bills must be passed by both houses in identical form and signed by the president. As a representative legislature, Congressional action on environmental policy reflects the views of its 535 voting members (100 in the Senate, 435 in the House), all of whom are strongly motivated to attend to electoral incentives. As a representative legislative body, Congress is a microcosm of the U.S. political system, reflecting not only the views of the American public but also the positions and activities of myriad organized interests and competing political institutions that vie to affect policymaking. In the context of climate change, federal inaction to reduce GHG emissions can largely be attributed to the complexity of the climate change problem, the influence of organized interest groups, a lack of public consensus on the issues, and the ideological differences of Democrats and Republicans (Kraft 2012, 2014).

Building policy consensus in Congress is rarely easy because of the diversity of members and interests whose concerns need to be met and the strong disagreements that can arise among committees and leaders, between the majority and minority party, or between the House and Senate. Hence, legislative gridlock is common (Kraft 2012, 2014). Party conflict during the 113<sup>th</sup> Congress reached a climax in November 2013, when Senate Democrats invoked the “nuclear option” to eliminate filibusters on executive branch nominations and federal judicial appointments. The action, also known as the “constitutional option”, allows the

Senate to override a rule or precedent with a simple majority vote; and prior to 2013, had only been used as a threat by members of the Senate to break confirmation stalemate. Preceded by a dramatic increase in Republican efforts to block the confirmation of nominations and appointments during the Obama presidency the historic decision to reform the filibuster rule was instigated by Republican efforts to block the confirmation of three Democratic judges to the U.S. Court of Appeals for the District of Columbia Circuit. Passage of the “nuclear option” allowed the Senate to confirm presidential nominations with a simple majority vote, rather than the traditional supermajority vote, and demonstrated the drastic measures that the Senate majority was willing to take in order to break policy stalemate.

By establishing an organized network of contrarian scientists and policy analysts, interests opposing climate change policy have provided the necessary ammunition for Congressional members to block legislative proposals to reduce GHG emissions. Most conservative politicians have been highly skeptical of anthropogenic climate change since the issue first received widespread public attention and was placed on the political agenda. Over the last two decades, conservative members of Congress have consistently held hearings to call into question the scientific understanding of anthropogenic climate change, made attempts to reverse existing legislation, and have sought to constrain the ability for existing scientific organizations and regulatory agencies to research and regulate GHG emissions.

One of the most important reasons for the climate change policy stalemate in Congress has been the prevalence of sharp ideological differences between the two

major parties. While some Republicans, such as Senators John McCain (R-AZ) and John Warner (R-VA), have acknowledged the climate change issue and have participated in efforts to formulate policy to regulate GHG emissions, and some Democrats openly deny the existence of anthropogenic climate change, political party affiliation is generally an important indicator of where elected officials stand on the climate change issue. Republican party ideology generally argues for individual liberty as opposed to government interference. Those who identify with this political ideology prefer a small government and hold a pro-business, free-market attitude and thus an aversion to government control, especially when it imposes perceived high economic costs through the adoption of environmental and other regulations (Dunlap and Gale 1974; Kraft 2014; Rosenbaum 2011). In contrast, Democratic party ideology is more commonly associated with liberalism and an acceptance of government involvement in the political, economic, and social lives of the people when societal problems grow in severity.

As discussed above, in the early decades of the environmental movement, environmental issues were commonly considered a nonpartisan issue, as it was thought that environmental protection was a universal concern and, therefore, transcended political ideology and partisan loyalties (Ogden 1971). In recent years a significant division has emerged between Democrats and Republicans, largely based on political ideology (Brewer 2008; Poole and Rosenthal 1997). Looking at a wide set of issues in a roll-call voting analysis, McCarty, Poole, and Rosenthal (2008) report that ideological differences between the parties in Congress have reached the highest

level in more than 120 years, chiefly because Republican members have shown increasingly conservative views. In their study of partisan differences in Congress as measured by League of Conservation Voters (LCV) scores, Shipan and Lowry (2001) show that the two parties have diverged increasingly over time in member voting on environmental issues.

There are certain characteristics associated with being a Republican or Democrat that appear to translate into support for or opposition to environmental protection (Kamieniecki 1995). Beck and Sorauf (1992) argue that political parties have three parts, a party organization, a party in government, and a party in the electorate. Political party platforms are largely formulated by the party organization prior to presidential elections. Often, the party platforms reflect the positions and goals of the front-runner for a party's nomination for president and indicate the kinds of policies the party will pursue if its candidates are elected to office (Kamieniecki 1995). Early research on political party positions on natural resource and environmental policy has found substantial differences between Republican and Democratic national party platforms (Engelbert 1961). A more recent analysis has found that, beginning in 1992, Republican party platforms began to devote more attention to environmental concerns than previous platforms (Kamieniecki 1995).

The Republican party's platform on environmental issues developed from the concept of conservation via "wise use," which became a cornerstone of public lands management during Theodore Roosevelt's Presidency and the Progressive Era. The term, "wise use," coined by Gifford Pinchot, the nation's first leader of the U.S.

Forest Service (then the Division of Forestry), was used to describe the concept of conservation of the earth and its resources for the lasting benefit of human society. The anthropocentric concept of conservation developed during this era of American history has remained an important principle of conservative ideology on environmental policy. Republicans and Libertarian political leaders often emphasize the protection of economic wellbeing and individual property rights when considering policy decisions. When considering issues related to the environment, policy opposition from these groups is often framed as the protection of economic growth and, when possible, solutions are often based in free market economic principles. The Pinchot concept of conservation provides a fitting parallel with neoliberal economic principles that allow the market to determine the most efficient use of resources and guide the mechanisms for adjusting market failures (e.g., environmental impacts).

In contrast, the Democratic party's platform on environmental policy is often characterized by the interventionist and social welfare concerns that underlie many of the party's policy positions. Following the civil rights movement, the environment took new precedence on the American political agenda for Democratic political leaders as environmental problems began to pose potentially significant health hazards for members of society. The causes of these issues were generally traced back to the actions of business and industry interests who benefitted from the absence of government regulation to prevent effectively environmental pollution as a consequence of production practices. It appeared that the existing government institutions and the free market principles that had guided America's economic

expansion following World War II were failing to adequately address the environmental externalities of development. Democrats have historically supported a mixed economy approach to address issues of social welfare, and the same principles were applied to reign in the activities of business and industry to solve environmental issues.

An analysis and summary of party platforms on climate change policy from 1988 to 2016 highlights areas of agreement and conflict between the two parties on addressing global climate change (see Table 1.1). There are substantial disagreements between the two major political parties on the climate change policy issue, however, there are areas in which both parties share similar beliefs. For example, beginning in 1988, both parties support the implementation of international agreements to address climate change. However, while the Democratic party tends to support U.S. leadership in the international community to commit to GHG emissions reductions, the Republican party does not support a leadership role and argues for the burden of emissions reduction to be shared by developed and developing nations. Additionally, both parties agree that investments in technological advancements to reduce emissions and improve infrastructure should be pursued to reduce U.S. carbon intensity. While the Republican party generally supports the use of market-based policies, loosening existing regulations to incentivize private investments and private sector initiatives to achieve reductions, the Democratic party supports government investment in infrastructure improvements and a combination of market-based and command-and control policies. The Democratic party generally supports the scientific



evidence for climate change and predictions of long-term climate change, while the Republican party highlights scientific uncertainty and calls for careful and calculated policies that consider such uncertainty when establishing reduction goals that may harm the economy.

The analysis reveals that the Republican party is sympathetic to the potential environmental impacts of global climate, which coincides with Kamieniecki's (1995) identification of recent trends in attention to environmental issues from the party. The analysis also supports the traditional characteristics of each party, where the Democratic Party generally supports increased spending, government action, and strong efforts to reduce emissions, the Republican party is less favorable to direct government intervention and adamantly opposes policies that will impede economic growth. The focus of the Republican party on scientific uncertainty regarding the severity and causes of climate change highlight the central role of science in the policy debate.

**Table 1.1** Positions on climate change in party platforms, 1988-2016.

<b>Democratic Party Platform</b>	<b>Year</b>	<b>Republican Party Platform</b>
The U.S. should convene world environmental summits to address the depletion of the ozone layer, the "greenhouse effect," and the destruction of tropical forests.	1988	Support private sector initiatives to develop new technologies, adopt processes and international agreements to solve complex global problems such as climate change.
The U.S. must become a leader, in the fight against global warming and should join European nations to limit CO <sub>2</sub> emissions to 1990 levels by the year 2000.	1992	Support government spending on research on global climate change. Support a global effort to address global climate change that relies on real action plans and does not place the burden on developed countries or threaten U.S. growth and workers.
Support a strong international agreement to further reduce GHG emissions worldwide.	1996	Support a commitment to addressing global climate change in a prudent and effective manner that does not punish the U.S. economy. Do not support binding targets and timetables, imposed only on the U.S. and other developed countries, to reduce GHG emissions given scientific uncertainty about the role of human activity in climate change. Criticize the abandonment of the voluntary GHG emissions reduction policies and the relinquishment of U.S. sovereignty on environmental issues to international bureaucrats and foreign economic competitors.
Support a strong international treaty to address global warming and protect ecological systems that is market-based and does not harm the economy. Moral obligation to protect future generations from the impacts of global warming. Support incentives for Americans to invest in more fuel-efficient vehicles, more energy-efficient homes, and more environmentally-sound appliances and equipment. Support scientific evidence and predictions of climate change impacts. Support improving fuel economy in a way that preserves and creates jobs and collaboration with oil industry to produce cleaner fuels that will allow automotive environmental equipment to achieve maximum possible reductions in emissions. Supports partnership with industry to create new generation of mass transit and cleaner, reliable power systems.	2000	Oppose including global climate, climate change on America's "security agenda". Opposed to international treaties that do not include China and exempt "developing" countries from necessary standards while penalizing American industry.

**Table 1.1 Continued.**

<b>Democratic Party Platform</b>	<b>Year</b>	<b>Republican Party Platform</b>
Criticize Bush administration for rewriting government reports to hide scientific evidence of climate change. Support addressing the challenge of climate change with the serious and purposeful policies. Support global leadership from the U.S. to address climate change.	2004	Support nuclear power to reduce dependence on foreign energy and address global climate change. Support markets and new technologies to improve energy efficiency and address global climate change. Strongly oppose the Kyoto Protocol and similar mandatory carbon emissions controls that harm economic growth and American jobs.
Support a sustainable energy plan and renewed American leadership in achieving energy security and combating climate change by revitalizing global institutions on climate change. Support a market-based cap and trades system to reduce CO <sub>2</sub> emissions and set interim reduction targets. Support investment, development and exportation of climate-friendly technologies.	2008	Support reducing transportation's impact on climate change, local environments, and the nation's energy use by reforming environmental reviews and permitting processes to improve project completion time. While the consequences of increased GHG emissions from economic development is the subject of ongoing scientific research, the U.S. should take measured and reasonable steps to reduce impacts on the environment. Supports steps that are consistent with U.S. global competitiveness, national security, energy independence, and the economy. Supports technology-driven, market-based solutions, especially zero-emission energy sources such as nuclear and other alternate power sources as opposed to increased regulation. Contend that all developed and developing economies should share the economic burden of addressing climate change. Support a "Climate Prize" for scientists who solve the challenges of climate change. Do not support policies that will force Americans to sacrifice their way of life or trim their hopes and dreams for their children.

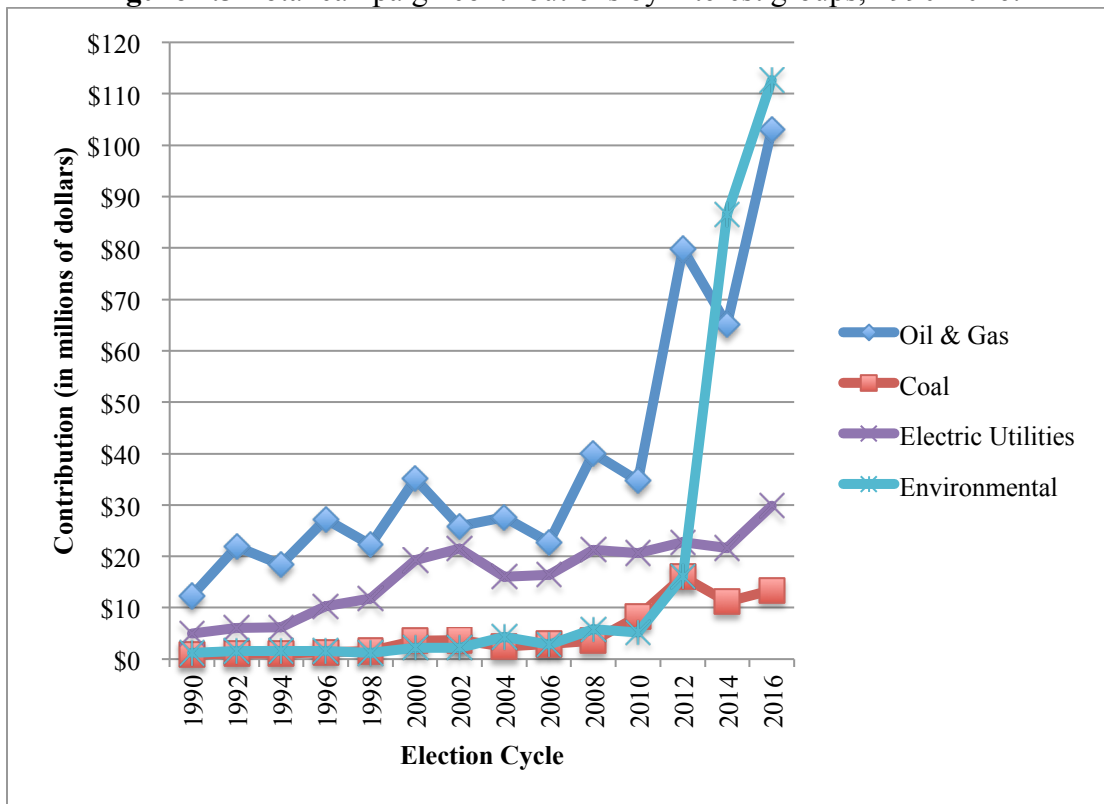
**Table 1.1 Continued.**

<b>Democratic Party Platform</b>	<b>Year</b>	<b>Republican Party Platform</b>
Faith-based organizations are critical allies in meeting challenges such as climate change. Affirm the science of climate change and support commitments to reducing GHG emissions by expanding clean energy generation and sustainable growth. Support international leadership on climate change, and joining international agreements to reduce emissions and protect national security. Support emissions reductions via regulatory and market-based solutions.	2012	Protecting the nation from foreign aggression should be a higher priority than addressing climate change.
Climate change poses a real and urgent threat to the U.S. economy, national security, tribal communities, and human health. Clean energy technology offers an important economic opportunity and can help mitigate costs of climate change action to coal communities. Support participation in international climate change agreements. Support infrastructure investments related to climate change adaptation and addressing environmental justice issues associated with climate change impacts and mitigation efforts. Address climate change through command-and-control and incentive-based policies by internalizing externalities associated with activities that release GHGs, supporting, establishing rules to improve energy efficiency, supporting research and development in clean energy technology, and forming partnerships with local and state-level.	2016	Believe that the IPCC is a political mechanism and is, therefore, biased and unreliable. Rejection of international agreements such as the Kyoto Protocol and Paris Agreement. The U.S. should, in accordance with the 1994 Foreign Relations Authorization Act, should halt funding for the UNFCCC, including the Green Climate Fund. Environmental problems, in general are best solved through incentive-based policies and technological innovation, rather than top-down, command-and-control regulations, which stifle economic growth and cost jobs.

One reason for the divergent trend in political ideology between Democrats and Republicans is the effect that interest group contributions to political campaigns have on candidates who are successfully elected. Providing financial support to congressional candidates is a valuable strategy for interest groups who stand to benefit by having political allies in Congress that share ideological values and by establishing networks of communication to successful candidates once in office.

These “high-cost” strategies are used to establish and maintain alliances with congressional candidates to influence subsequent voting practices of congressional members who seek to maintain alliances with important industry constituents. In terms of campaign financing, the oil and gas industry and electric utility companies consistently outspend environmental organizations and contribute overwhelmingly to Republican party candidates, as discussed below (see Figure 1.3). The access of business groups, such as the fossil fuel industry, to members of Congress can be explained in large part by their capacity to contribute financial support to election campaigns of members, and by their level of staffing, access to members, and other advantages that enable them to make their case on Capitol Hill. In particular, the gap in campaign contributions between environmental organizations and oil and gas interests continuously increased from 1990 to 2012 (see Figure 1.3). However, during the 2014 and 2016 election cycles, campaign contributions from environmental interests, for the first time, exceeded those provided by the oil and gas industry. This unprecedented occurrence can largely be attributed to the recent environmental and climate change policy efforts initiated by the Obama administration, the unprecedented success of international climate change policy discussions, exemplified by the 2015 UNFCCC Paris Agreement, and the promise of strong policy action under Democratic party presidential candidates, Bernie Sanders and Hillary Clinton, and, perhaps more importantly, the threat of policy reversal posed by, then presidential candidate, Donald J. Trump, and the Republican party.

**Figure 1.3** Total campaign contributions by interest groups, 1990-2016.

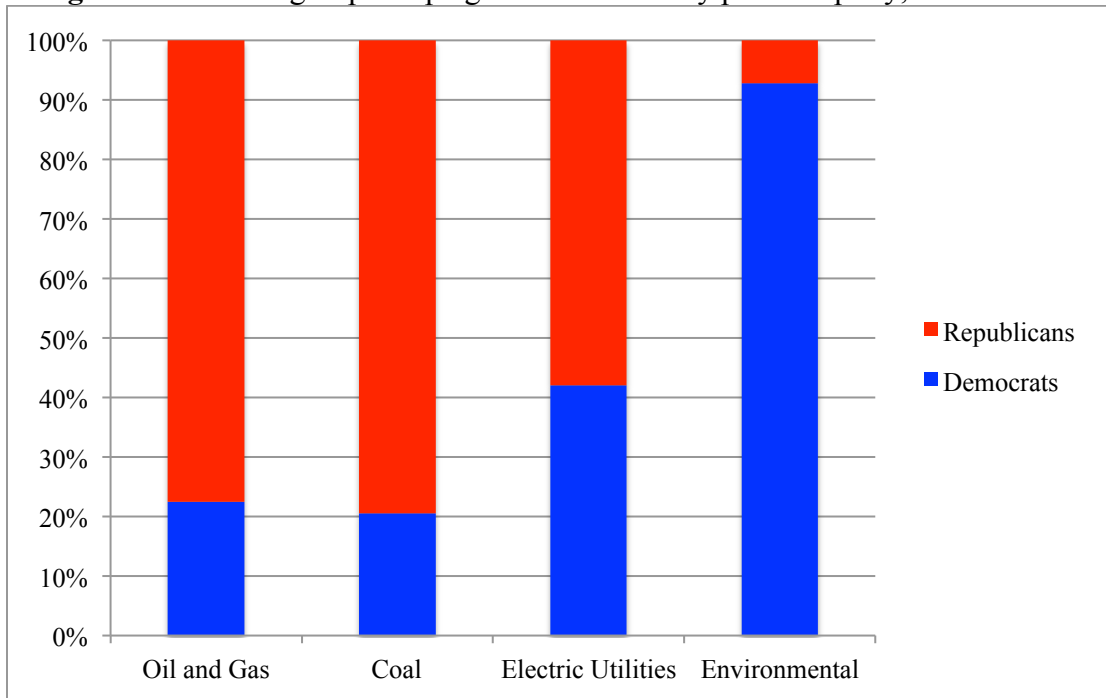


Source: Center for Responsive Politics 2017.

### **Interest Group Involvement**

Interest groups involved in the climate change policy issue do not contribute evenly to political parties (See Figure 1.4). In general, the companies from the fossil fuel industry tend to invest heavily in Republican campaigns. From 1990-2016 fossil fuel interests invested 77 percent of all campaign contributions to Republican candidates, while environmental organizations have, on average, invested more than 90 percent of campaign contributions into Democratic campaigns. Electric utility companies tend to distribute campaign contributions more evenly across political parties. On average, the industry has invested 58 percent and 42 percent of campaign contributions to Republican and Democrat candidates, respectively.

**Figure 1.4** Interest group campaign contributions by political party, 1990-2016.\*



\*Averaged across election cycles.

Source: Center for Responsive Politics 2017.

The oil industry, since the early 1900s, has benefitted from federal government intervention (e.g., prorationing, depletion allowances, import controls, etc.) that promoted domestic production in order to support economic growth and protect national security. The cooperative relationship between oil barons and national policymakers began during World War I, when antitrust policies on oil companies were weakened to support U.S. military demand, and solidified during the New Deal, when government intervention protected the industry from the uncertainties of the global market (Davis 1992). The history of government support to maintain and protect domestic oil production has allowed the industry to accumulate a significant amount of wealth. While the history of government intervention in the U.S. oil industry contradicts the laissez-faire capitalism and free market system

principles frequently embraced by conservative politicians, intervention has proven beneficial for political campaigns. Often, the oil industry, in exchange for industry-favored policies, has provided financial support to political candidates, particularly those competing for seats in the Senate and the presidency (Davis 1992).

A major consequence of the relationship between the oil industry and the federal government is that the price of fossil fuel has remained artificially low and does not include the negative impacts on the environment and public health of using such fuels. For instance, the price of a gallon of gasoline masks the true negative impacts of combustion on public health (e.g., lung cancer) and the environment (e.g., air and water pollution and hazardous waste) since the industry does not internalize these costs or invest in efforts to mitigate these impacts. By not internalizing the social and environmental costs of burning fossil fuels, the oil industry may have a competitive advantage over renewable sources. The Republican party's willingness to accept government intervention to support the oil industry is contradictory to traditional conservative ideology, which embraces laissez-faire capitalism and a true free market system. Thus, Republican opposition to federal support of renewable energy market may be a result of industry loyalty, rather than solely based on conservative values.

The unique distribution of campaign contributions from the electric utility industry amongst political parties, relative to those in the fossil fuel industry or environmental organizations, can perhaps be explained by the operational variation in electric utility companies in the nation. While a number of energy producers have

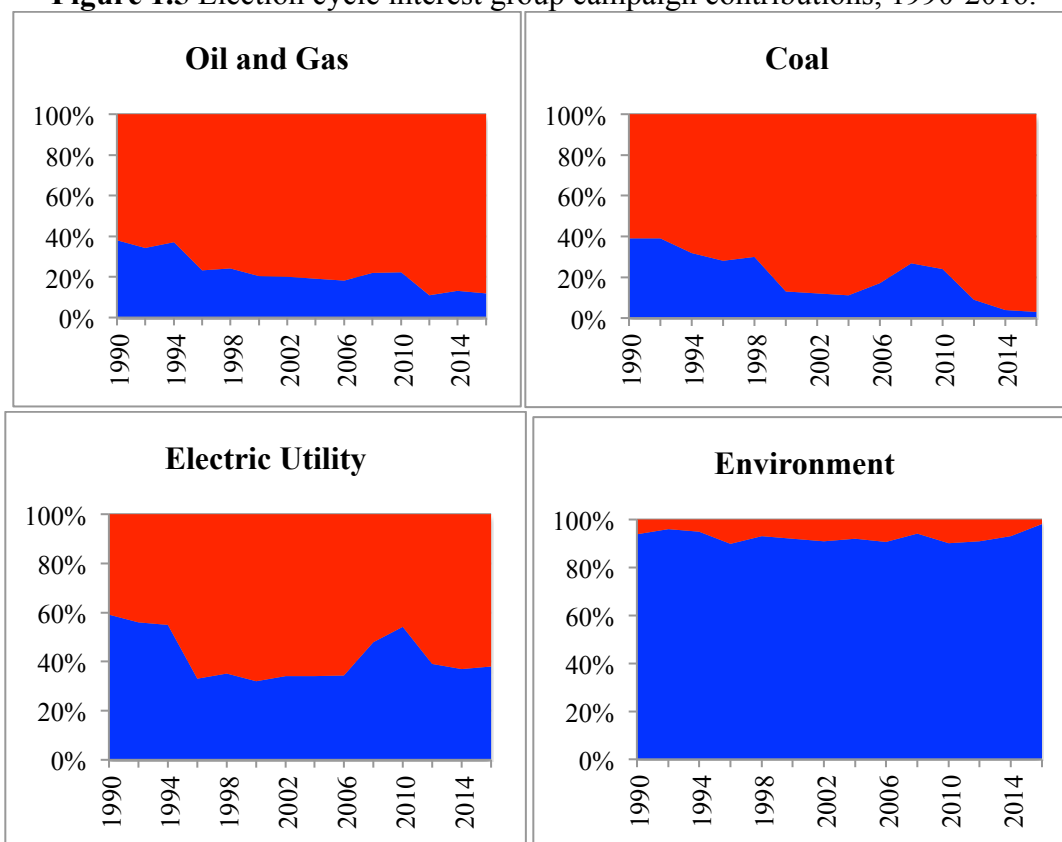


invested heavily in traditional forms of energy (e.g., coal) that generally result in large amounts of GHG emissions, many have sought to integrate or transition to less GHG intensive and more renewable forms of energy production. Utility companies that rely upon zero emissions (e.g., nuclear), renewable energy (e.g., solar, wind, and hydropower) or “clean” energy (e.g., natural gas) sources may support candidates who are more likely to favor policies that provide additional investments in these energy production methods. Alternatively, utility companies with a vested interest in protecting energy produced using coal are more likely to be interested in avoiding costly regulations, and are therefore more likely to contribute to the election of Republican candidates who, based on political ideology, are likely to oppose efforts to advance environmental protection via the expansion of government regulation in order to protect economic interests. Conversely, energy producers that have invested in technological improvements or have transitioned to low emissions energy production may be more likely to finance Democratic candidates in order to produce favorable policies that may provide a competitive advantage or financial support via subsidies. It is also likely that electric utility companies located in states where energy or climate change policy has been implemented to constrain the amount of GHG emissions generated from energy production would be interested in supporting Democratic candidates.

Following the 1994 mid-term elections when the Republicans gained a majority in both the House and the Senate, oil and gas industry investment in Democratic campaigns declined sharply and, has since, remained below 25 percent

despite a brief increase in Democratic party support during the 2008 and 2010 election cycles (see Figure 1.5). Campaign contributions from the coal industry have also consistently been favorable towards Republican candidates. As with contributions from the oil and gas industry, the proportion of contributions from coal companies declined following the 1994 mid-term elections and, with the exception of a brief increase during the 2006 and 2008 election cycles, has continuously fallen. Similarly, investments from electric utility companies in Democratic candidates declined significantly in the mid-90s before increasing during the 2008 election cycle, along with the coal industry. The change in campaign finance investments by the fossil fuel industry and electric utility companies was likely a response to the successful takeover of the Republican Party for the 14 years following the 1994 elections. By heavily investing in conservative candidates and maintaining control of Congress, industry interests are more likely to prevent the regulation of GHG emissions. Environmental organizations have consistently favored the elections of Democratic candidates since 1998. These interest groups have steadily contributed more than 90 percent of campaign contributions to liberal candidates.

**Figure 1.5** Election cycle interest group campaign contributions, 1990-2016.



Source: Center for Responsive Politics 2017.

An interesting observation of investment strategies across industry and environmental interest groups is the change in contributions among parties following a transfer of majority power in the Congress. While the fossil fuel industry and electric utility companies exhibit some flexibility with campaign finance decisions amongst the two major parties, environmental interests tend to invest predominantly in Democratic campaigns in spite of which party has control of the Congress. Fossil fuel interests and electric utility companies all show an increase in the share of Democratic candidate campaign contributions following the Democratic majority gained in the House and Senate in 2007. As with the Hagel-Byrd Resolution, interest

groups who are opposed to domestic climate change policy are capable of transcending political party lines by framing the issue as one of social welfare in light of the policy priorities set by the general public. Additionally, framing the issue as one of economic priority in the short-term is likely to be effective with Democratic candidates in states and districts in which the fossil fuel industry represents an important sector of the economy. In contrast, a reduction in GHG emissions via government regulation is in direct conflict with conventional conservative political ideology. Thus, environmental interest groups are unlikely to attain favorable policy decisions from Republican candidates and are therefore largely locked-in to investing in Democratic campaigns.

The extent to which the relationship between campaign contributions and subsequent congressional actions by successful candidates is favorable to an interest group is difficult to measure. In addition to the constituents who provide financial support for political campaigns, congressional members tend to vote based on the preferences of constituents from the general public as well as personal values and ideologies (Poole and Rosenthal 1997). Given the low saliency of the climate change issue amongst the general public and the importance of campaign finance to congressional candidates, interest group financing has very likely played a dominant role in guiding the direction of climate change policy voting behavior amongst members of the Congress.

This study analyzes the top 10 recipients of campaign contributions from fossil fuel, electric utility and environmental interest groups for members of the

House and Senate, respectively, from 2004 to 2014 using each member's LCV score on environmental issues related to climate change and energy production (see Tables 1.2 and 1.3). Not surprisingly, the top recipients of campaign contributions from fossil fuel industry interests are dominantly Republican candidates while all of the top recipients of environmental organization contributions are Democratic candidates. A comparison of the political party affiliations of top recipients of fossil fuel industry contributions illustrates the differences in local versus state-level politics. Most congressional districts are now heavily Democratic or Republican rather than closely divided between the two parties, therefore, interest group investments at the district-level are likely to be more focused on conservative representatives (Kraft 2012). Whereas, at the state level, party politics are relatively more heterogeneous and conservative interests groups are therefore more likely to invest in Democratic candidates to provide additional opportunities for influence.

Differences in scale for political regions covered by members of the House and the Senate are also likely to account for trends in supporting climate change and energy reform legislation. From the House, the average LCV score for top recipients from the oil and gas industry on climate change, clean energy, and dirty energy were 1 percent, 10 percent, and 3 percent, respectively, while average LCV scores in the Senate were 15 percent, 26 percent, and 27 percent.<sup>11</sup> Average LCV scores for top recipients of funds from the coal industry were 8 percent, 21 percent, and 9 percent

---

<sup>11</sup> Climate change refers to votes directly related to global warming pollution and increasing climate resilience for communities and wildlife. Clean energy refers to votes on renewable energy and energy efficiency. Dirty energy refers to votes on polluting energy sources, including conventional fossil fuels like oil, gas, and coal; non-conventional fossil fuels such as tar sands; and harmful energy subsidies for nuclear energy and fossil fuels.

on climate change, clean energy and dirty energy, respectively, while recipients in the Senate received scores of 18 percent, 22 percent, and 23 percent. The average voting score for top recipients of campaign contributions from the electric utility industry in the House on climate change, clean energy, and dirty energy were 35 percent, 29 and 30 percent, respectively, and 45 percent, 49 percent, and 46 percent in the Senate. The LCV voting scores of top recipients of campaign contributions from environmental organizations exhibited the least amount of variation between the House and the Senate. The average voting records for top recipients in the House on climate change, clean energy, and dirty energy were 99 percent, 95 percent and 91 percent, respectively, and 93 percent, 89 percent, and 88 percent in the Senate.

**Table 1.2** Top 10 recipients of campaign contributions by interest: House of Rep., 2004-14.

Interest Group	Rank	Candidate	Party	State-District	Amount (\$1,000s)	LCV Score (%)		
						Climate Change	Clean Energy	Dirty Energy
Oil & Gas	1	Pearce, S.	Rep	NM-02	\$1,218	0	5	2
	2	Boehner, J.	Rep	OH-08	\$1,070	0	0	2
	3	Barton, J.	Rep	TX-06	\$825	0	11	5
	4	Sullivan, J.	Rep	OK-01	\$699	0	8	4
	5	Boustany, C. Jr.	Rep	LA-03	\$646	7	8	0
	6	Conaway, M.	Rep	TX-11	\$620	0	0	4
	7	Blunt, R.	Rep	MO-07	\$588	0	7	5
	8	Berg, R.	Rep	ND-AL	\$557	0	50	0
	9	Cantor, E.	Rep	VA-07	\$552	0	3	3
	10	Rehberg, D.	Rep	MT-AL	\$521	4	8	2
Electric Utilities	1	Boehner, J.	Rep	OH-08	\$1,151	0	0	2
	2	Barton, J.	Rep	TX-06	\$1,072	0	11	5
	3	Hoyer, S.H.	Dem	MD-05	\$979	97	81	78
	4	Boucher, R.	Dem	VA-09	\$945	63	80	55
	5	Dingell, J.D.	Dem	MI-15	\$830	79	78	70
	6	Upton, F.	Rep	MI-06	\$778	12	29	14
	7	Clyburn, J.E.	Dem	SC-06	\$557	91	72	73
	8	Cantor, E.	Rep	VA-07	\$464	0	3	3
	9	Murphy, T.	Rep	PA-18	\$423	4	26	0
	10	Shimkus, J.M.	Rep	IL-19	\$395	3	7	1
Coal	1	Boehner, J.	Rep	OH-08	\$613	0	0	2
	2	Capito, S.M.	Rep	WV-02	\$511	7	21	11
	3	McKinley, D.	Rep	WV-01	\$307	0	29	0
	4	Blunt, R.	Rep	MO-07	\$210	0	7	5
	5	Murphy, T.	Rep	PA-18	\$187	4	26	0
	6	Rogers, H.	Rep	KY-05	\$173	0	14	6
	7	Whitfield, E.	Rep	KY-01	\$137	3	15	4
	8	Boucher, R.	Dem	VA-09	\$132	63	80	55
	9	Rehberg, D.	Rep	MT-AL	\$131	4	8	2
	10	Shimkus, J.M.	Rep	IL-19	\$130	3	7	1
Enviro.	1	Udall, M.	Dem	CO-02	\$353	100	92	98
	2	Heinrich, M.	Dem	NM-01	\$307	100	91	92
	3	McNerney, J.	Dem	CA-11	\$261	100	87	95
	4	Baldwin, T.	Dem	WI-02	\$149	100	96	96
	5	Udall, T.	Dem	NM-03	\$139	100	96	96
	6	Murphy, C.	Dem	CT-05	\$131	93	100	90
	7	Sestak, J.	Dem	PA-07	\$128	100	100	100
	8	Holt, R.	Dem	NJ-12	\$121	93	93	96
	9	Perriello, T.	Dem	VA-05	\$119	100	100	50
	10	Hodes, P.W.	Dem	NH-02	\$108	100	94	100

Source: Center for Responsive Politics 2014; League of Conservation Voters 2014.

**Table 1.3** Top 10 recipients of campaign contributions by interest: Senate, 2004-14.

Interest Group	Rank	Candidate	Party	State	Amount (\$1,000s)	LCV Score		
						Climate Change	Clean Energy	Dirty Energy
Oil & Gas	1	McCain, J.	Rep	AZ	\$2,690	13	19	29
	2	Cornyn, J.	Rep	TX	\$2,167	4	0	5
	3	McConnell, M.	Rep	KY	\$1,263	0	7	8
	4	Landrieu, M.L.	Dem	LA	\$981	39	48	33
	5	Obama, B.	Dem	IL	\$965	75	67	72
	6	Inhofe, J.M.	Rep	OK	\$797	4	3	5
	7	Hutchison, K.B.	Rep	TX	\$715	5	0	8
	8	Vitter, D.	Rep	LA	\$712	4	0	6
	9	Murkowski, L.	Rep	AK	\$696	13	24	10
	10	Lincoln, B.	Dem	AR	\$591	60	59	52
Electric Utilities	1	Obama, B.	Dem	IL	\$897	75	67	72
	2	McCain, J.	Rep	AZ	\$711	13	19	29
	3	Murkowski, L.	Rep	AK	\$692	13	24	10
	4	Landrieu, M.L.	Dem	LA	\$555	39	48	33
	5	Graham, L.	Rep	SC	\$473	7	3	9
	6	Clinton, H.	Dem	NY	\$420	78	82	79
	7	McConnell, M.	Rep	KY	\$416	0	7	8
	8	Manchin, J.	Dem	WV	\$391	22	50	60
	9	Dorgan, B.L.	Dem	ND	\$389	75	73	71
	10	Specter, A.	Dem	PA	\$378	53	55	32
Coal	1	Manchin, J.	Dem	WV	\$493	22	50	60
	2	McConnell, M.	Rep	KY	\$465	0	7	8
	3	Santorum, R.	Rep	PA	\$177	0	18	4
	4	Barrasso, J.A.	Rep	WY	\$152	6	0	12
	5	Inhofe, J.M.	Rep	OK	\$133	4	3	5
	6	McCain, J.	Rep	AZ	\$124	13	19	29
	7	Rockefeller, J.	Dem	WV	\$117	83	82	87
	8	Heller, D.	Rep	NV	\$116	14	10	11
	9	Specter, A.	Dem	PA	\$110	53	55	32
	10	Enzi, M.	Rep	WY	\$103	4	0	4
Enviro.	1	Obama, B.	Dem	IL	\$1,185	75	67	72
	2	Kerry, J.	Dem	AZ	\$816	100	93	92
	3	Markey, E.	Dem	MA	\$509	87	92	97
	4	Boxer, B.	Dem	CA	\$373	92	88	93
	5	Clinton, H.	Dem	NY	\$304	78	82	79
	6	Tester, J.	Dem	MT	\$263	90	95	86
	7	Udall, M.	Dem	CO	\$208	100	92	98
	8	Reid, H.	Dem	NV	\$187	100	87	87
	9	Murray, P.	Dem	WA	\$171	96	97	88
	10	Bennet, M.F.	Dem	CO	\$165	93	78	77

Source: Center for Responsive Politics 2014; League of Conservation Voters 2014.



The data provide an exemplar representation of the investment trends by climate change interest groups and the divergent voting patterns of Republican and Democratic members of the House and Senate. At the district level, where party politics and support are generally more homogeneous, the top recipients of campaign contributions from industry interest groups are conservative candidates, while liberal candidates are the primary recipients from environmental organizations. Top recipients from these two interest groups tend to vote favorably on climate change and energy policies, either opposing or supporting policy action. At the state level, where public interests are likely to be more diverse, industry interests follow a more distributive strategy of campaign finance. In the Senate, top recipients from the fossil fuel industry include members of the Democratic party, who tend to represent states in which fossil fuel production and consumption are important components of the economy (e.g., West Virginia, Louisiana, and Michigan). The economic significance of fossil fuel production to state and local economies provides industry the opportunity to frame the issue of anthropogenic climate change in the context of economic well-being such that liberal congressional members will maintain more moderate positions on policies to regulate GHG emissions. In contrast, the conflict between environmental regulation and conservative political ideology may explain trends regarding the distribution of campaign contributions from environmental organizations among the political parties.

Another important strategy used by interest groups to direct Congressional voting is the application of inside lobbying by certain organizations. Some business

groups, including the U.S. Chamber of Commerce and the fossil fuel industry, have been especially active in lobbying against proposals and regulatory action on climate change (Layzer 2007). Lobbying from environmental groups has grown in recent decades, largely as a response to increased efforts by industry interests to mobilize against environmental regulations beginning with the Reagan presidency. In spite of the expansion of organized environmental advocacy and political engagement, business interests are able to invest significantly more financial resources into direct lobbying, and therefore are likely to gain access to a greater number of congressional members. In addition, environmental organizations generally are involved in advocating for a range of environmental issues, whereas fossil fuel and electric utility companies have more focused interests. Thus, the focused interest and financial power of business and electric utility groups improve the efficiency of efforts to influence climate change policy relative to the more diffuse foci of environmental organizations.

Companies from the oil and gas industry that have been engaged in climate change policy opposition have consistently ranked among the top lobbying clients. Exxon Mobil, for example, has spent an average of \$14.2 million on inside lobbying efforts from 2003 to 2016, with a peak of \$29 million in 2008. Exxon was a founding member of the GCC and continues to lobby against the efforts of climate change policy proponents to prevent the regulation of GHG emissions. In addition, Koch Industries has been a top lobbying client from the oil and gas industry since 2006, spending an average of \$9.9 million each year (Center for Responsive Politics 2017).

Koch Industries, owned by brothers Charles and David Koch, has powerful ties to the conservative movement and has played a central role in generating “environmental skepticism” of anthropogenic climate change. The Koch brothers have founded CTTs, such as the Cato Institute, and they have provided financial support for a number of other CTTs. Koch Industries became a top lobbying client from the oil and gas industry in 2006, likely as a response to the resurgence of climate change policy discussions on Capitol Hill.

**Table 1.4.** Top 10 lobbying clients by industry, 2003-2016.

<b>Oil &amp; Gas</b>			<b>Coal</b>		
<b>Rank</b>	<b>Client</b>	<b>Total Amount (\$1,000s)</b>	<b>Rank</b>	<b>Client</b>	<b>Total Amount (\$1,000s)</b>
1	Exxon Mobil	\$198,390	1	Peabody Energy	\$49,229
2	Chevron Corp	\$125,249	2	CONSOL Energy	\$22,166
3	Koch Industries	\$109,690	3	Arch Coal	\$14,527
4	ConocoPhillips	\$94,185	4	American Coalition for Clean Coal Electricity	\$8,497
5	Royal Dutch Shell	\$92,591	5	Alpha Natural Resources	\$8,248
6	BP	\$91,094	6	Patriot Coal Corp	\$6,490
7	American Petroleum Institute	\$84,679	7	Bituminous Coal Operators Assn	\$4,704
8	Occidental Petroleum	\$62,537	8	Drummond Co	\$4,020
9	Marathon Oil	\$40,442	9	Murray Energy	\$2,849
10	American Fuel & Petrochem Manufacturers	\$21,285	10	Coal Act Fairness Alliance	\$1,863
<b>Electric Utilities</b>			<b>Environmental</b>		
<b>Rank</b>	<b>Client</b>	<b>Total Amount (\$1,000s)</b>	<b>Rank</b>	<b>Client</b>	<b>Total Amount (\$1,000s)</b>
1	Southern Co	\$179,321	1	Environmental Defense Fund	\$18,890
2	Edison Electric Institute	\$146,980	2	Nature Conservancy	\$14,966
3	PG&E Corp	\$114,630	3	Intl Assn of Fish & Wildlife Agencies	\$13,225
4	American Electric Power	\$72,547	4	Natural Resources Defense Council	\$8,500
5	Duke Energy	\$60,292	5	BlueGreen Alliance	\$7,568
6	Exelon Corp	\$54,771	6	Earthjustice Legal Defense Fund	\$6,263
7	Entergy Corp	\$43,594	7	Defenders of Wildlife	\$4,869
8	National Rural Electric Cooperative Assn	\$39,890	8	Trout Unlimited	\$4,325
9	Energy Future Holdings Corp	\$35,626	9	National Parks Conservation Assn	\$4,213
10	Public Service Enterprise Group	\$27,000	10	National Wildlife Federation	\$3,796

Source: Center for Responsive Politics 2017.

Lobbying efforts from the oil and gas industry peaked at more than \$174 million in 2009, during the most recent cap and trade policy proposal. The dramatic increase in lobbying indicates an increase in negative feedbacks likely driven by the positive feedbacks produced by President Obama, the Democratic majority in Congress, and U.S. CAP (see Figure 1.3 and Table 1.4). Lobbying efforts by environmental advocacy groups also reached an unprecedented in 2009; however, the \$24.7 million spent on lobbying was only a fraction of the \$189.72 million collectively spent by members of the fossil fuel industry (Center for Responsive Politics 2017). U.S. CAP, a top lobbying client from the environmental advocacy arena, was only involved in direct lobbying from 2007 to 2010. Following the unsuccessful efforts of U.S. CAP to break the legislative gridlock on climate change, the group's engagement in political advocacy declined. While top lobbying clients such as the Natural Resources Defense Council, Sierra Club, and Environmental Defense Fund remain heavily active in direct lobbying for climate change mitigation, these organizations also engage in a variety of other environmental issues, limiting their ability to focus all direct lobbying resources on policy to regulate GHG emissions.

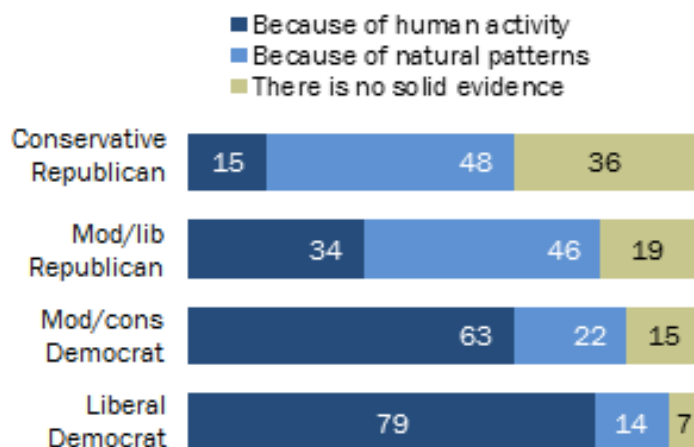
The trends in inside lobbying by the fossil fuel industry and electric utility companies underscore the ability for such interests to mobilize substantial amounts of financial resources to block opposing interests and reach policymakers to gain favorable policy outcomes. While environmental organizations continue to spend millions in direct lobbying each year, the absence of an advocacy group that is almost

entirely dedicated to achieving regulations on GHG emissions leaves the issue to other environmental advocacy groups, which are forced to distribute financial resources to addressing climate change in addition to other environmental issues. The ability for business interests to focus directly on protecting their interests in fossil fuel production allows these organizations to focus in-house resources on the generation of policy studies and media outreach that can then be presented to members of the Congress. The diffuse campaign issues covered by national environmental organizations, coupled with the limited financial resources of these organizations, may reduce the effectiveness of direct lobbying for climate change policy relative to industry interests.

In recent years the climate change issue has largely evolved from one framed by science to one defined by conservative American values and political ideology. Fossil fuel business and industry interests as well as conservative interest groups have aggressively led a campaign against the federal regulation of GHG emissions. Perhaps the transition of the climate change problem from an environmental issue rooted in science to one rooted in liberal versus conservative attitudes, beliefs, values, and economic self-interest can be explained by the dominant role that CTTs have played in blocking the issue from the political agenda in the 21<sup>st</sup> century. Nonetheless, the climate change issue has been found to carry different weight and opinion among the general public and elected officials, depending upon political party affiliations.

An early examination of the relationship between political party affiliation and belief in the climate change issue found that, in 1997, Democrats and Republicans shared very similar beliefs regarding the existence of climate change, with 47 percent of Democrats and 46 percent of Republicans stating that they believed that the effects of global climate change had already begun (Dunlap 2008). The same study found that between 1997 and 2008, the percentage of Democrats who believed that climate change had already begun had increased by nearly 30 percent, while those who identified as Republicans had fallen by almost 6 percent, indicating a divergence in the general public's perception of the climate change issue based on political party affiliation (Dunlap 2008). This study also found that, over time, Republicans were also increasingly inclined to believe that the seriousness of climate change was "exaggerated" by the media, and that warming trends were the result of natural causes rather than human activity. As of 2016, 63 percent of the general public who identify as conservative Republicans and 93 percent of those who identify as liberal Democrats believed that there is evidence of global climate change. Of those who believe that global climate change exists, 79 percent of Democrats believe that human activity is the primary cause, while only 15 percent of Republicans believe that the issue is anthropogenic in nature. In general, individuals who possess liberal political ideologies tend to have stronger beliefs regarding the existence of global climate change, and the effect of human activity on the climate, than those who identify with more conservative political beliefs (see Figure 1.6).

**Figure 1.6** Partisan views on global warming.



Source: Funk and Kennedy 2016.

There are clear divides across and within partisan lines amongst the general public on the issue of anthropogenic climate change. Individuals with more liberal political ideologies tend to believe in the existence of global warming, while those with more conservative views tend to question the existence of the issue (Brewer 2012; Guber 2013; Hamilton 2011). The differences in public opinion on the issue of global climate change across political party affiliation may be due to the general public forming their beliefs based upon the statements of elected officials and liberal or conservative media outlets (Brulle et al. 2012; Guber 2013; Krosnick, Holbrook, and Visser 2006).

### **Congressional Politics**

Following the failure of the 111<sup>th</sup> Congress (2009-2011) to reach a majority vote in favor of cap and trade legislation in the Senate, the odds of retaining political momentum to push the climate change issue onto the legislative agenda became less favorable on Capitol Hill. The emergence of the Tea Party during the 2010 midterm



election exemplified the growing division between left and right-wing political ideologies, as the libertarian group accounted for the largest recorded legislative leap to the far right. The oil and gas industry spent \$33.5 million on campaign finance, 77 percent of which was used to support republican candidates, while the coal industry spent \$8 million, a nearly \$5 million increase from the 2008 Congressional elections, 76 percent of which went to Republican candidates (see Figure 1.2). Republicans gained 5 seats in the Senate and a majority in the House, gaining 64 seats.<sup>12</sup>

The Republican-led House of the 112<sup>th</sup> Congress (2011-13) became the least environmental protective legislative body in the nation's history. During its tenure, the body voted 317 times to undermine environmental protection (Committee on Energy and Commerce 2013). The 112<sup>th</sup> Congress introduced 113 climate-specific bills, resolutions and amendments, compared to 263 and 235 such bills in the 111<sup>th</sup> and 110<sup>th</sup>, respectively. Of the climate-related bills introduced, nearly 50 percent would have blocked or constrained climate action.<sup>13</sup> Four such bills passed the House, though none made it through the Senate. This is likely another indication of the success of campaign finance and lobbying efforts of groups opposed to GHG regulation and the shifting political tide in the House and within certain states. For the first time since the introduction of the McCain-Lieberman cap and trade bill in 2003, there were no such proposals introduced during the 112<sup>th</sup> Congress.

---

<sup>12</sup> Of the 64 seats picked up by conservative candidates, 39 were Tea Party members while 5 were elected to the Senate.

<sup>13</sup> 55 bills, 40 of which sought to prohibit regulation of GHG emissions primarily by preventing the U.S. EPA from regulating emissions under the CAA.

By August 2014, the 113<sup>th</sup> (2013-2015) Congress had introduced 221 bills, resolutions and amendments focusing specifically on addressing climate change and extreme weather events largely attributed to climate change. While the Democratic party successfully gained control of the Senate and retained control of the Whitehouse with the reelection of President Obama, Republicans maintained control of the House. Of the congressional actions regarding climate change, 87 bills (39 percent) were intended to constrain climate action, 56 (25 percent) of which explicitly sought to limit the U.S. EPA's capacity to regulate GHG emissions from power plants. One proposal (S. 332) was drafted to attach a price to GHG emissions, and one bill (P.L. 113-79) was signed into law. Three bills that would limit GHG emissions regulations were passed by the House. H.R. 367 (passed on August 2, 2013) would have required any carbon tax rule to be submitted to Congress for a vote and presented to the President before taking effect; H.R. 2641 (passed on March 6, 2014) would have prohibited a lead agency from using the social cost of carbon in an environmental review or decision-making process; and H.R. 3826 (passed on March 6, 2014) sought to prohibit the U.S. EPA from issuing a rule to establish GHG performance standards at power plants, unless specific conditions were met. None of these bills were approved by the Senate.

Congressional committee hearings are an important indicator of the policy priorities and positions of members of the House and Senate. Members of Congress can have a major impact on the agenda through legislative and oversight hearings, which are generally used to gather and analyze information on a policy issue during

the process of legislative policymaking. Hearings often involve the testimony of experts and presentation of reports related to a particular issue. A number of committees in the House and the Senate are engaged in the climate change policy issue (e.g., Environment and Public Works and Commerce, Science, and Transportation in the Senate; Energy and Commerce and Science, Space, and Technology in the House). The chair of a committee, which plays an important role in shaping the agenda of a particular committee and setting hearings is always selected by the majority leader of either the House or the Senate. Therefore, the committee agenda and subsequent hearings are generally determined by the sentiment of the political party in power and its prevailing opinion on a particular issue.

The history of Republican led committee hearings on climate change is rich with party politics and the promotion of skepticism and denial. A range of CTT supported policy experts and climate change contrarians have been called to testify on the issue, as well as authors of popular literature, such as Michael Crichton, who published a book that was skeptical of anthropogenic climate change. The Republican House of the 113<sup>th</sup> Congress has continued the trend of denial and skepticism by blocking Democratic members from holding committee hearings and calling into question the scientific consensus on climate change. Representatives Henry Waxman and Bobby Rush have sent a number of letters to Energy and Commerce committee's chairman Fred Upton requesting to hold hearings on the issue, however, to date, the committee has held one such hearing. Meanwhile, the House Committee on Science, Space, and Technology, led by Chairman Lamar Smith has held three hearings on

climate change, the latest of which was held prior to the U.S. EPA's release of new standards for power plants to reduce GHG emissions. The hearing disputed the scientific consensus on the magnitude of global warming impacts and ridiculed the Obama administration for using "scare tactics" to justify the implementation of costly and unnecessary regulations. Meanwhile, the Senate's Environment & Public Works Committee, led by Senator Barbara Boxer (D-CA), has held nine hearings related to energy production and climate change since 2013. Many of the hearings included testimony from climate change scientists and policymakers to discuss the environmental and economic impacts of a changing climate, and were generally intended to move climate change policy forward.

In light of the continuing legislative gridlock on climate change policy, under the direction of President Obama's Climate Action Plan, the U.S. EPA announced the Clean Power Plan proposal in October 2015. The proposed rule calls for a 30 percent cut in nationwide carbon emissions from the power plant sector from 2005 levels by 2030. While the proposed reduction does not include some of the most important sources of GHG emissions such as the transportation sector and is less than those called for in the IPCC's latest assessment report, the rule is the first official federal mandate to address anthropogenic climate change by reducing GHG emissions. The rule led to immediate opposition from coal producing states and energy companies who claim that the mandatory reductions will "kill jobs" within the energy sector, and have taken the issue to federal courts. The regulation of GHG emissions, such as carbon, under the Clean Air Act was affirmed in *Massachusetts v. U.S. EPA* in 2007.

However, opponents of the rule have argued that the U.S. EPA's rule imposes a double-regulation of air pollution emissions from coal plants that are already obligated to comply with the rules of the Clean Air Act. The Clean Power Plan, however, may never be fully implemented as the emissions rule has remained in the federal courts since its inception in 2015, and, under the direction of President Donald J. Trump, is currently being dismantled by the U.S. EPA.

### **The Emergence of State Involvement in Climate Change Policy**

The consequences of global climate change present an environmental challenge that is not unlike those confronted during the environmental decade. Within the 115<sup>th</sup> Congress, 27 percent of members currently serving in the House of Representatives and 60 percent of U.S. Senators have made statements either disregarding the occurrence of climate change or that humans are the primary causes of global warming (Organizing for Action 2017). The influence of powerful interest groups and the organized efforts of CTTs have undoubtedly influenced how those in Congress respond to legislation to address climate change. While liberal public interest groups, including environmental organizations, have grown in number and have attracted hundreds of thousands of members, they are generally less well funded than business groups (Baumgartner and Jones 1993; Bosso 2005). Accordingly, studies of group influence in Congress often point to the dominance of business interests in policymaking (Clauson, Neustadt and Weller 1998; Hacker and Pierson 2010; Kraft and Kamieniecki 2007; Maisel and Berry 2011; Schlozman and Tierney 1986). Business groups may be especially influential when the Republican Party

controls one or both houses of Congress, citing the negative impact of regulations on business and job creation to restrain regulatory activities.

Given the recent trends regarding the divergence of political parties in the legislative branch and the inability to agree on policy solutions to address climate change policy, it is unlikely that a consensus will be reached in the short to medium-term on an effective GHG emissions reduction strategy (Falke 2011). American wealth, power, and social relations rest, in part, on generations of relatively inexpensive fossil fuels and the expectation of growing demand and supply of such energy. The nation's economy and major aspects of its social structure were built on these foundations. Members of Congress operate under two-year terms, and, therefore, have powerful electoral incentives that induce them to think as much about local and regional impacts of environmental policies, particularly short-term and highly visible impacts such as job losses and other costs linked to regulation, as they do about the larger national interest (Davidson et al. 2013; Jacobson 2012; Kraft 2012; Mayhew 2004). This political sentiment is embraced more powerfully by the Republican party than the Democratic party, which is more willing to accept some costs in order to improve the welfare of society. Such congressional policy appraisals often differ from those of the president and White House staff, environmental policy advocates, and the scientific community, all of whom tend to emphasize longer-term, more comprehensive, national perspectives on national issues. These kinds of legislative perspectives can create significant institutional barriers to acting on third-generation environmental and resource challenges such as climate change.

More than two hundred years ago, during the drafting of the new U.S. Constitution, James Madison composed the Federalist Paper Number 10, in which he sought to address the issue of “mischiefs of faction”. A faction, according to Madison, consists of, “a number of citizens, whether amounting to a majority or a minority of the whole, who are united and actuated by some common impulse of passion, or of interest, adverse to the rights of other citizens, or to the permanent and aggregate interests of the community” (Madison 1787). Madison predicted that, given the freedoms granted citizens under the Constitution to associate and form groups, these factions would be a natural product and price of liberty. He argued that inequality and the possession of economic resources would lie at the heart of the problem, however, the ability for factions to control the government would be limited by the three separate branches, which would serve as important checks and balances on one another.

Beginning in the 1960s, social scientists began elaborating upon the conditions under which some interests are effective at organizing, while others are not (Olson 1965). The dramatic growth in wealth and size of business group interests during this time, and throughout the 20<sup>th</sup> century, has led many to believe that such interests have grown too powerful and, through lobbying and campaign finance, contribute to legislative gridlock, undermine democracy and consequently threaten the well-being of society (Kraft and Kamieniecki 2007).

The existence of anthropogenic global climate change is undeniable, and the long-term consequences are potentially catastrophic. The costs of inaction will be

internalized by a multitude of economic sectors and experienced by generations to come. In spite of the likely impacts of climate change to regions throughout the U.S., the federal government's inability to address the issue of anthropogenic climate change effectively has prioritized the short-term interests of a well-organized faction of conservative and industry groups over the long-term well-being of the general public. The financial power of industry and conservative interests and the diverse set of actors who stand to be impacted by the regulations on fossil fuel production and consumption have motivated a powerful effort to block federal policy from reaching a legislative tipping point. While proponents of climate change policy have been successful at achieving incremental gains in the policymaking arena by engaging members of the business community and influential policy entrepreneurs, these efforts have been unsuccessful, overall, in an era of growing partisan divide on Capitol Hill. The question of how to allow business and other interest groups to form and participate in a modern democracy while controlling their influence continues to be an important dilemma in the U.S. While important finance reform legislation has been enacted in recent years in an attempt to "level the playing field" for competing interests, significant loopholes remain and inequity continues to exist (Kamieniecki and Kraft 2007).

In spite of the "mischief of faction" plaguing the passage of climate change policy at the federal level, concerns about climate change and its environmental impacts have prompted many states to acknowledge the climate change issue and implement an array of policies to reduce GHG emissions. Madison argued that as the



“sphere” of governance expands policymakers would find it more difficult to act as the diversity of interests and effected parties is greater relative to smaller polities (Madison 1787). He predicted that smaller units of government would be quicker to act on policy issues. While some have noted the susceptibility of states, in general, to reject or underfund policies that could reduce their state’s ability to compete with others for economic growth, resulting in a “race to the bottom,” in which bypassing regulation potentially allows problems to continue or worsen (Peterson 1995).

In the case of climate change, Madison’s prediction regarding policy action at lower levels of government has proven to be true. Table 1.5 shows the number of different climate change policies that states have initiated to manage, monitor, regulate, and reduce GHG emissions.<sup>14</sup> The table divides policies into those that are focused on a particular policy sector (building, energy and transportation) and those that are distributed across policy sectors (climate action). The twenty-one types of policies include a range of voluntary (e.g., GHG emissions reporting programs), and market-based (e.g., cap and trade) and command-and-control (e.g., low carbon fuel standard) regulatory tools that span multiple sectors (e.g., commercial, state, and residential), industries (e.g. automobile, energy producers), and jurisdictions (e.g., regional climate change policy agreements).

---

<sup>14</sup> State climate change policy activities are discussed further in Chapter 4 and Chapter 6.

**Table 1.5** State-level climate change policy adoption.

<b>Policy Sector</b>	<b>Type of Policy</b>	<b>No. of Policies</b>
Building	Building Standards For State Buildings	47
	Commercial Building Energy Codes	42
	Residential Building Energy Codes	41
	Appliance Efficiency Standards	14
Climate Action	Greenhouse Gas Inventories	44
	Greenhouse Gas Reporting And Registries	40
	Climate Action Plan	37
	Climate Change Adaptation Plan	23
	Active Climate Legislative Commissions And Executive Branch Advisory Groups	35
	Greenhouse Gas Emissions Targets	19
	Emissions Standards for the Electric Power Sector	6
	Cap and Trade	11
	Regional Agreements	15
Energy	Net Metering Programs	47
	Renewable and Alternative Energy Portfolio Standards	38
	Energy Efficiency Resource Standards	32
Transportation	Low Carbon Fuel Standard	13
	Renewable Fuel Mandates	35
	Smart Growth/Vehicle Miles Travelled Policies	25
	Vehicle Greenhouse Gas Emissions Standards	13
	Zero Emissions Vehicle Program	10

Sources: ACEEE 1016; C2ES 2014; DSIRE 2016

Table 1.6 shows how the 587 policies that have been adopted by U.S. states are distributed across state-level policy sectors. By-and-large state-level climate change policies have focused on programs that target emissions across policy and economic sectors (40 percent). Of the state-level policies that focus on specific policy sectors, the building sector accounts for more nearly a quarter of all policies (25

percent), followed by the energy (20 percent) and transportation (16 percent) sectors. While some states have been more active than others, all fifty states have implemented some form of climate change policy (see Table 1.7). Clearly, the potential economic costs of addressing the issue of anthropogenic climate change has not deterred policy action and produced a “race to the bottom” amongst the states.

**Table 1.6** State climate change policies by policy area.

<b>Sector</b>	<b>No of Policies</b>	<b>Percent of Total</b>
Climate Action	234	39
Energy	117	20
Transportation	96	16
Building	144	25

Sources: ACEEE 1016; C2ES 2014; DSIRE 2016

**Table 1.7** Climate change policy adoption by state.

<b>State</b>	<b>No. of Policies</b>	<b>State</b>	<b>No. of Policies</b>
Alabama	6	Montana	11
Alaska	8	Nebraska	4
Arizona	12	Nevada	10
Arkansas	9	New Hampshire	18
California	21	New Jersey	18
Colorado	10	New Mexico	11
Connecticut	20	New York	21
Delaware	17	North Carolina	12
Florida	10	North Dakota	3
Georgia	7	Ohio	9
Hawaii	13	Oklahoma	7
Idaho	7	Oregon	20
Illinois	15	Pennsylvania	15
Indiana	6	Rhode Island	20
Iowa	13	South Carolina	11
Kansas	8	South Dakota	5
Kentucky	9	Tennessee	8
Louisiana	7	Texas	9
Maine	17	Utah	10
Maryland	20	Vermont	19
Massachusetts	20	Virginia	13
Michigan	13	Washington	19
Minnesota	13	West Virginia	6
Mississippi	3	Wisconsin	13
Missouri	8	Wyoming	3

Sources: ACEEE 1016; C2ES 2014; DSIRE 2016

The ability of state-level policymakers to enact such a broad range of policies designed to reduce GHG emissions, in spite of the overwhelming conflict at the federal level, poses a number of interesting questions for scholars of the policy, political science, and public management literature. Early policy research on the issue of global climate change disproportionately focused on policy efforts at the national and international level and was surprisingly unengaged in the role of states in

addressing the climate change policy issue (Rabe 2004, 2010). More recently, scholars have investigated various aspects of the state climate change policy process. Beginning with Rabe's (2004) initial exploration of how various states have been able to overcome the political challenges of regulating GHG emissions, scholars have explored the process of horizontal (e.g., Bauer and Steurer 2014, Betsill and Rabe 2009) and vertical policy diffusion (e.g., Betsill and Rabe 2009; Fisher 2013; Posner 2010), as well as the comparison across states of particular policy instruments (e.g., renewable portfolio standards), and the impact that such policies are likely to have in the context of the U.S. contribution to global GHG emissions.<sup>15</sup> The findings of the research largely point to the importance of policy entrepreneurs and third party technocratic institutions in pushing policy forward, and the process of policy learning as a source of policy diffusion (e.g., Kraus 2012; Rabe 2004, 2007, 2011). While research on the policy and politics of state-level climate change policymaking has grown in recent years, the amount and scope of research has not kept pace with growth in the saliency and urgency of the climate change issue (Rabe 2010). In particular, little inquiry has been conducted on important areas such as policymaking processes, the role of stakeholder engagement in policy formulation and implementation and climate change adaptation (Bernauer 2013; Javeline 2014).

---

<sup>15</sup> "Horizontal diffusion" refers to the diffusion of one state's policy design or idea to other states. "Vertical diffusion" refers to the diffusion of policy design or ideas that occur at the federal or local level to the state level.

## **Conclusion**

Given the history of federal climate change policy efforts, namely the widespread and persistent efforts by members of the fossil fuel industry and CTTs, and the growing rift between highly ideological policymakers, the prospect of achieving a federal legislative policy to regulate and reduce GHG emissions within the critical window identified by the IPCC looks bleak. The unification of powerful business and industry interest groups who are opposed to climate change policy with conservative members of the Congress and society has produced an effective campaign against policy change. Of course, the election of President Donald Trump has made it virtually impossible for any legislation that reduces GHG emissions to become law.

The logic behind the advantage that unified, wealthy, private interest groups have on the policy process was first revealed in Mancur Olson's (1965) influential work on the dilemma of collective action problems. Olson contended that such interests, when the shared benefits were sufficient, have a comparative advantage in their ability to funnel resources into organization efforts and are therefore more efficient at mobilizing powerful campaigns to achieve particular policy outcomes. He argued that groups with many potential members, such as those supported by environmentally concerned citizens, seeking to achieve collective benefits have a significant disadvantage, as the individual incentive to "free ride" reduces the chances of successful unification. Smith (2000) expanded upon Olson's findings in his examination of the effect that business interests have on policymaking when unified

on a particular policy issue. The study concluded that the unified positions of business on policy issues are likely to achieve its legislative goals only when the public is strongly supportive of such efforts.

Undoubtedly, the prospect of a national policy to regulate and reduce the consumption of fossil fuels and reduce GHG emissions presents an economic threat to a number of powerful interests. Fossil fuel and energy producers (as well as the automobile industry) represent key actors in the climate change policy debate who have unified to invest in lobbying campaigns and political candidates in order to prevent the regulation of GHGs. More recently, CTTs have played an important role by organizing these efforts, preparing and disseminating “scientific” studies and policy analyses that call into question the existence of anthropogenic climate change and exaggerating the economic consequences of actions to reduce GHG emissions.

The strategies employed by what Dunlap and McCright (2011) refer to as the “Climate Denial Machine” has presumably influenced the general public’s opinion regarding the scientific consensus regarding anthropogenic climate change and the willingness to incur the potential costs of regulatory action. While environmental interest groups and coalitions that support a national climate change policy have been successful at organizing large scale campaigns and gaining political support from elected officials, the financial resources of such organizations has consistently been outmatched by their opponents. Furthermore, the efforts of climate change policy proponents have been plagued by the challenge of gaining widespread public support to address the climate change issue.

Despite the absence of federal legislation that establishes substantive GHG reduction targets and a means to achieve reductions, many states (and cities) have taken a leadership role in addressing the causes of anthropogenic climate change (Krause 2010; Portney 2010; Posner 2010; Rabe 2004, 2008). Both conservative and liberal governors and lawmakers have supported state climate change action by signing and voting into law a range of policies that address the causes and consequences of anthropogenic global climate change. Even states with extensive roots in conservative political ideology and fossil fuel production (e.g., Texas, Florida, and Kentucky) have taken steps to acknowledge the existence of anthropogenic climate change and adopt strategies to reduce emissions from energy production (Rabe 2004).

The discrepancy between federal-level legislative inaction and state action on climate change may be due to the presence of state-level policy entrepreneurs and the engagement of important stakeholder groups in the policy process. Stakeholder engagement in the formulation of environmental policy has been widely used to address environmental and natural resource problems (e.g., water quality, fisheries, and forest management) in the American states.

While a number of studies have applied theories related to stakeholder engagement in the policy process to understand and evaluate policy and environmental outcomes (e.g. Cheng and Mattor 2006; Heikkila and Gerlak 2005; Layzer 2008; Leach, Pelkey and Sabatier 2002; Smith 2009; Weber, Lovrich and Gaffney 2005), the application of such theories to climate change policy has yet to be



analyzed in the literature. The next chapter introduces a theoretical framework developed by Sabatier et al. (2005) to analyze stakeholder involvement in collaborative watershed management, which can potentially be useful for understanding the process of stakeholder engagement in the development of state-level climate change policy. The chapter builds upon the work of Sabatier et al. (2005) and outlines a conceptual framework for understanding the possible variables influencing collaborative climate change policymaking in the American states.

## References

- Aklin, M., & Urpelainen, J. (2013). Debating clean energy: Frames, counter frames, and audiences. *Global Environmental Change-Human and Policy Dimensions*, 23(5), 1225-1232. doi: 10.1016/j.gloenvcha.2013.03.007
- Anderegg, W. R. L., & Goldsmith, G. R. (2014). Public interest in climate change over the past decade and the effects of the 'climategate' media event. *Environmental Research Letters*, 9(5). doi: 10.1088/1748-9326/9/5/054005
- Bachrach, P., & Baratz, M.S. (1962). Two Faces of Power. *The American Political Science Review* 56(4), 947-952.
- Baumgartner, F.R. (2006). "Punctuated Equilibrium Theory and Environmental Policy". In *Punctuated Equilibrium and the Dynamics of U.S. Environmental Policy*, ed. R. Repetto, 24-46. New Haven, Connecticut: Yale University Press.
- Baumgartner, F. R., & B. D. Jones. (1993). *Agendas and Instability in American Politics*. Chicago, Illinois: University of Chicago Press.
- Baumgartner, F., and B. Leech. (1998). *Basic Interests: The Importance of Groups in Politics and in Political Science*: Princeton, New Jersey: Princeton University Press.
- Baumgartner, F., et al. (2009). *Lobbying and Policy Change: Who Wins, Who Loses, and Why*. Chicago, Illinois: University of Chicago Press.
- Bauer, A., & Steurer, R. (2014). Multi-level governance of climate change adaptation through regional partnerships in Canada and England. *Geoforum*, 51, 121-129.

doi: 10.1016/j.geoforum.2013.10.006

Beck, P.A., & Sorauf, F. (1992). *Party Politics in America*. 7th Edition. New York, New York: Harper Collins.

Bernauer, T. (2013). Climate Change Politics. *Annual Review of Political Science, Vol 16*, 16, 421-448. doi: 10.1146/annurev-polisci-062011-154926

Berry, J. (1999). *The New Liberalism: The Rising Power of Citizen Groups*. Washington, D.C.: Brookings Institution Press.

Betsill, M.M., & Rabe, B.G. (2009). "Climate Change and Multilevel Governance: The Evolving State and Local Roles." In *Toward sustainable Communities: Transition and Transformations in Environmental Policy*, eds. D. Mazmanian and M.E. Kraft, 201-226. Boston, Massachusetts: MIT Press.

Boden, T.A., Marland, G., & Andres, R.J. (2017). *National CO2 Emissions from Fossil-Fuel Burning, Cement Manufacture, and Gas Flaring: 1751-2014*. Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory, U.S. Department of Energy

Boehmer-Christiansen, S. (1994). Global climate protection policy: the limits of scientific advice. *Global Environmental Change*. 4(2),140-159. doi: 10.1016/0959-3780(94)90049-3

Bosso, C. J. (2005). *Environment, Inc.: From Grassroots to Beltway*. Lawrence, Kansas: University Press of Kansas.

Boykoff, M. T., & Boykoff, J. M. (2004). Balance as bias: global warming and the US prestige press. *Global Environmental Change-Human and Policy Dimensions*, 14(2),

125-136. doi: 10.1016/j.gloenvcha.2003.10.001

Brewer, P. R. (2012). Polarisation in the USA: climate change, party politics, and public opinion in the obama era. *European Political Science*, 11(1), 7-17. doi: 10.1057/eps.2011.10

Brewer, P. R., & Pease, A. (2008). Federal Climate Politics in the United States: Polarization and Paralysis. *Turning Down the Heat: the Politics of Climate Policy in Affluent Democracies*, 85-103.

Brock, W.A. (2006). "Tipping Points, Abrupt Opinion Changes, and Punctuated Policy Change". In *Punctuated Equilibrium and the Dynamics of U.S. Environmental Policy*, ed. R. Repetto, 47-77. New Haven, Connecticut: Yale University Press.

Brulle, R. J. (2014). Institutionalizing delay: foundation funding and the creation of US climate change counter-movement organizations. *Climatic Change*, 122(4), 681-694. doi: 10.1007/s10584-013-1018-7

Center for Climate and Energy Solutions (CCES) (2013). *U.S. States & Regions: Climate Action*. Retrieved from: <http://www.c2es.org/us-states-regions>.

Center for Responsive Politics (2014). *Influence and Lobbying: Oil and Gas*. Retrieved from <https://www.opensecrets.org/industries/indus.php?ind=E01>.

Center for Responsive Politics (2017). *Influence and Lobbying: Oil and Gas*. Retrieved from <https://www.opensecrets.org/industries/indus.php?ind=E01>.

Cheng, A. S., & Mattor, K. M. (2006). Why Won't They Come? Stakeholder Perspectives on Collaborative National Forest Planning by Participation

- Level. *Environmental Management* 38, 545–561.
- Clauson, D., Neustadt, A., & M. Weller. (1998). *Dollars and Votes: How Business Campaign Contributions Subvert Democracy*. Philadelphia: Temple University Press.
- Cobb, R.W., & Ross, M.H. (1997a). *Cultural Strategies of Agenda Denial*. Lawrence, Kansas: University Press of Kansas.
- Cobb, R.W., & Ross, M.H. (1997b). Agenda Setting and the Denial of Agenda Access: Key Concepts”. In *Cultural Strategies of Agenda Denial*. Lawrence, eds. R.W. Cobb and M.H. Cobb. Lawrence, Kansas: University Press of Kansas.
- Cole, S. (1992). *Making Science: Between Nature and Society*. Cambridge, Massachusetts: Harvard University Press.
- Davidson, R.H., Oleszek, W.J., Lee, F.E., & Schickler, E. (2013). *Congress and Its Members*. 14th Edition. Thousand Oaks, California: CQ Press.
- Davis, D.H. (1992). *Energy politics*. 4th Edition. New York: St. Martin’s Press.
- Ding, D., Maibach, E. W., Zhao, X., Roser-Renouf, C., & Leiserowitz, A. (2011). Support for climate policy and societal action are linked to perceptions about scientific agreement. *Nature Climate Change*, 1, 462-466.
- Dunlap, R.E. (1987). Polls, pollution, and politics revisited: Public opinion on the environment in the Reagan era. *Environment*, 29(6), 6-37.
- Dunlap, R.E. (2008). Climate-Change Views: Republican-Democratic Gaps Expand. *Gallup*. Retrieved from: <http://www.gallup.com/poll/107569/ClimateChange->

Views-RepublicanDemocratic-Gaps-Expand.aspx

- Dunlap, R.E & Catton, W.R. (1994). Struggling with Human Exemptionalism: The Rise, Decline, and Revitalization of Environmental Sociology. *The American Sociologist*, 25,5-30.
- Dunlap, R.E. & McCright, A.M. (2011). “Organized Climate Change Denial”. In *The Oxford Handbook of Climate Change and Society*, eds. J.S. Dryzek, R.B. Norgaard and D. Schlosberg, 144-1600. Oxford, United Kingdom: Oxford University Press.
- Dunlap, R. E., & Gale, R. P. (1974). “Party Membership and Environmental Politics: A Legislative Roll-Call Analysis.” *Social Science Quarterly* 55 (3), 670–690.
- Edelman, M.E. (1985). *The Symbolic Uses of Politics*. 2nd Edition. Chicago, Illinois: University of Illinois Press.
- Engelbert, E. (1961). Political Parties and Natural Resources Policies: An Historical Evaluation, 1790-950. *Natural Resources Journal*, 1,224-56.
- Falke, A. (2011). Business Lobbying and the Prospects for American Climate Change Legislation. *Gaia-Ecological Perspectives for Science and Society*, 20(1), 20-25.
- Fisher, D. R. (2013). Understanding the relationship between subnational and national climate change politics in the United States: toward a theory of boomerang federalism. *Environment and Planning C-Government and Policy*, 31(5), 769-784. doi: 10.1068/c111186
- Fisher, D. R., Waggle, J., & Leifeld, P. (2013). Where Does Political Polarization

- Come From? Locating Polarization Within the US Climate Change Debate.  
*American Behavioral Scientist*, 57(1), 70-92. doi:  
10.1177/0002764212463360
- Frankel, D., & Young, P. (2000). Resolving indeterminacy in dynamic settings: The role of shocks. *Quarterly Journal of Economics* 115,285-304.
- Funk, C., & Kennedy, B. (2016 October 4). The Politics of Climate Change. *Pew Research Center*. Retrieved from: <http://www.pewinternet.org/2016/10/04/public-views-on-climate-change-and-climate-scientists/>
- Gauchat, G. (2011). The cultural authority of science: Public trust and acceptance of organized science. *Public Understanding of Science*, 20(6), 751-770. doi:  
10.1177/0963662510365246
- Gelbspan, R. (1998). *The Heat is On: The Climate Crisis, The Cover-up, The Perception*. Updated Edition. New York, New York: Perseus Books.
- Global Change Research Act of 1990, Pub. L. No. 101-606, 104 Stat. 3096-3104 (1990).
- Goodell, J. (2007). *Big Coal: The Dirt Secret Behind America's Energy Future*. New York, New York: Mariner.
- Greenpeace (2010). *Koch Industries Secretly Funding the Climate Denial Machine*. Retrieved from <http://www.greenpeace.org/usa/en/campaigns/global-warming-and-energy/polluterwatch/koch-industries/>.
- Greenpeace (2012). *Koch Brothers Exposed: Fueling Climate Denial and Privatizing Democracy*. Retrieved from <http://greenpeaceblogs.org/2012/04/02/koch->

brothers-exposed-fueling-climate-denial-and-privatizing-democracy/.

- Guber, D.L. (2013). A Cooling Climate for Change? Party Polarization and the Politics of Global Warming. *American Behavioral Scientist*, 57 (1), 93-115.
- Hacker, J. S., & Pierson, P. (2010). *Winner-Take-All Politics: How Washington Made the Rich Richer—and Turned Its Back on the Middle Class*. New York, New York: Simon and Schuster.
- Hamilton, L. C. (2011). Education, politics and opinions about climate change evidence for interaction effects. *Climatic Change*, 104(2), 231-242. doi: 10.1007/s10584-010-9957-8
- Heikkila, T., & Gerlak, A. K. (2005). The Formation of Large-Scale Collaborative Resource Management Institutions: Clarifying the Roles of Stakeholders, Science, and Institutions. *Policy Studies Journal* 33 (4), 583–612.
- Jacques, P.J. (2006). The Rearguard of Modernity: Environmental Skepticism as a Struggle of Citizenship. *Global Environmental Politics*, 6(1),76-101. doi: 10.1162/glep.2006.6.1.76
- Jacques, P. J., Dunlap, R. E., & Freeman, M. (2008). The organisation of denial: Conservative think tanks and environmental scepticism. *Environmental Politics*, 17(3), 349-385. doi: 10.1080/09644010802055576
- Javeline, D. (2014). The Most Important Topic Political Scientists Are Not Studying: Adapting to Climate Change. *Perspectives on Politics*, 12(2), 420-434. doi: 10.1017/s1537592714000784
- Kraft, M.E., & Kamieniecki, S., eds. (2007). *Business and Environmental Policy:*



*Corporate Interests in the American Political System*. Cambridge, Massachusetts: MIT Press.

Krause, R. M. (2012). An Assessment of the Impact that Participation in Local Climate Networks Has on Cities' Implementation of Climate, Energy, and Transportation Policies. *Review of Policy Research*, 29(5), 585-604. doi: 10.1111/j.1541-1338.2012.00582.x

Intergovernmental Panel on Climate Change (IPCC) (1995). *Climate Change 1995: Impacts, Adaptations and Mitigation of Climate Change: Scientific-Technical Analyses*. eds. R.T. Watson, M.C. Zinyowera, and R.H. Moss. New York, New York: Cambridge University Press.

Intergovernmental Panel on Climate Change (IPCC) (2013). *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. eds. T.F. Stocker, D. Qin, G.K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley. New York, New York: Cambridge University Press.

Jacobson, G.C. (2012). *Politics of Congressional Elections*. 8th Edition. San Mateo, California: Pearson.

Kamieniecki, S. (1995). "Political Parties and Environmental Policy". In *Environmental Politics & Policy: Theories and Evidence*, 2nd Edition, 146-167. Durham, North Carolina: Duke University Press.

- Kamieniecki, S. (2006). *Corporate American and Environmental Policy: How Often Does Business Get Its Way?* Palo Alto, California: Stanford University Press.
- Kamieniecki, S. & Kraft, M.E. (2007). "Conclusions: The Influence of Business on Environmental Politics and Policy." In *Business and Environmental Policy: Corporate Interests in the American Political System*, eds. M.E. Kraft and S. Kamieniecki, 319-348. Cambridge, Massachusetts: MIT Press.
- Kingdon, J.W. (1995). *Agendas, Alternatives, and Public Policies*. New York, New York: HarperCollins.
- Korten, D.C. (1995). *When Corporations Rule the World*. Connecticut: Kumarian Press.
- Kraft, M.E. (2012). "Congress and Environmental Policy". In *The Oxford Handbook of US Environmental Policy*, ed. M.E. Kraft and S. Kamieniecki, 306-328. New York, New York: Oxford University Press.
- Kraft, M. E. (2014). *Environmental Policy and Politics*. 6th ed. New York: Pearson.
- Kraft, M., & S. Kamieniecki, eds. (2007). *Business and Environmental Policy: Corporate Interests in the American Political System*. Cambridge, Massachusetts: MIT Press.
- Krause, R.M. (2010). Policy innovation, intergovernmental relations, and the adoption of climate protection initiatives by U.S. cities. *Journal of Urban Affairs*, 33(1),45-60.
- Krosnick, J.A., Holbrook, A.L., & Visser P.S. (2000). The Impact of the Fall 1997 Debate About Global Warming on American Public Opinion. *Public*

*Understanding*, 9, 239-260.

- Layzer, J. A. (2007). "Deep Freeze: How Business Has Shaped the Global Warming Debate in Congress." In *Business and Environmental Policy: Corporate Interests in the American Political System*, eds. M. Kraft and S. Kamieniecki. Cambridge, Massachusetts: MIT Press.
- Layzer, J. A. (2008). *Natural Experiments: Ecosystem-Based Management and the Environment*. Cambridge, Massachusetts: MIT Press.
- Layzer, J.A. (2014). *Open for Business: Conservatives' Opposition to Environmental Regulation*. Cambridge, Massachusetts: MIT Press.
- Leach, W. D., Pelkey, N. W., & Sabatier, P. S. (2002). Stakeholder Partnerships as Collaborative Policymaking: Evaluation Criteria Applied to Watershed Management in California and Washington. *Journal of Policy Analysis and Management* 21 (4), 645–670.
- Lehne, R. (2001). *Government and Business: American Political Economy in Comparative Perspective*. New York, New York: Basic Books.
- Leiserowitz, A. A., Maibach, E. W., Roser-Renouf, C., Smith, N., & Dawson, E. (2013). Climategate, Public Opinion, and the Loss of Trust. *American Behavioral Scientist*, 57(6), 818-837. doi: 10.1177/0002764212458272
- Libby, R.T. (1998). *Eco-Wars: Political Campaigns and Social Movements*. New York, New York: Columbia University Press.
- Leiserowitz, A. A., Maibach, E. W., Roser-Renouf, C., Smith, N., & Dawson, E. (2013). Climategate, Public Opinion, and the Loss of Trust. *American*

- Behavioral Scientist*, 57(6), 818-837. doi: 10.1177/0002764212458272
- Lutzenhiser, L. (2001). The contours of US climate non-policy. *Society & Natural Resources*, 14(6), 511-523. doi: 10.1080/08941920121404
- Madison, J. (1787). *Federalist No. 10: The Same Subject Continued: The Union as a Safeguard Against Domestic Faction and Insurrection*. New York: New York Packet.
- Maisel, L. S., & Berry, J. M., eds. (2011). *The Oxford Handbook of American Political Parties and Interest Groups*. New York, New York: Oxford University Press.
- Mayhew, D.R. (2004). *Congress: The Electoral Connection*. 2nd Edition. New Haven, Connecticut: Yale University Press.
- McCarty, N., Poole, K.T. & Rosenthal H. (2008). *Polarized America: The Dance of ideology and Unequal Riches*. Cambridge, Massachusetts: MIT Press.
- McCright, A. M. (2011). Political orientation moderates Americans' beliefs and concern about climate change. *Climatic Change*, 104(2), 243-253. doi: 10.1007/s10584-010-9946-y
- McCright, A. M., & Dunlap, R. E. (2000). Challenging global warming as a social problem: An analysis of the conservative movement's counter-claims. *Social Problems*, 47(4), 499-522. doi: 10.1525/sp.2000.47.4.03x0305s
- McCright, A. M., & Dunlap, R. E. (2003). Defeating Kyoto: The conservative movement's impact on U.S. climate change policy. *Social Problems*, 50(3), 348-373. doi: 10.1525/sp.2003.50.3.348

- McCright, A. M., & Dunlap, R. E. (2010). Anti-Reflexivity: The American Conservative Movement's Success in Undermining Climate Science and Policy. *Theory and Culture*, 27(2-3),100-133. doi: 10.1177/0263276409356001
- McCright, A. M., Dunlap, R. E., & Xiao, C. (2013) Perceived scientific agreement and support for government action on climate change in the USA. *Climatic Change*. Advance online publication. doi: 10.107/s10584-013-0704-9.
- Nounes, A.J. (2002). *Pressure and Power: Organized Interests in American Politics*. Boston, Massachusetts: Houghton Mifflin.
- Ogden, D. (1971). "The Future of Environmental Struggle." In *The Politics of Neglect: The Environmental Crisis*, ed. R. L. Meek and J. A. Straayer. Boston, Massachusetts: Houghton Mifflin, 243–250. London, England: Bloomsbury Press.
- Olson, M. (1965). *The Logic of Collective Action: Public Goods and the Theory of Groups*. Cambridge, Massachusetts: Harvard University Press.
- Oreskes, N. & Conway, E.M. (2010). *Merchants of Doubt: How a Handful of Scientists Obscured the Truth on Issues from Tobacco Smoke to Global Warming*. New York, New York: Bloomsbury Press.
- Organizing for Action (2017). *Call Out the Climate Change Deniers*. Retrieved from <http://ofa.barackobama.com/climate-deniers/#/>.
- Peterson, P.E. (1995). *The Price of Federalism*. Washington, D.C.: Brookings Institution Press.

- Poole, K.T. & Rosenthal, H. (1997) *Congress: A Political-Economic History of Roll Call Voting*. New York, New York: Oxford University Press.
- Program on International Policy Attitudes (PIPA) (1998). *Americans on Global Warming: A Study of US Public Attitudes*. Washington, D.C.
- Portney, K.E. (2013). *Taking sustainable cities seriously: economic development, the environment and quality of life in American cities*, 2nd ed. Cambridge, Massachusetts: MIT Press.
- Posner, P.L. (2010). "The Politics of Vertical Diffusion: The States and Climate Change." In *Greenhouse Governance: Addressing Climate Change in America*, ed. B.G. Rabe, 73-100. Washington, D.C.: Brookings Institution Press.
- Powell, J.L. (2012). *The Inquisition of Climate Science*. New York, New York: Columbia University Press.
- Rabe, B.G. (2004). *Statehouse and Greenhouse: The Emerging Politics of American Climate Change Policy*. Washington, D.C.: Brookings Institution Press.
- Rabe, B. G. (2007). Beyond Kyoto: Climate change policy in multilevel governance systems. *Governance-an International Journal of Policy Administration and Institutions*, 20(3), 423-444. doi: 10.1111/j.1468-0491.2007.00365.x
- Rabe, B. G. (2008). States on Steroids: The Intergovernmental Odyssey of American Climate Policy. *Review of Policy Research*, 25(2), 105-128. doi: 10.1111/j.1541-1338.2007.00314.x

- Rabe, B.G. (2010). "Introduction: The challenges of U.S. Climate Governance." In *Greenhouse Governance: Addressing Climate Change in America*, ed. B.G. Rabe, 3-23. Washington, D.C.: Brookings Institution Press.
- Rabe, B.G. (2011). Contested Federalism and American Climate Policy. *Publius-the Journal of Federalism*, 41(3), 494-521. doi: 10.1093/publius/pjr017
- Rosenbaum, W. A. (2011). *Environmental Politics and Policy*. 8th ed. Washington, D.C.: CQ Press.
- Ross, A. (1991). Is Global Culture warming Up? *Social Text*, 28-3-30.
- Sabatier, P., Focht, W., Lubell, M., Trachtenberg, Z., Vedlitz, A., & Matlock, M. eds. (2005). *Swimming Upstream: Collaborative Approaches to Watershed Management*. Cambridge, Massachusetts: MIT Press.
- Schattschneider, E. E. (1960). *The Semi-Sovereign People: A Realist's View of Democracy in America*. New York, New York: Holt, Rinehart, and Winston.
- Schlozman, K. L., & Tierney, J. T. (1986). *Organized Interests and American Democracy*. New York, New York: Harper and Row.
- Shipan, C. R., & Lowry, W. R. (2001). Environmental Policy and Party Divergence in Congress. *Political Research Quarterly* 54 (June), 245–263.
- Skocpol, T. (2013). Naming the Problem: What it Will Take to Counter Extremism and Engage Americans in the Fight Against Global Warming. *Symposium on The Politics of America's Fight Against Global Warming*. Harvard University.
- Smith, M. A. (2000). *American Business and Political Power: Public Opinion, Elections, and Democracy*. Chicago, Illinois: University of Chicago Press.

- Smith, C. (2009). Institutional Determinants of Collaboration: An Empirical Study of County Open-Space Protection. *Journal of Public Administration Research and Theory* 19 (1), 1–21.
- Stefancic, J., & Delgado, R. (1996). *No Mercy: How Conservative Think Tanks and Foundations Changed America's Social Agenda*. Philadelphia, Pennsylvania: Temple University Press.
- Taylor, P.J. & Buttel, F.H. (1992). How Do We Know We Have Global Environmental Problems? *Geoforum*, 23,405-16.
- Union of Concerned Scientists (2007). *Smoke, Mirrors, and Hot Air*. Cambridge, Massachusetts: Union of Concerned Scientists.
- U.S. Environmental Protection Agency (USEPA) (2017). *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2015*. Washington, D.C.
- U.S. House of Representatives Committee on Energy and Commerce Minority Staff. (2013 December) *The Anti-Environmental Record of the U.S. House of Representatives 113<sup>th</sup> Congress (1<sup>st</sup> Session)*. Washington, D.C.
- Vogel, D. 1989. *Fluctuating Fortunes: The Political Power of Business in America*. New York, New York: Basic Books.
- Weber, E. P., Lovrich, N. P., & Gaffney, M. (2005). Collaboration, Enforcement, and Endangered Species: A Framework for Assessing Collaborative Problem-Solving Capacity. *Society and Natural Resources*, 18, 677–698.



## Chapter 2 - Theoretical Framework

This research draws upon the collaborative governance literature and contributes to the emerging scholarly discussion around the dimensions of climate change communication by conducting a stakeholder-focused analysis concerning climate change policymaking at the state level.<sup>16</sup> Collaborative governance is a concept that describes the process of facilitating and operating in multi-organizational arrangements to solve problems that cannot be solved, or at least solved easily, by single organizations on their own (Agranoff and McGuire 2003). Ansell and Gash (2008) draw upon the work of Lynn, Heinrich, and Hill (2001) and Stoker (1998) to define collaborative governance as “a type of governance in which public and private actors work collectively in distinctive ways, using particular processes, to establish laws and rules for the provision of public goods” (Ansell and Gash 2008, 545). In the environmental and natural resources management field, collaborative governance has become increasingly more prevalent and visible in recent decades (Ansell and Gash 2008; Durant et al. 2004; Gerlak, Heikkila and Lubell 2012; Koontz and Thomas 2006; Pretty 2003; Sabatier et al. 2005a). It has emerged in diverse arenas, including water management (Born and Genskow 2001; Clark et al. 2005; Imperial 2005; Leach et al. 2002), ecosystem restoration (Heikkila and Gerlak 2005; Karkkainen 2002; Layzer 2008), forest management (Cheng and Mattor 2006; Ebrahim 2004), land use

---

<sup>16</sup> Sabatier et al. (2005a) define the term stakeholder to include “policymakers, agency implementers, experts both within and outside government who participate in policymaking and policy implementation, private sector businesses that are economically or otherwise affected by policies, and environmental interest groups that purport to represent nonhuman values, among other groups” (Sabatier et al. 2005a, 20).

and open-space protection (Frame et al. 2004; Kellogg 2009; Smith 2009), and endangered species protection (Weber et al. 2005).

The major goal of this study is to explore the role of collaborative governance in the context of climate change policymaking and policy implementation at the state level. Following a brief overview of the emergence of collaborative governance in the environmental policy and natural resource management fields, I present and evaluate a conceptual framework for establishing a dialogue between the major players involved in climate change mitigation and adaptation policies in the American states. The framework description is followed by a discussion of the theoretical foundations that support the conceptual relationships included in the framework, and the introduction of several hypotheses regarding the causal mechanisms that drive the overall collaborative policymaking process.

### **Collaborative Governance and Environmental Policy**

The process of collaborative governance is often described as a collective decision-making process that allows diverse sets of actors who share a stake in a particular policy issue to work together to produce mutually beneficial policy outcomes (Agranoff and McGuire 2003; Gerlak, Heikkila and Lubell 2012). In the past few decades, collaborative environmental governance has emerged as an alternative to traditional managerial models and top-down regulatory and technocratic management. In environmental policy, where the regulated community is commonly dominated by industry interests, efforts to avoid potentially costly policy decisions have become increasingly common and have frequently led to expensive, long-term

conflicts over policy outcomes by impacted stakeholders (Ansell and Gash 2008; Brunner and Steelman 2005; Margerum and Whittall 2004; Wondolleck and Yaffee 2000). Public policy scholars and practitioners have argued that collective decision-making processes can reduce the transaction costs of traditional policy and management strategies, reduce conflict amongst stakeholders regarding policy outcomes, and potentially improve cooperation and environmental outcomes following program implementation.

Collaborative governance evolved, in part, from a growing recognition of the limitations of traditional policy solutions, particularly command-and-control, state-driven policies (Eisner 2007; Klyza and Sousa 2008; Mazmanian and Kraft 2009; Vig and Kraft 2010). During the first environmental epoch (1970-1990), also known as the “regulatory epoch,” proponents of regulation capitalized on the growing concern amongst the general public regarding national environmental quality and a favorable political climate to establish significant federal regulation on pollution sources (see Introduction; Mazmanian and Kraft 2009; Mazmanian and Nijaki 2012).

Environmental policy solutions during this period of environmental governance focused on “end of pipe” regulatory solutions to resolve prevailing environmental quality issues. The second environmental epoch (1980s-2000s) was defined by a push for efficiency-based regulatory reform and flexibility. Largely driven by the neo-liberal economic principles of the Reagan administration, the rise of Republican party influence on Capitol Hill, and the grievances of industry interests regarding the costs of regulation, new command-and-control rules were subjected to cost-benefit tests,

and the use of performance standards and market-based mechanisms to pollution control became a preferred solution over technology mandates. In addition, many regulatory oversight and enforcement responsibilities were decentralized and shifted to the state and local levels (Mazmanian and Nijaki 2012). The third environmental epoch (1990s-present), or the “sustainability epoch,” has emerged from the realization that the unresolved environmental issues of the 21<sup>st</sup> century will require a new paradigm of governance and management strategies. The regulatory achievements of prior decades have been quite successful at addressing many pollution problems, however, the top-down application of such “point source” policy instruments has been less effective at addressing complex environmental issues, such as anthropogenic climate change, nonpoint source pollution, and the protection of biodiversity (Kraft 2014; Mazmanian and Kraft 2009).

Allen and Gould (1986) characterize such issues as “wicked” environmental problems. Such issues are often considered “wicked” because they are plagued by scientific uncertainty, deep public disagreement over desired states and preferred outcomes, the impossibility of finding an optimal solution, and the requirement that, despite these unknowns and conflicts, the responsible decisionmaker must act. The sources and impacts of wicked problems are generally diffuse and require comprehensive and integrated policy strategies. The appropriate policy venue of this epoch is subnational, and the focus of policy processes has shifted to collaborative decision making among all affected stakeholders and public-private partnerships that

rely on incentive-based policies (Maser 1997; Mazmanian and Kraft 2009; Mazmanian and Nijaki 2012; Weber 2003; Wondolleck and Yaffee 2000).

Another factor driving the emergence of collaborative environmental governance has been the growing scientific understanding of ecosystems, ecology, and Earth systems and the symbiotic relationship between environmental quality and human activity. In the 1960s and 1970s, Rachel Carson's (1962) Silent Spring and Barry Commoner's (1971) The Closing Circle both highlighted the ecological consequences of human activities such as the widespread application of pesticides and nuclear testing, and the potential implications for societal wellbeing. A consequence of this has been an increasing awareness among scientists, government agencies, and the general public of the interdependencies of the components of ecosystems and the functions and services they provide (Millennium Ecosystem Assessment 2005; Norgaard 1994). The increasing attention to the complexities and interdependencies of the Earth's ecological, physical, and social systems has led to growing concerns regarding the inadequacies of existing administrative and regulatory structures to manage and address environmental problems at the appropriate scale and functional scope (Kenward et al. 2011; Mullner, Hubert and Wesche 2001).

A third factor that has contributed to the growth of collaborative environmental governance, which is also tied to dissatisfaction with traditional policy tools and to our growing awareness of the Earth's ecological impasses, is the rising number and intensity of conflicts over natural resources. Some of these conflicts stem

from the increasing competition among the growing urban and industrial sectors that consume natural resources, such as conflicts over water resources in the American west, as well as the externalities their uses impose on others through pollution or resource extraction (Emerson et al. 2009; Hanak et al. 2011; Kenney et al. 2011; Schlager and Heikkila 2009). Conflicts also are increasing regarding the preservation and protection of ecosystems, as many individuals, communities, and societies have come to recognize the intrinsic and “non-use” values of natural resources and environmental services.

Finally, collaborative governance is part of the international trend toward “New Public Management,” which focuses on the efficient delivery of public goods, public-private partnerships for infrastructure, and the use of non-regulatory policy tools like market-based instruments and incentives (Agranoff and McGuire 2003; Kettl 2006; Milward and Provan 2000; Rhodes 1996). Coupled with this trend has been a push toward greater decentralization of environmental governance, which allows for locally and regionally specific policies and programs that engage with local stakeholders and take into account unique local and regional circumstances (Jessop 1999; Lemos and Agrawal 2006). Thus, more diverse sets of actors have entered the governance scene from diverse sectors and scales, which can necessitate institutional arrangements that provide coordination and “metagovernance” (Bell and Park 2006), as well as through self-organized partnerships, networks, and regional agreements (Imperial 2005; Scharpf 1994), which typify many collaborative governance institutions.

In light of the potential benefits of collaborative governance institutions to address complex and diffuse environmental problems, a number of criticisms have been raised in the literature. Gerlak, Heikkila and Lubell (2012) summarize three important criticisms of the collaborative governance model that may limit its efficacy in building effective policies to solve environmental and natural resource management problems. The first criticism of collaborative governance is that the process may simply be an instance of “symbolic policy” (Edelman 1964; Lubell 2004). Symbolic policy occurs when policy actors accept a policy decision as a symbol of progress, consequently deflecting attention from enduring problems. As a result, problems that are left unsolved continue without any actual solution (Lubell 2004). The second criticism highlights the potential for agency “capture” to occur by interest groups involved in the policy process that possess greater unity and resources (McCloskey 2000). In the absence of countermeasures to include and represent less “powerful” stakeholder groups, such as “neutral” agency leadership, collaborative governance processes may be skewed against more diffuse stakeholder groups with fewer resources (Schuckman 2001). A third important criticism of the collaborative governance approach concerns the emphasis on consensus-based decision making to reach policy agreements (Kenney 2000). A true consensus-based decision making process can be easily derailed from achieving policy outcomes by stakeholders who are not satisfied with proposed plans and projects. Additionally, the negotiation process associated with consensus building can require extensive time and resource commitments from those engaged in the process. The lengthy process of stakeholder

negotiations during the policy formulation process has been a prevalent issue among collaborative process participants. A prolonged policy formulation process may actually increase transaction costs and allow environmental conditions to worsen, thereby undermining the benefits of collaborative governance relative to alternative policy processes (Coglianese and Allen 2003; Gunton and Day 2003; Imperial 2005; Margerum 2002; Roussos and Fawcett 2000; Till and Meyer 2001; Warner 2006; Yaffee and Wondolleck 2003). Readers should keep these potential problems in mind as they move through the analysis in this study.

### **Collaborative Governance and Climate Change**

In order to address the issue of climate change effectively, policymakers and public managers will need to form and implement strategic and comprehensive long-term plans to reduce GHG emissions. According to Balint et al. (2011), when confronted with the challenge of addressing wicked problems such as climate change, public managers often respond by applying the precautionary principle, adaptive management, and/or public participation. While the climate change problem presents a complex array of challenges for stakeholder engagement, such engagement is essential in order to bring together a variety of important stakeholders to craft innovative solutions to environmental issues. The sources of GHG emissions in the U.S. are spread throughout public and private sectors. Therefore, in many instances, reducing emissions effectively will require the cooperation of a diverse set of actors.

Where traditional command-and-control regulatory efforts may be compromised by the influence of industry interests (e.g., via lobbying) and can lead to



lengthy litigation following legislative action, and more contemporary, voluntary and incentive-based measures require a change in the behavior of the emissions producer, attaining real emissions reductions in the near to medium term will depend upon policies that are broadly perceived as fair and legitimate. Despite its potential problems, collaborative governance offers public managers and policymakers the opportunity to develop diverse policy portfolios to address GHG emissions across economic sectors and facilitate cooperation through collective decision-making processes (Fiack and Kamieniecki 2017).

Often, policy decisions and program implementation on complex and ubiquitous issues, such as climate change, are politically controversial, and the legitimacy of policy outcomes are influenced by the values and beliefs held by the effected parties. Environmental issues, and environmental policy in particular, have historically been perceived by stakeholders as a zero-sum game in which proponents of environmental regulation tend to argue that economic development will occur at the cost of environmental quality. The regulated community, often comprised of industry interests, opposes environmental protection, citing the economic imposition of regulatory action. In recent years, the emergence of the sustainability movement has in many ways sought to reconcile the conflict between winners and losers over environmental regulation by emphasizing decentralized actions that address environmental issues at the source (Mazmanian and Kraft 2009; Mazmanian and Nijaki 2012). Through the coordination of emissions reduction strategies in policy areas such as improved energy efficiency in buildings, public transportation, and land

use planning, public managers and policymakers can rely upon voluntary efforts by public stakeholders at the community level rather than only those created by private industry (Portney 2013). By implementing more voluntary and incentive-based policy tools, policymakers can potentially reduce the zero-sum stigma of environmental policy, and mitigate conflict among stakeholder groups by redistributing the burdens of emissions reduction.

The many factors that must be weighed and considered in the policymaking process produce a myriad combination of policy tools that can be implemented to address the climate change issue. Lingering scientific uncertainty with regard to the temporal and spatial distribution of climate change impacts is likely to affect the policy preferences of interest groups and the general public, which will in turn affect the combination of policy tools selected through the policy process. Consequently, determining the optimal combination of policy solution to address the issue is dependent upon the environmental, social and institutional characteristics of a particular region. Unless divergent actor groups are able to establish a dialogue on these issues, meaningful discussions about the causes and effects of climate change will not take place, government action will not be forthcoming, and additional harm to the ecosystem will occur. This, in turn, will place an impediment in front of public and private efforts to promote sustainability, making it even that much more difficult to reverse course and adopt needed changes to energy production and consumption in the future.

Developing comprehensive policies to mitigate the causes of climate change and adapt to its related environmental impacts are likely to call upon government agencies to modify existing protocols and implement new programs that also require interagency cooperation. Furthermore, in a decentralized institutional environment, conflict may arise over the distribution of government funds to support new programs. Power struggles and interagency politics may challenge the efficiency of program design and implementation, and subsequently reduce the effectiveness of policy outcomes. For example, water managers in regions where local water supplies are highly dependent upon seasonal snowpack and rainfall generally depend upon historic precipitation data to determine water supply management strategies. Scientists predict that climate change will alter precipitation patterns in certain regions, affecting the frequency and magnitude of rainfall events. Thus, water resource managers are faced with the challenge of integrating non-stationary weather patterns in resource management in order to meet the needs of environmental, domestic and industry users. Optimizing water management strategies in a changing climate will require careful coordination between management and regulatory agencies. In certain regions, agency decision making may prioritize the demands of water users with greater political and economic influence (e.g., large agricultural interests) over ecosystem requirements.

Determining the appropriate suite of voluntary and/or regulatory tools to achieve GHG emissions reductions requires policymakers and agency bureaucrats to determine the level of government intervention, as well as the desired environmental

outcomes, and prioritize the focus of reduction strategies on private and public interests within the region. While scientific certainty regarding the existence of climate change, and the role of human activity in contributing to warming temperatures, is virtually undeniable, uncertainty regarding the urgency, severity of the predicted impacts, and costs of implementation still remain. Predicting the rate at which climate change will transpire and the “tipping point” at which the inertia of change will be irreversible are still relatively unclear to scientists (Shaw 2013; Tol 2007). In addition, the magnitude of the effect that positive and negative feedback from changing temperatures have on the rate of change are not adequately understood. Thus, policymakers are faced with the challenge of determining effective and politically feasible reduction targets.

Potential policy solutions for addressing the climate change issue must be considered along social, institutional and environmental dimensions. Prior to designing a policy to reduce GHG emissions, policymakers must first determine the desired environmental outcomes. For example, how much should GHG emissions be reduced? Over what length of time should reductions in emissions be achieved? Should reductions occur by decreasing actual emissions, by increasing carbon offsets or by using some combination of the two? Additionally, the characteristics of a particular region’s ecological, hydrological, and physical processes and the interrelationships between these and climate change impacts will similarly have to be balanced in order to consider the most efficient focus of environmental and resource management planning and implementation.

Once the environmental goal has been established, policymakers must determine the policy tools to be implemented to achieve these goals. Potential policy tools include a variety of traditional command-and-control (e.g., restrictions, technological mandates, etc.), market-based and voluntary instruments. Determining the socially optimal outcome also requires consideration of which sectors of the economy ought to be impacted and to what extent each sector ought to be regulated given the desired environmental, economic, and civic goals of a particular community. Lastly, the capacity of existing management and regulatory institutions must be evaluated. The success of policy outcomes is dependent upon the ability for responsible agencies to facilitate procedural processes and program implementation effectively and the level of understanding among the general public regarding the issue to be addressed (Cohen, Kamieniecki and Cahn 2005).

In the U.S. widespread efforts to reduce GHG emissions have primarily occurred at the subnational level. The ability for state-level governments to enact a diverse array of policies to address the climate change issue is indicative of the ability for state-level leaders to interpret effectively the scientific implications of climate change, engage critical stakeholders, and develop appropriate institutional venues to reach policy outcomes in light of contentious debate at the national level. An analysis by Rabe (2010a) analysis of state-level policy development and emissions trends, for example, found that the national average for emissions growth between 1990 and 2007 was 16 percent. The states that experienced the lowest growth in emissions reduced GHG emission levels below those from the baseline year include Delaware (-

5 percent), Massachusetts (-5 percent), and New York (-4 percent). Meanwhile Arizona (62 percent), Colorado (46 percent), and South Carolina (45 percent) experienced the highest growth in emissions from the baseline year (2010a). To illustrate state engagement in climate change policy, the states were provided a score (0-20 points) as a proxy measure of their policy development, based upon the twenty policy options adopted by states as of 2009 (Rabe 2010b). Table 2.1 splits the states into four separate cells based upon their 1990 to 2007 GHG emissions growth and climate change policy adoption, compared to the national average. While a direct relationship between policy development and emissions growth is not observable, it is worth noting that the states that had experienced the lowest emissions growth (Delaware, Massachusetts, and New York) between 1990 and 2007 had adopted a large number of policies, relative to the national average. States that had experienced the lowest emissions growth (Arizona, Colorado, and South Carolina) adopted a small number of policies.

**Table 2.1** State climate policies and emissions growth, 1990-2007.

		Emissions Growth, 1990-2007	
		High (> 16 percent)	Low (< 16 percent)
Number of Policies, 2009	High (12-20)	Arizona Colorado Illinois Iowa Maine Minnesota Montana Nevada New Hampshire New Jersey Oregon Rhode Island Utah Vermont Wisconsin	California Connecticut Delaware Hawaii Maryland Massachusetts New Mexico New York Pennsylvania Texas Washington
	Low (0-11)	Alabama Alaska Arkansas Florida Georgia Idaho Kansas Kentucky Mississippi Missouri Nebraska North Carolina North Dakota Oklahoma South Carolina Tennessee Virginia	District of Columbia Indiana Louisiana Michigan Ohio South Dakota West Virginia Wyoming

Source: Rabe 2010a.

Following the approach taken by Rabe (2010a), Table 2.2 updates the national trend in policy development, emissions growth from 1990-2013, and the level of climate change policy development as of 2016. The national average for emissions growth was 8.9 percent during the 24 year time period, a 7 percent improvement from 1990 to 2007. Growth in state emissions ranged from a low of -23 percent in New York, -22.9 percent in Delaware, and -21.9 percent in Massachusetts, to a high of 62.9 percent in Nebraska, 49 percent in Arizona, and 45.6 percent in Idaho. The state climate change policy development score ranged from 0 to 21, and states were categorized as high or low policy states based on the national average of 12 points (policies adopted). States exhibiting a high level of extensive policy engagement include California and New York, which lead the nation in terms of climate change policy action with a policy score of 21, followed by Connecticut, Maryland, Massachusetts, Oregon, and Rhode Island, each with policy scores of 20. The table illustrates that, in general, states that have experienced strong policy development relative to the national average have also experienced low emission growth, relative to the national average, while states with weak policy development tend to have experienced high emissions growth.

A comparison between Table 2.1 and Table 2.2 of state movement within the four-cell grid may provide some insight into the role of political and institutional constraints on policy development and the effect of policy adoption on emissions reduction. Virginia is the only state to have moved from Low Policy-High Emissions



to High Policy-Low Emissions. Meanwhile Maine, New Hampshire, New Jersey, and Vermont each moved from High Policy-High Emissions to High Policy-Low Emissions while Michigan moved from Low Policy-Low Emissions to High Policy-Low Emissions. One potential explanation for these trends is the successful implementation of climate change policy programs by these states has contributed to a reduction or the stabilization of state-level emissions. Arizona, Colorado, Montana, Nevada, and Utah each moved from High Policy-High Emissions to Low Policy-High Emissions, while South Dakota and Wyoming moved from Low Policy-Low Emissions to Low Policy-High Emissions. These trends also support the argument that climate change policy implementation may be necessary in order to mitigate emissions. Meanwhile, Texas moved from High Policy-Low Emissions to Low Policy-High Emissions, an indication that policy adoption in the state has not kept pace with emissions growth or national trends in climate change policy adoption, perhaps as a result of political or institutional capacity constraints, and therefore successful mitigation will require continued efforts in order to achieve long-term emissions reductions.

While a number of observations in state-level emissions and policy trends provide supporting evidence for the relationship between climate change policy adoption and emissions reductions, a number of state movements within the four-cell grid provide evidence to the contrary. For example, two states, Kansas and Tennessee moved from the Low Policy-High Emissions cell to Low Policy-Low Emissions, while Alaska and Georgia each moved from Low Policy-High Emissions to Low

Policy-Low Emissions, and New Mexico moved from High Policy-Low Emissions to Low Policy-Low Emissions. This result implies that strong climate change policy action may not be necessary to achieve emissions reductions. It is worth noting, that Table 2.1 does not account for a number of important factors, which may influence the effectiveness of policy adoption. For example, the finding that some states have achieved relatively low emissions growth despite having a low level of policy adoption does not necessarily mean that policy adoption is not a necessary condition for emissions reduction. An alternative explanation may be that a particular policy that has been implemented within these states is highly successful at achieving emissions mitigation. Therefore, the table and observed trends in climate change policy adoption and emissions trends is intended to present a simple presentation of the potential relationship between policy adoption and emissions trends, and serves as a potential starting point for more in-depth inquiry.

**Table 2.2** State climate policies and emissions growth, 1990-2013.

		Emissions Growth, 1990-2013	
		High (> 9 percent)	Low (< 9 percent)
Number of Policies, 2016	High (13-21)	Illinois Iowa Minnesota Oregon Rhode Island Wisconsin	California Connecticut Delaware Hawaii Maine* Maryland Massachusetts Michigan* New Hampshire* New Jersey* New York Pennsylvania Vermont* Virginia* Washington
	Low (0-12)	Arizona* Alabama Arkansas Colorado* Florida Idaho Kentucky Mississippi Missouri Montana*	Nebraska Nevada* North Carolina North Dakota Oklahoma South Carolina South Dakota* Texas* Utah* Wyoming* Alaska* Georgia* Indiana Kansas* Louisiana New Mexico* Ohio Tennessee* West Virginia

\* Indicates that a state has moved from its position in Table 2.1  
 Sources: ACEEE 1016; C2ES 2014; DSIRE 2016; EIA 2015

Understanding the role of collaborative governance via stakeholder engagement in the climate change policy process is critical to building our understanding of the ability for policymakers and policy institutions to address the “wicked” problems of the sustainability era. One form of formal collaborative governance institutions that states have utilized to develop climate change policies are climate legislative commissions and executive branch advisory groups. Thirty-five states have established such groups, often by administrative or executive order, who

are generally charged with assessing state-level climate change impacts and devising strategies and potential programs and policies to mitigate and adapt to climate change within the state's jurisdiction. The membership of these commissions and groups vary from including scientific experts and government agency representatives, to representatives from business, industry, and the environmental community.

Table 2.3 shows the states that have established a climate change legislative commission or advisory group and their respective policy and emissions growth score using the methods described above. Of the 35 states that have a formal climate change commission or advisory group 20 (57 percent) have adopted more climate change policies than the national average, accounting for 95 percent of all the states placed in the High Policy cells in Table 2.2. The remaining 15 are located in the Low Policy cells and account for 52 percent of all states with a low policy score. All of the states in the High Policy-High Emissions Growth cell in Table 2.2 have had a formal climate change committee, while 93 percent of the states located in the High Policy-Low Emissions Growth cell have established a formal committee. The table illustrates a potential relationship between the magnitude of climate change policy development at the state-level, and the presence of formal collaborative climate change policy institutions, where states that have established a climate change commission or advisory group tend to have adopted more climate change policies, relative to the national average, than those without. However, the initial analysis does not suggest a relationship between collaborative climate change policy institutions and emissions reduction.

**Table 2.3** State Climate policies and emissions growth for states with climate legislative commissions and executive branch advisory groups.

		Emissions Growth, 1990-2013	
		High (> 9 percent)	Low (< 9 percent)
Number of Policies, 2016	High (13-21)	Illinois Iowa Minnesota Oregon Rhode Island Wisconsin	California Connecticut Delaware Hawaii Maine Maryland Massachusetts Michigan New Hampshire New York Pennsylvania Vermont Virginia Washington
	Low (0-12)	Arizona Arkansas Colorado Florida Idaho Kentucky Montana Nevada North Carolina South Carolina Utah	Alaska Kansas Louisiana New Mexico

Sources: ACEEE 1016; C2ES 2014; DSIRE 2016; EIA 2015.

The potential relationship between formal institutions that facilitate collaborative climate change governance at the state level and climate change policy adoption supports some of the findings in the environmental and natural resource collaborative governance literature. Studies have often found that such institutions contribute to the adoption of formal agreements or policy adoption to address a particular policy issue. However, research on collaborative governance institutions to solve common pool or public good problems is less conclusive on how such institutions contribute to actual environmental outcomes (Koontz and Thomas 2006). A number of large-scale watershed partnerships such as California’s CALFED Bay-Delta Program, the Chesapeake Bay Program, and the Comprehensive Everglades

Restoration Program have by-and-large been unsuccessful at attaining policy goals and achieving successful ecosystem restoration and water quality outcomes (Lubell, Leach and Sabatier 2009; Lubell and Segee 2010). For example, the Chesapeake Bay Program, one of the oldest watershed partnerships in the U.S., has consistently been unable to achieve its water quality goals (Chesapeake Bay Program 2006, 2011, 2013). As one of the most influential programs of the collaborative governance movement, the Program has been unable to successfully resolve stakeholder conflict, and in 2004 the Chesapeake Bay Foundation created a litigation branch, which has been involved in a number of lawsuits (Lubell, Leach and Sabatier 2009).

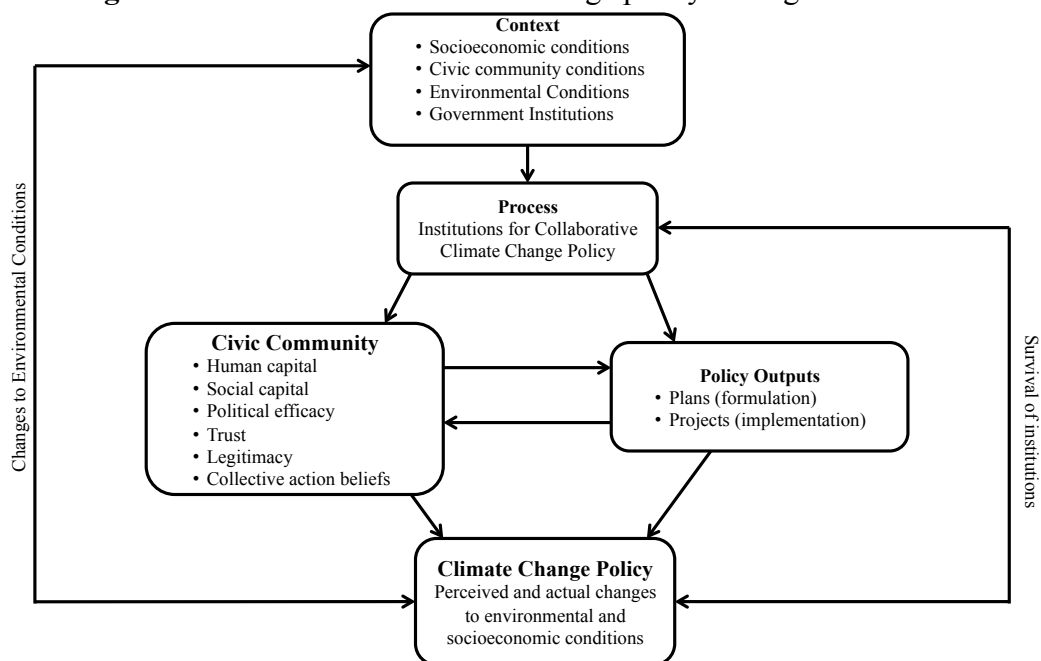
Of course, many potentially important variables have been omitted from the analysis above. For instance, it is difficult to be conclusive regarding the relationship between formal collaborative climate change policy institutions and environmental outcomes without including the number of policies that were adopted following the establishment of a commission or advisory group. Furthermore, there are a number of other independent variables, such as policy entrepreneurs, that may contribute to the adoption of climate change policies. Lastly, table 2.3 does not provide any insight into the role of informal collaborative policy institutions in the context of climate change policy adoption. The purpose of this research is to provide an in-depth investigation into each of these factors, among others, and to provide a clearer picture of how stakeholder engagement may or may not contribute to the adoption, implementation, and environmental outcomes of climate change policy adoption

within American states. The next section develops the conceptual framework that will guide the investigation.

### **A Framework for Collaborative Climate Change Governance**

Developing an effective stakeholder framework can help us to understand the multifaceted stakeholder dynamics around climate change communication and can be a critical contribution to theory and, subsequently, to policymaking by helping decision makers become aware and knowledgeable about their constraints and opportunities in addressing climate change. A potentially valuable framework for analyzing stakeholder interactions in climate change policymaking at the state level is found in Sabatier et al. (2005a). Building on their comprehensive analysis of stakeholder interests in watershed management, Figure 2.1 outlines a promising conceptual framework for understanding the variables that are likely to influence collaborative climate change policymaking in states throughout the U.S. The framework has the potential to explain the type of collaborative climate change management approach that will surface, as well as its likelihood of success.

**Figure 2.1** Framework for climate change policymaking at the state level.



Adapted from Sabatier et al. (2005a, 14)

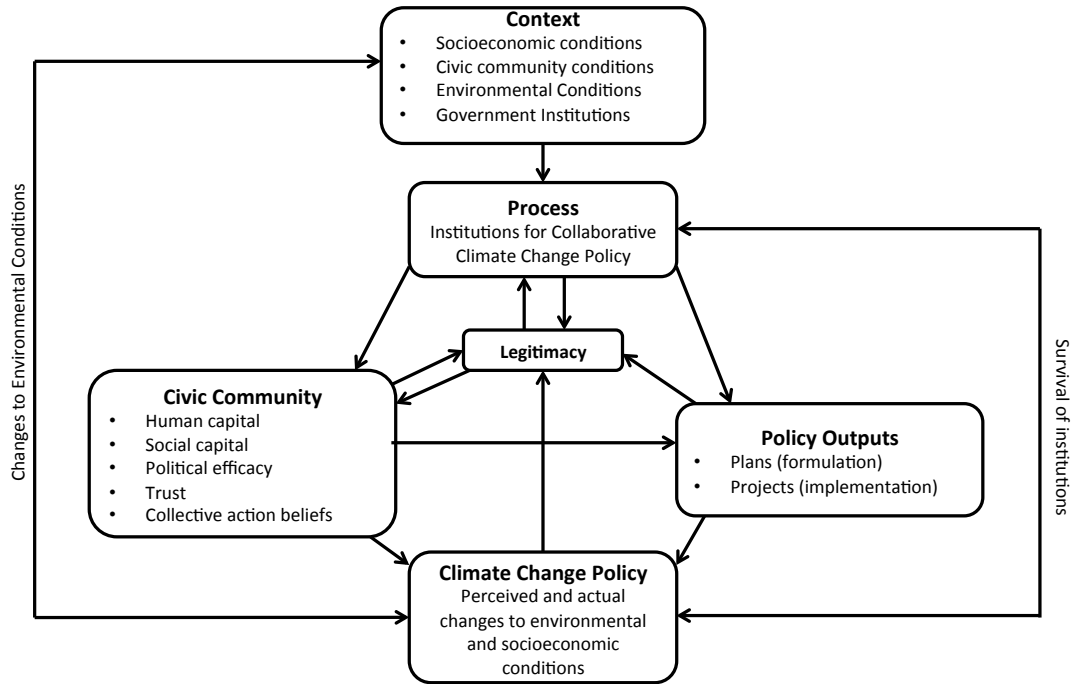
The model includes four constructs, Context, Process, Civic Community, and Policy Outputs that are hypothesized to affect the social and environmental outcomes of collaborative watershed policymaking processes. Drawing on the work of Ostrom (1990, 2007) and Sabatier et al. (2005a) treat a collaborative process as essentially a set of guidelines concerning the types of participants, their entry and exit from the deliberations, their authority to undertake certain duties and responsibilities, and how their actions lead to policy outcomes. Antecedent variables are identified at the top and include the Context (e.g., socioeconomic, civic, environmental/ecological, and government institutional) or initial conditions that exist prior to the formation of collaborative processes and partnership arrangements. These include the economic and social structure of the state, preexisting social networks, the severity of different



environmental and socioeconomic problems, and the set of governmental institutions that exist (Sabatier et al. 2005a). Contextual factors then interact with processes to produce both Civic Community and Policy Outputs. Civic Community and Policy Outputs interact to influence Climate Change Policy Outcomes, real and perceived conditions, both environmental (e.g., GHG emissions) and socioeconomic (e.g., unemployment rates and economic growth).

At the end of their study, legitimacy is moved out of the Civic Community box and is established as its own independent model element. As shown in Figure 2.2, Legitimacy has a reciprocal relationship with other Civic Community factors and collaborative processes, and is affected by Policy Outputs and Climate Change Policy Outcomes. They conclude that procedural legitimacy and substantive legitimacy, in interrelated ways, contribute to the survival of watershed collaborations, at least in the short or medium term. Based on the findings of their study, the researchers also decided to remove an arrow between Policy Outputs and Civic Community. Otherwise, the results of their investigation support the hypotheses reflected in the relationships presented in Figure 2.1. The conceptual model illustrated in Figure 2.2 provides the framework that will guide the investigation into the role of stakeholder engagement in the climate change policymaking process. The remainder of the section describes each of the variables in Figure 2.2.

**Figure 2.2** Updated framework for collaborative climate change policymaking.



Adapted from Sabatier et al. (2005a, 286)

### Context

The antecedent variables constrain the type of collaborative climate change policy approach that will surface, as well as its likelihood of success. The existing socioeconomic, civic community, environmental, and institutional conditions that exist at the outset of collaboration can either facilitate or discourage cooperation among stakeholders and between agencies and stakeholders (Ansell and Gash 2008). For example, heterogeneous populations, in which, socioeconomic conditions are characterized by power imbalances related to the unequal distribution of economic or political power between stakeholders, can limit the likelihood of collective action via collaborative governance (Ansell and Gash 2008; Gray 1989; Short and Winter 1999; Susskind and Cruikshank 1987; Tett, Crowther and O’Hara 2003; Warner 2006).

Similarly, states that are composed of widely scattered, fairly transient populations with broad ideological differences are less likely to be successful than smaller, more stable, and more homogeneous polities (Ansell and Gash 2008; Sabatier et al. 2005a). For instance, extractive industries are deeply rooted in a number of states in which the production of fossil fuels has provided the lifeblood of economic development. In states such as West Virginia and Kentucky, for example, the balance of socioeconomic power is likely to favor the coal industry over environmental interests and proponents of regulations to reduce GHG emissions, which are viewed by many communities to threaten the state's economic prosperity. In such cases, extractive industry interests have little incentive to participate in efforts to participate in collaborative policy processes.

With regard to civic community, a prehistory of antagonism or cooperation between stakeholders will either restrict or support collaboration (Andranovich 1995; Gray 1989; Margerum 2002). States facing challenging situations are likely to be very distrustful and thus insist on a variety of procedural rules and norms to protect each group's interest in the policymaking process, reducing the likelihood of collaboration and cooperation in the policymaking process. At the same time, more successful states will likely have substantial amounts of trust and social capital (networks) to build on, and thus will need less elaborate procedural rules (Sabatier et al. 2005a). California, for example, has a rich history of state-level environmental policy efforts that have produced a civic community of diverse groups of business, industry, public, and environmental stakeholders that has at times facilitated opportunities for

collaborative environmental management (Barbour and Teitz 2009; Mazmanian 2009).

Environmental conditions are also likely to affect the formation of collaborative policy processes. For instance, an environmental problem with immediate, severe, and widespread impacts, where a policy deadlock imposes a serious cost to many stakeholders, is more likely to contribute to the willingness and motivate cooperation among stakeholders to engage in a collective decision-making process. Conversely, an environmental problem characterized by impacts that are not immediate, or are imposed upon a particular facet of society, or group of stakeholders, is less likely to result in the convergence of stakeholders to address the issue due to the relative costs of collaboration relative to the costs of inaction born to those who are not affected by the particular issue at hand. In locations where the environmental impacts of climate change, such as droughts, wildfires, and sea level rise, are likely to have greater economic and social impacts, stakeholders are more likely to work towards achieving mutual agreements through collective decision-making processes.

Finally, the preexisting government institutions are also likely to affect the development of collaborative policy processes. If a set of formal legislative rules is already in place to address an environmental problem, some stakeholder groups may be less willing to engage in a collaborative process, despite the existence of a policy failure. For instance, it may be the case that certain stakeholders benefit from the shortcomings of existing laws, and are therefore less motivated to mobilize in an

effort to correct existing problems. Additionally, where different institutional venues already exist to address the agenda of stakeholders, there are likely to be fewer incentives to participate in an alternative process (Fung and Wright 2001; Kraft and Johnson 1999; Reilly 2001). Alternatively, collective decision-making processes may be more likely to occur if institutions that encourage collaboration, such as government grants or institutional venues that offset the transaction costs of collaboration exist.

### **Process**

The presence of collaborative climate change policy institutions are the central component of the policymaking process illustrated in Figure 2.2. The institutional design of a particular collaborative decision-making body is a critical aspect of the policymaking process and contributes to the development of climate change policy outputs, legitimacy, and the development of civic community among stakeholders engaged in the policymaking arena. Thus, one of the most fundamental institutional design issues is determining which stakeholders are to be granted access to the collaborative process.

The literature generally emphasizes that a collaborative process should be open and inclusive, largely because stakeholders who have participated in a process are more likely to be committed to the process and outcomes (Andranovich 1995; Ansell and Gash 2008; Burger et al. 2001; Chrislip and Larson 1994; Gray 1989; Gunton and Day 2003; Lasker and Weiss 2003; Margerum 2002; Martin, Tett and Kay 1999; Murdock, Weissner and Sexton 2005; Plummer and Fitzgibbon 2004;

Power et al. 2000; Reilly 1998, 2001). A deliberate effort to engage stakeholders in the collaborative process is likely to influence the success of the collaboration effort, while exclusion of critical stakeholders is often a key reason for the failure of collective decision making (Reilly 2001).

The literature also implies that clearly defined stakeholder roles, ground rules, and process transparency are important institutional design features (Busneberg 1999; Geoghegan and Renard 2002; Glasbergen and Driessen 2005; Gunton and Day 2003; Imperial 2005; Murdock, Weissner and Sexton 2005; Rogers et al. 1993). Process transparency refers to the openness of process negotiations among stakeholders, where effective process transparency prevents the occurrence of “backroom” deals. Clearly, defined roles of process participants and enforced ground rules are likely to improve the efficiency and functionality of the process and reinforce stakeholders’ perception that the policy process was fair, equitable and open (Bradford 1998; Murdock, Weissner and Sexton 2005).

In the context of policy outputs, a primary focus in the literature has been on the importance of consensus rules in reaching a policy plan or project decision. The definition of collaborative governance applied to this study describes the process as consensus-oriented, largely because consensus is not necessarily always achieved. While consensus has been seen as promoting representation of individual viewpoints and encouraging cooperation (Margerum 2002), consensus-based rulemaking has also been criticized in the literature for producing “least common denominator” outcomes (Coglianese and Allen 2003; Gunton and Day 2003) and decision stalemates (Till and

Meyer 2001), which may result in undesired environmental outcomes. Thus, while consensus rules are viewed as beneficial to cooperation and legitimacy, they may lead to policy outputs that do not produce environmental outcomes that are effective and meet legislative goals. Also, there is no evidence that strict consensus-based decision making is a necessary condition for collaborative governance institutions; therefore, the present study does not constrain collaborative climate change policy processes to include only consensus-based processes.

Sabatier et al. (2005a) note four general variants of the collaborative management process as they apply to watershed management (see Table 2.4). This study applies these concepts to the collaborative management institutions that may be initiated to facilitate and implement climate protection policies. As identified in Table 2.4, the four general variants of collaborative management institutions include: (1) collaborative engagement processes; (2) collaborative partnerships; (3) collaborative superagencies; and (4) collaborative panels. Variations in collaborative management forms are distinguished by duration, short-term versus long-term, and decision power or influence, informal advisory versus formal authority. Superagencies have been found to play an important role in the context of watershed management largely due to the spatial context of these environmental quality issues and the presence of legal jurisdictions and regulatory institutions in place at the state and federal levels to manage this resource (Heikkila and Gerlak 2005; Sabatier et al. 2005a). Table 1.5 shows that a number of states have established collaborative engagement processes to investigate the severity of the climate change issue, assess potential impacts to state-

level resources, and formulate climate protection plans and policies. States also participate in collaborative partnerships such as the North America 2050 (NA2050) program which was established to facilitate and coordinate state efforts to design and implement climate protection policies. The extent to which states have or have not participated in collaborative panels or superagency processes is less clear and has yet to be extensively explored in the literature. The various forms of collaborative climate change policy institutions and institutional designs of these governance bodies will be elaborated upon in Chapter 7 of this study.

**Table 2.4** Variations of collaborative management institutions.

<b>Duration</b>	<b>Decision Power or Influence</b>	<b>Collaborative Management Institution</b>	<b>Characteristics</b>
Short-term	Informal	Engagement	Applies techniques for conflict resolution among diverse stakeholders, developed by outside actors and applied to specific planning exercises
	Formal	Panel	Consist of multi-level government representatives and nongovernment stakeholder partnerships
Long-term	Informal	Partnership	Involve a wide variety of governmental and nongovernmental stakeholders seeking to develop some form of environmental or resource management plan and implementation of projects to achieve the identified goals
	Formal	Superagency	Consist of multi-level government representatives and nongovernment stakeholder partnerships

Source: Sabatier et al. 2005a.

### **Civic Community, Legitimacy and Policy Outputs**

The framework depicted in Figure 2.2 includes three intervening variables, Civic Community, Legitimacy, and Policy Outputs, which link collaborative processes to policy outcomes. The intervening variables are included to help to



explain how stakeholder engagement vis-à-vis collaborative policy institutions, influence the socioeconomic and environmental outcomes of policy decisions. One causal pathway leads from Process and Context to Civic Community, which includes human capital (e.g., knowledge about climate change conditions), social capital (e.g., networks of reciprocity), trust of others, and attitudes toward collective action. A second causal pathway leads from Process and Context to Policy Outputs, which includes the plans and projects produced by the collaborative policy process. Civic Community is also hypothesized to influence Policy Outputs. A third pathway leads from Process and Context to Legitimacy, and Legitimacy, in turn, affects Process. As illustrated by the framework, Civic Community, Policy Outputs, and Climate Change Policy also affect Legitimacy, albeit at different stages of the policy process (Sabatier et al. 2005a).

### **Civic Community**

Putnam, Leonardi, and Raffaella (1993) refer to civic community as a “republican” theory of successful self-governance stressing the importance of concern with the common welfare, active engagement in community associations and affairs, tolerance of opposing views, generalized trust in others, and relatively egalitarian relationships. Much of the collaborative governance literature suggests that the process of collaborative governance is not simply about negotiations and policy outcomes but is also about building trust among stakeholder groups (Alexander, Comfort and Weiner 1998; Beierle and Konisky 2001; Brinkerhoff 1999; Glasbergen and Driessen 2005; Imperial 2005; Murdock, Wiessner and Sexton 2005; Short and

Winter 1999; Tett, Crowther and O'Hara 2003; Vangen and Huxham 2003). Thus, the civic community variables are conceived as both an end in themselves and a means to improve climate policy outputs. This study adopts the assumption of Sabatier et al. (2005a) that increasing trust and social capital among state-level stakeholders is desirable, even if it does not lead to significant environmental protection, where such an outcome can nurture future efforts to adapt implemented policies to improve environmental outcomes.

The first civic community variable, human capital, includes characteristics such as education and intelligence, which increase the capability of actors to accomplish a wide variety of tasks. In particular, education is linked to many forms of political participation, particularly in those dealing with complex issues like environmental quality (Sabatier et al. 2005a). In the context of climate change policy, the scientific foundation and complexity of the issue requires a baseline understanding of how GHGs influence the atmosphere and effect natural and physical processes. A collaborative policy process that includes relevant technical and scientific experts who can communicate the effects of GHG emissions on atmospheric, natural, and physical processes, can improve human capital by elevating the education of other stakeholders who may have been misinformed or lacked a scientific understanding about the climate change issue. Human capital is also linked with trust and with several measures of social capital (Putnam 2000).

Social capital refers to norms and beliefs that increase the capabilities of groups to achieve collective tasks. Following Putnam (1993, 2000) and Sabatier et al.

(2005b), this study regards social capital as including the density and breadth of social networks and norms of reciprocity (norms encouraging the exchange of favors over time). A collaborative policymaking process that is transparent, reflexive, and facilitates opportunities for face-to-face dialogue is likely to increase social capital (Ansell and Gash 2008). Producing a venue for stakeholders to hold a dialogue and formulate policy options can break down preconceived stereotypes among stakeholders and other existing barriers to communication that may have averted the exploration of mutual gains prior to partnership formation (Bentrup 2001). As discussed in Chapter 1, climate change policy has been plagued by conflict and, more often than not, policy stalemates. Allowing divergent interests to meet in a mutual setting to discuss potential solutions to reducing GHG emissions can facilitate the opportunity for stakeholders to negotiate policy preferences, and potentially result in the discovery of mutual gains and the development of new cooperative networks.

Political efficacy refers to the confidence and trust that a citizen has in their government and the ability to influence government decisions. Political scientists have defined two dimensions of political efficacy, internal efficacy and external efficacy (Miller et al. 1980, 253). Internal efficacy refers to an individual's perception that they are capable of understanding politics and are competent enough to participate in political acts (e.g., voting). External efficacy, in contrast, refers to beliefs about the responsiveness of political institutions to an individual's needs. Low external efficacy suggests that the public cannot influence political outcomes because government leaders and institutions are unresponsive to their needs. In terms of

climate change policy, particularly at the federal level, one may assume that there is a general sense of low external efficacy among proponents of change, who have had little influence on achieving federal legislative action in spite of a majority of Americans who believe that climate change is occurring. The framework assumes that collaborative policymaking processes are more likely to improve political efficacy, relative to traditional forms of environmental regulation and management, largely via transparent, consensus-oriented decision-making processes.

Trust represents the confidence that one actor, or group of actors, has in another actor, or group of actors, to behave in an honorable fashion. In general, trust can be defined by three components, the willingness and ability to keep promises and agreements; a sincere effort to understand the interests of others and to take these interests into account when making decisions; and a willingness to reciprocate acts of goodwill or generosity. Trust can also be categorized as generalized trust, trust in types of actors, and specialized trust, trust in specific individuals or types of individuals (e.g., government officials vs. nongovernment stakeholders) (Sabatier et al. 2005a).

A lack of trust among stakeholders is a common starting point for collaborative governance processes, especially those that involve a history of conflict over natural resource or environmental management (Weech-Maldonado and Merrill 2000). Collaborative governance processes that are transparent and facilitate face-to-face dialogue and “thick communication” can build trust and mutual respect between stakeholders, especially those with a history of antagonism (Ansell and Gash 2008;

Gilliam et al. 2002; Lasker and Weiss 2003; Plummer and Fitzgibbon 2004; Schneider et al. 2003; Tompkins and Adger 2004; Warner 2006). In the context of climate change policymaking, and environmental policy more generally, a history of mistrust between environmental and industry groups may exist as a result of conflict over previous policy issues. In such instances, establishing trust incrementally via collaborative policymaking processes may be essential prior to undertaking important negotiations (Ansell and Gash 2008).

The final civic community variable, collective action beliefs, represents the beliefs that stakeholders have regarding the nature of the environmental problem (e.g., severity, diffuseness, uncertainty) and institutional performance (e.g., conflict resolution, perceived fairness) (Lubell 2005). The presence of collaborative policymaking institutions can reduce what Lubell (2000) refers to as “cognitive conflict,” which occurs when the policy-core beliefs of stakeholders lead to divergent perceptions of the environmental problem and impede cooperation. In the context of climate change, environmental and industry interests have often disagreed over the severity and urgency of the issue, and the latter has often disputed policy action efforts, citing the economic impacts of GHG emissions reduction measures. At some point during the collaborative policy process, stakeholders are likely to develop some shared understanding of the environmental issue to be addressed and what policy outputs can be achieved via the collective decision-making process (Tett, Crowther and O’Hara 2003). Developing a shared understanding of the environmental issue can improve collective action beliefs by helping stakeholders define the problem, identify

important factors that contribute to existing conditions, and determine what information is necessary to address the problem moving forward (Ansell and Gash 2008).

### **Legitimacy**

Legitimacy refers to the concept of political legitimacy, which can be described as an individual's recognition and acceptance of the validity of the rules imposed by a political system and the decisions of policy elites (Trachtenberg and Focht 2005). Political legitimacy is an important component of a democratic society, where legitimation involves morally justifying a political structure by showing its consistency with a set of accepted moral principles (Barker 1990). To determine the contribution of stakeholder participation in collaborative watershed management, Sabatier et al. (2005a) refer to the importance of procedural and structural legitimacy. Procedural legitimacy refers to the fundamental values of autonomy and self-rule and the notion that those who are bound by policy decisions must have direct influence on its formulation. The procedural legitimacy of a collaborative policy process depends, in part, upon stakeholders' perception that they have been provided fair access and participation (Ansell and Gash 2008). Substantive legitimacy refers to the fundamental values of welfare and justice. This concept reflects the notion that policy outputs ought to improve the conditions of life for community stakeholders, and that the benefits and costs of these improved conditions are fairly distributed.

After completing their empirical analysis of watershed management, Sabatier et al. (2005a) conclude that collaborative institutions, their civic community, policy

outputs, and perceived watershed outcomes, contribute to the legitimacy of watershed policymaking along both procedural and substantive dimensions. An inclusive process that provides clear and consistently applied ground rules can reassure participants that the process is fair, equitable, and open (Murdock, Weissner and Sexton 2005). However, as discussed above, fair and equitable processes may lead to lowest common denominator policies that do not address environmental problems effectively. A community of stakeholders in which collaborative processes support the development of trust and social capital is likely to influence positively the stakeholders' belief that decision-making processes are fair and equitable. Policy outputs that incorporate the interests of stakeholders engaged in the policy process are likely to affect positively perceived legitimacy, while outputs that omit the preferences of some stakeholders are likely to reduce perceived legitimacy of these groups. Similarly, socioeconomic and environmental outcomes that disproportionately distribute the costs and benefits of policy action across sectors of society are likely to affect negatively substantive legitimacy. Procedural and substantive legitimacy, in turn, affect Civic Community and Process, where favorable stakeholders perception of fairness, openness and equity in policy dialogues and outcomes is likely to contribute to the development of trust and norms of reciprocity among stakeholders, and reinforce a sense of "commitment to the process," improving the functionality of future policy negotiations (Ansell and Gash 2008).

## **Policy Outputs**

Policy Outputs represent the plans and projects developed from the collective decision-making process. The diversity of climate change policy outputs is exhibited in Table 1.5. In general, policy plans can be applied to any sector of society, and projects can be divided into two categories, emissions reduction and carbon sequestration. The institutional design of the collaborative policymaking process contributes to the likelihood of successfully adopting plans and projects to address the environmental problem. Policy outputs are influenced by Civic Community where, for example, improved collective action beliefs (understanding of the severity of the problem) among stakeholders is likely to produce effective plans and projects to improve environmental conditions. Similarly, efforts that increase trust and social reciprocity are more likely to result in environmental management plans and pollution control (GHG emissions in our case) projects than efforts that do not. In addition, reaching agreement on a plan or a GHG reduction project feeds back into Legitimacy because the outcome indicates that stakeholders resolve many of their differences if they take the time to listen carefully to the concerns of others and recommended solutions compatible to the interests of others, and honor agreements.

## **Climate Change Policy**

The final set of variables, climate change policy, represent the study's primary dependent variable and, in the context of climate change, consists of actual GHG reductions. As discussed above, emissions reductions can occur through various mechanisms, and by either reducing actual emissions or increasing carbon capture



and storage. Often, determining the environmental outcomes of policy action to address diffuse pollution problems is limited by the quality of the data that are available. Critical data requirements include baseline data and post-project monitoring, in addition to long time-series data that can be used to account for changes in pollution levels due to background factors. In the context of climate change, important baseline data include the level of emissions produced within a particular political boundary and post-project monitoring of emissions levels following the implementation of GHG emissions reduction projects. For sectors that generally do not directly emit GHG emissions, such as residential and commercial buildings, GHG emissions trends can be estimated by identifying the amount of energy consumed and the source of energy production. In the case of policies that are focused on the implementation of “carbon capture” projects, as opposed to emissions reduction, GHG emissions reductions will have to be determined based upon the amount of emissions that have been “removed” from the atmosphere. Often, such calculations may be limited to general assumptions regarding energy and carbon sequestration efficiency, and thus some measurement error is likely to exist.

Important background factors that are likely to affect GHG emissions include land use change not related to climate change policy within a particular region, such as the creation of carbon sinks via an increase in vegetation or wetlands, which can mitigate emissions by reducing ambient CO<sub>2</sub> levels. The provision of carbon sinks is likely to improve environmental conditions (i.e., reduce atmospheric CO<sub>2</sub> levels), however, the level and quality of data to quantify such reductions may be limited.

Additionally, increased urbanization in a particular region can also contribute to factors that affect climate change including a decrease in carbon sequestration from the removal of vegetation, and a decrease in albedo, which can contribute to an increase in localized temperatures creating an “urban heat island” effect. Assessing the environment outcomes of global commons problems, such as anthropogenic global climate change, must also be considered in the global context. In the absence of international efforts to reduce GHG emissions, actions at the subnational level are less likely to result in actual environmental improvement in the long-term. Thus, background effects may also include the environmental impact of GHG emissions occurring outside of the particular region in which emissions reduction is occurring. Such impacts may be difficult to account for when determining the effectiveness of climate change policy projects.

The framework hypothesizes that Process influences Climate Change Policy Outcomes via Civic Community largely as a function of the shared collective action beliefs of stakeholders involved in the process. Collective action beliefs reflect a stakeholder’s willingness to engage in cooperative, collaborative negotiations, and therefore influence the effectiveness of socioeconomic and environmental outcomes (Sabatier et al. 2005a). Another causal pathway also leads from Process to Climate Change Policy Outcomes via Policy Outputs. The relationship between these variables is intuitive, where the formulation of comprehensive and strategic plans and projects during the collaborative process is directly related to the actual environmental and socioeconomic outcomes following project implementation. The

perceived and actual socioeconomic and environmental outcomes following project implementation also affect legitimacy, where preferred or equitable outcomes are likely to support the perception of substantive legitimacy among stakeholders involved in the policy process.

### **Theoretical Orientations**

Sabatier et al. (2005b) draw upon three general theoretical perspectives that have been used to explain the success of a variety of policymaking institutional arrangements to substantiate the proposed causal processes developed in their framework of collaborative watershed management. The theoretical perspectives include, Institutional Rational Choice (IRC), exemplified by Lubell et al.'s (2002) Political Contracting and Ostrom's (2007) Institutional Analysis and Development (IAD) approaches; the social capital approach, derived from the work of Putnam, Leonardi and Nanetti (1993) and Coleman (1988); and the Advocacy Coalition Framework (ACF) developed by Sabatier and Jenkins-Smith (1988, 1993, 2007). Multiple theoretical orientations are presented because none are comprehensive enough to explain the relationships throughout the entire model, and each tends to elucidate a different portion of the conceptual model. For instance, IRC may be useful for understanding how the Context of a particular state affects the type of climate change policymaking process that results, whereas theories regarding social capital are most effective for explaining the development of stakeholder interactions and subsequent policy outcomes (Sabatier et al. 2005b). Each of the theoretical perspectives are useful for defining the mechanisms by which one variable in Figure

2.2 affects the other, and formulating testable hypotheses about the potential role of stakeholder engagement in the development of state-level climate change policy. The hypotheses provide the foundation for the empirical investigation of stakeholder engagement in state-level climate change policymaking. The following section provides an overview of particular aspects of each theoretical perspective that are useful for explaining these relationships. Each description is paired with a table of hypotheses developed from the theory that can be applied to the concept of collaborative climate change policy processes.

### **IRC: Institutional Analysis and Development and Political Contracting**

The IRC perspective seeks to explain the patterns of interactions and outcomes that emerge from actors who make decisions and behave within a set of institutional constraints. The framework assumes that actors are self-interested, but their ability to engage in behavior to pursue such interest is constrained by limited cognitive and information processing abilities, what Simon (1955) refers to as, “bounded rationality.” Institutions are defined by the set of formal and informal norms that structure human behavior within a particular society. Formal rules define sets of required, forbidden, and allowable behaviors as well as the punishments for violating such rules. Often, formal rules are recorded in legislation, judicial rulings, agency rulemaking, management plans, or some other form of authoritative statement. Informal rules, or norms, are shared prescriptions that are typically enforced through individuals using reciprocal strategies, with punishment carried out through withdrawal of cooperation or social sanctions (Ostrom 1990, 2007; Ostrom,

Gardner and Walker 1994). The IAD (Ostrom 1990, 2007) and PC (Libecap 1989; Lubell et al. 2002) are two variants of the IRC approach that are particularly promising for explaining the formation and success of climate change policy partnerships.

### **Institutional Analysis and Development**

The IAD orientation originated from Kiser and Ostrom (1982) and has been developed through a number of empirical studies from a wide range of social science disciplines (e.g., Ostrom 1990, 2007; Ostrom, Gardner and Walker 1994). The IAD perspective has primarily been applied to the governance of common pool resources (e.g., watershed, forestry and fisheries management) whereby the costs of pollution or consumption of a particular resource by an actor or group of actors, who derive some benefit from their behavior, are distributed to the entire population of resource users. The issue of global climate change can be described as a global commons problem where local GHG emissions, and the environmental consequences of global climate change, are imposed upon the global population. Clearly, the behavior of actors at the subnational level, to reduce GHG emissions in order to address the problem of climate change, will not be adequate in the absence of a global effort to curb GHG emissions. Nonetheless, I assume that the effects of local climate change impacts, present real costs to local actors, which will, in turn, motivate actors to seek to address the issue in the local arena.

The IAD approach includes multiple levels of rules, where decision outputs at higher levels produce the rules that are implemented at lower levels (Kiser and

Ostrom 1982; Ostrom 1999). According to Ostrom (2007), “operational rules” exist at the lowest level and are the specific formal and informal rules that govern the use of a particular resource. “Collective choice” rules govern the process by which operational rules are changed and, at the highest level, “constitutional rules” govern the changing of collective choice rules. Within the rules hierarchy, actors who are dissatisfied with the decision outputs at a particular level can appeal to higher-level authorities to alter existing rules. Modifying existing rules at higher levels becomes increasingly challenging, as the number and diversity of stakeholders involved is likely to increase with the geographic scale covered by the rules, and transaction costs will be greater.

Sabatier et al. (2005b) argue that, in the context of regional watershed management, collaborative processes for environmental governance occur at the collective choice level, where management actions produced by collaborative institutions create new sets of operational rules that govern the use of resources within a particular watershed. In the context of state-level climate change, policies also occur at the collective choice level, where government mandates impose new operational rules for public and private stakeholders, including lower levels of government. At times state-level climate change policy rules have been challenged in the federal courts, such as the case with California’s low carbon fuel standard (LCFS) when the oil and ethanol industry sought to overturn the state’s limits on carbon intensity of motor vehicle fuel, arguing that the rule violated the Commerce Clause of the U.S. Constitution (*Rocky Mountain Farmers Union v. Corey* 2014). While the rule was upheld in the U.S. Ninth Circuit Court of Appeals, the efforts of industry

interests who were dissatisfied with the LCFS rule and sought to overturn the decision by appealing to higher level authority, is illustrative of how dissatisfied actors can appeal to higher level authorities and invoke constitutional rules in an attempt to overturn decisions made at the collective choice level.

The central focus of the IAD is the “action arena,” a conceptual unit that consists of a set of actors who behave according to an explicit model of the individual and a decision-action situation (Kiser and Ostrom 1982; Ostrom 2007).<sup>17</sup> Together, the decisions and behaviors of actors within the structural constraints of the action arena produce the observable patterns of interaction and outcomes in a particular policy setting.

The structure of a decision-action situation is determined by three sets of variables, the biophysical structure of the resource under consideration; the attributes of the community; and institutional rules-in-use. The biophysical nature of the resource refers to whether the resource is overexploited and the nature and complexity of the causal relationships between human behaviors and environmental outcomes. Community attributes encompass the homogeneity of behavioral norms, cultural differences, people’s discount rates,<sup>18</sup> and the aggregate levels of human and social capital (Ostrom 2007). Lastly, existing institutional rules refer to the existing

---

<sup>17</sup> The model of the individual specifies the assumptions being made concerning actors’ preferences, information-processing capabilities, current information, personal resources, and decision rules. The decision-action situation comprises a set of resources and constraints defining which actors are allowed to participate in a policy game, the positions for various patterns of individual actions, and the associated payoffs for the actors for each outcome.

<sup>18</sup> The extent to which they discount future benefits and costs.

sets of social choice or management rules structuring how new rules are made or how resources are used.

### **Political Contracting Theory**

The Political Contracting approach developed by Lubell et al. (2002) is based upon the contracting for property rights concept of Libecap (1989) and, more generally, on the literature involving new institutional economics and transaction costs (Eggertson 1990; North 1990; Williamson 1975, 1985). The key problem identified in this literature is that contracts (i.e., formal or informal agreements) between two agents are plagued by three sources of transaction costs. These sources include, searching for information required to estimate the benefits and costs of various alternatives; negotiating about which of the various alternatives will be incorporated into the final agreement; and monitoring and compliance with the agreement and sanctioning violators. In the context of collaborative policy institutions, transaction costs are a problem for both the formation and maintenance of collaboration because both stages involve some type of political contracting (Lubell et al. 2002; Sabatier et al. 2005b). The formation of collaborative institutions entails agreeing on a set of institutional rules that will be issued to structure decision making about specific management plans. Ongoing maintenance requires successful, contracting about management actions, which takes place within the structure of the collaborative institution (Ansell and Gash 2008; Lubell et al. 2002; Sabatier et al. 2005b).



In Ostrom's terms, the collaborative institution identifies the rules for collective choice, and the management plan defines operational rules. The general argument from the PC perspective is that the likelihood of partnership formation and success increases with stakeholder valuations of the benefits of partnerships, decreases with the magnitude of transaction costs involved in forming and running a partnership, and increases with the resources available to pay those costs. The benefits and transaction costs of collective action are determined by the same three categories of variables that affect the structure of the action arena, the biophysical structure of the resource; institutional rules; and attributes of the community. Applying IRC theory to the study of state-level climate change policy, Table 2.5 distinguishes a number of hypotheses that can be suggested regarding the factors that are likely to affect the formation of climate change policy institutions at the state level.

**Table 2.5** IRC hypotheses, factors that affect formation of collaborative policy processes.

	More likely to form	Less Likely to Form
<b>Environmental Problem</b>	<b>H<sub>1</sub>:</b> Heterogeneous in nature and geographically dispersed. <b>H<sub>2</sub>:</b> Severe or perceived by most actors to be severe. <b>H<sub>3</sub>:</b> Scientific knowledge about the problem is good.	
<b>Existing Institutions</b>	<b>H<sub>4</sub>:</b> Have enough resources to subsidize initial transaction costs. <b>H<sub>5</sub>:</b> Are not actively addressing the climate change problem. <b>H<sub>6</sub>:</b> High-level institutions grant local autonomy.	
<b>Community</b>	<b>H<sub>7</sub>:</b> High existing stores of human and social capital. <b>H<sub>8</sub>:</b> Stakeholders have low discount rates, which equates to a willingness to trade short-term costs for long-term benefits. <b>H<sub>9</sub>:</b> The costs and benefits of management actions are spread equitably over different segments of the community. <b>H<sub>10</sub>:</b> Dominated by service industries.	<b>H<sub>11</sub>:</b> High cultural or belief heterogeneity. <b>H<sub>12</sub>:</b> Dominated by extractive industries.

Source: Kiser and Ostrom 1982; Lubell et al. 2002; Ostrom 1990, 1999; Sabatier et al. 2005b.

### Social Capital Theory

The theory of social capital was initially developed by Putnam, Leonardi, and Nanetti (1993) and Coleman (1988) and was defined as a triangle of trust, norms of reciprocity, and horizontal social networks.<sup>19</sup> Like IRC, social capital theory assumes that bounded rationality limits decision making at the individual level, and that individuals are generally motivated by self-interest. Social capital theory also posits that everyday behavior is guided by a heavy reliance on habits and norms. The social capital framework (SCF) posits that each of the three elements reinforces the other

<sup>19</sup> The term network is defined as any social arrangement that provides opportunities for “interpersonal communication and exchange, both formal and informal” (Putnam, Leonardi and Nanetti 1993, 173).

and together they promote collective action behavior. Horizontal networks refer to interpersonal communication amongst individuals of “equivalent status and power,” whereas vertical networks refer to linkages between, “unequal agents in asymmetric relations of hierarchy and dependence” (Putnam, Leonardi and Nanetti 1993, 173). Trust refers to generalized trust and specific trust in people or individuals to keep their promises, treat others fairly, and show concern for the welfare of others.<sup>20</sup> The third aspect of the SCF, norms of reciprocity, refers to the willingness of general and specific actors to initiate and return favors and reward cooperative behavior.

The relationships between the three facets of social capital within the SCF are important contributors to collective action outcomes. Networks facilitate trust among policy process participants by facilitating the development of norms of cooperation and reciprocity and by imposing social sanctions on defectors. Generalized trust is critical for initiating new network linkages and developing new relationships amongst stakeholders. Specific trust is a necessary condition for maintaining established relationships and an environment of cooperation within the community of stakeholder groups. Finally, where trust is present, norms of reciprocity are congruent with long-term self-interest because the benefits of repeated interactions generally outweigh the short-term benefits of defection. The expectation of trust and reciprocity that are built into the context of one interaction are often generalized to new interactions, and can accelerate the evolution of cooperation among stakeholder groups. According to the SCF, when trust and reciprocity norms are widely held within a community of

---

<sup>20</sup> Generalized trust refers to confidence in the general population. Specific trust refers to confidence in specific individuals.

stakeholders, and few actors defect from community norms, efficiency of collaborative governance processes is improved because the transaction costs (e.g., time and money spent on creating enforceable contracts, monitoring agreements, and penalizing defectors) of policy planning and implementation are reduced. Under such conditions, rational individuals are more likely to place greater value on the perceived long-term benefits of cooperation and become more willing to incur the short-term costs of collective action.

Research on social capital primarily focuses on the effect of social capital on civic engagement among the American public. Civic engagement generally refers to the collective behaviors that facilitate a democratic and civil society (e.g., volunteering, philanthropy, participation in politics, and engagement with current events). Sabatier et al. (2005b) extend the scope of the SCF by focusing on collective action among policy elites as opposed to the general public, and by seeking to explain the negotiated agreements of watershed partnerships and project implementation as collective outcomes, rather than civic engagement.<sup>21</sup> This study applies the same focus to collaborative climate change policy formulation and implementation. I assume that the existence of social capital (i.e., the existence of trust, norms of reciprocity, and horizontal networks) should contribute to the formulation of climate change policy agreements and the implementation of those agreements via efforts to reduce GHG emissions. Table 2.6 provides two hypotheses regarding the success of collaborative climate change policy outputs provided by the SCF.

---

<sup>21</sup> Policy elites refers to public officials and representatives from stakeholder organizations.

**Table 2.6** SCF hypotheses, factors that affect collaborative partnership outputs.

---

<b>More Common and Extensive</b>	
<b>Partnership Agreements &amp; Project Implementation</b>	<b>H<sub>13</sub>:</b> If high trust is exhibited <b>H<sub>14</sub>:</b> If norms of reciprocity are strong <b>H<sub>15</sub>:</b> If social networks are extensive

---

Source: Coleman 1988; Putnam, Leonardi and Nanetti 1993; Sabatier et al. 2005b.

### **The Advocacy Coalition Theory**

The ACF is a policymaking theory developed by Sabatier and Jenkins-Smith (1988, 1993, 2007) to address “wicked” problems. The theory posits that actors from interest groups, agencies, research institutions, and legislatures may be grouped into advocacy coalitions whose members share a set of normative beliefs and perceptions of the world and act in concert to some degree in pursuit of their common policy objectives. The ACF assumes that policymaking occurs primarily among specialists who regularly seek to influence policy within a policy subsystem. According to Zafonte and Sabatier (1998), a subsystem is characterized by functional (e.g., climate change) and territorial (e.g., a state) dimensions where, historically, interaction has occurred primarily amongst specialists in a given functional area rather than among those in different functional areas within the same territory.

The ACF differs from IRC most significantly with regard to its model of the individual (Sabatier and Schlager 2000; Schlager 1995). In contrast to the a priori assumption in the IRC, that actors are self-interested, the ACF assumes that normative beliefs must be empirically ascertained, and does not preclude the possibility of actors to engage in altruistic behavior. The ACF emphasizes the difficulty of changing normative beliefs and the tendency of actors to relate to the

world through a set of perceptual filters composed of preexisting beliefs that are difficult to alter. Consequently, according to the theory, actors from different coalitions are likely to perceive the same information in very different ways, which may lead to distrust. The ACF also adopts a proposition from prospect theory (Quattrone and Tversky 1988), which posits that actors tend to value losses more than gains. The interactions of the differences between coalitions regarding normative beliefs and the proposition that actors remember losses more than victories produce “the devil shift,” which in turn solidifies relationships within coalitions and exacerbates conflict across coalitions.<sup>22</sup> Thus, the ACF is well suited to explain the escalation and continuation of policy conflict, and requires modification to account for de-escalation and conflict resolution.

The ACF treats belief systems of policy elites as a tripartite structure. At the deepest and broadest level are “deep core beliefs.” These involve very general normative and ontological assumptions about human nature, the relative priority of fundamental values, the relative priority of welfare across different groups, the role of government versus markets in solving public policy problems, and about who should be included in the decision-making process. At the next level are “policy core beliefs.” This level of beliefs involves the application of “deep core beliefs” to a particular policy subsystem (e.g., state-level climate change policy), as well as the proper role of stakeholders (e.g., the general public, elected officials, civil servants,

---

<sup>22</sup> “The devil shift” refers to the tendency for actors to view their opponents as less trustworthy, more evil, and more powerful than they probably are (Sabatier, Hunter and McLaughlin 1987; Sabatier and Jenkins-Smith 1999).

scientific experts, etc.) and the relative seriousness and causes of policy problems in the subsystem as a whole. The ACF assumes that policy elites are knowledgeable about the relationships within their policy subsystem and therefore may be willing to adjust the application of certain core beliefs given the nature of the problem being addressed. The final level consists of “secondary beliefs.” These beliefs are relatively narrow in scope and address detailed rules and operational aspects of a particular policy’s program, the seriousness and causes of problems in a specific location, and public participation guidelines within a particular stature, among others. The ACF assumes that as the scale or scope of the policy beliefs become less broad, altering such beliefs becomes less difficult.

The ACF argues that stakeholders who share similar policy core beliefs will form an advocacy coalition in an effort to coordinate their behavior and bring about changes in public policy. Among members of a given coalition, trust is common and belief change is relatively easy on secondary beliefs. However, due to the “devil shift,” belief change across coalitions is posited to be highly difficult. Thus, there is a strong tendency for coalitions to be rather stable over long periods of time, and policy change to occur rarely. When policy change does occur, it is generally the result of significant perturbations from other policy areas, as a response to changing socioeconomic conditions or the core beliefs of major actors (Sabatier and Jenkins-Smith 1993).

In order to identify the conditions under which agreements that require a change in policy core beliefs can be reached across advocacy coalitions, Sabatier et

al. (2005b) integrate hypotheses derived from the ACF concerning policy-learning across coalitions (Sabatier and Jenkins-Smith 1988; Sabatier and Zafonte 2001) with the literature on alternative dispute resolution (ADR) (Bingham 1986; Carpenter and Kennedy 1988; O’Leary and Bingham 2003; Susskind, McKearnan and Thomas-Larmer 1999; Ury 1993) to derive prescriptions concerning the institutions for negotiating and implementing policy agreements. Many ADR theorists (e.g., Carpenter and Kennedy 1988) begin with a situation in which actors are grouped into relatively homogenous coalitions based upon beliefs, and use a model of the individual that emphasizes the role of perceptual filters and distrust in perpetuating a policy environment characterized by conflict. Given the similarities between ACF and ADR regarding the behavior of individuals and stakeholder groups, several hypotheses regarding the conditions for reaching effective negotiated agreements are offered in Table 2.7.



**Table 2.7** ACF hypotheses, factors that affect negotiated agreements.

	More Likely	Less Likely
<b>Agreements</b>	<p><b>H<sub>16</sub>:</b> When a professional forum exists to help resolve technical disputes among experts from different coalitions.</p> <p><b>H<sub>17</sub>:</b> When participants seriously consider information provided by members of opposing coalitions.</p>	<p><b>H<sub>18</sub>:</b> When there is intense policy core conflict across coalitions</p>

---

Hypotheses from the merger of ACF and ADR

---

- H<sub>19</sub>:** When all major stakeholders regard the status quo as unacceptable.
- H<sub>20</sub>:** When all major stakeholders are included in negotiations.
- H<sub>21</sub>:** When there is a consensus decision rule.
- H<sub>22</sub>:** When there is a respected, knowledgeable, and relatively neutral person to lead negotiations.
- H<sub>23</sub>:** When key stakeholders commit at least a year to the negotiations, stay personally involved, and report regularly to their constituents.
- H<sub>24</sub>:** When some of the major conflicts concern empirical topics.
- H<sub>25</sub>:** When most stakeholders trust each other to treat others' concerns seriously.
- H<sub>26</sub>:** When most stakeholders trust each other to keep agreements.
- H<sub>27</sub>:** When more than one coalition provides funding.

---

Source: Bingham 1986; Carpenter and Kennedy 1988; O'Leary and Bingham 2003; Sabatier and Jenkins-Smith 1988, 1993, 1999; Sabatier et al. 2005b; Susskind, McKearnan and Thomas-Larmer 1999; Ury 1993.

### **Conclusion**

As a “wicked problem” of the third environmental epoch, the issue of anthropogenic global climate change will require mitigation efforts to occur across a diverse set of stakeholder groups in order to be addressed effectively. In the wake of

the prevailing complexities of contemporary environmental issues, stakeholder engagement via collaborative policymaking processes has emerged as a potentially effective management model. A growing body of research has contributed to our understanding of the role that stakeholder engagement and collaborative governance has played in addressing complex problems related to natural resource and environmental management. This study seeks to expand this literature by conducting a stakeholder-focused analysis concerning climate change policymaking in American states. The conceptual framework and theoretical foundations developed by Sabatier et al. (2005a) to examine the role of stakeholder engagement and collaborative governance, within the context of watershed management, offers a potentially valuable approach for investigating how such processes may transpire within the context of state-level climate change policymaking. The next chapter presents the methodological approach that will be applied to assess state-level trends related to climate change mitigation and policy action, and investigate the role of collaborative climate change policy processes in the development and implementation of state-level climate change policy.

## References

- American Council for an Energy-Efficient Economy (ACEEE). (2016). *State and Local Policy Database*. Retrieved from: <http://database.aceee.org/>
- Agranoff, R., & McGuire, M. (2003). *Collaborative Public Management*. Washington, D.C.: Georgetown University Press.
- Alexander, J.A., Comfort, M.E., & Weiner, B.J. (1998). Governance in public-private community health partnerships: A survey of the Community Care Network: SM demonstration sites. *Nonprofit Management & Leadership*, 8:231–332.
- Allen, G.M. & Gould, E.M. (1986). Complexity, wickedness, and public forests. *Journal of Forestry*, 84(4):20-23.
- Andranovich, G. (1995). Achieving consensus in public decision making: Applying interest based problem-solving to the challenges of intergovernmental collaboration. *Journal of Applied Behavioral Research*, 31:429–45.
- Ansell, C., & Gash, A. (2008). Collaborative Governance in Theory and Practice. *Journal of Public Administration Research and Theory*, 18:543-571.
- Balint, P.J., Stewart, R.E., Desai, A., & Walters, L.C. (2011). *Wicked Environmental Problems*, 2nd ed. Washington, D.C.: Island Press.
- Barbour, E., & Teitz, M. (2009). “Blueprint Planning in California: An Experiment in Regional Planning for Sustainable Development.” In *Toward sustainable Communities: Transition and Transformations in Environmental Policy*, eds. D. Mazmanian and M.E. Kraft, 171-200. Boston, Massachusetts: MIT Press.
- Barker, R.S. (1990). *Political Legitimacy and the State*. Oxford: Clarendon Press.

- Beierle, T.C., & Konisky, D. (2001). What are we gaining from stakeholder involvement? Observations from environmental planning in the Great Lakes. *Environment and Planning C: Government and Policy*, 19:515–27.
- Bell, S., & Park, A. (2006). The Problematic Metagovernance of Networks: Water Reform in New South Wales. *Journal of Public Policy*, 26 (1): 63–83.
- Bentrup, G. (2001). Evaluation of a collaborative model: A case study of analysis of watershed planning in the Intermountain West. *Environmental Management*, 27:739–48.
- Bingham, G. (1986). *Resolving Environmental Disputes: A Decade of Experience*. Washington, D.C.: Conservation Foundation.
- Born, S. M., & K. D. Genskow. 2001. *Toward Understanding New Watershed Initiatives: A Report from the Madison Watershed Workshop*. University of Wisconsin—Cooperative Extension.
- Bradford, N. (1998). Prospects for associative governance: Lessons from Ontario, Canada. *Politics & Society*, 26:539–73.
- Brinkerhoff, D.W. (1999). Exploring state-civil society collaboration: Policy partnerships in developing countries. *Nonprofit and Voluntary Sector Quarterly*, 28 (Suppl. 1): 59–86.
- Brunner, R. D., & Steelman, T. A. (2005). *Adaptive Governance: Integrating Science, Policy, and Decision Making*. New York, New York: Columbia University Press.

- Burger, J., Gochfeld, M., Powers, C.W., Waishwell, L., Warren, C., & Goldstein, B.D. (2001). Science, policy, stakeholders, and fish consumption advisories: Developing a fish fact sheet for Savannah River. *Environmental Management*, 27: 501–14.
- Busenberg, G. (1999). Collaborative and adversarial analysis in environmental policy. *Policy Sciences*, 32:1–11.
- Carpenter, S.L., & Kennedy, W.J.D. (1988). *Managing Public Disputes: A Practical Guide to Handling Conflict and Reaching Agreements*. San Francisco, California: Jossey-Bass.
- Carson, R. (1962). *Silent Spring*. New York: Houghton Mifflin.
- Center for Climate and Energy Solutions (C2ES). (2014). *U.S. Climate Policy Maps*. Retrieved from: <http://www.c2es.org/us-states-regions/policy-maps>
- Cheng, A. S., & Mattor, K. M. (2006). Why Won't They Come? Stakeholder Perspectives on Collaborative National Forest Planning by Participation Level. *Environmental Management*, 38: 545–561.
- Chesapeake Bay Program (2006). *Chesapeake Bay 2006 Health and Restoration Assessment*. Retrieved from: [http://www.chesapeakebay.net/content/publications/cbp\\_15548.pdf](http://www.chesapeakebay.net/content/publications/cbp_15548.pdf)
- Chesapeake Bay Program (2011). *Bay Barometer: A Health and Restoration Assessment of the Chesapeake Bay and Watershed in 2010*. Retrieved from: [http://www.chesapeakebay.net/documents/cbp\\_59306.pdf](http://www.chesapeakebay.net/documents/cbp_59306.pdf)

- Chesapeake Bay Program (2013). *Bay Barometer: Health and Restoration of the Chesapeake Watershed*. Retrieved from:  
[http://www.chesapeakebay.net/documents/BAROMETER\\_2013-3.6singles.FINAL.pdf](http://www.chesapeakebay.net/documents/BAROMETER_2013-3.6singles.FINAL.pdf)
- Chrislip, D., & Larson, C.E. (1994). *Collaborative leadership: How citizens and civic leaders can make a difference*. San Francisco, California: Jossey-Bass.
- Clark, B. T., Burkardt, N., & King, M. D. (2005). Watershed Management and Organizational Dynamics: Nationwide Findings and Regional Variation. *Environmental Management*, 36(2): 297–310.
- Coglianesi, C., & Allen, L.K. (2003). *Building Sector-Based Consensus: A Review of the EPA's Common Sense Initiative*. Working Paper RWPO3. Cambridge, Massachusetts: Harvard University, JFK School of Government.
- Cohen, S., Kamieniecki, S., & Cahn, M.A. (2005) *Strategic Planning in Environmental Regulation: A Policy Approach That Works*. Cambridge, Massachusetts: MIT Press.
- Coleman, L. (1988). Social Capital in the Creation of Human Capital. *American Journal of Sociology*. 94:S95-S120.
- Commoner, B. (1971). *The Closing Circle*. New York, New York: Random House Inc.
- Database of State Incentives for Renewables & Efficiency (DSIRE). (2016). *Programs*. Retrieved from: <http://programs.dsireusa.org/system/program>

- Durant, R. F., Chun, Y. P., Kim, B., & Lee S. (2004). Toward a New Governance Paradigm for Environmental and Natural Resources Management in the 21st Century? *Administration and Society*, 35: 643–682.
- Ebrahim, A. (2004). Institutional Preconditions to Collaboration: Indian Forest and Irrigation Policy in Historical Perspective. *Administration and Society*, 36: 208–242.
- Edelman, M. (1964). *The Symbolic Uses of Politics*. Urbana, Illinois: University of Illinois Press.
- Eggertsson, T. (1990). *Economic Behavior and Institutions*. Cambridge, Massachusetts: Cambridge University Press.
- Eisner, M. A. (2007). *Governing the Environment: The Transformation of Environmental Regulation*. Boulder, Colorado: Lynne Rienner.
- Emerson, K., Orr, P. J., Keyes, D. L., & McKnight, K.M. (2009). Environmental Conflict Resolution: Evaluating Performance Outcomes and Contributing Factors. *Conflict Resolution Quarterly*, 27 (1): 27–64.
- Fiack, D. & Kamieniecki S. (2017). Stakeholder engagement in climate change policymaking in American cities. *Journal of Environmental Studies and Sciences*. 7(1): 127-140. doi: 10.1007/s13412-014-0205-9
- Frame, T. M., Gunton, T. I., & Day, J. C. (2004). The Role of Collaborative Planning in Environmental Management: An Evaluation of Land and Resource Management Planning in British Columbia. *Journal of Environmental Planning and Management* 22: 767–776.

- Fung, A., & Wright, E.O. (2001). Deepening democracy: Innovations in empowered participatory governance. *Politics & Society*, 29:5–41.
- Geoghegan, T., & Renard, Y. (2002). Beyond community involvement: Lessons from the insular Caribbean. *Parks*, 12(2): 16–26.
- Gerlak, A.K., Heikkila, T., & Lubell, M. (2012). “The Promise and Performance of Collaborative Governance”. In *The Oxford Handbook of US Environmental Policy*, eds. M.E. Kraft and S. Kamieniecki, 413-436. New York, New York: Oxford University Press.
- Gilliam, A., Davis, D., Barrington, T., Lacson, R., Uhl, G., & Phoenix, U. (2002). The value of engaging stakeholders in planning and implementing evaluations. *AIDS Education and Prevention*, 14(Suppl. A): 5–17.
- Glasbergen, P., & Driessen, P.J. (2005). Interactive planning of infrastructure: The changing role of Dutch project management. *Environment and Planning C: Government and Policy*, 23: 263–77.
- Gray, B. (1989). *Collaborating: Finding common ground for multi-party problems*. San Francisco, CA: Jossey-Bass.
- Gunton, T. I., & Day, J. C. (2003). The Theory and Practice of Collaborative Planning in Resource and Environmental Management. *Environments*, 31(2): 5–19.
- Hanak, E., Lund, J., Dinar, A., Gray, B., Howitt, R., Mount, J., Moyle, P., & Thompson, B. (2011). *Managing California’s Water: From Conflict to*



*Reconciliation*. San Francisco, California: Public Policy Institute of California.

Heikkila, T., & Gerlak, A.K. (2005). The Formation of Large-Scale Collaborative Resource Management Institutions: Clarifying the Roles of Stakeholders, Science, and Institutions. *Policy Studies Journal*, 33(4): 583–612.

Imperial, M. (2005). Using Collaboration as a Governance Strategy: Lessons from Six Watershed Management Programs. *Administration and Society*, 37: 281–320.

Jessop, B. (1999). “Narrating the Future of the National Economy and the National State: Remarks on Remapping Regulation and Reinventing Governance.” In *State/Culture: State Formation after the Cultural Turn*, ed. G. Steinmetz, 378–405. Ithaca, New York: Cornell University Press.

Karkkainen, B. C. (2002). Collaborative Ecosystem Governance: Scale, Complexity, and Dynamism. *Virginia Environmental Law Journal*, 21: 54.

Kellogg, W. A. (2009). Ohio’s Balanced Growth Program: A Case Study of Collaboration for Planning and Policy Design. *Journal of Environmental Planning and Management*, 52(4): 549–570.

Kenney, D. S. (2000). *Arguing about Consensus: Examining the Case against Western Watershed Initiatives and Other Collaborative Groups Active in Natural Resources Management*. Boulder, Colorado: University of Colorado School of Law, Natural Resources Law Center.

- Kenney, D., Bates, S., Bensard, A., & Berggren, J. (2011). The Colorado River and the Inevitability of Institutional Change. *Public Land and Resources Law Review*, 32 :103-152.
- Kenward, R. E., Whittingham, M.J., Arampatzis, S., Manos, B.D., Hahn, T., terry, A., Simoncini, R., Alcorn, J., Bastian, O., Donlan, M., Elowe, K., Franzén, F., Karacsonyi, Z., Larsson, M., Manou, d., Navodaru, I., Papadopoulou, O., Papathanasiou, J., von Raggamby, A., Sharp, R.J.A., Söderqvist, T., Soutukorva, A., Vavrova, L., Aebischer, N.J., Leader-Williams, N., & Rutz, C. (2011). Identifying Governance Strategies That Effectively Support Ecosystem Services, Resource Sustainability, and Biodiversity. *Proceedings of the National Academies of Science*, 18(13): 5308–5312.
- Kettl, D. F. (2006). Managing Boundaries in American Administration: The Collaborative Imperative. *Public Administration Review*, 66(6): 10–19.
- Kiser, L., Ostrom, E. (1982). “The Three Worlds of Action.” In *Strategies of Political Inquiry*, ed. E. Ostrom. Beverly Hills, California: Sage.
- Klyza, C. M., & Sousa, D. (2008). *American Environmental Policy, 1990–2006: Beyond Gridlock*. Cambridge, Massachusetts: MIT Press.
- Koontz, T. M., & Thomas, C.W. (2006). What Do We Know and Need to Know about the Environmental Outcomes of Collaborative Management? *Public Administration Review*, 66(6): 111–121.
- Kraft, M. E. (2014). *Environmental Policy and Politics*. 6th ed. New York, New York: Pearson.

- Kraft, M.E., & Johnson, B.N. (1999). "Clean water and the promise of collaborative decisionmaking: The case of the Fox-Wolf Basin in Wisconsin." In *Toward Sustainable Communities: Transition and Transformations in Environmental Policy*, eds. D. Mazmanian and M.E. Kraft, 113–152. Boston, Massachusetts: MIT Press.
- Lasker, R.D., & Weiss, E.S. (2003). Broadening participation in community problem-solving: A multidisciplinary model to support collaborative practice and research. *Journal of Urban Health: Bulletin of the New York Academy of Medicine*, 80:14–60.
- Layzer, J. A. (2008). *Natural Experiments: Ecosystem-Based Management and the Environment*. Cambridge, Massachusetts: MIT Press.
- Leach, W.D., Pelkey, N.W., & Sabatier, P.A. (2002). Stakeholder Partnerships as Collaborative Policymaking: Evaluation Criteria Applied to Watershed Management in California and Washington. *Journal of Policy Analysis and Management*, 21(4): 645–670.
- Lemos, M. C., & Agrawal, A. (2006). Environmental Governance. *Annual Review of Environment and Resources*, 31: 297–325.
- Libecap, G.D. (1989). *Contracting for Property Rights*. Cambridge, Massachusetts: Cambridge University Press.
- Lubell, M. (2000). Cognitive Conflict and Consensus Building in the National Estuary Program. *American Behavioral Scientist*, 44(4):628-647.
- Lubell, M. (2004). Collaborative Environmental Institutions: All Talk and No

- Action? *Journal of Policy Analysis and Management*, 23(3): 549–573.
- Lubell, M. (2005). “Do Watershed Partnerships Enhance Beliefs Conducive to Collective Action?” In *Swimming Upstream: Collaborative Approaches to Watershed Management*. ed. P.A. Sabatier, W. Focht, M. Lubell, Z. Trachtenberg, A. Vedlitz and M. Matlock, 201-232, Cambridge, Massachusetts: MIT Press.
- Lubell, M., Leach, W.D., & Sabatier, P.A. (2009). “Collaborative Watershed Partnerships in the Epoch of Sustainability.” In *Toward Sustainable Communities: Transition and Transformation in Environmental Policy*, 2nd ed., eds. D. A. Mazmanian and M. E. Kraft, 255-288. Cambridge, Massachusetts: MIT Press.
- Lubell, M., Mete, M., Schneider, M., & Scholz, J. (2002). Watershed Partnerships and the Emergence of Collective Action Institutions. *American Journal of Political Science*, 46(1):148-163.
- Lubell, M., & Segee, B. (2010). “Conflict and Cooperation in Natural Resource Management.” In *Environmental Policy: New Directions for the Twenty-First Century*, eds. N.J. Vig and M.E. Kraft, 171-196. Washington, D.C.: Brookings Institution Press.
- Lynn, L.E., Heinrich, C.J., & Hill, C.J. (2001). *Improving Governance: A New Logic for Empirical Research*. Washington, D.C.: Georgetown University Press.
- Margerum, R.D. (2002). Evaluating Collaborative Planning: Implications from an Empirical Analysis of Growth Management. *Journal of the American*

*Planning Association*, 68(2): 179–193.

Margerum, R.D., & Whitall, D. (2004). The Challenges and Implications of Collaborative Management on a River Basin Scale. *Journal of Environmental Planning and Management*, 47(3): 409–429.

Martin, J., Tett, L., & Kay, H. (1999). Developing collaborative partnerships: Limits and possibilities for schools, parents and community education. *International Studies in Sociology of Education*, 9:59–75.

Maser, C. (1997). *Sustainable Community Development: Principles and Concepts*. Del Ray, Florida: St. Lucie Press.

Mazmanian, D.A. (2009). “Los Angeles’ Clean Air saga – Spanning the Three Epochs.” In *Toward sustainable Communities: Transition and Transformations in Environmental Policy*, eds. D. Mazmanian and M.E. Kraft, 89-114. Boston, Massachusetts: MIT Press.

Mazmanian, D. A., & Kraft, M.E. (2009). “The Three Epochs of the Environmental Movement.” In *Toward Sustainable Communities: Transition and Transformation in Environmental Policy*, 2nd ed., eds. D. A. Mazmanian and M. E. Kraft, 3–42. Cambridge, Massachusetts: MIT Press.

Mazmanian, D. A., & Nijaki, L.K. (2012). “Sustainable Development and Governance”. In *The Oxford Handbook of US Environmental Policy*, eds. M.E. Kraft and S. Kamieniecki, 184-206. New York, New York: Oxford University Press.

- McCloskey, M. (2000). Problems with Using Collaboration to Shape Environmental Public Policy. *Valparaiso University Law Review*, 34: 423.
- Millennium Ecosystem Assessment. 2005. *Ecosystems and Human Well-Being: Synthesis*. Washington, DC: Island.
- Miller, W.E., Arthur, H.M., & Schneider, E.J. (1980). *American National Election Studies Data Sourcebook: 1952-1978*. Cambridge, Massachusetts: Harvard University Press.
- Milward, H. B., & Provan, K. G. (2000). "How Networks Are Governed." In *Governance and Performance: New Perspectives*, eds. C. J. Heinrich and L. E. Lynn, 238–262. Washington, D.C.: Georgetown University Press.
- Mullner, S.A., Hubert, W.A., & Wesche, T.A. (2001). Evolving Paradigms for Landscape-Scale Renewable Resource Management in the United States. *Environmental Science and Policy*, 4: 39–49.
- Murdock, B., Wiessner, C., & Sexton, K. (2005). Stakeholder participation in voluntary environmental agreements: Analysis of 10 Project XL case studies. *Science, Technology & Human Values*, 30:223–50.
- Norgaard, R.B. (1994). *Development Betrayed: The End of Progress and a Co-Evolutionary Revisioning of the Future*. New York, New York: Routledge.
- North, D. (1990). *Institutions, Institutional Change, and Economic Performance*. Cambridge, Massachusetts: Cambridge University Press.

- O’Leary, R., Bingham, L., eds. (2003). *The Promise and Performance of Environmental Conflict Resolution*. Washington, D.C.: Resources for the Future.
- Ostrom, E. (1990). *Governing the Commons: The Evolution of Institutions for Collective Action* Cambridge, Massachusetts: Cambridge University Press.
- Ostrom, E. (2007). “Institutional Rational Choice: An Assessment of the Institutional Analysis and Development Framework.” In *Theories of the Policy Process*, 2nd ed., ed. P.A. Sabatier. 35-72. Boulder, CO: Westview Press.
- Ostrom, E., Gardner, R., Walker, J. (1994). *Rules, Games, and Common-Pool Resources*. Ann Arbor, Michigan: University of Michigan Press.
- Plummer, R., & Fitzgibbon, J. (2004). Co-management of natural resources: A proposed framework. *Environmental Management*, 33:876–85.
- Portney, K.E. (2013). *Taking sustainable cities seriously: economic development, the environment and quality of life in American cities*, 2nd ed. Cambridge, Massachusetts: MIT Press.
- Power, J., McKenna, J., MacLeod, M.J., Cooper, A.J.G., & Convie, G. (2000). Developing integrated participatory management strategies for Atlantic dune systems in County Donegal, Northwest Ireland. *Ambio*, 29:143–9.
- Pretty, J. 2003. Social Capital and the Collective Management of Resources. *Science*, 302 (5652): 1912–1914.
- Putnam, R.D. (2000). *Bowling Alone: The Collapse and Revival of American Community*. New York: Simon & Schuster.

- Putnam, R.D., Leonardi, R., and Nanetti, R. (1993). *Making Democracy Work: Civic Traditions in Modern Italy*. Princeton, New Jersey: Princeton University Press.
- Quattrone, G.A., & Tversky, A. (1988). Contrasting Rational and Psychological Analyses of Political Choice. *American Political Science Review*, 82(3):719-736.
- Rabe, B.G. (2010a). "Introduction: The challenges of U.S. Climate Governance." In *Greenhouse Governance: Addressing Climate Change in America*, ed. B.G. Rabe, 3-23. Washington, D.C.: Brookings Institution Press.
- Rabe, B.G. (2010b). "Racing to the Top, the Bottom, or the Middle of the Pack?" In *Environmental Policy: New Directions for the Twenty-First Century*, eds. N.J. Vig and M.E. Kraft, 27-50. Washington, D.C.: Brookings Institution Press.
- Reilly, T. (1998). Communities in conflict: Resolving differences through collaborative efforts in environmental planning and human service delivery. *Journal of Sociology and Welfare*, 25:115–42.
- Reilly, T. (2001). Collaboration in action: An uncertain process. *Administration in Social Work*, 25(1): 53–73.
- Rhodes, R.A.W. (1996). The New Governance: Governing without Government. *Political Studies*, 44(4): 652–667.
- Rocky Mountain Farmers Union v. Corey, 740 F.3d 507, 508 (9th Cir., 2014).
- Rogers, T., Howard-Pitney, B., Feighery, E.C., Altman, D.G., Endres, J.M., & Roeseler, A.G. (1993). Characteristics and participant perceptions of tobacco



- control coalitions in California. *Health Education Research, Theory & Practice*, 8:345–57.
- Roussos, S.T., & Fawcett, S.B. (2000). A Review of Collaborative Partnerships as a Strategy for Improving Community Health. *Annual Review of Public Health*, 21: 269–402.
- Sabatier, P.A., & Jenkins-Smith, H. (1988). Special Issue: Policy Change and Policy-Oriented Learning. *Policy Sciences*, 21:123-278.
- Sabatier, P.A., & Jenkins-Smith, H.C., eds. (1993). *Policy Change and Learning: An Advocacy Coalition Approach*. Boulder, Colorado: Westview Press.
- Sabatier, P.A., & Jenkins-Smith, H.C. (2007). “*The Advocacy Coalition Framework: An Assessment.*” In *Theories of the Policy Process*. 2nd ed., ed P.A. Sabatier, 117-168. Boulder, Colorado: Westview Press.
- Sabatier, P.A., Focht, W., Lubell, M., Trachtenburg, Z., Vedlitz, A., & Matlock, M. eds. (2005a). *Swimming Upstream: Collaborative Approaches to Watershed Management*. Cambridge, Massachusetts: MIT Press.
- Sabatier, P.A., Hunter, S., & McLaughlin, S. (1987). The Devil Shift: Perception and Misperceptions of Opponents. *The Western Political Quarterly*, 40(3): 449-476.
- Sabatier, P.A., Leach, W.D., Lubell, M., & Pelkey, N.W. (2005b). “Theoretical Frameworks Explaining Partnership Success.” In *Swimming Upstream: Collaborative Approaches to Watershed Management*. ed. P.A. Sabatier, W.

- Focht, M. Lubell, Z. Trachtenberg, A. Vedlitz and M. Matlock, 73-200,  
Cambridge, Massachusetts: MIT Press.
- Sabatier, P.A., & Schlager, E. (2000). Les Approaches cognitives des politiques publiques: Perspectives américaines (Cognitive approaches to public policy: An American Perspective). *Revue française de science politique*, 50(2):209-234.
- Sabatier, P.A., & Zalfonte, M. (2001). "Public Knowledge: Advocacy Organizations." In *International Encyclopedia of the Social and Behavioral Sciences*, eds. N.J. Smelser and P.B. Baltes. Amsterdam: Elsevier.
- Scharpf, F. (1994). Games Real Actors Play: Positive and Negative Coordination in Embedded Negotiations. *Journal of Theoretical Politics*, 6: 27–53.
- Schlager, E. (1995). Policy Making and Collective Action: Defining Coalitions within the Advocacy Coalition Framework. *Policy Sciences*, 28(3):243-270.
- Schlager, E., & Heikkila, T. (2009). Resolving Water Conflicts: A Comparative Analysis of Interstate River Compacts. *The Policy Studies Journal*, 37(3): 367-392
- Schneider, M., Scholz, J., Lubell, M., Mindruta, D., & Edwardsen, M. (2003). Building consensual institutions: Networks and the national estuary program. *American Journal of Political Science*, 47:143–58.
- Schuckman, M. (2001). Making Hard Choices: A Collaborative Governance Model for the Biodiversity Context. *Washington University Law Quarterly*, 79: 343.

- Shaw, C. (2013). Choosing a dangerous limit for climate change: Public representations of the decision making process. *Global Environmental Change*, 23: 563-571.
- Short, C., & Winter, M. (1999). The problem of common land: Towards stakeholder governance. *Journal of Environmental Planning and Management*, 42:613–30.
- Simon, H.A. (1955). A Behavioral Model of Rational Choice. *Quarterly Journal of Economics*, 69(1):99-118.
- Smith, C. (2009). Institutional Determinants of Collaboration: An Empirical Study of County Open-Space Protection. *Journal of Public Administration Research and Theory*, 19(1): 1–21.
- Stoker, G. (1998). Governance as theory: Five propositions. *International Social Science Journal*, 50:17–28.
- Susskind, L., & Cruikshank, J. (1987). *Breaking the Impasse: Consensual Approaches to Resolving Public Disputes*. New York, New York: Basic Books.
- Susskind, L., McKearnan, S., & Thomas-Larmer, J. eds. (1999). *The Consensus Building Handbook: A Comprehensive Guide to Reaching Agreement*. Thousand Oaks, California: Sage.
- Tett, L., Crowther, J., & O’Hara, P. (2003). Collaborative partnerships in community education. *Journal of Education Policy*, 18:37–51.
- Till, J. E., & Meyer, K. R. (2001). Public Involvement in Science and Decision

- Making. *Health Physics*, 80: 370–378.
- Tol, R. S. J. (2007) Europe’s long-term climate target: a critical evaluation. *Energy Policy* 35: 424–432.
- Tompkins, E.L., & Adger, W.N. (2004). Does adaptive management of natural resources enhance resilience to climate change? *Ecology and Society*, 9(2): 10.
- Trachtenberg, Z., & Focht, W. (2005). “Legitimacy and Watershed Collaborations: The Role of Public Participation.” In *Swimming Upstream: Collaborative Approaches to Watershed Management*. ed. P.A. Sabatier, W. Focht, M. Lubell, Z. Trachtenberg, A. Vedlitz and M. Matlock, 53-82, Cambridge, Massachusetts: MIT Press.
- U.S. Energy Information Administration (EIA). (2015). *State Carbon Dioxide Emissions*. Retrieved from: <https://www.eia.gov/environment/emissions/state/>
- Ury, W. (1993). *Getting Past No: Negotiating Your way from Confrontation to Cooperation*. Rev. ed. New York, New York: Bantam Books.
- Vangen, S., & Huxham, C. (2003). Nurturing collaborative relations: Building trust in interorganizational collaboration. *Journal of Applied Behavioral Science*, 39:5–31.
- Vig, N., & Kraft, M. E., eds. (2010). *Environmental Policy: New Directions for the Twenty-First Century*, 7th ed. Washington, D.C.: Congressional Quarterly Press.

- Warner, J. F. (2006). More Sustainable Participation? Multi-Stakeholder Platforms for Integrated Catchment Management. *Water Resources Development*, 22(1): 15–35.
- Weber, E.P. (2003). *Bringing Society Back In: Grassroots Ecosystem Management, Accountability, and Sustainable Communities*. Cambridge, Massachusetts: MIT Press.
- Weber, E. P., Lovrich, N. P., & Gaffney, M. (2005). Collaboration, Enforcement, and Endangered Species: A Framework for Assessing Collaborative Problem-Solving Capacity. *Society and Natural Resources*, 18: 677–698.
- Weech-Maldonado, R., & Merrill, S. (2000). Building partnerships with the community: Lessons from the Camden Health Improvement Learning Collaborative. *Journal of Healthcare Management*, 45:189–205.
- Williamson, O.E. (1975). *Markets, Hierarchies, Analysis and Antitrust Implications: A Study in the Economics of Internal Organization*. New York, New York: Free Press.
- Williamson, O.E. (1985). *The Economic Institutions of Capitalism*. New York, New York: The Free Press.
- Wondolleck, J.M., & Yaffee, S.L. (2000). Making Collaboration Work: Lessons from Innovation in Natural Resource Management. Washington, D.C.: Island Press.
- Yaffee, S. L., & Wondolleck, J. (2003). Collaborative Ecosystem Planning Processes in the United States: Evolution and Challenges. *Environments*, 31 (2): 59–72.
- Zafonte, M., & Sabatier, P.A. (1998). Shared Beliefs and Imposed Interdependencies

as Determinants of Ally Networks in Overlapping Subsystems. *Journal of Theoretical Politics*, 10(4): 473-505.

### **Chapter 3 - Study Methods**

The goal of inquiry in the politics and policy sciences is often to assess whether some occurrence was the cause of a particular outcome or a particular case. The intent of this research is to evaluate the contingency model for collaborative governance developed by Sabatier et al. (2005a) within the context of climate change policymaking in several American states. This chapter introduces the methodological approach that will be used to select four states for case study analysis, and test the hypotheses developed from the theoretical framework initially crafted by Sabatier et al. (2005a). The chapter begins by providing a justification and rationale for conducting a comparative state-level analysis concerning collaborative climate change policy processes, and continues with a discussion regarding the criteria for case study selection. The chapter continues by introducing the methodological approach that is used to facilitate case study selection, and concludes with a discussion of the methodological approach that is applied to examine the four states based upon the conceptual framework for collaborative climate change policymaking that was introduced in Chapter 2.

The unit of analysis in this study of collaborative climate change processes is state government. States offer useful units of analysis for explaining the various characteristics of collaborative climate change processes and policy outcomes because they offer a diverse and potentially large number of potential collaborators. Additionally, the fifty states do not differ significantly insofar as government institutions and legislative processes are structured. Thus, interstate diversity across

social, economic, and environmental variables, and the interstate homogeneity of governing structures, facilitates the opportunity to undertake within-case and across-case comparisons that examine the framework for collaborative climate change policy institutions.

When viewed as a hierarchical model of policy and environmental outcomes, the collaborative governance framework depicted in Figure 2.2 identifies two dependent variables of concern, institutions for collaborative climate change policy and climate change policy outcomes. The focus of the investigative process is to examine and explain the causal mechanisms that are hypothesized to contribute to collaborative governance institutions and subsequently lead to successful climate change policy outcomes. The investigation relies on process tracing techniques to examine the intermediate steps in the policymaking process presented in the theoretical framework described above to test hypotheses on how climate change policymaking takes place across the American states, whether and how the process generates policy outcomes, and the role of stakeholder engagement in producing policy outcomes. I posit that states that engage relevant stakeholders in the policymaking process are more likely to produce policy outputs and improve environmental conditions (via GHG emissions reduction) than those that do not.

The study begins by selecting four states that differ along two dimensions, climate change mitigation and climate change policy action. One state is selected in which significant climate change policy outcomes (i.e., significant mitigation and climate change action) have occurred relative to the other fifty states, one state is



selected in which little or no climate change action and mitigation has occurred, one state in which significant climate action and little or no mitigation has occurred, and one state is selected in which little or no climate change policy action and little or no mitigation has occurred. Based upon the selection criteria, and the hypothesized relationship between collaborative governance institutions and climate change policy outcomes, the states are placed into three case categories, most-likely, least-likely, and deviant (see Table 3.1).

The most-likely case represents a vanguard state in which, given the successful achievement of policy action and mitigation, one would expect to find the existence of collaborative engagement processes. The least-likely case represents a “laggard” state in which little or no policy action and climate change mitigation has occurred, and therefore it is unlikely that collaboration has occurred. The deviant cases represent a state in which either climate change action has occurred and little or no mitigation has transpired, and a state in which little or no climate change action has occurred, yet mitigation has been achieved. States placed in these categories represent “grey area” cases in which the in-depth analysis of the hypothesized relationship between collaborative governance institutions and policy outcomes, as well as the importance of intervening variables, such as legitimacy, may provide important insight into the validity of the proposed framework and the role of alternative hypotheses in explaining climate change policy outcomes. King, Keohane and Verba argue that, “When observations are selected on the basis of a particular value of the dependent variable, nothing whatsoever can be learned about the causes

without taking into account other values [of the dependent variable]” (King, Keohane and Verba 1994, 129). Thus, in addition to the state that has achieved significant climate change policy outcomes the study will investigate three additional cases, one state that has achieved significant policy outcomes and relatively low mitigation, one state that has not achieved significant policy outcomes but has achieved relatively high mitigation, and one state that has not achieved significant climate change policy or mitigation (see Table 3.1).

**Table 3.1** State-level climate change policy case selection.

	<b>Low Climate Change Policy Action</b>	<b>High Climate Change Policy Action</b>
<b>High Climate Change Mitigation</b>	Deviant Case	Most-Likely Case
<b>Low Climate Change Mitigation</b>	Least-Likely Case	Deviant Case

**A Composite Indicator for State Climate Change Performance and Policy Action**

In order to determine the level of climate change policy action and mitigation that has occurred across the fifty states, each must first be ranked based upon their relative climate change policy performance. Thus, the first step in the study is to develop a method that can compare climate change performance and quantitatively rank each state based upon their emissions trends and climate change policy actions. A number of separate variables can be used to determine how a state has addressed climate change. For example, one can measure changes in aggregate or per capita emissions over time, or the proportion of energy produced using renewable energy

sources. Additionally, with regard to policy action, one can determine the level of action based upon the number of policies that have been adopted, or the relative stringency of emission reduction goals or commitments. In order to produce a comprehensive climate change performance score for each of the fifty states, quantitative and qualitative data representing a range of variables are measured and integrated using two composite indicators (CIs).

An indicator is often defined as a quantitative or a qualitative measure that is derived from a series of observations in a given area. CIs are formed by synthesizing individual indicators into a single index on the basis of an underlying theoretical model (Freudenberg 2003; OECD 2008). The application of CIs to compare government performance has become increasingly recognized as useful tool to in policy analysis and public communication (Bandura 2008). The primary benefit that a CI provides is the ability to summarize complex, multi-dimensional phenomenon that cannot fully be captured by a single individual indicator, into a single “score” without omitting the underlying information base (Freudenberg 2003; OECD 2008). Rather than preparing a multitude of indicators and data analyses, CIs may be more effective for facilitating communication, as they are often easier for the general public, the media and decision-makers to understand and interpret. The primary caveat regarding the use of CIs is that they may oversimplify the complexity of the particular policy issue under investigation, which may contribute to ambiguity for actors who are interested in remediating shortcomings in a particular area. Including transparency in the CI construction process, and performing uncertainty and sensitivity analysis to

assess the robustness of the index can reduce the magnitude of these imprecisions, and subsequent misinterpretations by stakeholders.

Generally, the structure of a CI can be divided into three levels, individual indicators, thematic groupings, and the composite indicator. Individual indicators include the separate variables and associated data that are used to calculate the CI. The individual indicators represent the crux of the CI analytical design. Generally, the individual indicators are selected based upon analytical soundness, measurability, coverage, the relevance of the indicator to the phenomenon being measured and the relationship to each other (OECD 2008). Organizing individual indicators into categories based upon their shared relationships forms the second level, thematic groupings. For instance, two indicators, such as aggregate emissions from transportation and aggregate emissions from industry, are likely to be placed in the same group, whereas proportion of energy produced from renewable energy is likely to be placed in a separate grouping. Determining the appropriate thematic groupings of individual indicators also affects the robustness of the CI as the individual weights that are assigned to each indicator are aggregated to represent the weight of each thematic group to determine overall performance. The final level, the composite indicator, represents the synthesis of individual indicators and the composite measure of overall performance.

To date, much of the analysis on climate change policy performance has focused on comparisons at the national level. The development of international climate change negotiations following the establishment of the United Nations

Framework Convention on Climate Change (UNFCCC) has contributed to a growing interest among policymakers, nongovernmental organizations, and the media in developing and publicizing the relative performance of countries with regard to climate change mitigation efforts (Christoff and Eckersley 2011). Such analyses offer opportunities for elected officials and public managers interested in addressing the climate change issue to highlight areas in which future policy focus may be appropriate or identify areas in which existing institutions may be falling short. Performance measurements may also be influential politically, where proponents of climate change action (or inaction) can leverage policy decisions by identifying actors who are falling short of the prevailing trends in policy action, feeding the debate over “burden-sharing” which has played an important role in the U.S. Congress’ refusal to ratify international climate change agreements.

Many would argue that the ultimate measure of climate change performance is the level of, and changes in, a particular polity’s emissions. Christoff and Eckersley (2011) identify three thematic groupings that can be used to score climate change performance. These groups include indicators that measure past emissions performance, current emissions performance and emissions trends, and policy goals or commitments for present and future emissions reduction. Common measures include aggregate and per capita emissions levels, emissions intensity, and rates and types of decarbonization (Christoff and Eckersley 2011; Burck, Hermwille and Bals 2014; Burck, Marten and Bals 2014). Perhaps the most widely used CI of climate change policy performance is the Germanwatch/CAN Europe Climate Change

Performance Index (CCPI) which, beginning in 2006, has been used to produce annual reports that evaluate and compare the climate protection performance of countries that are responsible for more than 90 percent of global energy-related CO<sub>2</sub> emissions. Each year, the CCPI is presented to the UNFCCC to evaluate how far countries have come in achieving to ensure the prevention of dangerous climate change as outlined in Framework Convention on Climate Change.

The most recent CCPI evaluated 58 nations and is composed of five thematic groups, Emissions Level, Development of Emissions, Renewable Energies, Energy Efficiency, and Climate Policy, in which seventeen indicators are utilized (see Table 3.2). Indicators are measured using energy related emissions data from the International Energy Agency and qualitative data on climate change policy is collected via surveys disseminated to local climate change experts, who are asked to outline the most important policy measures to promote emissions reductions across individual sectors (e.g., energy production, transportation, etc.). The CI is formed by combining indicator results into one index using the following weightings, emissions trends 60 percent, energy efficiency 10 percent, renewable energy 10 percent, and climate change policy 20 percent. By providing an overall weight of 40 percent to climate change policy, energy efficiency, and renewable energy, Germanwatch/CAN Europe argue that “achievements in reducing emissions and promoting mitigation technologies are adequately included in the index” (Burck, Marten and Bals 2015, 5). Similarly, the CCPI sets a maximum weight of 30 percent for the level of current emissions to allow the indicator to be “responsive enough to adequately capture

ambitious climate policy” (Burck, Marten and Bals 2014, 5). One potential pitfall of the CCPI is the assignment of weights to each of the fifteen indicators. Indicators should be weighted according to some underlying theoretical framework, or estimated using statistical methods. Burck, Marten, and Bals (2014) do not explicitly state the theoretical basis or method of calculation used to derive the weights employed in the CCPI. The subjective nature of weight selection for the CCPI may affect the robustness of the results, by over- or underestimating the importance of a particular indicator in determining overall climate change performance.

**Table 3.2.** Components of the Climate Change Performance Index.

Thematic Group (weight as %)	Indicator	Weight (%)
Emissions Level (30)	• Primary energy supplied per capita	7.5
	• CO <sub>2</sub> emissions per capita	7.5
	• Target-performance comparison	10
	• Emissions from deforestation per capita	5
Development of Emissions (30)	CO <sub>2</sub> emissions from:	
	• Electricity and heat production	10
	• Manufacturing and industry	8
	• Transportation	4
	• Residential use and buildings	4
• Aviation	4	
Efficiency (10)	• Efficiency trend	5
	• Efficiency level	5
Renewable Energy (10)	• Share of renewable energy in total primary energy supply	2
	• Development of energy supply from renewable energy sources	8
Climate Change Policy (20)	• National climate policy	10
	• International climate policy	10

Source: Burck, Hermwille and Bals 2014; Burck, Marten and Bals 2015.

The CCPI applies the Min-Max methodology to normalize the value of each individual indicator.<sup>23</sup> The Min-Max normalization approach sets the country that is the best performer for a particular indicator as the highest possible score. Thus, any country’s individual score will indicate climate performance relative to that of all other countries. The CCPI’s final country ranking is calculated by aggregating the weighted indicator scores for each country.<sup>24</sup> The resulting CCPI places each individual country in a performance ranking relative to the performance indicators of all other countries. While the CCPI score places the highest performing nation(s) at the top of the performance “ladder”, the aggregate score does not necessarily indicate that a particular country performed better than all countries below it in all areas evaluated. Thus, each thematic grouping, and individual indicator, can be separately analyzed to rank performance on specific climate change areas and individual sectors.

This study draws upon the methodological approach employed by Germanwatch/Can Europe to develop a systematic ranking of the fifty U.S. states. In

---

<sup>23</sup> Min-Max normalization equation

$$X_{ic} = 100 \cdot \left( \frac{x_{ic} - \min(x_i)}{\max(x_i) - \min(x_i)} \right)$$

X = Normalized indicator score

x = Measured value

c = country, 1, ..., 58

i = individual indicator, 1, ..., 15

<sup>24</sup> Climate Change Protection Index Formula

$$I = \sum_{i=1}^n w_i X_{ic}$$

I = Climate Change Performance Index

X<sub>ic</sub> = Normalized indicator for indicator, i, in country, c

W<sub>i</sub> = weighting of indicator i,  $\sum_{i=1}^n w_i = 1$  and  $0 \leq w_i \leq 1$

i = individual indicator, 1, ..., 15

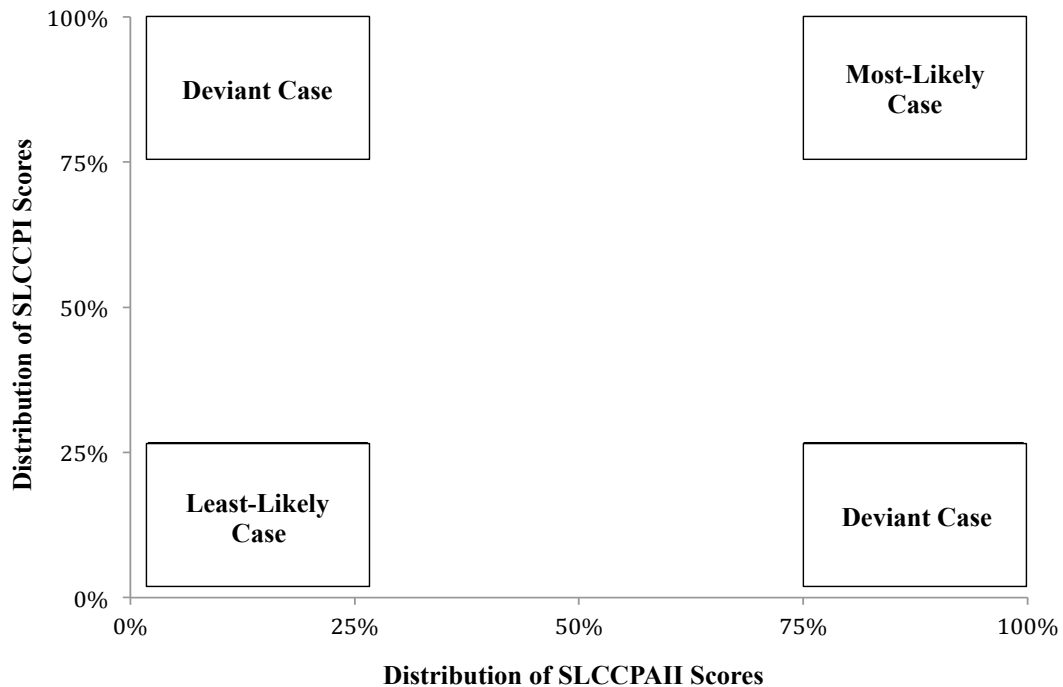


contrast to the CCPI, two separate composite indices, a State-Level Climate Change Performance Index (SLCCPI) and State-Level Climate Change Policy Adoption and Implementation Index (SLCCPAII), to determine the climate change mitigation and policy action scores of a particular state. The SLCCPI is based upon the aggregation of six indicators divided across three thematic groupings, emissions development, energy efficiency, and alternative energy development (see Chapter 6). The second index, SLCCPAII, consists of 21 individual indicators from five thematic groupings, emissions, energy efficiency, renewable energy, multistate agreements, and climate change policy planning (see Chapter 6). SLCCPI and SLCCPAII indicators are normalized using the Min-Max methodology in order to produce a state-level performance “ladder” that ranks state performance relative to all other states. Individual indicators are assigned equal weights; as it is assumed that all variables hold equal value with respect to their contribution to climate change policy performance. The final composite index scores are then determined using the additive aggregation method.

The final indices present a ranking of the fifty states along two separate dimensions, of climate change policy performance and climate change policy action. Each of the four case studies were selected based upon their indices rankings. One vanguard state (most-likely case) was chosen by selecting the top ranking state from those that scored above the 25<sup>th</sup> percentile in both indices (see Figure 3.1). One “laggard” state (least-likely case) was chosen by selecting the lowest ranking state from those that scored below the 25<sup>th</sup> percentile in both climate change policy action

and performance. One high climate change policy action and low climate change mitigation (deviant case) case was selected by choosing a state that placed above the 25<sup>th</sup> percentile for climate change policy action and below the 25<sup>th</sup> percentile for climate change performance and had the greatest difference between each score, relative to all other states with scores in these two quartiles. One low climate change policy action and high climate change mitigation (deviant case) case was selected by choosing a state that ranked below the 25<sup>th</sup> percentile for climate change policy, and above the 25<sup>th</sup> percentile for climate change performance and had the greatest difference between each score, relative to all other states with scores in these two quartiles. Figure 3.1 provides an example of the how four states were selected for case study investigations following the across-case comparison criteria described above.

**Figure 3.1** Case study selection criteria.



As discussed above, the primary pitfall of using a CI to rank a state's relative climate change performance is the potential oversimplification of the actual processes and underlying mechanisms that may be driving climate change protection (or preventing action). A primary goal of this study is to further our understanding of why some states are taking action to address climate change, while others are not, and why some states have experienced mitigation in the absence of formal policy action, while others have seen little change in preexisting environmental conditions despite substantial formal action. Therefore the purpose of the SLCCPI and the SLCCPAII is to establish a systematic approach to organize state climate change performance and facilitate case study selection. Once the four states were selected, the case study investigations were carried out using a process tracing research design.

### **Process Tracing**

As a qualitative method, process tracing is often identified as the most important tool of causal inference in qualitative and case study research (Collier 2011; George and Bennett 2005). The process tracing research design is distinct from alternative single and small-n case study methods in that the approach enables the researcher to identify the intervening causal process and study the causal mechanisms that link a hypothesized causal condition (or set of conditions) that facilitate or constrain the occurrence of a particular outcome. In general, process tracing is conducted by examining the intermediate steps in a process to make inferences about hypotheses on how that process took place and whether and how it generated the

outcome of interest. George and Bennett (2005) define process tracing as the use of “histories, archival documents, interview transcripts, and other sources to see whether the causal process a theory hypothesizes or implies in a case is in fact evident in the sequence and values of the intervening variables in that case.” The process tracing method focuses on the mechanisms, processes and dynamics that produce a particular event, rather than building arguments that are structural in nature. The general goal of process tracing, as a qualitative analytical tool, is to organize preexisting generalizations regarding a particular event or phenomenon with specific observations from within a single case in order to then make causal inferences about the case being studied. While both process tracing and structural case study designs offer important contributions to the academic community as well as individuals who work within the policy arena, case study research conducted on the observable implications of mechanisms gives decisionmakers new insight on a range of potentially “manipulable” factors. Thus, some have argued that process tracing techniques are better suited for capturing the complex world within which policymakers interact (Bennett and Checkel 2014).

Nesting each of the four case studies into a cross-case design for comparative analysis using the process tracing approach provides the opportunity to investigate deviant cases and develop insight into the policy and political processes that either drive or prevent climate change policy via collaborative policy institutions and stakeholder engagement. Cross-case comparisons of the four states that differ in terms of mitigation trends and climate change policy action provides the opportunity to

determine whether the presence or absence of the independent and intervening variables under investigation are indeed related to the development of collaborative climate change policy institutions and policy outcomes. Additionally, cross-case comparison may elucidate how alternative explanations might contribute to differences regarding the policy and environmental outcomes amongst the cases included in the investigation. The inclusion of least-likely and deviant cases in the investigation is also valuable for evaluating the proposed causal mechanisms and building a theoretical framework that explains the development of climate change policy. For example, case comparisons, in which two cases differ on one independent variable and on the dependent variable, process tracing can help establish that the one independent variable that differs is related through a convincing hypothesized causal process to the difference in the outcomes of the cases.

As most-similar cases rarely control for all but one potentially causal factor, process tracing can also establish that other differences between the cases do not account for the difference in their outcomes. Similarly, process tracing can help affirm that the one independent variable that is the same between two least-similar cases accounts for the similarity in their outcomes, and that similarities in other potentially causal factors do not explain the common outcome of the cases. Each of these contributions is critical for developing a theory that explains climate change policymaking in American states.

## **Process Tracing and Collaborative Climate Change Policymaking**

The current study evaluates the theoretical framework, explained above, in the context of state-level climate change policy. Thus, the goal of the study is to establish an initial test of the hypothesized causal mechanisms that influence collaborative climate change policymaking in American states. The theoretical framework (Figure 2.2) that is employed to investigate the factors that affect stakeholder engagement in the climate change policy process and the outcomes of policy implementation is exceedingly well suited for deeper examination via the process tracing design. While the theories of collaborative governance and collective action problems in the context of natural resources have been relatively well developed through a multitude of qualitative and quantitative research designs, the issue of climate change and the role of stakeholder engagement in the policy process have largely been neglected within the literature (Bernauer 2013). The framework developed by Sabatier et al. (2005a, 2005b) establishes the theoretical foundation for explaining each step that influences the outcome of a particular climate change policy.

Beach and Pederson (2012) define three variants of process tracing, theory-testing, theory-building, and explaining outcomes. In theory-testing process tracing the objective is to deduce a theory from the existing literature and then test whether there is evidence that the hypothesized causal mechanism is actually present in a given case (Bennett 2008a, 2008b; Checkel 2008; George and Bennett 2005). Theory-building process tracing seeks to build a theoretical explanation by using the evidence of a case to infer the existence of a more general causal mechanism. This study

employs a theoretical framework of collaborative governance in which causal mechanisms of the policy process have been supported by the literature. The study engages in both theory-centric variants of the process tracing design by testing the proposed mechanisms of collaborative management institutions in the context of climate change policymaking, and subsequently developing a new theory to describe the process of GHG governance in American states.

The results of this study build upon the work of Sabatier et al. (2005a), who originally applied the theory to the investigation of collaborative watershed management, by applying the framework to collaborative climate change policymaking at the state level. In order to build a theory of collaborative climate change policymaking in American states, inference must be made regarding the causal mechanisms that are present within the policymaking process and the scope conditions in which they operate. A review of the literature reveals a multitude of definitions of causal mechanisms (Hedstroem and Ylikoski 2010; Mahoney 2001). This study employs a definition of causal mechanisms provided by George and Bennett (2005) where causal mechanisms are, “social...processes through which agents with causal capacities operate, but only in specific contexts or conditions, to transfer... information... to other entities. In doing so, the causal agent changes the affected entities’ characteristics, capacities, or propensities in ways that persist until subsequent causal mechanisms act upon them” (George and Bennett 2005, 137). The scope conditions or context referenced in the definition of a causal mechanism allow a given mechanism to function and can be defined as the “...relevant aspects of a

setting (analytical, temporal, spatial, or institutional) in which a set of initial conditions leads...to an outcome of a defined scope and meaning via a specified causal mechanism or set of causal mechanisms” (Falletti, Tulia and Lynch, 2009: 1152). For example, the formation of collaborative climate change policy institutions (outcome) is affected by the context (causal mechanism) of the state in which policy is being formulated. The social, environmental and institutional conditions (scope conditions) of the state determine the effect of the context on the collaborative process.

I posit that the engagement of stakeholders in the climate change policymaking process and the existence of collaborative governance institutions are key components of producing successful policy outcomes. Therefore, in the absence of informal and formal collaborative policy efforts, effective reduction of GHG emissions at the state-level is less likely to be achieved. Insofar as the successful formulation and implementation of climate change policy is dependent upon collaboration and stakeholder engagement in the policymaking process, the absence or failure to enact climate change policy may be the result of inadequate collaboration across stakeholder groups.

### **Conducting the Analysis**

Conducting process tracing analyses often occur through a mix of inductive and deductive approaches. For phenomena on which there is little prior knowledge and for cases that are not well explained by extant theories, process tracing proceeds primarily through inductive study where events are analyzed backward through time



from the outcome of interest (e.g., Policy Outputs) to the potential antecedent causes (e.g., Context) (Bennett and Checkel 2014; Mahoney 2012). The more probable potential explanations uncovered by this procedure can then be rendered formal and deductive and tested rigorously against evidence within the case and across cases that are independent of the evidence that gave rise to each hypothesis. Alternatively, where theories that appear to offer potential explanations of a case already exist, process tracing can be applied deductively. A key step in the deductive approach is the development of observable implications of the theories that are applied (for example, see Bakke 2012). Whether the research approach is inductive or deductive, good process tracing casts the net widely for alternative explanations (Bennett and Checkel 2014). The consideration of theoretical explanations in the academic literature, as well as context-specific arguments that regional or functional experts have offered, the implicit theories of journalists or others following the policy issue, and the understandings participants in the policy process have about what they are doing and why they are doing it are potential sources of alternative explanations and potential causal mechanisms. Seeking to identify additional observable implications that may affect a particular outcome will protect against confirmation bias. Particularly valuable are new testable implications that, if found, would fit only the modified theory and not the alternative explanations, or that had not already been observed and had not been used to construct the hypothesis (Lakatos 1970).

Identifying the presence of causal mechanisms and testing the effect that these variables have on a particular outcome is facilitated by the careful analysis of the

scope conditions defined by the theoretical framework. The scope conditions are operationalized by the collection of quantitative and qualitative data such as press accounts, scientific studies, and non-government and government documents. The data serve as observable implications or causal process observations (CPOs) and represent the link between the causal mechanism of interest and the outcome.<sup>25</sup> The predicted value or content of the CPO is dependent upon the hypothesis being tested and should hold true if the causal relationship under investigation exists (Mahoney 2012). Whenever possible, the type of CPOs will be selected both on the ability to assess the mechanism under review and to perform empirical hypothesis tests.

### The Starting Point

The study applies an inductive and deductive approach to investigate the climate change policymaking process, and the role of stakeholder engagement in successful policy outcomes. To date, little research has been conducted to analyze and determine the mechanisms that affect the climate change policymaking process at the state-level and, in particular, the role of collaborative governance and stakeholder engagement in the policy outcomes. Thus, little prior knowledge exists regarding the “black box” that lies within the climate change policymaking process. The collaborative climate change policy framework (Figure 2.2) is proposed as one possible theoretical model to explain the policymaking process, and offers causal mechanisms that serve as important checkpoints in the research process. Thus, the study is conducted by examining the climate change policy outcomes backwards

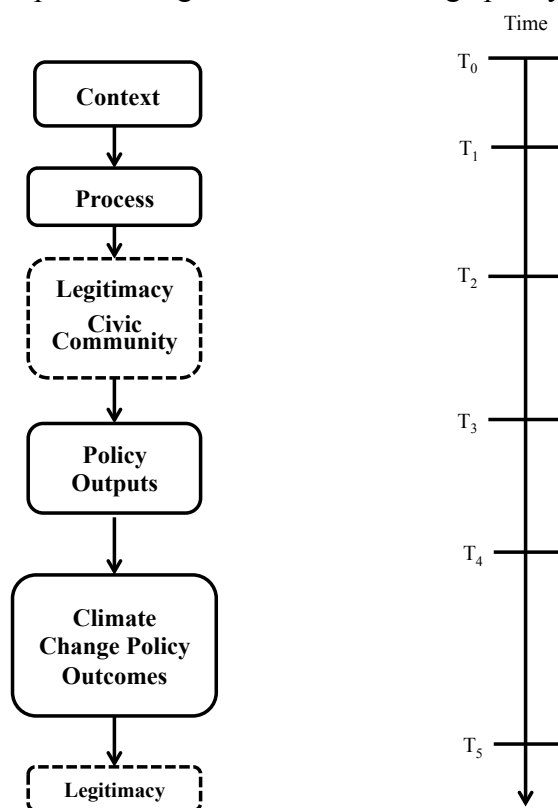
---

<sup>25</sup> For more on causal process observations see Collier, Brady, and Seawright 2004.

through time, where each climate change policy within a case is selected, and the process through which the policy was developed is analyzed until the initial conditions that catalyzed the policymaking process are reached.

Good and efficient process tracing also establishes a reasonable start date to set the lower bound from which the particular event or issue under investigation could have been initiated. According to Bennett and Checkel (2014), a reasonable starting point for the investigation may be a critical moment at which an institution or practice was contingent or open to alternative paths, and actors or exogenous events determined which path it would take. Another kind of starting point is the time at which a key actor or agent enters the scene or gains some material, ideational, relational, or informational capacity. This can be effective when alternative explanations hinge upon or work through the motivations, knowledge, and capacities of individual agents, and when particular agents behave differently, or with different effects, from their predecessors (Bennett and Checkel 2014). The issue of global climate change emerged as a national and international policy issue during the late 1980s. The testimony of scientist Dr. James Hansen and the creation of the IPCC by the international community in 1988 were important events that captured the attention of policymakers at multiple levels of government and stakeholders and interests from the industry and environmental community (see Chapter 1). Therefore, where the initial context of a policy process is not conclusively identified during the inductive process of a within case analysis, the year 1988 (e.g.,  $T_0 = 1988$ ) will serve as the baseline year for the investigation (see Figure 3.2).

**Figure 3.2** The temporal setting of the climate change policymaking process.



### Policy Outputs

The investigation begins at T<sub>3</sub>, Policy Outputs, by identifying state-level climate change policy initiatives. State-level legislation and executive branch initiatives are likely to be the driving force behind subsequent GHG emissions reduction plans and projects and are identified by reviewing state climate change legislation and executive orders. In the proposed framework, Policy Outputs are hypothesized to affect Climate Change Policy Outcomes (i.e., socioeconomic and environmental impacts). The study identifies three primary CPOs that influence Climate Change Policy Outcomes, legislation, executive orders, and climate change action plans and projects (see Table 3.3). To identify and classify CPOs, government

documents (e.g., legislation, executive orders, etc.) and nongovernment reports are reviewed and the scope of GHG emissions reduction (i.e., distribution of plans across economic sectors) policies is documented. Climate change policy outputs are expected to be influenced by stakeholder engagement and civic community through collaborative policy institutions. Thus, each case study proceeds to T<sub>1</sub> to identify the presence and characteristics of collaborative climate change institutions in the climate change policymaking process.

**Table 3.3** Causal process observations and policy outputs.

<b>Variable</b>	<b>Indicator</b>	<b>CPO</b>	<b>Data</b>
Policy Outputs	Plans and Projects	1. Adopted legislation	1. Legislative documents, government and nongovernment reports
		2. Adopted climate change action plans	
		3. Implemented GHG emissions reduction projects	

### Process

In the proposed framework, institutions for collaborative climate change policy are hypothesized to influence civic community and procedural legitimacy variables as well as the ability for policy agreements to be attained and policy to be adopted. The presence of collaborative climate change policy processes at T<sub>1</sub> will be traced from climate change policy, plan and project documents. The study identifies four CPOs that are likely to influence civic community, legitimacy, and policy outputs (see Table 3.4). These include, the type of climate change policy institutions established (i.e., collaborative vs. traditional), the level of stakeholder conflict during

the policy process, stakeholder inclusiveness, and decision-making rules. The CPOs are analyzed by reviewing government and nongovernment reports that document the collaboration process, procedures, and ground rules for making policy decisions as well as media and stakeholder press releases. Where the quality or existence of CPOs cannot be identified, semi-structured interviews of stakeholder groups and journalists who have documented the policy process are used. Each case study proceeds to T<sub>0</sub> to analyze the preexisting conditions that are expected to influence the development of collaborative climate change institutions.

**Table 3.4** Causal process observations and climate change policymaking processes.

<b>Variable</b>	<b>Indicator</b>	<b>CPO</b>	<b>Data</b>
Process	Institutions for Collaborative Climate Change Policy	<ol style="list-style-type: none"> <li>1. Type of climate change policy institutions that were established</li> <li>2. Level of conflict among stakeholder groups</li> <li>3. Stakeholder inclusiveness</li> <li>4. Type of decision-making process</li> </ol>	<ol style="list-style-type: none"> <li>1. Government and nongovernment documents and reports</li> <li>2. Media and stakeholder press releases</li> <li>3. Decisionmaking process documents and reports</li> </ol>

### Context

In the proposed framework, the initial societal and environmental conditions represent the causal mechanisms that influence the institutions for collaborative climate change policy institutions and stakeholder engagement. The scope conditions include the socioeconomic, civic community and environmental characteristics of the state, as well as the existing government institutions. According to IRC theory, these

conditions are likely to influence or constrain the type of collaborative climate change management approach that will surface, as well as its likelihood of success. For instance, states composed of widely scattered, fairly transient populations with broad ideological differences are less likely to be successful than smaller, more stable, and more homogeneous polities. States facing challenging situations are likely to be very distrustful and thus insist on a variety of procedural rules and norms to protect each group's interest. At the same time, more successful states will likely have substantial amounts of human and social capital (networks) to build on, and thus will need less elaborate procedural rules (Sabatier et al. 2005a).

The study identifies thirteen CPOs that are likely to influence the formation of collaborative climate change policy processes (see Table 3.5). The mechanisms are distributed across the three contextual variables and include, the nature of the climate change problem, state-level resources to facilitate collaboration, and civic community attributes such as existing human and social capital, among others. The CPOs are analyzed by reviewing government and nongovernment reports that document the collaboration process, procedures, and ground rules for making policy decisions as well as media and stakeholder press releases. Quantitative and qualitative secondary data from government databases and scientific reports were collected and reviewed to measure the socioeconomic, civic community, and environmental conditions.

**Table 3.5** Causal process observations and context.

Variable	Indicator	CPO	Data
	Environmental Problem	<ol style="list-style-type: none"> <li>1. Nature of the climate change problem</li> <li>2. Severity of climate change impacts</li> <li>3. Public perception of severity</li> <li>4. Quality of scientific knowledge about climate change</li> </ol>	<ol style="list-style-type: none"> <li>1. Predicted regional climate change impacts</li> <li>2. Societal impacts of predicted environmental impacts</li> <li>3. Public opinion on climate change</li> <li>4. State of climate change science</li> </ol>
Context	Existing Institutions	<ol style="list-style-type: none"> <li>1. Resources to subsidize initial transaction costs</li> <li>2. State-level environmental institutions</li> <li>3. High-level institutions grant local autonomy</li> </ol>	<ol style="list-style-type: none"> <li>1. Budget of environmental programs</li> <li>2. Existing climate change programs</li> <li>3. Federal policy and grant programs</li> </ol>
	Community	<ol style="list-style-type: none"> <li>1. Existing human and social capital</li> <li>2. Stakeholders discount rates</li> <li>3. Distribution of the costs and benefits of management</li> <li>4. Proportion of economy employed by service industries</li> <li>5. Cultural or ideological diversity</li> <li>6. Proportion of economy employed by extractive industries</li> </ol>	<ol style="list-style-type: none"> <li>1. State-level education, health and healthcare services, income, poverty levels, workforce</li> <li>2. Past environmental legislation/policy action</li> <li>3. Identify GHG producers</li> <li>4. Proportion of economy employed by service industry</li> <li>5. Cultural/ethnic diversity, political characteristics</li> <li>6. Proportion of economy employed by extractive industries</li> </ol>

### Civic Community

Civic community variables (e.g., human and social capital, political efficacy, trust, and collective action beliefs) are influenced by the type of climate change policy process that is carried out. The theoretical framework posits that collaborative climate change institutions are likely to improve civic community variables, which in



turn is likely to influence the climate change policy outcomes. Table 3.6 shows the six CPOs that are likely to influence the nature of climate change policy processes. The CPOs include concepts drawn from the SCF, and each are hypothesized to be positively affected by stakeholder engagement in the climate change policy process. Additionally, a positive effect on each of the CPOs is likely to increase Climate Change Policy Outcomes. For instances, improvements in the level of trust and norms of reciprocity among stakeholders is likely to increase cooperation among stakeholders during project implementation and the likelihood of real reductions in GHG emissions. Although the study does not provide an extensive investigation of these variables, future research regarding the effect of collaborative policy processes on Civic Community can be carried out using the CPOs identified in Table 3.6. Changes in civic community can be documented by reviewing each concept, prior to the development of the climate change policy process, and after the establishment of policy formulation processes. Where such data are not available, structured interviews with key stakeholder groups and journalists covering the climate change policy process can be applied to determine the levels of civic community variables pre- and post-policy process.

**Table 3.6** Causal process observations and civic community.

<b>Variable</b>	<b>Indicator</b>	<b>CPO</b>	<b>Data</b>
Civic Community	Human Capital	1. Stakeholder understanding of the climate change issue	1. Media documents, stakeholder and media interviews
	Social Capital	1. Strength of norms of reciprocity	1. Historical reports, media and press releases
	Political Efficacy	1. Stakeholder commitment to policymaking process	1. Stakeholder reports and press releases 2. Decision-making process documents and reports
	Trust	1. Level of trust among stakeholders 2. Extensiveness of social networks	1. Media documents, stakeholder and media interviews 2. Decision-making process documents and reports
	Collective Action Beliefs	1. Stakeholder beliefs regarding the causes and consequences of climate change	1. Media documents, stakeholder and media interviews

### Legitimacy

As discussed above, legitimacy can be divided into two dimensions, procedural and substantive. Procedural legitimacy occurs at T<sub>2</sub> and refers to how stakeholders perceive the fairness of the policy decision-making process, and is

therefore influenced by the climate change policy process and civic community variables. Substantive legitimacy occurs at T<sub>5</sub> and refers to the perceived fairness and the distribution of the costs and benefits of GHG emissions reduction projects, and is influenced by the Climate Change Policy variable. As with civic community, a focused examination of legitimacy is beyond the scope of the current study. However, future research can use two CPOs, transparency of the decision-making process, and stakeholder acceptance of climate change policies, plans, and projects to evaluate the legitimacy of the climate change policy process, and climate change policy outcomes (see Table 3.7). Legitimacy CPOs can be evaluated via analysis of decisionmaking process documents and reports, as well as the identification of subsequent litigation following policy adoption. Where such data cannot illuminate the effect of climate change policy processes and policy outcomes on procedural and substantive legitimacy, structured interviews should be carried out with key stakeholder groups.

**Table 3.7** Causal process observations and legitimacy.

<b>Variable</b>	<b>Indicator</b>	<b>CPO</b>	<b>Data</b>
Legitimacy	Procedural	1. Transparency of decision-making process	1. Decisionmaking process documents and reports 2. Stakeholder and media interviews
	Substantive	1. Stakeholder acceptance of policy, plans and project	1. Stakeholder press releases 2. Court cases 3. Stakeholder and media interviews

### Climate Change Policy

Climate change policy outcomes include the perceived and actual environmental and socioeconomic impacts of climate change policy implementation are influenced by the climate change policy outputs and civic community variables. I posit that climate change policy processes that improve civic community conditions and effectively engage stakeholders in the policy planning and implementation process are more likely to produce actual GHG emissions reductions and are less likely to produce negative socioeconomic impacts. In addition, improvements in civic community and stakeholder engagement in policy process are likely to improve the perceived socioeconomic and environmental impacts of climate change policy outcomes via substantive legitimacy. Although the case study analysis does not evaluate these variables, four CPOs can be used in future research to identify the actual and perceived, socioeconomic and environmental impacts of climate change policy outcomes (see Table 3.8).

**Table 3.8** Causal process observations and climate change policy outcomes.

<b>Variable</b>	<b>Indicator</b>	<b>CPO</b>	<b>Data</b>
Climate Change Policy	Actual Socioeconomic Conditions	1. Post-implementation social and economic impacts to affected industries and stakeholders	1. Government and stakeholder reports and data
	Actual Environmental Conditions	1. Post-implementation GHG emissions levels	1. Before-after emissions trends and reporting
	Perceived Socioeconomic Conditions	1. Stakeholder beliefs regarding consequences of policy adoption and project implementation	1. Media, stakeholder press releases
	Perceived Environmental Conditions	1. Post-implementation beliefs regarding nature of climate change problem	1. Media, stakeholder press releases 2. Subsequent policy action

### Hypotheses Testing

In order to establish that a particular antecedent event occurred and that a subsequent outcome was produced, and that the former was the cause of the latter, a series of process tracing tests can be applied to evaluate the study's primary hypotheses. The analysis process evaluates the significance of proposed causal mechanisms by conducting a sequence of tests designed to investigate whether and how an explanatory variable(s) effects the dependent variable under investigation (Beach and Pedersen 2012, 2013; George and Bennett 2005; Gerring 2007). A 2x2

typology of empirical hypothesis tests developed by Van Evera (1997) is commonly used in process tracing research to establish that: (1) a specific event or process took place, (2) a different event or process occurred after the initial event or process took place, and (3) the former was the cause of the latter (Bennett 2008a, 2010; Collier 2011; Mahoney 2012). The typology is comprised of two dimensions related to the CPOs that can be derived from a particular hypothesis (see Table 3.9).

**Table 3.9** Types of hypothesis tests and causal inference.

		Certainty	
		High	Low
Uniqueness	High	Doubly Decisive Test	Smoking Gun Test
	Low	Hoop Test	Straw-in-the-wind test

Source: Van Evera 1997.

The first dimension is called certitude or certainty and captures how likely it is to gather a specific observable implication in process tracing. The second dimension is called uniqueness and raises the question as to whether an observable implication can be derived from a single or multiple hypotheses. The intersection of high and low certitude with uniqueness and non-uniqueness produces four tests that allow the derivation of inferences about a working hypothesis and rival hypotheses, conditional on whether the working hypothesis passes or fails the test (Bennett 2010; Collier 2011).

Hoop tests and smoking gun tests are two main kinds of empirical tests that are used to evaluate hypotheses regarding causal mechanisms in process tracing (Van Evera 1997, 31-32; see also Bennett 2008:706; Collier 2011). A hoop test proposes that a given piece of evidence or CPO must be present for a hypothesis to be valid.

Failing a hoop test eliminates a hypothesis, but passing a hoop test does not confirm a hypothesis. Smoking gun tests, by contrast, propose that if a given piece of evidence or CPO is present, then the hypothesis must be valid. Passing a smoking gun test lends decisive support in favor of a hypothesis, though failing a smoking gun test does not eliminate a hypothesis. Hoop tests and smoking guns tests are defined by whether passing a test is necessary for confirming a given explanation (i.e., a hoop test) or whether passing a test is sufficient for confirming a given explanation (i.e., a smoking gun test). To the extent that the tests cannot draw on generalizations about necessary or sufficient conditions, but rather must use probabilistic generalizations, they become straw in the wind tests. Straw in the wind tests point in the direction of a hypothesis being valid or not, but can neither confirm nor eliminate it (Bennett 2008; Collier 2011). The hypotheses regarding social, environmental, and institutional characteristics that affect the formation of collaborative climate change institutions are evaluated based upon the relevant data, using hoop and straw-in-the-wind tests. Additionally, throughout the investigation, evidence of alternative explanations for the development of climate change policy outputs are included. Alternative explanations, such as the role of policy entrepreneurs, policy “mobilizers” (e.g., media outlets, interest groups, etc.), and changes in public opinion, can offer valuable insight regarding the development of state-level climate change policy, and build upon the proposed theoretical framework.

## **Conclusion**

In order to conduct an in-depth investigation of collaborative, stakeholder engagement in state-level climate change policymaking, it is imperative to first understand how the fifty states vary with respect to their contribution to climate change mitigation and climate change policy action efforts. Additionally, in order to draw informative conclusions regarding the role of collaborative policy processes in state-level climate change policymaking, and assess the applicability of the conceptual framework that was introduced in Chapter 2, the states that are selected for case study analysis ought to exhibit variation with respect to the expected climate change mitigation and policy outcomes proposed by the framework. The beginning of the chapter introduced the CI methodology as a practical approach for capturing the multidimensionality of climate change mitigation and policy action. The CI approach was then used to develop two state-level climate change indices, the SLCCPI and SLCCPAII, that can be used to assess and rank the states, and select four states for case study analysis based upon their relative performance in these areas. The chapter then introduced the process tracing methodological design, which provides an appropriate tool for examining the role of stakeholder engagement in the development of climate change policy in each of the four cases and test the hypotheses and causal mechanisms introduced from the theoretical foundations of the conceptual framework. The next chapter sets the stage for the construction of the SLCCPAII by reviewing climate policy initiatives that have been enacted across the fifty states to date.



## References

- Bakke, K. (2012). "Copying and Learning from Outsiders? Assessing Diffusion from Transnational Insurgents in the Chechen Wars." In *Transnational Dynamics of Civil War*, ed. J.T. Checkel. Cambridge, Massachusetts: Cambridge University Press.
- Bandura R. (2006), *A Survey of Composite Indices Measuring Country Performance: 2008 Update*. New York: United Nations Development Programme – Office of Development Studies. Retrieved from:  
[http://web.undp.org/developmentstudies/docs/indices\\_2008\\_bandura.pdf](http://web.undp.org/developmentstudies/docs/indices_2008_bandura.pdf)
- Beach, D., & Pedersen, R. B. (2012, August). Case selection techniques in Process-tracing and the implications of taking the study of causal mechanisms seriously. In *presentation at The American Political Science Association Annual Meeting*, New Orleans, Louisiana.
- Beach, D., & Pedersen, R.B. (2013). *Process-Tracing Methods: Foundations and Guidelines*. Ann Arbor, Michigan: University of Michigan Press.
- Bennett, A. (2008a). "Process-Tracing: A Bayesian Perspective." In *The Oxford Handbook of Political Methodology*, eds. J.M. Box-Steffensmeier, H.E. Brady and D. Collier, 702- 721. New York, New York: Oxford University Press.
- Bennett, A. (2008b). "The mother of all 'isms': Organizing political science around causal mechanisms." In *Revitalizing causality: realism about causality in philosophy and social science*, ed. R. Groff, 205-219. London: Routledge.

- Bennett, A. (2010). "Process Tracing and Causal Inference." In *Rethinking Social Inquiry: Diverse Tools, Shared Standards*, 2nd ed., eds. H.E. Brady and D. Collier, 207–19. Lanham, Maryland: Rowman and Littlefield.
- Bennett, A., & Checkel, J.T. (2014). "Process tracing: from philosophical roots to best practices." In *Process Tracing: From Metaphor to Analytic Tool*, eds. A. Bennett and J.T. Checkel, 3-38. Cambridge, Massachusetts: Cambridge University Press.
- Bernauer, T. (2013). Climate Change Politics. *Annual Review of Political Science*, Vol 16, 16, 421-448. doi: 10.1146/annurev-polisci-062011-154926
- Burck, J., Hermwille, L., & Bals, C. (2014). *The Climate Change Performance Index: Background and Methodology*. Germanwatch/CAN Europe. Retrieved from: <https://germanwatch.org/en/download/8579.pdf>
- Burck, J., Marten, F., & Bals, C. (2014). *The Climate Change Performance Index: Results 2014*. Germanwatch/CAN Europe. Retrieved from: <https://germanwatch.org/en/download/8599.pdf>
- Checkel, J.T. (2008). Tracing Causal Mechanisms. *International Studies Review*, 8(2): 362-370.
- Christoff, P., & Eckersley, R. (2011). "Comparing State Responses." In *The Oxford Handbook of Climate Change and Society*, eds. J.S. Dryzek, R.B. Norgaard, and D Schlosberg, 431-448. New York, New York: Oxford University Press.
- Collier, D. (2011). Understanding process tracing. *PS: Political Science & Politics*, 44(4): 823-830.

- Collier, D., Brady, H.E., & Seawright, J. (2004). "A Sea Change in Political Methodology." In *Rethinking Social Inquiry*, 2nd Edition eds. H.E. Brady, D. Collier, 1-10. Lanham, MD: Rowan & Littlefield Publishing Group, Inc.
- Falleti, T.G., & Lynch, J.F. (2009). Context and Causal Mechanisms in Political Analysis. *Comparative Political Studies*, 42:1143-1166.
- Freudenberg, M. (2003). *Composite Indicators of Country Performance: A Critical Assessment*. Organization for Co-operation and Development. Retrieved from: [http://www.oecd-ilibrary.org/science-and-technology/composite-indicators-of-country-performance\\_405566708255?crawler=true](http://www.oecd-ilibrary.org/science-and-technology/composite-indicators-of-country-performance_405566708255?crawler=true)
- George A.L., & Bennett, A. (2005). *Case studies and theory development in the social sciences*. Cambridge, Massachusetts: MIT Press.
- Gerring, J. (2007). *Case Study Research. Principles and Practices*. Cambridge, Massachusetts: Cambridge University Press.
- Hedstroem, P. & Ylikoski, P. (2010). Causal Mechanisms in the Social Sciences. *Annual Review of Sociology*, 36: 49-67.
- King, G., Keohane, R.O., & Verba, S. (1994). *Designing Social Inquiry: Scientific Inference in Qualitative Research*. Princeton, New Jersey: Princeton University Press.
- Lakatos, I. (1970). "Falsification and the Methodology of Scientific Research Programs." In *Criticism and the Growth of Knowledge*, eds. I. Lakatos and A. Musgrave. Cambridge, Massachusetts: Cambridge University Press.
- Mahoney, J. (2001). Review - Beyond Correlational Analysis: Recent Innovations in

Theory and Method. *Sociological Forum*, 16(3): 575-93.

Mahoney, J. (2012). The logic of process tracing tests in the social sciences.

*Sociological Methods & Research*, 41(4): 570-597.

Organization for Economic Co-operation and Development (OECD). (2008).

*Handbook on Constructing Composite Indicators: Methodology and User Guide*. OECD. Retrieved from: <http://www.oecd.org/std/42495745.pdf>

Sabatier, P.A., Focht, W., Lubell, M., Trachtenburg, Z., Vedlitz, A., & Matlock, M.

eds. (2005a). *Swimming Upstream: Collaborative Approaches to Watershed Management*. Cambridge, Massachusetts: MIT Press.

Sabatier, P.A., Leach, W.D., Lubell, M., & Pelkey, N.W. (2005b). “Theoretical

Frameworks Explaining Partnership Success.” In *Swimming Upstream: Collaborative Approaches to Watershed Management*. ed. P.A. Sabatier, W.

Focht, M. Lubell, Z. Trachtenberg, A. Vedlitz and M. Matlock, 73-200, Cambridge, Massachusetts: MIT Press.

Van Evera, S. (1997). *Guide to Methods for Students of Political Science*. Ithaca,

New York: Cornell University Press.

## **Chapter 4 - State-Level Climate Change Policy in the U.S.**

Chapter 1 discussed the historical and recent trends in climate change policy and politics at the federal level. The analysis showed that, in light of the unwavering stalemate within the U.S. Congress, federal climate change policy initiatives have been limited to executive-level actions. Arguably, the most significant federal actions related to climate change mitigation have occurred during the presidency of Barack Obama. A few of the Obama administration's most notable domestic climate change policy achievements include the development of a federal Climate Action Plan, which included directives for the U.S. EPA to create rules to reduce methane emissions from fossil fuel production and CO<sub>2</sub> emissions from the electric power sector, as well as a temporary moratorium on new coal leases on federal lands (see Chapter 1). At the international level, President Obama attended the 21<sup>st</sup> meeting of the Conference of the Parties to the UNFCCC, held in Paris, France in December 2015, to participate in the multilateral effort to strengthen the global response to the climate change issue. The Conference culminated with the Paris Agreement, which was adopted by a consensus from the 197 participating nations and aimed to keep global temperature rise below 2 degrees Celsius above pre-industrial levels, among other things (UNFCCC 2017a). President Obama signed the agreement in April 2016, pledging the U.S. to cut GHG emissions 26 to 28 percent below 2005 levels by 2025. As of May 2017, the agreement has been ratified by 145 countries and signifies the most ambitious climate change agreement in world history (UNFCCC 2017b).

The 2017 inauguration of President Donald Trump, along with the reestablishment of a Republican majority in both the House and the Senate, has repositioned the federal government's climate change and energy policy agenda. Since President Trump has taken office, the Executive branch has taken a number of actions intended to undermine President Obama and the U.S. EPA's efforts related to climate change mitigation, and environmental regulation more generally. The launch of the Trump administration's policy agenda with respect to climate change, and environmental policy more generally, began with the appointment of Oklahoma Attorney General Scott Pruitt as the new Administrator of the U.S. EPA. Pruitt is a fossil fuel industry advocate and a skeptic of anthropogenic climate change, who has had a historically adversarial relationship with the agency (Dennis 2017). Additionally, on March 28, 2017, the President issued an Executive Order designed to reverse each of the Obama-era efforts to reduce the nation's production and reliance on fossil fuels and GHG emissions from oil and gas production and the electric power sector. Shortly thereafter, in June 2017, the Trump administration formally withdrew the U.S. from the Paris Agreement, joining Syria and Nicaragua as the only nonparticipating nations in the monumental international climate change mitigation effort (Trump 2017).

Given the uncertain future of the recent advancements in climate change policy efforts at the federal level, understanding the actions that local and state-level policymakers have taken to address the climate change issue remains an extremely critical area of U.S. climate change policy discussions. Subnational initiatives

designed to address anthropogenic climate change have been pursued by various states since the issue first became an important topic for policymakers following the widespread media coverage of Dr. James Hansen's testimony before the Senate Committee on Energy and Natural Resources on June 23, 1988 (Shabecoff 1988). Early efforts by the U.S. EPA to track and document these initiatives found that, by the early 1990s, a number of states had begun a broad-based response to climate change mitigation via executive-level and legislative action (see for example, USEPA 1992).

Many of the early state-level initiatives related to emissions reductions were developed to meet goals other than climate change mitigation, such as the promotion of utility demand-side management, pollution prevention, and economic competitiveness. States also pursued policies directed towards the climate change issue. However, from 1988 to 1992, only a small cohort of regionally and politically diverse states, including Alaska, California, Connecticut, Iowa, Oregon, Missouri, New Jersey, South Carolina, and Texas, enacted broad-based legislative and administrative policies to assess and address the climate change issue (USEPA 1992). The California legislature, for example, passed Assembly Bill 442 in 1988 which directed the California Energy Commission to prepare and maintain an inventory of GHG emissions, study the effects of climate change on the state's energy, economy, and environment, and provide recommendations for avoiding, reducing, and addressing identified impacts. In 1990 the Connecticut state legislature passed An Act

Concerning Global Warming, which established a number of energy efficiency measures and mandates for transportation improvements (USEPA 1992).

As the climate change issue continued to gain saliency among policymakers, environmental advocacy groups, and the general public, nearly all of the states have enacted policies that contribute to climate change mitigation. These initiatives include direct emissions reduction mandates and indirect, energy conservation- and substitution-based approaches that apply both command-and-control and market-based mechanisms to support climate change mitigation across multiple economic sectors.

This chapter presents a contemporary state-level review of emissions and energy policy implementation. Given the complexity of some state-level regulatory structures with respect to policy areas such as energy, a comparison of climate change policy adoption and implementation can be a complex undertaking. Therefore, the analysis is limited to a discussion of high-level policy efforts related to areas such as emissions regulation, renewable energy development, and energy efficiency improvements. The chapter includes a brief discussion of each policy approach, followed by a summary of important state-level trends. The chapter concludes with an assessment of overall trends in state-level climate change policy action and highlights important periods of policy adoption, identifying states that have served as leaders in climate change policy adoption and those that have lagged behind.



## **Early State-Level Climate Change Policy**

Although federal involvement in climate change policy has predominantly remained stagnant in recent years, early state-level climate change policy efforts were largely supported by technical and financial assistance from federal programs established by the U.S. EPA. In 1990, the U.S. EPA initiated the State and Local Climate Change Program to help build awareness among state and local-level policymakers regarding the causes of global climate change and provide technical expertise and financial resources to assist subnational governments to mitigate and prepare for climate change impacts (USEPA 1998, 2001). The program was developed, in part, to fulfill obligations under several legal mandates, including the Global Climate Protection Act of 1987, which directed the U.S. EPA to develop domestic policy on climate change, and the Clean Air Act Amendments of 1990, which mandated the agency to create and implement non-regulatory approaches for reducing CO<sub>2</sub> emissions, among other air pollutants (USEPA 1998). At the international level, the State and Local Climate Change Program fulfills part of the U.S. commitment to the UNFCCC, which was ratified by the U.S. Senate in 1992 during the George H.W. Bush administration, and requires participating nations to promote public awareness of climate change through outreach initiatives (USEPA 1998).

Two of the State and Local Climate Change Program's primary action items were to facilitate the completion of local and state-level GHG emissions inventories and climate action plans. One way to evaluate systematically how a particular state

contributes to anthropogenic climate change is to commission a GHG inventory by tracking the total annual emissions that occur as a result of economic activity.

Emissions data are typically reported by the source of emissions and the economic sector in which they occur, which can provide a better understanding of the sources of emissions within a particular policy and guide the development of emissions reduction policies and programs (USEPA 2015).

By 1998, the State and Local Climate Change Program had assisted 28 states with the completion of a GHG inventory, while an additional six states were in the process of completing an inventory (USEPA 1998). Just three years later, in 2001, 37 states had completed an inventory, with two states, Texas and Oklahoma, in the process of completing an initial inventory (USEPA 2001). As of 2016, only two states, North Dakota and Nebraska, had no record of completing a state-level GHG inventory, while the remaining 48 states had completed an inventory, although the extent to which these states have continued to assess statewide emissions through updated inventories varies. While Indiana, Mississippi, and Tennessee each completed an initial GHG inventory via the U.S. EPA State and Local Climate Change Program, for example, there is no indication that any of these states have continued to update their GHG emissions on a regular basis.

While a GHG gas inventory provides an important starting point for evaluating and prioritizing efforts to reduce CO<sub>2</sub> emissions, state-led initiatives to push reduction efforts farther along in the policy process should be included in an assessment of climate change policy action. Therefore, a second component of

climate change policy planning includes the deliberate effort by states to establish a comprehensive strategy for the implementation of policies to achieve emissions reductions. State-level efforts to develop a strategic plan for climate change mitigation policy are often initiated with the completion of a climate action plan. In 1997, ten states had completed climate change action plans and, by 2001, 19 states had completed an assessment of potential policy strategies to mitigate emissions to address the climate change issue (USEPA 1998, 2001). A climate action plan builds upon the information gathered from the completion of a GHG inventory by outlining specific activities and policies that can be undertaken to reduce emissions (C2ES 2016). Thus, the completion of such reports can benefit the policy planning process by providing policymakers with an overview of potential emissions reduction policies that consider both environmental and socioeconomic impacts of implementation as well as the consequences of inaction. As of 2016, only 13 states, Georgia, Idaho, Indiana, Kansas, Louisiana, Mississippi, Nebraska, North Dakota, Oklahoma, South Dakota, Texas, West Virginia, and Wyoming, had not completed climate change action plans.

### **Emissions-Based Policy Efforts**

Among the potential policy approaches that states can undertake to address the climate change issue, policies designed to reveal, regulate, and reduce GHG emissions are among the most effective. In the U.S., states have implemented a range of policies focused on emissions including the establishment of reduction goals, information-based reporting requirements, and direct regulation of transportation and

electric power sector emissions, which generally account for the largest contribution to anthropogenic CO<sub>2</sub> emissions. The following section provides a state-level overview of activity related to each of these emissions-based policies. The assessment reveals that while the establishment of voluntary mechanisms to reduce emissions and provide information regarding the amount of emissions that are produced by public and private actors has been relatively widespread, direct regulation of emissions has been limited to a small subgroup of the states.

### **GHG Emissions Reduction Targets**

An emissions reduction target is designed as a performance standard, and establishes a goal for emissions reductions, based upon a baseline level of emissions, to be achieved within a particular period of time. To date, 24 states have adopted GHG emissions reduction targets. Although state-level emissions reduction goals do not establish mandatory statewide compliance, the adoption of such goals by elected officials establishes the issue as a priority agenda item, and can serve as a motivation and reference for future climate change mitigation policy efforts. Among the states with emissions reduction targets, California is the only state to have established a mandatory, statewide reduction target through the adoption and implementation of legislative action. The state's initial reduction targets, to achieve emissions equivalent to 2000 by 2010, 1990 levels by 2020, and 80 percent below 1990 levels by 2050, were established in 2005 by Governor Arnold Schwarzenegger via Executive Order (Executive Order S-03-05). In 2006, the Governor's state-level emissions targets became mandatory with the adoption of the Global Warming Solutions Act

(Assembly Bill 32), which established the nation's first economy-wide GHG emissions cap and trade program, setting an emissions cap of 1990 levels by 2020 (discussed below; Global Warming Solutions Act of 2006, discussed below).

While most of these policies were established through executive order or legislative action, a number of state-level goals were developed via multistate initiatives. As Figure 4.1 shows, for example, as participants in the New England Governors/Eastern Canadian Premiers' Climate Change Action Plan, which was established in 2001, the Governors of Maine, New Hampshire, and Rhode Island, each committed their respective states to an emissions reduction goal of 1990 levels by 2010, 10 percent below 1990 levels by 2020, and 75 to 85 percent below 2001 levels in the long term (NEG/ECP 2001).<sup>26</sup> Iowa, Kansas, and Wisconsin each took steps towards establishing an emissions reduction target through participation in the Midwest Greenhouse Gas Reduction Accord, a regional partnership established in 2007, between Illinois, Iowa, Kansas, Michigan, Minnesota, and Wisconsin and the Canadian Province, Manitoba. Although the partnership is no longer active, an initial regional emissions reduction target of 20 percent below 2005 levels by 2020 and 80 percent below 2005 levels by 2050 was proposed for adoption by the Midwestern

---

<sup>26</sup> The initial goal has remained the performance standard for New Hampshire and Rhode Island, while Maine updated its state-level emissions reduction goal with the passage of the Act to Provide Leadership in Addressing the Threat of Climate Change in 2003. The law changed the state's long-term emissions performance standard to 2003 levels rather than 2001 (An Act to Provide Leadership in Addressing the Threat of Climate Change 2003).

Greenhouse Gas Reduction Accord Advisory Group in 2009 (State of Illinois 2010; see Figure 4.1).<sup>27</sup>

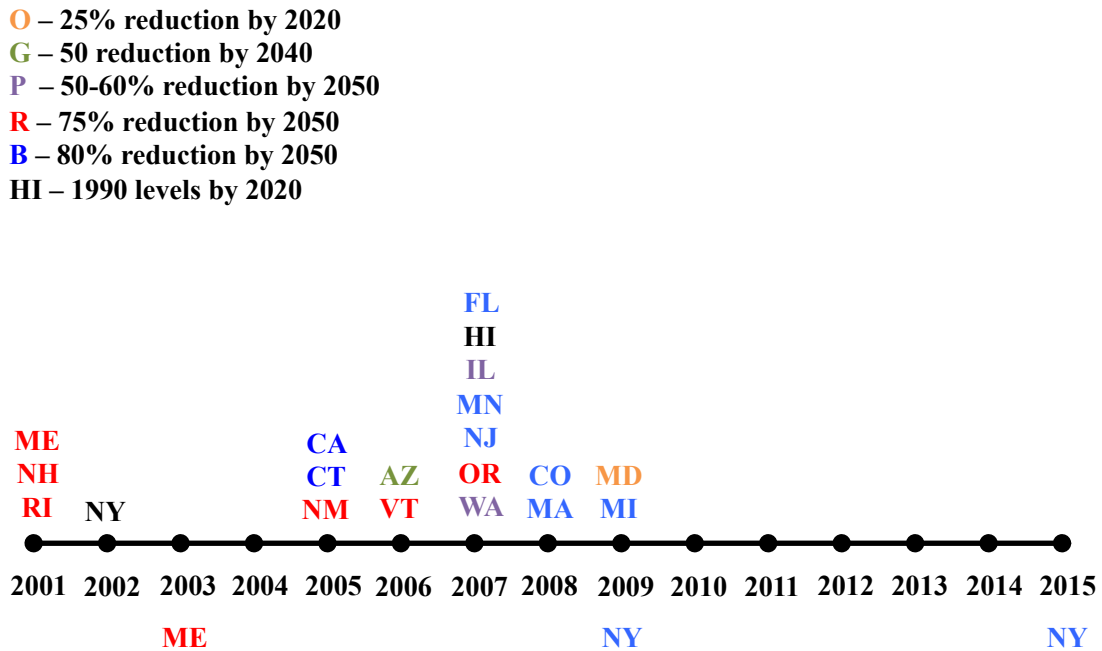
Among the states that have established GHG emissions reduction goals, New York is the only state that established its initial performance targets through administrative order. In 2002, the New York State Energy Plan established emissions reduction targets of 5 percent reduction below 1990 levels by 2010, and 10 percent below by 2020. The goal of the State Energy Plan is to guide the New York's energy future by showing how the state can provide adequate energy supplies, reduce demand, preserve environmental quality, and reduce reliance on energy imports while stimulating economic growth and protecting the welfare of New York citizens (NYSEPB 2002). The planning process is facilitated by the State Energy Planning Board, a conglomeration of state representatives from various administrative and regulatory agencies related to the energy plan's objectives, as well as executive-level and legislative representatives, and includes stakeholder engagement via a public comment process (NYSEPB 2002). Since the State Energy Planning Board established the initial emissions reduction goals, a number of updates have occurred to increase the timeline and rate of emissions reduction for the state. In 2009, via Executive Order, New York Governor David Paterson amended the state's emissions reduction goal, extending the previous timeline to 2050, at which time the state is encouraged to achieve 80 percent reduction from 1990 emissions levels (Executive Order No. 24). In 2015, the state updated its emissions reduction targets through the

---

<sup>27</sup> While Illinois, Michigan, and Minnesota each went on to adopt formal reduction goals in, Iowa, Kansas, and Wisconsin have not established reduction targets.

completion of a new State Energy Plan. The new reduction goals include previous performance standards for state-level emissions reductions and include a 40 percent reduction below 1990 levels by 2030 benchmark (NYSEPB 2015).

**Figure 4.1** State emissions reduction target adoption timeline.



Source: C2ES 2013a.

### GHG Emissions Reporting

Another non-regulatory action that states have taken related to climate change policy mitigation has been the establishment of state-level GHG emissions reporting programs. While not directly related to climate change mitigation, GHG reporting programs are a type of information-based policy that document emissions trends for state-level actors. Such programs can be an important starting point for identifying effective mitigation opportunities, but may also incentivize voluntary emissions mitigation by providing public awareness of high-emitting facilities and activities

(Bui 2005; Kraft, Stephan and Abel 2011; Niles and Lubell 2012). In 2009 the U.S. EPA established a federal Greenhouse Gas Reporting Program, which requires mandatory reporting of GHG gas emissions from sources that emit 25,000 metric tons or more of CO<sub>2</sub> equivalent per year (Greenhouse Gas Reporting Rule 2009). However, prior to federal reporting requirements, nearly all of the states had established unilateral reporting programs or participated in multistate GHG reporting efforts. Early state-level action to develop GHG emissions reporting programs were relatively constrained, and were offered as a voluntary opportunity for entities to track and report emissions activities. Mandatory reporting requirements began to occur throughout the country in the mid-2000s and, in most cases, were implemented to support policy efforts to reduce emissions from stationary sources.

In 1999, New Hampshire became the first state in the nation to establish a GHG emissions reporting program when Governor Jeanne Shaheen signed the New Hampshire Greenhouse Gas Reduction Registry (Senate Bill 159) into law, creating the Eastern Climate Registry (ECR). The goal of the ECR was to encourage voluntary emissions reductions to protect the state's economy under potential federal level regulatory action to reduce emissions (New Hampshire Greenhouse Gas Reduction Registry 1999). The following year, Wisconsin passed legislation creating the Wisconsin Air Pollution Emissions Reduction Registry (Act 195), which required the state's Department of Natural Resources to create and maintain a registry to track GHG emissions, as well as air contaminants, produced by public and private entities (Wisconsin Air Pollution Emissions Reduction Registry 2000). California became the

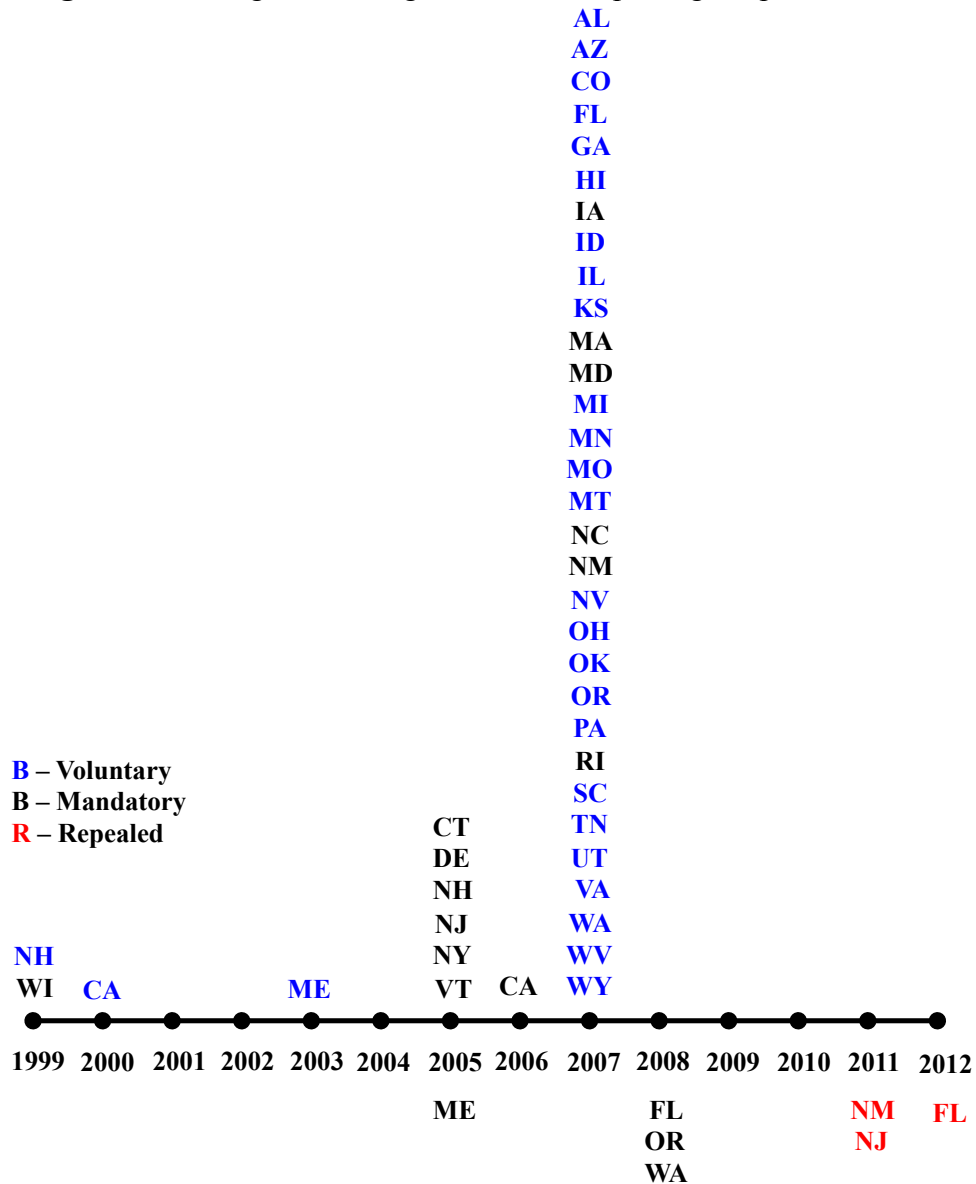


third state to develop an emissions registry when, in 2000, the legislature passed Senate Bill 1771, creating the California Climate Action Registry (CCAR) (California Climate Action Registry 2000). In addition to providing a voluntary mechanism for statewide entities to report and track emissions, CCAR also included third-party auditing to ensure the quality and objectivity of emissions records for participating bodies. Maine later developed a GHG reporting program, as part of the state's Lead-by-Example initiative, to assist the Maine Department of Environmental Protection with completing a long-term climate action plan to meet the state's emissions reduction goals (Lead-by-Example Initiative 2003).

The nation's first mandatory reporting requirements were initiated in 2005 with the creation of the Regional Greenhouse Gas Initiative (RGGI), a multistate cap and trade program designed to reduce emissions from the electric power sector. RGGI included ten northeastern states, Connecticut, Delaware, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Maine, Rhode Island, and Vermont, although New Jersey and Massachusetts each established intrastate reporting requirements with the passage of the 2007 Global Warming Response Act and 2008 Global Warming Solutions Act, respectively. Similarly, California and Florida established mandatory emissions reporting requirements with the adoption of legislation in 2006 and 2008, respectively, that mandated the development of statewide cap and trade programs to reduce emissions, although Florida's reporting requirements were later repealed (discussed below). As indicated in Figure 4.2, from 2007 to 2008, seven additional states, specifically Iowa, New Mexico, North

Carolina, Oregon, Washington, West Virginia, and Wisconsin, each adopted independent mandatory requirements for a variety of state-level emissions sources to establish uniform monitoring procedures for intrastate emissions. Of the states to have implemented mandatory reporting requirements New Mexico joined Florida in 2011 to become the second state to repeal statewide emissions reporting rules.

**Figure 4.2** State greenhouse gas emissions reporting adoption timeline.



Source: C2ES 2013b.

In addition to the mandatory registries that were established during the second half of the 2000s, in 2007 a coalition of states formed The Climate Registry (TCR). TCR is an independent non-profit organization and was modeled after CCAR and was developed to support voluntary reporting efforts for entities to share emissions data by providing a single clearinghouse and technical assistance for emissions reporting for public and private entities throughout the U.S. and establishing a transparent and uniform GHG emissions calculation, verification, and public reporting protocol (TCR 2015). By the end of 2007, 39 states had joined TCR in addition to six Canadian Provinces, two Mexican states, and three Native American tribes (TCR 2008).

Kentucky became the 40<sup>th</sup> member of TCR in 2008, leaving 10 U.S. states, Alaska, Arkansas, Indiana, Louisiana, Mississippi, Nebraska, North Dakota, South Dakota, Texas, and West Virginia, as the only nonparticipant polities. Although, the same year that TCR was established, West Virginia created its mandatory reporting program with the passage of Senate Bill 337. In 2009, Texas passed legislation (House Bill 1796) to establish a separate voluntary emissions reporting program for intrastate entities (see Figure 4.2). Thus, prior to the establishment of the federal reporting program, only eight states (Alaska, Arkansas, Indiana, Louisiana, Mississippi, Nebraska, North Dakota, and South Dakota) had not implemented or participated in either voluntary or mandatory GHG emissions reporting efforts.

## **Transportation Sector Emissions Policies**

Emissions produced from the transportation sector have been another area of focus for state initiatives related to climate change mitigation. In general, state-level emissions mitigation policies for the transportation sector have been in the form of command-and-control, performance based standards. The initiatives include mandating a specific emissions-level for vehicle tailpipe emissions, reducing the carbon intensity of fuels, and mandates to increase the number of registered zero-emissions (ZEV) and low-emissions vehicles (LEV) on the road. In many states, emissions from the transportation sector account for the second largest source of emissions behind the electric power sector. In some cases, transportation sector emissions account for a state's greatest source of emissions (discussed in Chapter 5). Given the relatively significant contribution that the sector makes to emissions, and the fact that emissions are produced directly through the energy consumption, whereas emissions from the residential and commercial sectors most often originate from the electric power sector, it is not surprising that states have undertaken policy initiatives designed to reduce emissions from transportation.

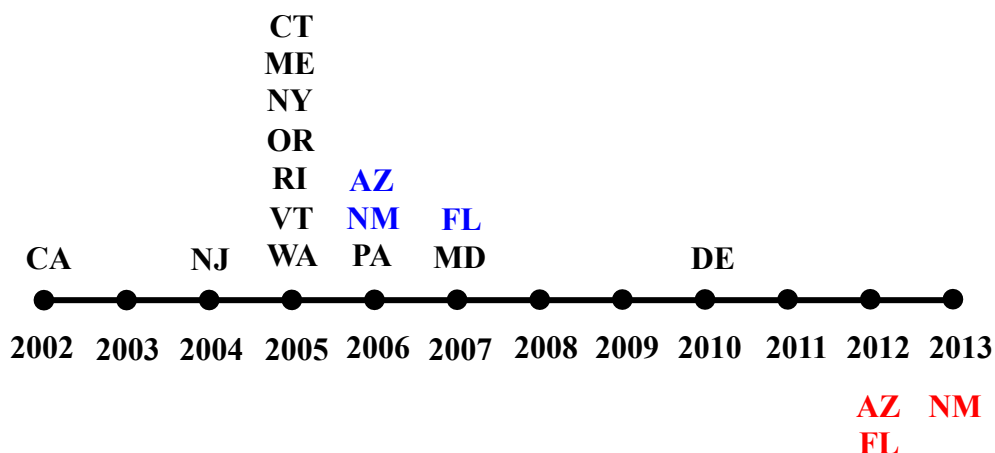
Among the states, California has paved the way for policy approaches to reduce emissions from the transportation sector by establishing innovative legislation in each of these areas and, in the case of vehicle tailpipe emissions, superseding federal emissions requirements. In 2002, California Governor Gray Davis signed the Clean Cars Law (Assembly Bill 1493), which directed the California Air Resources Board (ARB) to develop and adopt rules to achieve emissions reduction vehicles.

Two years later, in 2004, the ARB adopted formal rules that require new vehicles to, on average, achieve a 30 percent reduction in emissions by 2016. In the following year, the ARB filed a petition with the U.S. EPA requesting a waiver of preemption from the federal Clean Air Act (CAA) to authorize the state to establish its own standards for passenger vehicles and light duty trucks (CARB 2017a). Following a 2007 Supreme Court ruling that the EPA must regulate GHG emissions under the CAA, the agency initiated the waiver approval process, beginning with public hearings. The waiver was granted in 2009 and the ARB rule on vehicle emissions applied to 2009 models (CARB 2017a).

As reported in Figure 4.3, following the adoption of California's Clean Cars Law, sixteen states adopted statewide rules to implement the state's vehicle emissions standards. Under Section 177 of the CAA, following the approval of California's waiver to implement vehicle emissions standards, other states are allowed to adopt vehicle emissions standards set by California without seeking federal approval (USEPA n.d.). Although a number of states also created standards via the adoption of administrative rules and executive orders, the adoption of tailpipe emissions standards has primarily occurred through legislative action. Of the 16 states to adopt California's vehicle emissions standards, New Mexico, Florida, and Arizona are the only three states to have repealed the program. These states implemented their vehicle emissions standards through Executive Order and each repealed the program in anticipation of new federal rules regarding vehicle emissions set to begin with 2012 model year vehicles (C2ES 2013e).

**Figure 4.3** State vehicle emissions standards adoption timeline.

**B** – Executive Order  
**B** – Legislation  
**R** – Repealed



Source: C2ES 2013e.

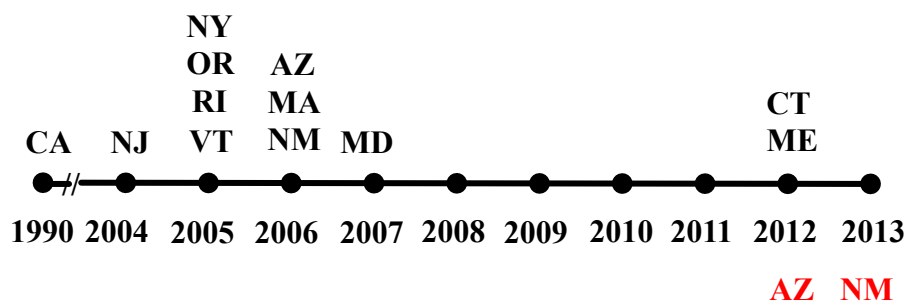
California also became the first state to adopt performance standards for ZEVs when, in 1990, the ARB established a rule that mandated at least two percent of new car sales be zero-emitting by 1998, followed by five percent in 2001 and ten percent in 2003 (CARB 2011). With respect to climate change mitigation, ZEV programs can achieve long-term emissions reduction by requiring vehicle manufacturers to provide specific numbers of vehicles using clean car technologies (i.e., battery electric, plug-in hybrid electric, and fuel cell vehicles) for sale within the regulated region. The 1990 California ZEV requirement was adopted as part of the state's LEV standards and has since undergone a number of amendments. For example, following the adoption of the initial performance standards for ZEVs, the ARB removed the interim performance benchmarks and left only the 10 percent by 2003 requirement. Additionally, in 1998, the program was adjusted to allow LEVs to receive partial

ZEV credits toward the overall ZEV requirement (CARB 2011). The ARB established the ZEV program as a stand-alone regulation, and has continued to modify and amend the program. Most recently, in 2012, the ARB adopted the Advanced Clean Cars program which, among other things, established new performance standards for ZEVs including a goal of more than 10 percent of new vehicle sales to be ZEVs by 2025 (CARB 2012). To support the program, Governor Jerry Brown issued an Executive Order directing the state to set a long-term goal of 1.5 million registered ZEVs in the state by 2025 (Executive Order B-16-2012).

California's ZEV program has served as a model for the development of policies to establish ZEV requirements in a number of states throughout the U.S. As Figure 4.4 reveals, in total, 11 other states have adopted statewide goals and mandates to increase the number of ZEV. With the exception of New Jersey, which set a statewide vehicle emissions mandate in 2004 of 11 percent of total vehicles sold in the state to be zero-emissions and 16 percent by 2017, each of the states referenced the California ZEV mandate as the statewide standard (NJDEP 2005). In anticipation of federal standards regarding vehicle emissions, which were set to begin in 2012, Arizona and New Mexico each repealed their state-level ZEV standards. The ZEV standards in these states were established via Executive Order in 2006 as part of each states adoption of California's Clean Cars Program, which included emissions standards among other things (C2ES 2013e; Executive Order 2006-13; Executive Order 2006-69).

**Figure 4.4** State zero emissions vehicle mandates adoption timeline.

**R – Repealed**



Source: C2ES 2013d.

Another approach to reducing emissions from the transportation sector is to reduce the carbon intensity of fuel by establishing performance based standards. This approach is referred to as a low carbon fuel standard (LCFS) and, to date, California is the only state to have formally implemented this type of policy. A distinguishing characteristic of an LCFS is the inclusion of a life-cycle assessment to examine the GHG emissions associated with the production and transportation of a particular fuel, in addition to the emissions associated with combustion by the end-user. The life-cycle approach to determining the carbon intensity of respective fuel options is unique from other efforts to reduce the carbon intensity of fuel such as a Renewable Fuel Standard, for example, which requires transportation fuel to include a specific portion of biofuel but does not explicitly account for the life-cycle emissions associated with biofuel production in determining emissions reductions.

The LCFS was identified by the ARB as a potential program to help the state achieve its GHG emissions reduction goal by decreasing emissions from the state's transportation sector through the establishment of long-term carbon intensity



reduction goals for transportation fuels consumed within the state (CARB 2017b). The LCFS was mandated in 2007, via Executive Order from Governor Arnold Schwarzenegger, and called for a 10 percent reduction in the carbon intensity of California's transportation fuels by 2020 (Executive Order S-01-07). The ARB developed the rules for the LCFS program which were adopted in 2009 and began in 2011 (CARB 2017b). A number of procedural amendments have been made to the California's LCFS program, although the 10 percent by 2020 goal remains the long-term performance standard.

Following the implementation of California's LCFS program in 2009, Oregon and Washington each initiated state-level efforts to enact standards for transportation fuel carbon intensity. Oregon's program was established via legislative action while Washington's was initiated via an Executive Order from Governor Christine Gregoire (ODEQ 2011; Executive Order 09-05). Each state has had some stagnation in terms of establishing formal rules to implement their respective LCFS. However, in 2015 Oregon passed additional legislation that directed the Department of Environmental Quality to move forward with the LCFS rulemaking process (Theriault 2015). Meanwhile, in the same year, the Washington legislature passed a transportation revenue bill to effectively prohibit the adoption of an LCFS by including a "poison-pill" provision that would curtail transportation funds for alternative transportation infrastructure if a fuel standard is adopted via Executive Order (Senate Bill 5987).

In addition to Oregon and Washington, a number of eastern states have sought to reduce emissions from the transportation sector by establishing a multistate LCFS

program. The collaborative originated in 2008 when the state of Massachusetts passed the Clean Energy Biofuels Act (House Bill 4951) requiring the state to coordinate with other New England states to develop a multistate LCFS (MOEEA n.d.). In 2009, a Memorandum of Understanding to establish the Northeast and Mid-Atlantic Low Carbon Fuel Standard was developed, and the governors of 11 northeastern states (Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont) and the District of Columbia signed on to the initiative, which includes a goal to reduce the carbon intensity of fuels by 10 percent (Rell et al. 2009). While the regional agreement was not formally disbanded, the initiative has yet to establish a formal LCFS program to achieve emissions reductions from transportation fuels.

### **Electric Power Sector Emissions Policies**

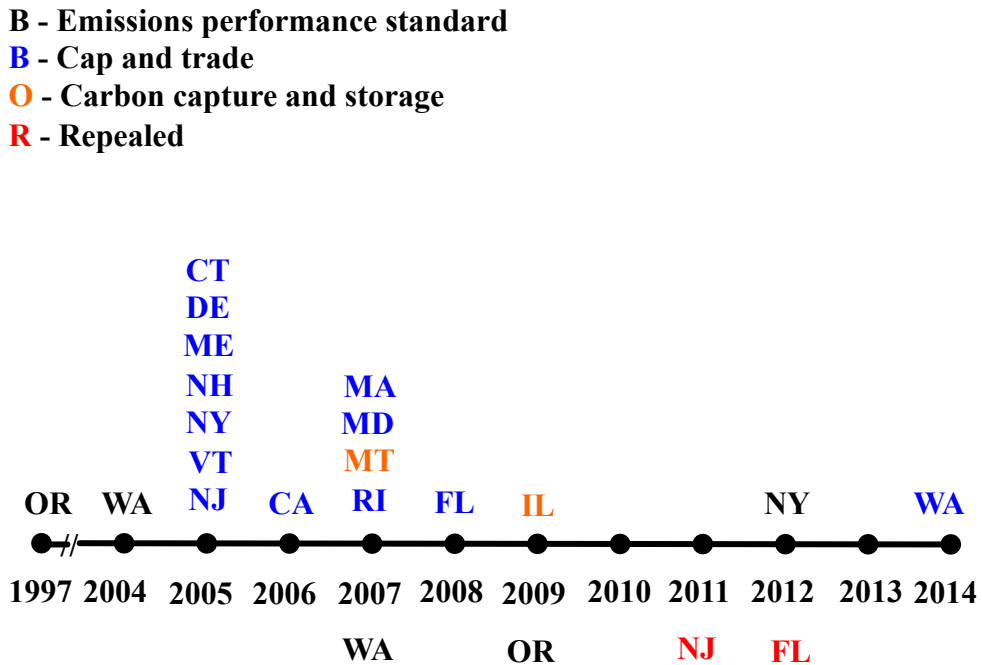
In addition to regulatory policies focused on the transportation sector, a number of states have also undertaken policy initiatives to regulate directly CO<sub>2</sub> emissions produced from the generation of electricity. These efforts have been characterized by both performance and market-based policies designed to reduce emissions from fossil fuel-based electric power production. With the exception of the transportation sector, the electric power sector serves as the primary energy provider for all of the economic end-use sectors and, therefore, is often the primary source of anthropogenic CO<sub>2</sub> emissions (discussed in Chapter 5). As such, climate change mitigation policy efforts that seek to reduce emissions from the generation of electricity are likely to have the broadest impact in terms of overall emissions

reductions. However, to date, only a few states have taken action to regulate CO<sub>2</sub> emissions from the electric power sector.

Based on the information included in Figure 4.5, as of 2016, six states (California, Illinois, Montana, New York, Oregon, and Washington) have adopted state-level performance standards concerning CO<sub>2</sub> emissions produced from the electric power sector. The first state to establish performance based standards was Oregon which, in 1997, adopted House Bill 3283 requiring baseload gas plants, non-baseload power plants using any type of fossil fuel, and non-generating facilities that emit carbon dioxide to reduce emissions to 17 percent below the “cleanest” known plant in the country (House Bill 3283). The law allows covered utilities that are in noncompliance to offset emissions through carbon sequestration projects directly or through third party assistance with organizations such as the Climate Trust, a nonprofit organization that formed following the passage of Oregon’s emissions performance standards to assist regulated entities with the purchase of carbon offsets and management of carbon sequestration projects (TCR n.d.). In 2004, Washington became the second state to adopt emissions performance standards for the electric power sector when Governor Gary Locke signed into law House Bill 3141 (House Bill 3141). The state’s initial approach to emissions reduction from the electric power sector relied upon carbon mitigation projects (e.g. purchase of carbon offsets). However, a second bill, which was signed into law by Governor Christine Gregoire in 2007, established a more conventional emissions performance standard. The new law restricts long-term purchase agreements between utilities and power plants to

facilities that emit less than 1,110 pounds of GHG per megawatt-hour (Senate Bill 6001). California and New York, and each adopted comparable emissions performance standards in 2006 and 2005, respectively.

**Figure 4.5** Electric power sector emissions performance standards adoption timeline.



Source: C2ES 2013c.

In contrast to emissions-based performance standards implemented in these states, Montana and Illinois have each adopted performance based policies for the electric power sector that require carbon capture and storage to be used to reduce emissions from new coal-fired power plant facilities. In 2007, Montana adopted House Bill 25, which directs the state’s Public Service Commission to deny applications for new coal-fired power plants that do not capture and store at least 50 percent of total CO<sub>2</sub> emissions (House Bill 25). Illinois’ emissions performance standard was adopted in 2009. The state’s Clean Coal Portfolio Standards, Senate Bill

1987, was signed by Governor Rod Blagojevich established criteria for coal-fired power plants to be designated as Clean Coal Facilities (Clean Coal Portfolio Standard Act). Under the law, from 2009 to 2015, new facilities must capture and store 50 percent of CO<sub>2</sub> emissions, with an increase to 70 percent in 2016, and 90 percent thereafter. The law creates an incentive for Clean Coal designation by requiring the state's utilities and retail electricity suppliers to purchase at least five percent of their electricity from Clean Coal Facilities beginning in 2015 (Clean Coal Portfolio Standard Act).

To date, thirteen states have implemented market-based, cap and trade programs to reduce emissions from the electric power sector. The first, and perhaps most well-known, cap and trade program to be initiated in the U.S. is the RGGI. RGGI is a regional cap and trade program that was initiated by New York Governor George Pataki in 2003, and it began with discussions between eight other northeastern states (Connecticut, Delaware, Maine, Massachusetts, New Hampshire, New Jersey, Rhode Island, and Vermont). The final agreement was established via a Memorandum of Understanding in 2005, at which time seven states (Connecticut, Delaware, Maine, New Hampshire, New Jersey, New York, and Vermont) became active in 2009. Maryland, Massachusetts, and Rhode Island joined the RGGI in 2007 (C2ES 2015; Fershee 2007). The initial cap on CO<sub>2</sub> emissions applied to all power plants within participating states that generate at least 25 Megawatts of electricity and was designed to freeze emissions from 2009 to 2014 and then achieve a 10 percent reduction from 2009 to 2019. In 2012, the parties to the RGGI agreement amended

the RGGI model rule, establishing a new cap in 2014 and requiring a 2.5 percent reduction in emissions each year from 2015 to 2020 (Rell et al. 2005). Since the RGGI program began in 2009, New Jersey is the only state to have exited the agreement. In 2011, New Jersey Governor Chris Christie withdrew the state from RGGI claiming that the regional electric utility cap and trade program is an ineffective approach to reducing CO<sub>2</sub> emissions (Navarro 2011).

Florida is the only state to have adopted legislation to establish a unilateral cap and trade program for electric power sector emissions. In 2008, then Governor Charlie Crist signed into law the Florida Climate Protection Act (House Bill 4001), authorizing the Florida Department of Environmental Protection (FDEP) to adopt rules to create a cap and trade regulatory program to reduce GHG emissions from state utilities (Florida Climate Protection Act 2008). The initiative was a response to a series of Executive Orders Issued by Governor Crist in 2007 that called upon Florida policymakers to address the climate change issue by creating new mandates to support energy efficiency improvements, renewable energy procurement, and emissions reductions from the state's electric power sector (Executive Order 07126, 07-127, 07-128). Despite the successful passage of House Bill 4001, the cap and trade program was repealed following the election of Republican Governor Rick Scott in 2010 and a resurgence of Republican control of the Florida statehouse. Due to concern regarding the effect of a cap and trade program on the Florida economy, and general skepticism regarding the scientific evidence regarding the effect of human

activity on the climate, the Florida Climate Protection Act was repealed in 2012 (Florida Climate Protection Act 2012; Korten 2015).

Of the thirteen states that have implemented a cap and trade policy approach to reduce emissions only two, California and Washington, have adopted programs that include sources of emissions other than the electric power sector. The state of Washington has just begun to craft a statewide cap and trade program that would reduce emissions from the state's electric power plant facilities, natural gas distributors, petroleum refiners, industrial sector activities, and waste facilities by 30 percent from 2017 to 2035. The program was established by the state's Department of Ecology Clean Air Rule, which was directed by Governor Jay Inslee via Executive Order in 2014 (Executive Order 14-04). The cap and trade program is set to begin in 2017 and is designed to reduce emissions from two-thirds of the in-state GHG emitters by reducing total emission from regulated entities by 5,000 metric tons of CO<sub>2</sub> equivalents (MTCO<sub>2</sub>e) every three years from 2017 to 2035 (Clean Air Rule).

California's cap and trade program was established with the passage of the 2006 Global Warming Solutions Act (Assembly Bill 32), which was signed into law by Governor Arnold Schwarzenegger (Global Warming Solutions Act 2006). The program was established to assist the state with meeting its GHG emissions reduction goal to reduce emissions to 1990 levels by 2020, and 80 percent below 1990 levels by 2050 (Executive Order S-03-05). The ARB was directed to design the emissions trading program, which covers approximately 450 sources of emissions statewide and began in 2013 with an initial cap on electricity generators and large industrial

facilities that emit 25,000 metric tons of CO<sub>2</sub> equivalents (CARB 2015). From 2013 to 2015, regulated entities were required to reduce emissions by approximately two percent annually and, in 2015, the cap extended to distributors of transportation, natural gas, and other fuels and the annual decrease in emissions increased to three percent (CARB 2015). Despite a number of lawsuits regarding the cap and trade programs emissions permit auction process, the allocation of proceeds from the cap and trade program, and whether adoption of the program requires approval by a two-thirds majority of the legislature, the program continues to operate and is set to continue until 2020 (Kahn 2017).

### **Alternative and Renewable Energy Policies**

Although the regulation of GHG emissions produced from various economic activities may be the most direct approach for states to address the issue of anthropogenic climate change, mitigation can also be achieved via less direct avenues of policy intervention. The substitution of fossil fuel energy with less carbon-intensive or zero emissions energy alternatives, for example, can reduce the demand for fossil fuels and, subsequently, reduce emissions. At the state level, renewable energy policies have been relatively widespread and, therefore, offer a potentially valuable approach for achieving long-term climate change mitigation.

In the context of climate change mitigation, one of the primary benefits of renewable energy policies is a potential reduction in emissions produced from the electric power sector. However, increasing the amount of energy generated from resources other than fossil fuels offers additional benefits, including a reduction of



harmful air pollutants associated with fossil fuel combustion, improved energy security and stabilized electricity prices, and economic development by supporting industries associated with renewable energy facilities and infrastructure (Heeter et al. 2014; Hurlbut 2008). As with emissions policies, state-level approaches to increasing renewable energy supplies have utilized both performance and market-based policies designed to address the energy-mix of both the electric power and transportation sectors. The following section provides an overview of the more common state-level renewable energy policy initiatives that have been undertaken by states throughout the U.S.

### **Net Metering**

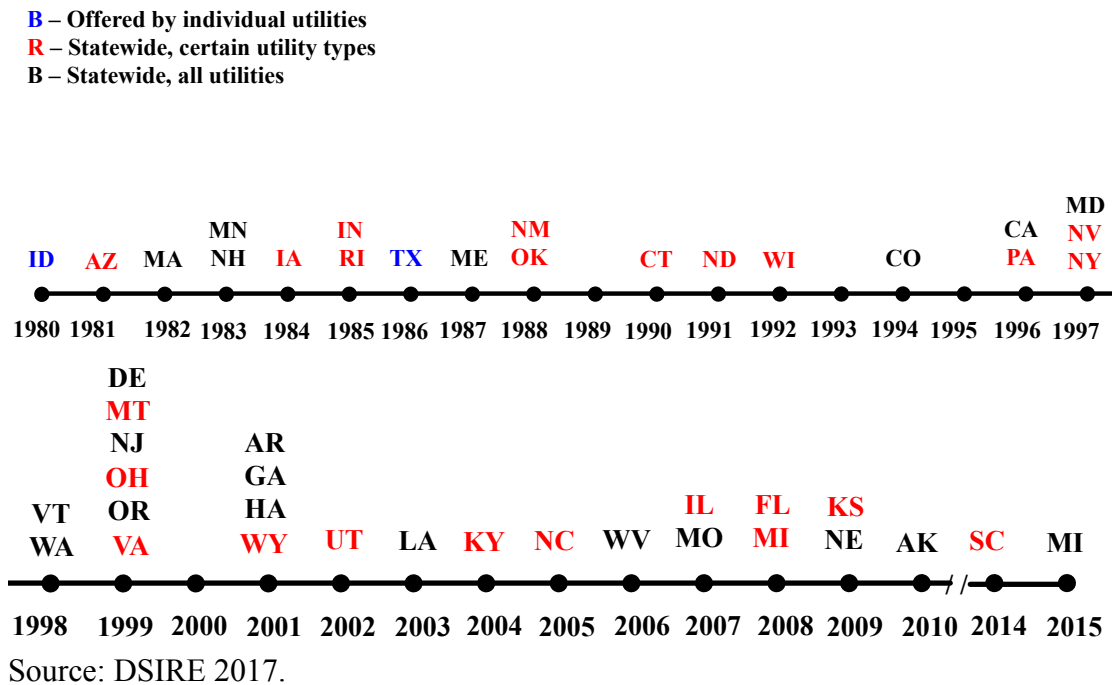
The most widely adopted state-level renewable energy policy is net metering programs, which are designed to incentivize investments in distributed energy systems. The policy is characterized by a billing mechanism that allows owners of renewable energy systems (e.g., rooftop solar photovoltaic) to distribute unused energy back into a grid, and credits the owner such that they are only charged for net energy consumption. Thus, net metering programs provide financial incentives for private investment in distributed energy systems by lowering utility bills and the costs associated with the installation of distributed energy systems. They are therefore considered a critical component of renewable energy development. While utilities can also benefit from distributed energy systems by reducing the costs associated with transmission and distribution infrastructure investments and maintenance, utility companies have often been opposed to the implementation of such programs,

claiming that the loss of demand produced by customers who receive energy from distributed solar will reduce utility earnings, while operating costs remain (EIA 2013; Gunther 2013; Halper 2014; Sommer and Samuel 2016). In general, state-level net metering policies vary with respect to the types of technology and fuel sources that are eligible for compensation (e.g., solar, combined heat and power, solid waste, etc.), system capacity limits (e.g., maximum kilowatts or percentage of connected load) which can vary depending on the type of customer (i.e., residential or non-residential), aggregate capacity limits for utilities (i.e., requiring a utility to honor net metering applications until the total amount of net metered energy exceeds a particular percentage of the utility's total retail sales), the size or type of utility required to support net metering (e.g., public or investor-owned utilities, electric cooperatives, etc.), and the compensation rate or price (e.g., retail or wholesale) received for generated electricity (NCSL 2016; EIA 2012a).

To date 45 states have implemented mandatory net metering policies for at least a portion of utility companies. Two states, Idaho and Texas, currently have voluntary net metering programs while South Dakota, Tennessee, and Alabama have no existing net metering initiatives (DSIRE 2017; NCSL 2016). Figure 4.6 suggests that, although the number of states with net metering programs has steadily increased since the 1980s, the number of electricity consumers participating in net metering programs has primarily occurred during the second half of the 2000s. In 2003, 38 states throughout the U.S. reported having net-metered customers, with a total of 6,800 customers nationwide, 77 percent (5,242 customers) of which were located in

California, while Arizona, the next largest state, accounted for 4.8 percent (330 customers) (EIA 2012b). By 2010, the total number of net metering customers in the U.S. had grown by more than 2,000 percent to 155,841 customers, with an average annual growth rate of 56 percent across the seven-year time period. Every state, with the exception of Tennessee, reported net-metering customers with California remained a national leader, accounting for 56 percent (86,495 customers) of total U.S. net metering customers, followed by Colorado (6 percent; 9,776 customers), Arizona (5.5 percent; 8,559 customers), New Jersey (4.8 percent; 7,526 customers), and New York (3.6 percent; 5,638 customers) (EIA 2012b). Even though net metering has grown rapidly as of 2010, the total number of net metering customers only accounted for about 0.1 percent of all customers.

**Figure 4.6** State net metering program adoption timeline.



## **Renewable Portfolio Standards**

Perhaps one of the most broadly studied policy approaches associated with climate change mitigation through renewable energy development are renewable portfolio standards (RPS). RPS policies, sometimes referred to as an alternative energy portfolio standard, are performance based standards that establish a specific percentage or quantity of state-level electricity generation from non-fossil fuel sources of energy to be achieved within a particular timeframe. The portion of electricity to be generated from alternative energy sources is generally increased incrementally and RPS goals vary from state to state. For example, South Carolina's RPS, adopted in 2014, established a voluntary target for state utilities to acquire two percent of aggregate generation capacity from renewable energy sources by 2021, while, in 2015, state legislators in Hawaii amended the state's existing RPS and established a goal of 100 percent of the state's electricity to be generated from renewable energy sources by 2045 (DSIRE 2017).

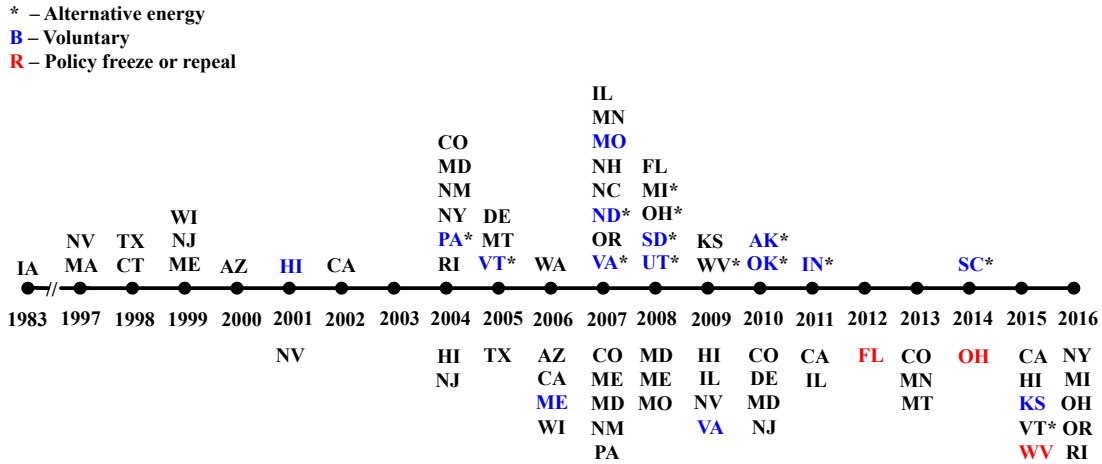
In addition to the overall renewable energy requirement, and the timeline provided for achievement, state-level RPS policy designs also vary with respect to the kind of RPS mandate (voluntary or mandatory), the type and size of utilities covered under the standard, and the type of energy sources that are eligible to meet RPS compliance. In some states RPS are designed to support the development of a particular types of energy sources via "carve-out" provisions that require a specific percentage of the RPS to be achieved from a specific technology or group of technologies. In addition to promoting the development of a particular technology,

carve-outs are also used to promote in-state renewable energy generation (NCCETC 2014). Some RPS policy designs have incorporated an incentive-based mechanism for offsetting compliance challenges for electricity providers by allowing renewable energy credits (RECs) to be traded between regulated entities (Heeter et al. 2014; Hurlbut 2008). In California, for example, the Public Utility Commission issued a decision in 2011 that authorizes the use of tradable RECs, allowing regulated utilities to meet up to 25 percent of a particular utility's compliance via RECs with a maximum price of \$50 per Megawatt Hour. In the same year, the state legislature adopted new regulations in the state that mandate the percent of compliance met by traded RECs to reduce to 10 percent by 2017 (DSIRE 2017).

As can be seen in Figure 4.7, as of 2016, 38 states have adopted and implemented an RPS, and while a majority of the state-level RPS policies require mandatory renewable energy generation, 10 states currently have voluntary standards. Half of the RPS policies (19) have been adopted during the 10-year period from 2007 to 2017, about half of which (9) were voluntary programs. Additionally, Kansas, which adopted a mandatory RPS for the state's investor-owned utilities and electric cooperatives to produce 20 percent of peak demand electricity by 2020 in 2009, amended its RPS with legislation in 2015 that changed the mandatory standard to a voluntary goal. Prior to 2007, only two states (Pennsylvania and Vermont) had implemented voluntary RPS policies, while Maine was the only state to have switched from a mandatory RPS to a voluntary RPS, although the policy became mandatory once again in 2008. In contrast, three states, Hawaii, Vermont, and

Missouri, originally implemented voluntary renewable energy goals that were later amended via legislative action to become mandatory standards.

**Figure 4.7** Renewable and alternative energy portfolio standards adoption timeline.



Source: DSIRE 2017.

Another recent trend in RPS policy designs has been the inclusion of alternative resources as eligible sources of energy to meet electricity generation requirements. Alternative resources refers to sources of energy that are traditionally considered to be nonrenewable energy types such as thermal resources other than those produced from geothermal activity, landfill or anaerobic gases, and nuclear energy. A number of states have also included energy efficiency (Connecticut, Hawaii, Michigan, Nevada, North Carolina, Ohio, Pennsylvania, and West Virginia) categories of fossil fuels, such as coal bed methane, coal fired with carbon capture and storage, and natural gas (Indiana, Michigan, Ohio, and West Virginia). Policies that include alternative resources as an eligible type of energy to meet the state’s energy portfolio goals are often referred to as Clean Energy Standards (CES) or Alternative Energy Portfolio Standards (AEPS). In total, thirteen states have adopted

RPS policies that include alternatives to renewable energy resources as qualifying sources to meet state-level goals (see Figure 4.7). Eleven of the 19 states that have adopted an RPS policy from 2007 to 2016 include alternatives to renewable energy as an eligible source to comply with the standards whereas, prior to 2007, only two states (Pennsylvania and Vermont) had allowed alternative energy resources to meet the RPS policy. Of the 13 states that have included alternative energy under the RPS policy, 10 of the policy were voluntary requirements. The CES or AEPS policy design may be undertaken by states that are interested in using locally available resources and supporting regional economic goals, and reducing the economic impact of policy implementation, while still achieving some level of mitigation related to environmental impacts from electric power production.

State-level RPS policies are among the most active climate change policy areas within the U.S. In addition to changes related to the voluntary versus mandatory compliance with RPS policies, many states have amended existing RPS policies, in most cases by increasing the portion of energy to be provided from renewable or alternative energy resources, expanding the time period for compliance, or some combination of the two (Carley, Nicholson-Crotty and Miller 2016; see Figure 4.7). Only two states, Florida and West Virginia, have repealed existing RPS policies, while the legislature in one state, Ohio, froze the RPS for a period of two years (2014-2016). Additionally, the RPS policies in seven states (Iowa, Maine, Montana, North Dakota, Oklahoma, South Dakota, and Wisconsin) have reached the end of the compliance period (see Figure 4.7).

## Renewable Fuel Standards

A third approach that states have taken to mitigate anthropogenic climate change via the substitution of fossil fuel consumption with renewable energy development is through the promotion of transportation fuels produced from renewable energy resources. Renewable fuels, or biofuels, represent an alternative to traditional fuels made from petroleum for combustion engines that rely on gasoline or diesel fuel and are considered renewable as they are produced from biomass material. A common supplement for gasoline, ethanol, is produced by distilling sugar from biomass material (e.g., corn, sugar cane, or barley), while biodiesel is commonly produced from vegetable oils (e.g., soybean oil) and animal fats. Although diesel engines can use high concentrations of biofuels without modification, gasoline-powered engines are generally limited with respect to the concentration of biofuel-blended gasoline that can be used in cars and light-duty trucks (AFDC n.d.a).<sup>28</sup> Currently, nearly all gasoline sold within the U.S. is comprised of 10 percent ethanol (E10), which provides a number of potential benefits including a reduction in CO<sub>2</sub> emissions, economic development for biofuel-related industries, and energy security (AFDC n.d.b).

The widespread consumption of biofuel throughout the U.S. can be attributed to policy efforts that have taken place at both the state and federal level. The Energy Policy Act of 2005, which established the National Renewable Fuel Standard

---

<sup>28</sup> Most vehicles manufactured after 2001 can use gasoline with 10 percent ethanol, vehicles manufactured after 2007 can use gasoline with 15 percent ethanol, while higher concentrations (e.g., E85, a fuel that contains 51 percent to 83 percent ethanol) can only be used in flexible-fuel vehicles.



(NRFS) mandated the production of 4 billion gallons of biofuel in 2006 with an increase to 7.5 billion gallons by 2012, creating a reliable market for the production of ethanol for the transportation sector (Schnepf and Yacobucci 2013). The Energy Independence and Security Act of 2007 expanded the NRFS, requiring renewable fuel usage to increase to 36 billion gallons annually by 2022 (Energy Independence and Security Act of 2007; USEPA 2016; Schnepf and Yacobucci 2013).<sup>29</sup> At the state level, every polity, with the exception of Mississippi, has implemented specific mandates or financial incentives to support the development and consumption of ethanol and biodiesel (Alternative Fuels Data Center 2017).

One sweeping policy approach that states have taken to increase the supply of renewable fuels is through the adoption and implementation of state-level Renewable Fuel Standards (RFS). As with the federal-level policy, a state-level RFS is a legal mandate for a minimum amount of biofuels to be incorporated into a state's fuel supply. The RFS policy design can direct biofuel requirements at specific points in the supply chain (e.g., refiners, blenders, importers, distributors, retailers) allowing for the incorporation of market-based mechanisms into the design by providing the opportunity for producers or distributors to purchase credits from other entities to meet individual and state-level targets (NREL 2008). The RFS policy approach supports the development of renewable energy by reducing the investment risks

---

<sup>29</sup> The new RFS which currently guides national ethanol policy states that only 15 billion gallons of production should be produced from corn grain (starch) —the remaining 22 billion should come from other advanced and cellulosic feedstock sources.

associated with infrastructure investments associated with the biofuel industry by ensuring a reliable transportation sector market for biofuel.

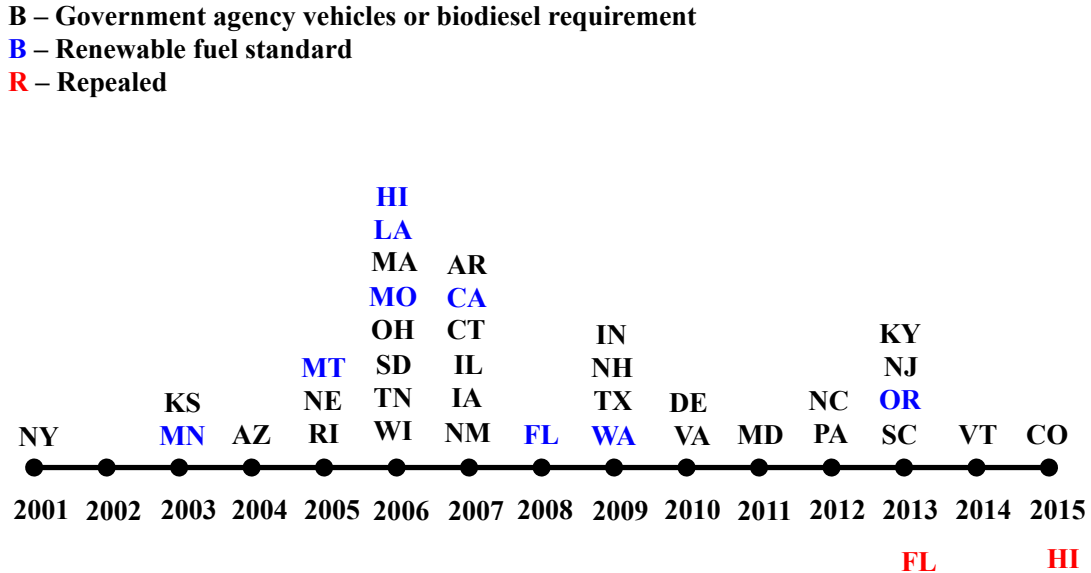
According to Figure 4.8, to date, 37 states have adopted policies that mandate the use of biofuels or an increase in the supply of alternative fuel vehicles. However, only nine states have adopted a state-level RFS policy, only seven of which have an RFS that is active as of 2017, while the remaining state-level renewable fuel policies apply only to biodiesel fuel use or alternative fuel procurement solely for government vehicles.<sup>30</sup> Hawaii and Minnesota each enacted legislation requiring the integration of biofuels into state fuel supplies prior to the adoption of the national RFS. However, the remaining states, Florida, Louisiana, Missouri, Montana, Oregon, Pennsylvania, and Washington each adopted state-level RFS policies following the adoption of federal standards for biofuel consumption. Two states, Hawaii and Florida, recently repealed their RFS policies. In the case of Hawaii, a lack of domestic development of the ethanol industry was cited as the motivation behind the RFS policy repeal which occurred in 2015, while in Florida, Governor Rick Scott signed legislation in 2013 to repeal the state-level RFS citing the duplicative nature of the policy, given existing federal regulations, and disagreement with the regulatory approach of supporting a particular technology or industrial sector over others (Bussewitz 2015; Voegele 2013). California has taken an alternative policy approach that is designed to more directly address emissions from the transportation sector by implementing an LCFS,

---

<sup>30</sup> States with requirements for biodiesel or state vehicle alternative fuel use requirements include: Arizona, Arkansas, Colorado, Connecticut, Delaware, Illinois, Indiana, Iowa, Kansas, Kentucky, Maryland, Massachusetts, Nebraska, New Hampshire, New Jersey, New Mexico, New York, North Carolina, North Dakota, Ohio, Rhode Island, South Carolina, South Dakota, Tennessee, Texas, Vermont, Virginia, and Wisconsin.

which can support the development of renewable fuels, among other low-emissions technologies (discussed above).

**Figure 4.8** State renewable fuel standards adoption timeline.



Source: Alternative Fuels Data Center 2017.

### Energy Efficiency

A third state-level climate change mitigation approach that has been undertaken in many regions throughout the U.S. is the implementation of policies designed to improve energy efficiency. As with renewable energy, state-level policies designed to improve energy efficiency both at the electric power generation and end-use levels have generally been more widely applied. While the direct effect of energy efficiency improvements is a reduction in the amount of energy consumed per unit of energy produced, and subsequent reduction in the demand for primary energy sources, such initiatives can also mitigate anthropogenic climate change via emissions reductions. These policy approaches have been applied to nearly all of the major

economic sectors and include performance and market-based designs as well as comprehensive mandates concerning land use planning. Energy efficiency improvements often experience high political feasibility across diverse constituencies, as such policies offer potential co-benefits to both public and private actors by reducing demand-side energy dependence, which can subsequently reduce energy costs while also improving energy security through reduced reliance on fossil fuel energy sources.

### **Building and Appliance Energy Efficiency Policies**

The most common energy efficiency requirements that have been adopted by the states are energy efficiency standards for public and private sector building via energy code requirements. Building energy codes mandate minimum efficiency requirements for new infrastructure and renovations. As the largest end-use source of new energy consumption in most electricity systems throughout the U.S., energy efficiency requirements for new infrastructure offer a particularly effective opportunity to reduce overall emissions (C2ES 2009; DOE n.d.). Additionally, as market barriers are often cited as a limitation to voluntary efforts to improve building energy efficiency, due to the costs associated with building design and capital investments required to construct more energy efficient buildings, such standards level the playing field by establishing a baseline requirement for builders to follow (C2ES 2009; DOE 2014).

At the federal level, the Energy Policy Act of 1992 established requirements for all states to adopt residential and commercial energy efficiency standards (Energy

Policy Act of 1992). The Act set the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Energy Conservation in New Building Design (Standard 90.1) as the mandated benchmark for state-level building efficiency.<sup>31</sup> In 1994, the International Code Council (ICC), a nonprofit organization created by the nation's three regional model building code entities (the Building Officials Code Administrators, the Southern Building Code Congress International, and the International Conference of Building Officials), formed to develop a single set of national model building codes. Three years later, in 1997, the ICC released the International Energy Conservation Code (IECC) for commercial and residential buildings (ACNEEP 2013; Energy Policy Act of 1992; ICC n.d.).

Standard 90.1 and the IECC are each updated regularly by ASHRAE and the ICC and serve as the technical baseline for state and local building code regulations under the Energy Policy Act of 1992 for commercial and residential buildings, respectively. The Energy Policy Act of 1992 also included amendments to the Energy Conservation and Production Act of 1975, which created a regulatory procedure for updating building energy efficiency code requirements, and granted the Department of Energy (DOE) oversight regarding state-level residential and commercial energy efficiency standards revisions (Energy Policy Act of 1992). The DOE's Building Energy Codes Program reviews Standard 90.1 and IECC standard updates and provides final determinations regarding updates to the base building code requirements. Although there is no official enforcement mechanism to ensure state-

---

<sup>31</sup> Development of Standard 90.1 began during the energy crisis of 1973, and the final stand in 1975 (Alliance Commission on National Energy Efficiency Policy 2014).

level adoption of updated model building codes, states are required to demonstrate compliance, or provide justification for noncompliance, within two years of the DOE's final determination. The DOE does provide technical assistance to support the state-level adoption process and provides incentive funding to state governments to support the implementation of residential and commercial building energy efficiency codes.

The DOE has updated its state-level building code standards for residential and commercial buildings every three years since 2000 and 2001, respectively. However, given that the standards are not officially enforced, the states have adopted energy efficiency standards for residential and commercial buildings to varying degrees. To date, all but nine states have adopted state-level building code requirements for residential buildings, while eight have yet to adopt standards for commercial buildings (DOE 2017b; see Table 4.1). With the exception of Mississippi, which has adopted energy efficiency standards for commercial buildings, but not residential, the remaining states that have not adopted baseline energy efficiency codes for buildings are “home rule” states in which local municipalities are responsible for building code adoption.<sup>32</sup>

As evident in Table 4.1, with respect to energy efficiency standards for commercial buildings, nearly half of the states have adopted either the 2007 or 2010 ASHRAE 90.1 Standards, and only three states, California, Massachusetts, and Washington have adopted state-level building energy efficiency codes for commercial

---

<sup>32</sup> Home rule states include: Arizona, Colorado, Hawaii, Kansas, Missouri, North Dakota, South Dakota, and Wyoming.

buildings that exceed the most recent DOE approved ASHRAE standards. Alaska is the only state that has not adopted energy efficiency standards for commercial buildings, and does not delegate building code standards to local jurisdictions. Meanwhile Hawaii, despite being a home rule state, has established a baseline requirement for commercial and residential building energy efficiency using the IECC 2006 codes standards via legislation in 2009. Relative to commercial building codes, the states have generally applied more stringent energy efficiency code requirements for residential buildings. Currently, 40 states have adopted at least the 2009 IECC standards for residential buildings. As with energy efficiency standards for commercial buildings, California, Massachusetts, and Washington, have each established energy efficiency requirements that exceed the most recent IECC standards, while Tennessee, which currently implements the 2006 IECC standards, has the lowest energy efficiency requirements for residential buildings. Mississippi, Alaska, and the home rule states, with the exception of Hawaii, do not currently have energy efficiency codes for residential buildings.

**Table 4.1** Residential, commercial, and state building code standards.

<b>State</b>	<b>Res. Building Codes IECC Reference Year</b>	<b>Com. Building Codes ASHRAE Reference Year</b>	<b>State Building Year Adopted</b>	<b>State</b>	<b>Res. Building Codes IECC Reference Year</b>	<b>Com. Building Codes ASHRAE Reference Year</b>	<b>State Building Year Adopted</b>
AL	2015	90.1-2013	2006	MT	2012	90.1-2010	2009
AK			2010	NE	2009	90.1-2007	
AZ			2003	NV	2012	90.1-2010	2005
AR	2009	90.1-2007	2009	NH	2009	90.1-2007	2010
CA	> 2015	> 90.1-2013	2004	NJ	2015	90.1-2013	2008
CO			2007	NM	2009	90.1-2007	2006
CT	2012	90.1-2010	2006	NY	2015	90.1-2013	2004
DE	2012	90.1-2010	2010	NC	2009	90.1-2010	2007
FL	2012	90.1-2010	2006	ND			
GA	2009	90.1-2007	2008	OH	2009	90.1-2010	2007
HI	2006	90.1-2007	2006	OK	2009	90.1-2004	2008
ID	2012	90.1-2010	2008	OR	2012	90.1-2010	1991
IL	2015	90.1-2013	2007	PA	2009	90.1-2007	2004
IN	2009	90.1-2007	2008	RI	2012	2012 IECC	2009
IA	2012	90.1-2010	2005	SC	2009	90.1-2007	2007
KS			2006	SD			2008
KY	2009	90.1-2010	2008	TN	2006	90.1-2010	2008
LA	2009	90.1-2007	2007	TX	2015	90.1-2013	2001
ME	2009	90.1-2007	2004	UT	2015	90.1-2013	2006
MD	2015	90.1-2013	1992	VT	2015	90.1-2013	2011
MA	> 2015	> 90.1-2013	2007	VA	2012	90.1-2010	2007
MI	2012	90.1-2007	2005	WA	> 2015	> 90.1-2013	2005
MN	2012	90.1-2010	2001	WV	2009	90.1-2007	2012
MS		90.1-2010	2013	WI	2009	90.1-2010	2006
MO			2008	WY			

Source: DOE 2017.

In addition to energy efficiency requirements for privately owned buildings, nearly all of the states have adopted energy efficiency mandates for state-owned buildings through legislative action or executive order. To date, 47 states have implemented energy efficiency measures for public buildings that range from specific



performance standards or specific efficiency standards such as the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) (Durkay 2013). States have also implemented energy efficiency codes based on the ASHRAE, IECC, and the U.S. EPA's ENERGY STAR program. A majority of the states with energy efficiency requirements for public buildings require LEED certification or Green Globes standards, ENERGY STAR standards, or the ASHRAE or IECC model building energy codes (Durkay 2013). The most common approach among the states is to require LEED Silver certification. Fourteen states require adherence to energy efficiency codes or standards and performance standards (e.g., percentage based targets for energy efficiency), while Idaho and Nevada have implemented performance based standards. Pennsylvania and Vermont both require energy efficiency improvements without specific performance targets or building standards (Durkay 2013).

Another energy efficiency policy approach that has been applied to varying degrees across the states is performance based standards designed to reduce the amount of energy consumed by appliances. Appliance efficiency standards have been one of the most effective policies implemented by federal and state-level governments to achieve energy savings (deLaski and Mauer 2017; DOE 2017a). Setting minimum energy conservation requirements for consumer products and commercial and industrial equipment can reduce electricity demand, subsequently reducing the amount of various pollutants produced from the electric power production process while also saving consumers. Federal oversight of minimum

appliance efficiency standards began with the Energy Policy and Conservation Act of 1975, and has been updated via a series of statutes, most recently the Energy Independence and Security Act of 2007 (ACNEEP 2013; Energy Independence and Security Act of 2007; EPCA 1975). According to the U.S. Department of Energy, products regulated under the Appliance and Equipment Standards Program account for 90 percent, 60 percent, and 30 percent of household, commercial, and industrial energy demand, respectively; and, in 2015, saved U.S. households \$63 billion, while reducing CO<sub>2</sub> emissions by 2.6 billion tons across the program's lifetime (DOE 2017a).

California is the only state to have established appliance efficiency standards prior to the adoption of federal efficiency programs. The state's Warren-Alquist State Energy Conservation and Development Act of 1974 created the California Energy Commission, and granted the new regulatory body the authority to adopt appliance and equipment efficiency standards. Massachusetts and New York each followed California's efforts by establishing various appliance energy efficiency standards during the 1980s although Massachusetts was the first state to request a waiver of federal efficiency standards to allow the adoption of separate, more stringent standards for gas furnaces (Nadel and Goldstein 1996). Since the mid-2000s 11 other states (Arizona, Connecticut, Florida, Maryland, New Hampshire, Nevada, New Jersey, Oregon, Rhode Island, Vermont, and Washington) have adopted energy efficiency standards for appliances that exceed or preceded federal regulatory efforts (ACEEE 2016). Although federal appliance efficiency standards are regularly

updated, and often preempt state-level policy action, a number of these states have actively pursued improvements in appliance efficiency beyond federal requirements by establishing standards that exceed federal requirements and by developing efficiency standards that do not fall under the Appliance and Equipment Standards Program's oversight.

### **Energy Efficiency through Smart Growth and Vehicle Miles Travelled**

In addition to direct mandates for energy efficiency improvements in consumer products and building design, a number of states have also implemented land use and urban planning policies that contribute to climate change mitigation and efficiency improvements via reductions in urban sprawl. These efforts, often referred to as “smart growth” policies, are generally designed to create high population density, increase opportunities for alternative modes of transportation (e.g., walking, bicycling, public transportation), preserve green and open spaces, support mixed-use development, and constrain road construction through comprehensive land use planning (Frumkin, Frank and Jackson 2004; Harris and Evans 2000; Jackson and Kochtitzky n.d.; Resnik 2010). Although the objectives of such comprehensive policy efforts are distributed across issues related to economic development, social equality, public health, and environmental quality, climate change mitigation is a co-benefit of such efforts which can be achieved through improvements in carbon sequestration from preserved open space, and reduced demand for fossil fuels by reducing the need and demand for passenger vehicles by providing alternative and more efficient transportation options, respectively. In some cases, states have included emissions

reduction, primarily from the transportation sector, as an explicit goal of smart growth policy efforts. For example, California's Sustainable Communities and Climate Protection Act (Senate Bill 375), passed in 2008 under Governor Arnold Schwarzenegger, directs the ARB to establish regional caps for reducing GHG emissions from passenger vehicles and light-duty trucks (Sustainable Communities and Climate Protection Act 2008). In 2010, Oregon Governor Ted Kulongoski signed into law Senate Bill 1059, which directed the Oregon Transportation Commission to work with metropolitan planning organizations, state agencies, local governments, and stakeholders to develop strategies to reduce state-level emissions from the transportation sector (Senate Bill 1059).

According to Table 4.2, to date, half of the states have enacted, through legislation and executive order, rules intended to improve the efficiency of land use and land use planning, often through directives designed to decrease urban sprawl. While states such as Hawaii, Vermont, Oregon, and Virginia established rules related to land use and planning during the 1960s and 1970s, in an effort to manage growth and contain expanding urban sprawl following the rapid economic growth after World War II and the creation of the national highway system and the booming automobile industry, a majority of state-level efforts related to growth management have been enacted in the 1990s and after the turn of the century (Freilich, Sitkowski and Mennillo 2010). In addition to land use, these initiatives expanded into a more comprehensive, sustainability driven effort to support economic development and social equality, while also protecting natural spaces. As such, many of the initial

state-level efforts have been amended to reflect explicitly this more multifaceted perspective on the urban environment.

**Table 4.2** State smart growth and vehicle miles travelled policy adoption timeline.

<b>State</b>	<b>Policy Type</b>	<b>Year Adopted</b>
Hawaii	Smart Growth Policies	1961
Vermont	VMT and Smart Growth Policy	1970
Oregon	VMT and Smart Growth Policy	1973
Virginia	Smart Growth Policies	1975
Maine	Smart Growth Policies	1987
Rhode Island	Smart Growth Policies	1988
Georgia	Smart Growth Policies	1989
Washington	VMT and Smart Growth Policy	1990
Maryland	Smart Growth Policies	1992
Delaware	Smart Growth Policies	1995
Massachusetts	VMT and Smart Growth Policy	1996
Arizona	Smart Growth Policies	1998
Tennessee	Smart Growth Policies	1998
New Hampshire	Smart Growth Policies	1999
Wisconsin	Smart Growth Policies	2000
New Jersey	Smart Growth Policies	2001
Connecticut	Smart Growth Policies	2003
Illinois	Smart Growth Policies	2007
New York	VMT and Smart Growth Policy	2007
California	VMT Targets and Smart Growth Policy	2008
Florida	Smart Growth Policies	2008
Michigan	Smart Growth Policies	2008
North Carolina	Smart Growth Policies	2009
North Dakota	Smart Growth Policies	2009
Iowa	Smart Growth Policies	2010

Source: C2ES 2013f.

Smart growth efforts associated with emissions reduction from the transportation sector are often a component of supplemental policies that explicitly facilitate or establish goals to reduce the average vehicle miles travelled (VMT) within urban areas. While the smart growth policy approach is primarily focused on

incentivizing high-density, compact, and mixed-use urban development, VMT policies are specifically intended to reduce the demand for passenger vehicle transportation and often establish explicit performance standards and strategies for reducing VMT. The VMT policy approach is a more recent development related to urban development and, to date, only six states have enacted specific goals or standards for reducing VMT from the transportation sector (again, see Table 4.2).

### **Electric Power Sector Energy Efficiency Policies**

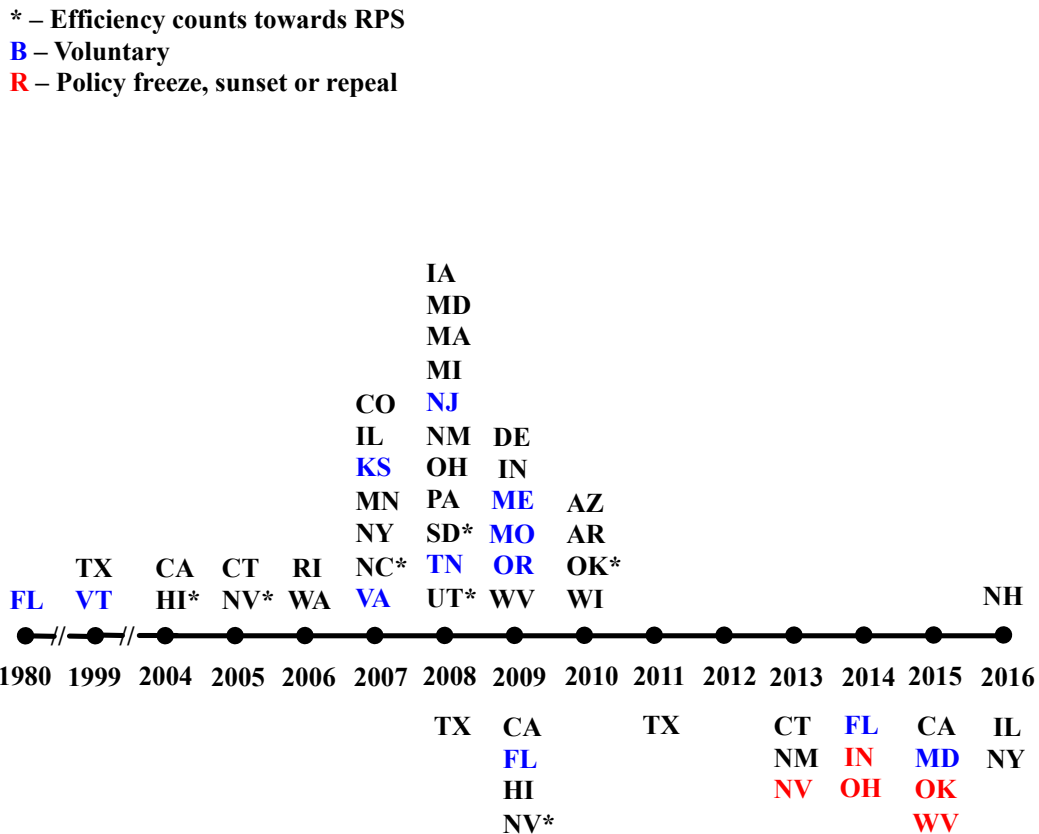
Another way that states can contribute to climate change mitigation through energy efficiency improvements is through reductions in the amount of energy used by the electric power sector via Energy Efficiency Resource Standards (EERS). An EERS is analogous to an RPS, in that the policy is a performance standard that establishes a specific amount or percentage of energy reduction, from a baseline level of consumption (often set by the peak demand or consumption) within a particular year, for utilities to achieve over a period of time. As with the RPS, some states have integrated a market-based component to the EERS policy design by allowing utilities that have achieved relatively significant savings to sell “savings certificates” to utilities that are not meeting reduction requirements. Although the policy is designed to generate energy efficiency by regulating upstream energy producers, an EERS can stimulate energy efficiency improvements by end-use sectors, as utilities or other program operators often establish programs for energy customers to improve downstream energy efficiency.

Florida became the first state in the nation to establish an EERS when the state enacted the Florida Energy Efficiency and Conservation Act of 1980, which created a voluntary EERS by authorizing the state’s Public Service Commission to establish energy efficiency goals for regulated utilities (Florida Energy Efficiency and Conservation Act of 1980; see Figure 4.9). Since 1980, 36 states have enacted some form of an EERS either through legislative adoption or the establishment of administrative rules by Public Utility Commissions. In general, state-level energy efficiency policies for utilities can be placed into three categories: 1) mandatory, statewide energy efficiency targets, 2) voluntary or utility-specific energy efficiency targets, and 3) including energy efficiency as an eligible “resource” in a state-level RPS (Sciortino et al. 2011).

According to Figure 4.9, as of 2016, 31 states had an active EERS in place, a majority of which (21) were passed between 2006 and 2010. Ten of the active state-level EERS are voluntary goals, while only four include energy efficiency as a component of the state’s RPS, rather than a standalone policy. Although the RPS has been a popular energy policy approach among the states, most states have established separate efficiency and renewable energy targets to ensure that both efficiency and renewable energy generation are implemented. Many EERS policies (21) were passed after states had already established RPS policies, and Arkansas and Tennessee are the only states that do not have an RPS but have enacted an EERS. Indiana, Nevada, Ohio, Oklahoma, and West Virginia have each either repealed an existing EERS

(Indiana, Oklahoma, and West Virginia), frozen the policy (Ohio), or the EERS has sunset based on the initial timeline of the policy (Nevada).

**Figure 4.9** State energy efficiency resource standards adoption timeline.



Source: DSIRE 2017.

**Multistate Initiatives**

An important challenge of addressing the climate change issue has been the ability for various levels of government to achieve large-scale reductions in GHG emissions through multilateral agreements. As a trans-boundary environmental issue, effective mitigation will benefit significantly from cooperation and collaboration in the policy development and implementation process. In the international arena, with



the exception of the recent agreements achieved in Paris, France at the 21<sup>st</sup> Conference of the Parties to the UNFCCC, efforts to establish international partnerships to mitigate climate change have largely been unsuccessful. The U.S., in particular, has often fallen short of achieving a legally binding commitment to participate in international climate change policy agreements, largely due to opposition from conservative members of the Senate (McCright and Dunlap 2003).

With respect to international climate change policy, apprehension to participate in multilateral agreements, such as the Kyoto Protocol and the Paris Climate Agreement, from more developed nations is often the result of concerns regarding a potential reduction in economic competitiveness and free riding from less developed nations (Selin and VanDeveer 2007). Meanwhile, opposition to international climate change policy commitments in less developed nations is often the result of concern regarding a potential slowdown of economic growth primarily from the absence of low-cost alternative energy technology and contention regarding the historic contributions that industrialized nations have made to producing anthropogenic climate change, relative to less developed regions (Geck et al. 2013; Gupta 2015; Okereke 2008, 2010). Concern regarding the economic impacts and the distribution of the costs of climate change mitigation has produced significant political barriers to achieving an international treaty that can effectively address anthropogenic climate change.

Although the U.S. has yet to establish a firm commitment to reduce GHG emissions in the international climate change agreements, at the subnational level,

many states have initiated regional agreements related to climate change mitigation. As Table 4.3 shows, to date, 25 states have entered into multistate partnerships intended to reduce emissions from various economic activities via eleven different regional initiatives. In some cases, these agreements have transcended national borders. The New England Governors/Eastern Canadian Premiers: Climate Change Action Plan, for example was a multistate effort to develop a region wide climate action plan to address the climate change issue and included the states of Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont, and the Eastern Canadian Provinces (New Brunswick, Newfoundland and Labrador, Nova Scotia, Prince Edward Island, and Quebec). On the west coast, the Pacific Coast Collaborative, a partnership established to coordinate a broad range of climate change and sustainability-oriented initiatives, includes the state of Alaska, California, Oregon, Washington, and British Columbia.

**Table 4.3** State multistate initiative participation.

<b>Regional Agreement</b>	<b>Year Initiated</b>	<b>Participant States</b>	<b>Status</b>
New England Governors/Eastern Canadian Premiers: Climate Change Action Plan	2000	Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont	Active
West Coast Governor's Global Warming Initiative	2004	California, Oregon, Washington	Inactive
Regional Greenhouse Gas Initiative	2005	Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New York, Rhode Island, Vermont	Active
Southwest Climate Change Initiative	2006	Arizona, New Mexico	Inactive
Western Climate Initiative	2007	Arizona, California, Montana, New Mexico, Oregon, Utah, Washington	Inactive
Midwest Greenhouse Gas Reduction Accord	2007	Illinois, Iowa, Kansas, Michigan, Minnesota, Wisconsin	Inactive
Pacific Coast Collaborative	2008	Alaska, California, Oregon, Washington	Active
Northeast and Mid-Atlantic Low Carbon Fuel Standard	2009	Connecticut, Delaware, Maine, Maryland, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, Washington	Active
Transportation Climate Initiative	2010	Connecticut, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont	Active
North America 2050	2012	Arizona, California, Connecticut, Delaware, Illinois, Maine, Maryland, Massachusetts, Minnesota, Montana, New Jersey, New Mexico, Oregon, Rhode Island, Vermont, Washington	Inactive
State Zero-Emission Vehicle Programs	2013	California, Connecticut, Maryland, Massachusetts, New York, Oregon, Rhode Island, Vermont	Active

The primary goal of four of these cross-state collaborations (i.e., West Coast Governor's Global Warming Initiative, RGGI, Midwest Greenhouse Gas Reduction Accord, and Western Climate Initiative) was to establish a cap and trade program for CO<sub>2</sub> emissions. These efforts were initiated from 2004 to 2007 and included states throughout the U.S. Three multistate agreements (Northeast and Mid-Atlantic Low Carbon Fuel Standard, Transportation Climate Initiative, State Zero-Emission Vehicle Program), were created to coordinate efforts to reduce emissions from the transportation sector. With the exception of the State Zero-Emission Vehicle Program, a multistate agreement to coordinate the implementation of ZEV programs that includes participation from California and Oregon, the multistate transportation agreements are limited to states located in the northeastern region of the U.S. The remaining multistate initiatives, the New England Governors/Eastern Canadian Premiers: Climate Change Action Plan, North America 2050, Pacific Coast Collaborative, and Southwest Climate Change Initiative, are regional partnerships that were established to coordinate and develop more broad policy approaches to climate change mitigation including efforts to increase monitoring of GHG emissions, renewable energy development, energy efficiency, and low-carbon transportation infrastructure, among others. Of these initiatives, North America 2050, which was the successor of three regional agreements (RGGI, Midwest Greenhouse Gas Reduction Accord, and Western Climate Initiative), yielded the broadest level of state participation.

Although half of the states have engaged in multistate initiatives in recent years, only fifteen are currently engaged in six active collaborative initiatives. While a number of the multistate initiatives, such as the Southwest Climate Change Initiative, Midwest Greenhouse Gas Reduction Accord, and North America 2050, have disbanded, others have transitioned into new initiatives. The West Coast Governor's Global Warming Initiative, for example, was established in 2004 and included the states of California, Oregon, and Washington. Although the regional agreement is no longer active, these states have continued to coordinate climate change policy efforts via the Western Climate Initiative, established in 2007, and the Pacific Coast Collaborative, formed in 2008.

Some regional agreements, such as RGGI, have led to the successful adoption and implementation of policies that have achieved actual emissions reductions (RGGI 2016).<sup>33</sup> However, other attempts at multistate climate change initiatives, such as the Midwest Greenhouse Gas Initiative and Western Climate Initiative, which sought to establish a regional cap and trade program, have fallen short of achieving regional climate change policy action (Klinsky 2013).<sup>34</sup> Although the Northeast and Mid-Atlantic Low Carbon Fuel Standard, Transportation Climate Initiative, and State Zero-Emission Vehicle Program have not formally disbanded, these initiatives are de facto inactive. Northeast and Mid-Atlantic Low Carbon Fuel Standard and

---

<sup>33</sup> Initial parties to the agreement included Connecticut, Delaware, Maine, New Hampshire, New Jersey, New York, and Vermont. Massachusetts, Maryland, and Rhode Island joined in 2007 and New Jersey exited the agreement in 2011.

<sup>34</sup> Initial parties to the Midwest Greenhouse Gas Initiative included Illinois, Iowa, Kansas, Michigan, Minnesota, Wisconsin, and the premier of Manitoba. Initial parties to the Western Climate Initiative included Arizona, British Columbia, California, Manitoba, Montana, New Mexico, Ontario, Oregon, Quebec, Utah, and Washington.

Transportation Climate Initiative have yet to achieve a cohesive regional adoption of the policy objectives while the State Zero-Emission Vehicle Program, with the exception of a few of the participant states that have successfully established ZEV mandates, is still in the developing stages.

### **Discussion**

Since climate change has gained increased public awareness since the late 1980s, a diverse array of state-level policies related to climate change mitigation have been enacted throughout the U.S. As suggested in Table 4.4, these initiatives include a wide range of mechanisms to regulate emissions and energy dynamics across each of the primary economic sectors. To date, of the 19 policy approaches discussed above, the fifty states have, on average, adopted 10 policy types. Energy standards for commercial, residential, and state buildings, net metering programs, GHG emissions reporting, and the completion of GHG inventories are among the most widely applied policy tools. Additionally, energy efficiency improvements and renewable energy development have generally been a more active area of policy intervention; even in politically conservative states in which politically powerful economic interests have historically been opposed to regulatory efforts to address the climate change issue. While initiatives that focus explicitly on GHG emissions have received a wide range of state-level participation, these efforts have largely been limited to voluntary mechanisms to reduce and track emissions.

**Table 4.4** State-level climate change policy adoption by policy.

<b>Policy</b>	<b>No. of States</b>
Building Standards For State Buildings	47
Net Metering Program	47
Greenhouse Gas Inventories	44
Commercial Building Energy Codes	42
Residential Building Energy Codes	41
GHG Reporting And Registries	40
Renewable and Alternative Energy Portfolio Standards	38
Climate Action Plan	37
Renewable Fuels Mandate	35
Energy Efficiency Resource Standards	32
Vehicle Miles Traveled-Related Policies And Incentives	25
Greenhouse Gas Emissions Targets	19
Regional Initiatives and Multistate Agreements	15
Appliance Efficiency Standards	14
Vehicle GHG Emissions Standards	13
Low Carbon Fuel Standard	13
Cap and Trade	11
ZEV Program	10
Performance Standards for Electric Power Sector Emissions	6

Policy adoption among the states was particularly active between 2005 and 2009. During this period a distinguishable portion of states enacted measures to establish GHG emissions reduction targets (see Figure 4.1), emissions reporting programs (Figure 4.2), renewable or alternative energy portfolio standards (Figure 4.7), and energy efficiency resource standards (Figure 4.9). While research on the factors that influence state-level policy adoption has identified horizontal diffusion as an important factor in the adoption of climate change and energy policies, another important factor that may have influenced state-level climate change policy activity during this period is the threat of federal-level policy action (e.g., Carley, Nicholson-Crotty and Miller 2016; Chandler 2009; Lyon and Yin 2010; Matisoff

2008; Soutenborough and Beverlin 2008). In 2007, support for climate change policy action at the federal level was gaining momentum. The U.S. Climate Action Partnership had formed to draft a cap and trade program that could be marketed to legislators, the 110<sup>th</sup> Congress was under Democratic control, and the House Committee on Energy and Commerce introduced House Resolution 969, a bill designed to amend the Public Utilities Regulatory Act of 1978 to establish a federal RPS (House Resolution 969; see Chapter 1). Following these efforts, in 2009, House Representatives Henry Waxman (D-CA) and Ed Markey (D-MA) introduced the American Clean Energy and Security Act of 2009 (House Resolution 2454), which sought to establish a federal cap and trade program for GHG emissions, and was passed by the House of Representatives (American Clean Energy and Security Act of 2009). Although the proposed RPS never made it passed the House floor, and the cap and trade proposal was not advanced by the Senate, the House's effort sent a strong signal that climate change mitigation was high on the Congressional political agenda, which may have incentivized preemptive state-level policy action.

Table 4.5 shows how many states have enacted rules designed to address the various drivers of anthropogenic climate change, yet, some have undertaken more substantial initiatives to directly reduce emissions. In some instances, these efforts have contributed to policy diffusion, creating opportunities for more widespread mitigation. California, for example, a state that has often been at the forefront of many environmental policy initiatives, has had a distinguishable effect on state-level climate change policy action, particularly with respect to emissions produced from



the transportation sector. As the first state to adopt standards for ZEVs and vehicle emissions standards, California's policy model has been adopted by legislatures and regulatory agencies throughout the country. California's progressive approach to regulating GHG emissions is also exemplified by the economy-wide cap and trade program that was established by the state's Global Warming Solutions Act, which was signed into law in 2006. Additionally, the state's participation in regional policy initiatives such as the West Coast Governor's Global Warming Initiative, the Western Climate Initiative, and the Pacific Coast Collaborative has influenced similar state-level action in Oregon and Washington, the latter of which is poised to implement its own version of a statewide cap and trade program.

**Table 4.5** State-level climate change policy adoption by state.

<b>State</b>	<b>No. of Policies</b>	<b>State</b>	<b>No. of Policies</b>
California	19	Colorado	9
New York	19	Nevada	9
Connecticut	18	Ohio	9
Maryland	18	South Carolina	9
Massachusetts	18	Texas	9
Oregon	18	Utah	9
Rhode Island	18	Arkansas	8
New Jersey	17	Florida	8
Vermont	17	Kentucky	8
Washington	17	Missouri	8
New Hampshire	16	Tennessee	8
Delaware	15	Georgia	7
Maine	15	Kansas	7
Illinois	14	Oklahoma	7
Pennsylvania	13	Alabama	6
Arizona	11	Alaska	6
Hawaii	11	Idaho	6
Iowa	11	Indiana	6
Michigan	11	Louisiana	6
Minnesota	11	West Virginia	6
North Carolina	11	South Dakota	5
Virginia	11	Nebraska	4
Wisconsin	11	Mississippi	3
Montana	10	North Dakota	3
New Mexico	10	Wyoming	3

State-level leadership in climate change policy action has also become common practice in the northeastern U.S. Beginning with the formation of RGGI in 2005, the nation's first cap and trade program, a collection of states, including Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New York, Rhode Island, and Vermont, have continued to advance and support intra-and interstate policy initiatives to address the climate change issue. These states were

among the early actors to adopt major energy initiatives and, in addition to Oregon and Washington, are the only states to have implemented and sustained California's vehicle emissions and ZEV standards (see Figure 4.4, Figure 4.5, Figure 4.6, Figure 4.7, and Figure 4.9). Among the northeastern states, New York is the only state that is currently involved in a regional initiative, has completed various climate change mitigation planning activities (i.e., GHG emissions inventory, climate action plan, and climate adaptation plan), and has adopted each of the various policies related to climate change mitigation.

In contrast to the states that have established themselves as climate change policy leaders, a number of states have comparatively low performance records with respect to climate change policy adoption. Nebraska, Mississippi, North Dakota, and Wyoming were have adopted the lowest number of climate change initiatives and ranked below the 10<sup>th</sup> percentile in terms of overall policy adoption (again, see Table 4.5). While each of these states have established net metering programs, one of the most commonly adopted policies throughout the U.S., they each exhibit some variation in the types of policies that have been enacted within each polity. Mississippi and Nebraska, for example, have each established energy codes for new buildings (commercial and state in Mississippi and commercial and residential in Nebraska), although Nebraska has also established renewable fuel mandates for state-owned vehicles. North Dakota, in addition to its net metering program, enacted an RPS, in 2007, that required 10 percent of all retail electricity sold in the state be obtained from renewable energy and recycled energy by 2015. Two years later, in

2009 the state established a smart growth policy that mandates the development of transportation plans and programs for metropolitan areas that include measures to promote efficient transportation systems. Among the climate change policy laggards, Wyoming is the only state to have participated in emissions-based climate change policy initiatives. In 2007, the Wyoming Department of Environmental Quality completed a GHG inventory, with the assistance of the Center for Climate Strategies, and also became a founding member of TCR (Bailie et al. 2007; Wilson 2007).

### **Conclusion**

The recent advancements in climate change policy that have been achieved at the federal level under President Barak Obama are currently under threat of elimination by the Trump administration. This shift in the executive-level's climate change policy agenda will likely undermine the unprecedented actions being undertaken by the international community to address the issue of anthropogenic global climate change. Therefore, in the U.S., subnational initiatives related to climate change mitigation are likely to remain a critical facet of emissions reduction efforts made by the U.S. This chapter has provided an up to date assessment of the major energy and emissions initiatives associated with climate change mitigation that the U.S. states have undertaken. Although the federal government has, thus far, fallen short of establishing substantive regulatory mechanisms to address the climate change issue, policy activity at the national level has had an effect on state-level climate change policy action. Beginning with the U.S. EPA's State and Local Climate Change Program, federal initiatives have provided direct and indirect

incentives for state-level policy adoption. Albeit in some instances, states have led federal policy initiatives, as is evident in California's experience with vehicle emissions regulations and the northeastern state's Regional Greenhouse Gas Initiative. While various command-and-control and market-based policy mechanisms have been widely applied to support renewable energy development and produce improvements in energy efficiency, mandatory policies to constrain the significant contributors to the climate change issue (i.e., transportation and electric power sector emissions) have been limited to a collection of states that have consistently been at the forefront of climate change mitigation efforts. Despite the general movement towards climate change mitigation across the U.S., a number of states continue to lag behind the climate change policy curve. While some states have enacted climate change policy, only to later reverse their forward momentum, others have failed to engage in substantial state-level initiatives altogether. The next chapter shifts the policy discussion to the physical drivers of the anthropogenic climate change issue and provides an assessment of national and state-level trends with respect to GHG emissions and energy consumption.

## References

- Alliance Commission on National Energy Efficiency Policy (ACNEEP). (2013). *The History of Energy Efficiency*. Washington, D.C: Alliance to Save Energy
- Alternative Fuels Data Center. (2017). *Federal and State Laws and Incentives*. U.S. Department of Energy. Retrieved from: <http://www.afdc.energy.gov/laws>
- Alternative Fuels Data Center. (n.d.a). *Biodiesel Blends*. U.S. Department of Energy. Retrieved from: [http://www.afdc.energy.gov/fuels/biodiesel\\_blends.html](http://www.afdc.energy.gov/fuels/biodiesel_blends.html)
- Alternative Fuels Data Center. (n.d.b). *Ethanol Fuel Basics*. U.S. Department of Energy. Retrieved from: [http://www.afdc.energy.gov/fuels/ethanol\\_fuel\\_basics.html](http://www.afdc.energy.gov/fuels/ethanol_fuel_basics.html)
- American Clean Energy and Security Act of 2009, H.R. 2454, 111th Cong. (2009).
- American Council for an Energy-Efficient Economy (ACEEE). (2016). *State and Local Policy Database*. Retrieved from:
- An Act To Provide Leadership in Addressing the Threat of Climate Change, Me. Rev. Stat. Ann. tit. 3-A §§ 574-578 (2003).
- Bui, Linda. 2005. *Public Disclosure of Private Information as a Tool for Regulating Environmental Emissions: Firm-Level Responses by Petroleum Refineries to the Toxics Release Inventory*. Waltham, MA: Brandeis University International Business School.
- Bussewitz, C. (2015 May 7). Legislature votes to repeal renewable fuel standard. *Associated Press*. Retrieved from: [database.aceee.org](http://database.aceee.org)  
<https://www.eenews.net/greenwire/2015/05/07/stories/1060018157>

California Air Resources Board (CARB). (2011). *Zero-Emission Vehicle Legal and Regulatory Activities-Background*. Retrieved from:

<https://www.arb.ca.gov/msprog/zevprog/background.htm> for Climate and Energy

California Air Resources Board (CARB). (2012). *The Zero Emission Vehicle (ZEV) Regulation*. Retrieved from:

[https://www.arb.ca.gov/msprog/zevprog/factsheets/general\\_zev\\_2\\_2012.pdf](https://www.arb.ca.gov/msprog/zevprog/factsheets/general_zev_2_2012.pdf)

California Air Resources Board (CARB). (2015). *Overview: ARB Emissions Trading Program*. Retrieved from:

[https://www.arb.ca.gov/cc/capandtrade/guidance/cap\\_trade\\_overview.pdf](https://www.arb.ca.gov/cc/capandtrade/guidance/cap_trade_overview.pdf)

California Air Resources Board (CARB). (2017a). *Clean Car Standards – Pavley, Assembly Bill 1493*. Retrieved from:

<https://www.arb.ca.gov/cc/ccms/ccms.htm>

California Air Resources Board (CARB). (2017b). *Low Carbon Fuel Standard: Background Information*. Retrieved from:

<https://www.arb.ca.gov/fuels/lcfs/lcfs.htm>

California Climate Action Registry, Cal. Health and Safety Code ch. 6 § 42800 (2000)

Carley, S., Nicholson-Crotty, S., & Miller, C.J. (2016). Adoption, reinvention and amendment of renewable portfolio standards in the American states. *Journal of Public Policy*, 1-28. doi:10.1017/S0143814X15000379

- Center for Climate and Energy Solutions (C2ES). (2009). *Buildings Overview*.  
Climate TechBook Retrieved from:  
<https://www.c2es.org/docUploads/Buildings%20Overview%20Final.pdf>
- Center for Climate and Energy Solutions (C2ES). (2013a). *Greenhouse Gas Emissions Targets*. Retrieved from:  
<https://www.c2es.org/sites/default/modules/usmap/pdf.php?file=5902>
- Center for Climate and Energy Solutions (C2ES). (2013b). *U.S. Climate Policy Maps: Greenhouse Gas Reporting and Registries*. Retrieved from:  
<https://www.c2es.org/us-states-regions/policy-maps/ghg-reporting-and-registries>
- Center for Climate and Energy Solutions (C2ES). (2013c). *U.S. Climate Policy Maps: Standards for Electricity GHG Emissions*. Retrieved from:  
<https://www.c2es.org/us-states-regions/policy-maps/electricity-emissions-caps>
- Center for Climate and Energy Solutions (C2ES). (2013d). *U.S. Climate Policy Maps: ZEV Program*. Retrieved from: <https://www.c2es.org/us-states-regions/policy-maps/zev-program>
- Center for Climate and Energy Solutions (C2ES). (2013e). *Vehicle Greenhouse Gas Emissions Standards*. Retrieved from:  
<https://www.c2es.org/sites/default/modules/usmap/pdf.php?file=5905>
- Center for Climate and Energy Solutions (C2ES). (2013f). *VMT-Related Policies and Incentives*. Retrieved from:  
<https://www.c2es.org/sites/default/modules/usmap/pdf.php?file=6638>



- Center for Climate and Energy Solutions (C2ES) (2015). *Q&A Regional Greenhouse Gas Initiative*. Retrieved from: <https://www.c2es.org/us-states-regions/regional-climate-initiatives/rggi/faq>
- Center for Climate and Energy Solutions (C2ES). (2016). *Climate Change 101: Understanding and Responding to Global Climate Change*. Arlington, VA: C2ES
- Chandler, J. (2009). Trendy Solutions: Why do States Adopt Sustainable Energy Portfolio Standards? *Energy Policy*, 37:3274-3281.
- Bailie, A., Strait, R., Roe, S., Jamison, A., Lindquist, H. (2007). *Wyoming Greenhouse Gas Inventory and Reference Case Projections 1990-2020*. Center for Climate Strategies. Retrieved from: [https://www.uwyo.edu/sustainability/\\_files/documents/uw\\_ggei\\_90\\_07.pdf](https://www.uwyo.edu/sustainability/_files/documents/uw_ggei_90_07.pdf)
- Clean Air Rule, Wash. Admin. Code § 173-442-030 (2012).
- Clean Coal Portfolio Standard Act, 20 Ill. Comp. Stat. § 3855/1-10 (2009).
- Database of State Incentives for Renewables & Efficiency (DSIRE). (2017). *Programs*. Retrieved from: <http://programs.dsireusa.org/system/program>
- deLaski, A. & Mauer, J. (2017). *Energy-Saving States of America: How Every State Benefits from National Appliance Standards*. Washington, D.C.: American Council for an Energy-Efficient Economy
- Dennis, B. (2017 February 17). Scott Pruitt, longtime adversary of EPA, confirmed to lead agency. *The Washington Post*. Retrieved from: <https://www.washingtonpost.com/news/energy->

environment/wp/2017/02/17/scott-pruitt-long-time-adversary-of-epa-confirmed-to-lead-the-agency/?utm\_term=.031a87156f41

Durkay, J. (2013 November 11). *State Net Metering Policies*. National Conference of State Legislatures. Retrieved from:

<http://www.ncsl.org/research/energy/energy-efficiency-requirements-for-public-buildings.aspx>

Energy Independence and Security Act of 2007. P. L. No. 110-140, Stat. (2007).

Energy Policy Act of 1992, P.L. 102-486, 42 USC 13201 (1992).

Energy Production and Conservation Act (EPCA) of 1975, P.L. 94-1063, 42 U.S.C. 6201 (1975).

Executive Order 07-126. (2007). State of Florida

Executive Order 07-127. (2007). State of Florida

Executive Order 07-129. (2007). State of Florida

Executive Order 09-05. (2009). State of Washington

Executive Order 14-04. (2014). State of Washington

Executive Order 2006-13. (2006). State of Arizona

Executive Order 2006-69. (2006). State of New Mexico

Executive Order B-16-2012. (2012). State of California

Executive Order No. 24. (2009). State of New York

Executive Order S-01-07. (2007). State of California

Executive Order S-03-05. (2005). State of California.

Fershee, J.P. (2007). Levels of Green: State and Regional Efforts, in Wyoming and

Beyond, to Reduce Greenhouse Gas Emissions. *Wyoming Law Review*. 7(2):  
269-2007.

Florida Climate Protection Act, Fla. Stat. § 403.44 (2008).

Florida Climate Protection Act, Fla. Stat. § 403.44 (2012).

Florida Energy Efficiency and Conservation Act of 1980, Fla. Stat. § 366.80-85 and  
403.519 (1980).

Freilich, R.H., Sitkowski, R.J., & Mennillo, S.D. (2010). *Smart Growth, New  
Urbanism, Green Development, and Renewable Energy*. 2nd Edition.  
Chicago, IL: American Bar Association.

Frumkin, H., Frank, L. & Jackson, R. (2004). *Urban Sprawl and Public Health*.  
Washington, DC: Island Press

Geck, M., Weng, X. X., Bent, C., Okereke, C., Murray, T., & Wilson, K. (2013).  
Breaking the impasse: towards a new regime for international climate  
governance. *Climate Policy*, 13(6), 777-784.  
doi:10.1080/14693062.2013.823308

Global Warming Solutions Act, Cal. Health and Safety Code § 38500 et seq. (2006).

Greenhouse Gas Reporting Rule 2009

Gunther, M. (2013 September 3). With Rooftop Solar on Rise, U.S. Utilities Are Striking  
Back. *Yale Environment* 360. Retrieved from:

[http://e360.yale.edu/feature/with\\_rooftop\\_solar\\_on\\_rise\\_us\\_utilities\\_are\\_striking\\_bac  
k/2687/](http://e360.yale.edu/feature/with_rooftop_solar_on_rise_us_utilities_are_striking_back/2687/)

- Gupta, J. (2015). "The North-South divide." In *Research Handbook on Climate Governance*, eds. K. Bäckstrand and E. Lövbrand, 142-152. Northampton, MA: Edward Edgar Publishing, Inc.
- Halper, E. (2014 August 9). Rules prevent solar panels in many states with abundant sunlight. *Los Angeles Times*. Retrieved from: <http://www.latimes.com/nation/la-na-no-solar-20140810-story.html>
- Harris, J. & Evans, J. (2000). Sprawl brawl: battle lines drawn in smart growth debate. *Real Estate Issues*. Retrieved from: <http://recenter.tamu.edu/pdf/1371.pdf>
- Heeter, J., Barbose, G., Bird, L., Weaver, S., Flores-Espino, F., Kuskova-Burns, K., & Wiser, R. (2014). *A Survey of State-Level Cost and Benefit Estimates of Renewable Portfolio Standards*, CO: National Renewable Energy Laboratory.
- House Bill 25, § 30-2A-101, MCA (2007).
- House Bill 3141, Wash. Rev. Code § 80-70-010 (2004).
- House Bill 3283, Or. Rev. Stat. § 469.409 (1997).
- House Resolution 969, 110th Congress (2007).
- Hurlbut, D. (2008). *State Clean Energy Practices: Renewable Portfolio Standards*. Golden, CO: National Renewable Energy Laboratory.
- International Code Council (ICC). (n.d.). *About ICC*. Retrieved from: <https://www.iccsafe.org/about-icc/overview/about-international-code-council/>
- Jackson, R. & Kochtitzky, C. (n.d.). *Creating a healthy environment: the impact of the built environment on public health*. Atlanta, GA: Centers for Disease Control and Prevention. Retrieved from:

<http://www.cdc.gov/healthyplaces/articles/Creating%20A%20Healthy%20Environment.pdf>.

Kahn, D. (2017 April 7). Court Upholds California's Cap-and-Trade Program. *Scientific American*. Retrieved from: <https://www.scientificamerican.com/article/court-upholds-californias-cap-and-trade-program/>

Klinsky, S. (2013). Bottom-up policy lessons emerging from the Western Climate Initiative's development challenges. *Climate Policy*, 13(2), 143-169.  
doi:10.1080/14693062.2012.712457

Korten, T. (2015 December 27). Florida's case of climate denial: A tale of two governors. *Miami Herald*. Retrieved from:  
<http://www.miamiherald.com/news/local/environment/article51778500.html>

Kraft, Michael E., Mark Stephan, and Troy D. Abel. 2011. *Coming Clean: Information Disclosure and Environmental Performance*. Cambridge, MA: The MIT Press.

Lead-by-Example Initiative, Me. Rev. Stat. Ann. tit. 3-A §§ 575 (2003).

Lyon, T.P. & Yin, H. (2010). Why Do States Adopt Renewable Portfolio Standards? An Empirical Investigation. *Energy Journal*, 31(3): 133-157.

Massachusetts Office of Energy and Environmental Affairs (MOEEA). (n.d.). *Clean Energy Biofuels Act*. Retrieved from: <http://www.mass.gov/eea/energy-utilities-clean-tech/renewable-energy/advanced-biofuels/clean-energy-biofuels-act.html>

Matisoff, D.C. (2008). The Adoption of State Climate Change Policies and Renewable Portfolio Standards: Regional Diffusion or Internal Determinants?

*Review of Policy Research*, 25(6): 527-546.

McCright, A.M. and R.E. Dunlap. (2003). 'Defeating Kyoto: The Conservative Movement's Impact on US Climate Change Policy', *Social Problems*, 50, 3, 348-73.

Mosey G. & Kreycik, C. (2008). *State Clean Energy Practices: Renewable Fuel Standards*, CO: National Renewable Energy Laboratory.

Nadel, S. & Goldstein, D. (1996). *Appliance and Equipment Efficiency Standards: History, Impacts, Current Status, and Future Directions*. American Council for an Energy-Efficient Economy. Retrieved from:  
[http://aceee.org/files/proceedings/1996/data/papers/SS96\\_Panel2\\_Paper17.pdf](http://aceee.org/files/proceedings/1996/data/papers/SS96_Panel2_Paper17.pdf)

National Conference of State Legislatures (NCSL). (3 November 2016). *State Net Metering Policies*. Retrieved from: <http://www.ncsl.org/research/energy/net-metering-policy-overview-and-state-legislative-updates.aspx>

Navarro, M. (2011 May 26). Christie Pulls New Jersey From 120-State Climate Initiative. *The New York Times*. Retrieved from:  
<http://www.nytimes.com/2011/05/27/nyregion/christie-pulls-nj-from-greenhouse-gas-coalition.html>

New England Governors/Eastern Canadian Premiers (NEG/ECP). (2001). *Climate Change Action Plan 2001*. Committee on the Environment and of New England Governors and Eastern Canadian Premiers

New Hampshire Greenhouse Gas Reduction Registry, RSA Env-A: 3800-3804 (1999).

- New Jersey Department of Environmental Protection (NJDEP). (2005). *Compliance Advisory Update: DEP Proposes New Low-Emission Vehicle Rules*. Compliance and Enforcement. Retrieved from:  
<http://www.nj.gov/dep/enforcement/advisories/2005-14.pdf>
- New York State Energy Planning Board (NYSEPB). (2002). *2002 New York State Energy Plan*. New York.
- New York State Energy Planning Board (NYSEPB). (2015). *2002 New York State Energy Plan*. New York.
- Niles, M. T., & Lubell, M. (2012). Integrative Frontiers in Environmental Policy Theory and Research. *Policy Studies Journal*, 40, 41-64. doi:10.1111/j.1541-0072.2012.00445.x
- Okereke, C. (2008). Equity norms in global environmental governance. *Global Environmental Politics*, 8(3), 25-+. doi:10.1162/glep.2008.8.3.25
- Okereke, C. (2010). Climate justice and the international regime. *Wiley Interdisciplinary Reviews-Climate Change*, 1(3), 462-474.  
doi:10.1002/wcc.52
- Oregon Department of Environmental Quality (ODEQ). (2011). *Oregon Low Carbon Fuel Standards: Advisory Committee Process and Program Design*. Portland, OR: State of Oregon
- Regional Greenhouse Gas Initiative (RGGI). (2016). *The Investment of RGGI Proceeds through 2014*. RGG, Inc. Retrieved from:  
[https://www.rggi.org/rggi\\_benefits](https://www.rggi.org/rggi_benefits)

- Rell, J., Minner, R.A., Baldacci, J.A., Lynch, J., Codey, R., Pataki, G.E., Douglas, J. (2005). *Regional Greenhouse Gas Initiative*. Memorandum of Understanding
- Rell, J.M., Markell, J., Baldacci, J., O'Malley, M., Patrick, D., Lynch, J.H., Corzine, J.S., Paterson, D.A., Rendell, E.G., Carcieri, D.L., & Douglas, J.H. (2008). *Northeast and Mid-Atlantic Low Carbon Fuel Standard*. Memorandum of Understanding.
- Resnik, D.B. (2010). Urban Sprawl, Smart Growth, and Deliberative Democracy. *American Journal of Public Health*, 100(10): 1852-1856
- Schnepf, R., & Yacobucci, B.D. (2013). *Renewable Fuel Standard (RFS): Overview and Issues*. Washington, D.C.: Congressional Research Service.
- Sciortino, M., Nowak, S., Witte, P., York, D., & Kushler, M. (2011). *Energy Efficiency Resource Standards: A Progress Report on State Experience*. Washington, D.C.: American Council for an Energy-Efficient Economy
- Selin, H. and VanDeveer, S. D. (2007), Political Science and Prediction: What's Next for U.S. Climate Change Policy?. *Review of Policy Research*, 24: 1–27.  
doi:10.1111/j.1541-1338.2007.00265.x
- Senate Bill 5987, 64th Legislature (2015).
- Senate Bill 6001, Wash. Rev. Code § 80-70-010 (2007).
- Senate Bill 1059, Or. Leg. Special Session ch. 85 § 5 (2010).
- Shabecoff, P. (1988 June 24). Global Warming Has Begun, Expert Tells Senate. *New York Times*. Retrieved from <http://www.nytimes.com/1988/06/24/us/global-warming-has-begun-expert-tells-senate.html>



- Sommer, L., & Samuel, M. (2016 January 1) Like Night and Day: How Two States' Utilities Approach Solar. *NPR*. Retrieved from:  
<http://www.npr.org/2016/01/01/460960961/like-night-and-day-how-two-states-utilities-approach-solar>
- State of Illinois. (2010). *Illinois Update on The Midwestern Greenhouse Gas Reduction Accord for The Governors Climate and Forestry Task Force*. Retrieved from  
<http://www.gcftaskforce.org/documents/State%20of%20Illinois%20MGGRA%20update%205.6.2010.pdf>
- Stoutenborough, J.W. & Beverlin, M. (2008). Encouraging Pollution-Free Energy: The Diffusion of State Net Metering Policies. *Social Science Quarterly*, 89(5): 1230-1251.
- Sustainable Communities Strategy and Climate Protection Act, S.B. 375, 2007–2008 Leg. Sess. (Cal. 2008).
- The Climate Registry (TCR) (2008). *Voluntary Carbon Market Development*. Retrieved from: <http://www.climateregistry.org/2007-achievements.html>
- The Climate Registry (TCR) (2015). Membership Benefits & Options. *The Climate Registry*. Retrieved from: <https://www.theclimateregistry.org/programs-services/voluntary-reporting/membership-benefits/>
- The Climate Trust (TCR). (n.d.). *The Climate Trust: About*. Retrieved from: <https://www.climatetrust.org/about/>

- Therriault, D.C. (2015 March 12). Kate Brown makes it official, signs bill pushing Oregon's low-carbon fuel standard. *The Oregonian*. Retrieved from:  
[http://www.oregonlive.com/politics/index.ssf/2015/03/kate\\_brown\\_makes\\_it\\_official\\_s.html](http://www.oregonlive.com/politics/index.ssf/2015/03/kate_brown_makes_it_official_s.html)
- Trump, D.J. (2017 March 28). *Presidential Executive Order on Promoting Energy Independence and Economic Growth*. Washington, D.C.: The White House
- U.S. Department of Energy (DOE). (2014). *Saving Energy and Money with Building Energy Codes in the United States*. Energy Efficiency & Renewable Energy. Retrieved from:  
[https://energy.gov/sites/prod/files/2014/05/f15/saving\\_with\\_building\\_energy\\_codes.pdf](https://energy.gov/sites/prod/files/2014/05/f15/saving_with_building_energy_codes.pdf)
- U.S. Department of Energy (DOE). (2017a). *About the Appliance and Equipment Standards Program*. Appliance & Equipment Standards. Retrieved from:  
<https://energy.gov/eere/buildings/appliance-and-equipment-standards-program>
- U.S. Department of Energy (DOE). (2017b). *State Code Adoption Tracking Analysis*. Building Energy Codes Program. Retrieved from:  
<https://www.energycodes.gov/state-code-adoption-tracking-analysis>
- U.S. Department of Energy (DOE). (n.d.). *About the Building Technologies Office*. Office of Energy Efficiency & Renewable Energy. Retrieved from:  
<https://energy.gov/eere/buildings/about-building-technologies-office>
- U.S. Energy Information Administration (EIA) (9 May 2012a). Policies for compensating behind-the-net-meter generation vary by State. *Today in*

- Energy*. Retrieved: <https://www.eia.gov/todayinenergy/detail.php?id=6190>
- U.S. Energy Information Administration (EIA) (15 May 2012b). Participation in electric net-metering programs increased sharply in recent years. *Today in Energy*. Retrieved: <https://www.eia.gov/todayinenergy/detail.php?id=6270>
- U.S. Energy Information Administration (EIA) (2013). Most new residential solar PV projects in California program are not owned by homeowners. *Today in Energy*. Retrieved: <http://www.eia.gov/todayinenergy/detail.cfm?id=12991>
- U.S. Environmental Protection Agency (USEPA). (1992). *Selected Summary of Current State Responses to Climate Change*. Washington, D.C.
- U.S. Environmental Protection Agency (USEPA). (1998). *State and Local Climate Change Program: Mapping A Cleaner Future*. Washington, D.C.
- U.S. Environmental Protection Agency (USEPA). (2001). *Partnerships and Progress: EPA State and Local Climate Change Program 2001 Progress Report*. Washington, D.C.
- U.S. Environmental Protection Agency (USEPA). (2015). *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2013*. U.S. Environmental Protection Agency. Washington, D.C.
- U.S. Environmental Protection Agency (USEPA). (2016). *Renewable Fuel Standard Program: Program Overview for Renewable Fuel Standard Program*. Retrieved from: <https://www.epa.gov/renewable-fuel-standard-program/program-overview-renewable-fuel-standard-program>

United Nations Framework Convention on Climate Change (UNFCCC). (2017a).

*The Paris Agreement*. Retrieved from:

[http://unfccc.int/paris\\_agreement/items/9485.php](http://unfccc.int/paris_agreement/items/9485.php)

United Nations Framework Convention on Climate Change (UNFCCC). (2017b).

*The Paris Agreement-Status of Ratification*. Retrieved from:

[http://unfccc.int/paris\\_agreement/items/9444.php](http://unfccc.int/paris_agreement/items/9444.php)

Voegele, E. (2013 June 4). Florida governor signs legislation to repeal state RFS.

*Biomass Magazine*. Retrieved from:

<http://biomassmagazine.com/articles/9054/>

Wilson (2007 May 9). 31 states join Climate Registry. *Los Angeles Times*. Retrieved

from: [http://articles.baltimoresun.com/2007-05-09/news/0705090545\\_1\\_gas-emissions-greenhouse-gas-registry](http://articles.baltimoresun.com/2007-05-09/news/0705090545_1_gas-emissions-greenhouse-gas-registry)

Wisconsin Air Pollution Emissions Reduction Registry, Wis. Stat. § 285.78 (2000)

## **Chapter 5 - Emissions, Energy, and Climate Change**

The focus of the analysis now turns to the primary driver of anthropogenic climate change, CO<sub>2</sub> emissions, and the significance of primary energy consumption within the context of climate change mitigation. The goal of this chapter is to provide a rationale for situating CO<sub>2</sub> emissions and renewable energy development at the center of the climate change policy discussion. The chapter begins by discussing the dominant role that CO<sub>2</sub> emissions have played with respect to the U.S. contribution to anthropogenic climate change relative to other forms of GHGs. The chapter then focuses on primary energy consumption in the U.S. The analysis concludes with a state-level investigation of CO<sub>2</sub> emissions and energy consumption, setting the stage for a comparative analysis of state-level climate change performance in Chapter 6.

### **Emissions and Climate Change**

The majority of climate change policy efforts, at all levels of government, have focused on mechanisms designed to reduce CO<sub>2</sub> emissions in order to circumvent the predicted environmental consequences of an increase in average global temperatures. However, there are several other types of gases produced from various human activities that have contributed to the human-enhanced greenhouse effect (Myhre 2013; Rao and Riahi 2006; USEPA 2015a). Methane (CH<sub>4</sub>), for instance, is an important GHG that has recently become a focus in environmental policy discussions both at the state and federal level (Alvarez et al. 2012; Brandt et al. 2014; EDF 2016; Miller et al. 2013; Mooney and Dennis 2016). Advancements in detection technology have led to the discovery of fugitive emissions from the oil and

gas industry and the aging infrastructure of municipal energy management systems. This has generated concern regarding the environmental, economic, and public health impacts associated with CH<sub>4</sub> emissions and questions about the adequacy of existing regulatory policies (Kort et al. 2008; Miller et al. 2013; Zavala-Araiza et al. 2015; Karion et al. 2013, 2015; McGarry and Flamm 2014; McKain et al. 2015). In October 2015, the discovery of a massive CH<sub>4</sub> leak from an underground storage facility in southern California sparked concern among policymakers, members of the general public, and environmentalists (EDF 2016; Lovett 2016; Lovett and Wines 2016). The leak, which was repaired in February 2016, released approximately 100,000 tons of CH<sub>4</sub> into the Los Angeles air basin and was predicted to produce a global warming impact equivalent to the average annual GHG emissions from more than half-a-million passenger vehicles (Conley et al. 2016). The potential environmental impacts from the event have led some to refer to the incident as, “the worst environmental disaster since Deepwater Horizon,” an offshore oil spill in 2010, which left 4.9 million barrels of crude oil in the Gulf of Mexico (McGrath 2016). The spill devastated the marine ecosystem and local economies (Beyer et al. 2016; Hester et al. 2016; Murawski et al. 2016).

Moreover, recent efforts to determine the amount of CH<sub>4</sub> leaks from natural gas production and urban distribution infrastructure throughout various regions in the U.S. have found that fugitive emissions are more pervasive than had been previously assessed (Howarth, Santoro and Ingraffea 2011; Kang et al. 2014; Karion et al. 2013; Kort et al. 2008; Miller et al. 2013; McGarry and Flamm 2014; Pétron G, et al. 2012;

Wunch et al. 2009; Zavala-Araiza et al. 2015). For example, a study focused on the city of Boston revealed that CH<sub>4</sub> leaks from the city's natural gas distribution system are two to three times greater than had been estimated in the Massachusetts' state GHG inventory, indicating an underestimation of the warming impacts produced from CH<sub>4</sub> and the state's overall contribution to anthropogenic climate change (McGarry and Flamm 2014; McKain et al. 2015). Thus, any effort to employ CO<sub>2</sub> as a climate change policy priority ought to consider the significance of this particular GHG with respect to its contribution to global climate change, relative to all others.

In addition to CO<sub>2</sub> and CH<sub>4</sub>, the most important GHGs that are known to have an effect on the global climate as a result of direct emissions from human activity include nitrous oxide (N<sub>2</sub>O), and several species of fluorinated gases, such as hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulfur hexafluoride (SF<sub>6</sub>), and nitrogen trifluoride (NF<sub>3</sub>) (Myhre 2013; USEPA 2015a). Three of the most important characteristics of the GHGs, with respect to their relative effect on the global climate, include the length of time that each spends in the Earth's atmosphere, their associated potency or heat-trapping capabilities, and the amount each gas has been emitted into the environment. A range of variation across these three categories exists among the various types of gases, and each has contributed to the issue of climate change to varying degrees.

The IPCC has developed a standardized metric called the Global Warming Potential (GWP) to provide a common measure that can account for the primary characteristics of GHGs and be used to compare the impact from the direct emissions

of each gas. The GWP is determined by the atmospheric lifetime and the radiative forcing (RF) of a particular gas, relative to that of a reference gas (Myhre et al. 2013).<sup>35</sup> The RF is essentially a measurement of the ability of a GHG to affect the Earth's energy balance by either deflecting incoming solar radiation or absorbing outgoing infrared radiation over the gas's residence time in the Earth's atmosphere. GHGs that absorb infrared radiation produce a warming effect and have a positive RF value, while gases that deflect incoming solar radiation (such as aerosols) produce a cooling effect and have a negative RF value (Myhre et al. 2013). The reference gas used by the IPCC is CO<sub>2</sub>. Therefore, GWP-weighted emissions are generally measured in tons of CO<sub>2</sub> equivalent (T CO<sub>2</sub> Eq.). Thus, the product of the total amount of emissions for a particular type of GHG and the corresponding GWP provide a standardized measure of emissions over a particular period of time that can be used to compare the relative contribution of each gas to anthropogenic climate change.

As of 2007, the IPCC reported the GWP for all species of GHGs for 20 and 100-year integration periods, although the standard GWP timeframe used to develop climate change policies is 100 years (Forster et al. 2007).<sup>36</sup> Determining the GWP of each gas over a specific length of time allows the lifespan of a particular gas to be accounted for when determining the overall warming effect from its emissions. A molecule of CH<sub>4</sub>, for example, remains within the atmosphere for an average of 12

---

<sup>35</sup> The IPCC defines GWP as, "the ratio of the time-integrated relative forcing from the instantaneous release of a particular greenhouse gas." (Myhre et al. 2013)

<sup>36</sup> The Kyoto Protocol, for example uses a 100-year GWP for GHG measurements.



years while a molecule of CO<sub>2</sub> can last for hundreds to thousands of years.<sup>37</sup>

Table 5.1 shows the 100-year GWP values for a selection of GHGs as reported in the IPCC Fifth Assessment Report. A notable observation from Table 5.1 is that, in terms of GWP, CO<sub>2</sub> has the smallest effect among the GHGs, with respect to its heat-trapping capabilities. For example, the GWP of CH<sub>4</sub> and N<sub>2</sub>O is 24 times and 298 times larger than the GWP of CO<sub>2</sub>, respectively, while SF<sub>6</sub>, the most potent GHG, is 22,000 times more powerful than CO<sub>2</sub> on a “pound-for-pound” basis. Therefore, if one were to only be interested in addressing the most powerful GHGs, policy efforts ought to focus on gases that have the greatest GWP. However, understanding the severity of an environmental quality problem innately requires consideration of the amount of a particular pollutant that is entering a particular system. Thus, in the context of global climate change, the relative strength of a particular GHG may become less significant considering the quantity of each type of gas that is emitted through anthropogenic processes.

---

<sup>37</sup> “Carbon dioxide cycles between the atmosphere, oceans and land biosphere. Its removal from the atmosphere involves a range of processes with different time scales. About 50 percent of a CO<sub>2</sub> increase will be removed from the atmosphere within 30 years, and a further 30 percent will be removed within a few centuries. The remaining 20 percent may stay in the atmosphere for many thousands of years” (Denman et al. 2007).

**Table 5.1** 100-year global warming potential for a selection of greenhouse gases.

<b>Gas</b>	<b>GWP</b>
CO <sub>2</sub>	1
CH <sub>4</sub> <sup>a</sup>	25
N <sub>2</sub> O	298
HFC-23	14,800
HFC-32	675
HFC-125	3,500
HFC-134a	1,430
HFC-143a	4,470
HFC-152a	124
HFC-227ea	3,220
HFC-236fa	9,810
HFC-4310mee	1,640
CF <sub>4</sub>	7,390
C <sub>2</sub> F <sub>6</sub>	12,200
C <sub>4</sub> F <sub>10</sub>	8,860
C <sub>6</sub> F <sub>14</sub>	9,300
SF <sub>6</sub>	22,800
NF <sub>3</sub>	17,200

Source: IPCC (2007)

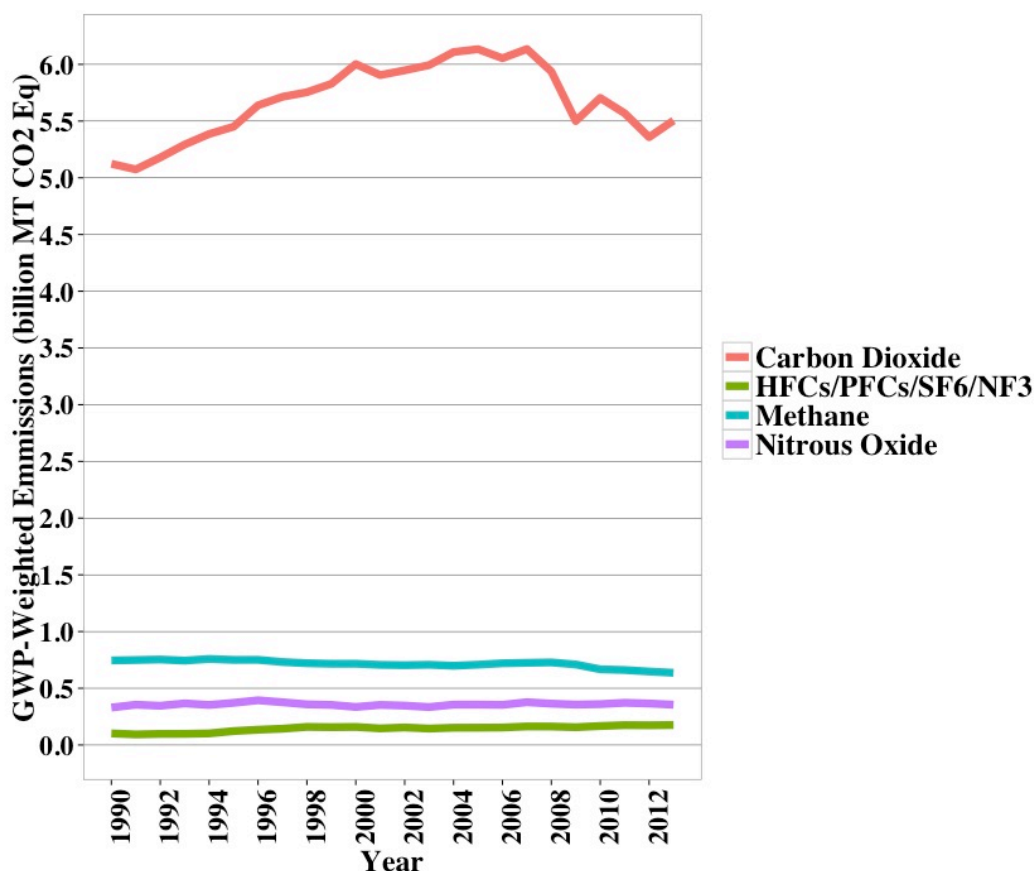
<sup>a</sup> The CH<sub>4</sub> GWP includes the direct effects and those indirect effects due to the production of tropospheric ozone and stratospheric water vapor. The indirect effect due to production of CO<sub>2</sub> is not included.

Since the Industrial Revolution, the U.S. has been a major source of anthropogenic GHG emissions, and is the largest single contributor to anthropogenic climate forcing, contributing to nearly 25 percent of the change in average global temperatures since 1850 (Matthews et al. 2014; Ward and Mahowald 2014). As of 2013, the U.S. accounted for approximately 14 percent of global emissions of all GHGs and ranked second, behind China, in total emissions (6,673 MMT CO<sub>2</sub> Eq.) (CAIT Climate Data Explorer 2015).<sup>38</sup> From 1990 to 2013, CO<sub>2</sub> has consistently contributed the largest portion of total U.S. emissions, on average, accounting for 82 percent of the nation's annual GWP-weighted emissions followed by emissions of

<sup>38</sup> MMT CO<sub>2</sub> Eq. = million metric tons of CO<sub>2</sub> equivalent

CH<sub>4</sub> (10 percent), N<sub>2</sub>O (5 percent), and the fluorinated gases (2 percent). Over the same time period, emissions of CO<sub>2</sub> experienced an overall increase of 7 percent (381.5 MMT CO<sub>2</sub> Eq.) (see Figure 5.1; USEPA 2015a). The increase in total emissions from CO<sub>2</sub> over this period has primarily been the result of an increase in the consumption of fossil fuels from the electric power and transportation sectors due to an overall expansion of the U.S. economy and growth in the national population (Raupach et al. 2007; USEPA 2015a). Emissions of N<sub>2</sub>O and HFCs have also experienced an overall increase, growing by nearly 8 percent (25.3 MMT CO<sub>2</sub> Eq) and 250 percent (116.4 MMT CO<sub>2</sub> Eq.) from 1990 to 2013, respectively (see Table 5.2). The change in N<sub>2</sub>O emissions is attributed to trends in the use of fertilizers and soil management practices by the agricultural industry, as well as an increase in fossil fuel combustion from stationary sources and automobiles in the industrial and transportation sectors (Davidson and Kanter 2014; Park et al. 2012; USEPA 2015a). The relatively dramatic increase in HFC emissions can predominantly be attributed to an overall increase in the demand for the gas as a refrigerant substitute for ozone depleting substances, chlorofluorocarbons (CFCs) and hydrofluorocarbons (HFCs), a trend that is expected to continue in the near-term as CFCs and HCFCs continue to be phased-out in the U.S. in compliance with the Montreal Protocol and the Copenhagen Amendments to the Montreal Protocol (USEPA 2015a; Velders et al. 2009).

**Figure 5.1.** U.S. greenhouse gas emissions by greenhouse gas, 1990 to 2013.



Source: U.S. EPA 2015a.

In contrast to those GHGs that have experienced an increase in overall emissions, direct emissions of CH<sub>4</sub>, PFCs, and SF<sub>6</sub> have experienced steady declines in recent years. According to U.S. EPA estimates, from 1990 to 2013, CH<sub>4</sub> emissions have decreased by 15 percent (108.9 MMT CO<sub>2</sub> Eq.) (see Table 5.2).<sup>39</sup> The change in CH<sub>4</sub> emissions can primarily be credited to a decrease in cattle populations, an overall decrease in emissions from natural gas production and distribution systems, as well as

<sup>39</sup> Although the U.S. EPA has reported an observed decrease in CH<sub>4</sub> emissions, recent research using both down and upstream observations of CH<sub>4</sub> emissions has found that CH<sub>4</sub> emissions have increased in recent years, indicating a lack of consensus in the literature regarding overall trends in CH<sub>4</sub> emissions (Miller et al. 2013).

a reduction in the amount of decomposable materials (i.e., paper and paperboard, food scraps, and yard trimmings) that are discarded in municipal landfills (Allen et al. 2013; Lamb et al. 2015; USEPA 2015a). Another important contributor to the change in national CH<sub>4</sub> emissions has been an increase in the amount of landfill gas that is collected and combusted at municipal solid waste facilities for the production of energy, which would, in the absence of carbon-capture protocols, also have a positive effect on total emissions from CO<sub>2</sub> as the gas is combusted to produce electricity (USEPA 2015a, 2016c). Emissions of PFCs, a byproduct of aluminum production, has declined by 76 percent (18.5 MMT CO<sub>2</sub> Eq) from 1990 to 2013. The significant decline in emissions from 1990 to 2013 is primarily from reductions in domestic aluminum production and changes in the management practices of the aluminum production process, in part as a response to an understanding of the significant GWP of perfluorocarbon emissions (Chase, Gibson and Marks 2005; USEPA 2015a). As of 2013, emissions of SF<sub>6</sub>, a gas that is primarily used as an insulator to prevent electric discharges from high-voltage lines and equipment, and is commonly used for the manufacturing process of semiconductors accounted for 0.1 percent (6.9 MMT CO<sub>2</sub> Eq) of total GWP-weighted emissions (Wines 2013). From 1990 to 2013 emissions from the largest source of SF<sub>6</sub> emissions, electric power transmission and distribution systems, decreased by nearly 80 percent (20.3 MMT CO<sub>2</sub> Eq.) largely as a result of a sharp increase in the price of SF<sub>6</sub>, the implementation of voluntary environmental programs such as the U.S. EPA's voluntary SF<sub>6</sub> Emission Reduction Partnership for Electric Power Systems, and federal government initiatives to reduce emissions

(Executive Order No. 13514 2009; USEPA 2015a, 2015b). The efforts to address the various activities that are responsible for the release of fugitive SF<sub>6</sub> emissions have proven to be quite successful, and, from 1990 to 2013, overall emissions of SF<sub>6</sub> have decreased by 78 percent (24.2 MMT CO<sub>2</sub> Eq.) (USEPA 2015a, 2015b).

**Table 5.2** U.S. greenhouse gas by gas, million metric tons CO<sub>2</sub> Eq.

<b>Gas</b>	<b>2013</b>	<b>Percent of Total</b>	<b>Change</b>	
			<b>1990-2013</b>	<b>Percent Change</b>
CO <sub>2</sub>	5,505.18	82.50	381.48	7.45
CH <sub>4</sub>	636.31	9.54	-109.18	-14.65
NO <sub>x</sub>	355.19	5.32	25.29	7.67
HFCs/PFCs/SF <sub>6</sub> /NF <sub>3</sub>	176.27	2.64	74.30	72.87

Source: EPA 2015a.

A review of recent trends in U.S. GHG emissions has revealed that CO<sub>2</sub> has consistently accounted for a significant portion of overall climate forcing and has also experienced the largest increase in total emissions among the various species of GHGs. As of 2013, CO<sub>2</sub> accounted for 82 percent of total U.S. GHG emissions, followed by CH<sub>4</sub> (9 percent), NO<sub>x</sub> (5 percent), and the fluorinated gases (2 percent) (see Table 5.2). In 2013, the U.S. produced more than 5 billion metric tons of CO<sub>2</sub>, 15 percent of global CO<sub>2</sub> emissions (Olivier et al. 2015; CAIT Climate Data Explorer 2015). The nation led the world in total emissions of CO<sub>2</sub> until 2005 when China became the world leader; while, in terms of per capita emissions, with approximately 16.5 tons of CO<sub>2</sub> emitted per person, the U.S. is ranked 11<sup>th</sup> globally and 2<sup>nd</sup>, behind Australia, among industrialized countries (Olivier et al. 2015; CAIT Climate Data Explorer 2015). The recent increase in emissions of N<sub>2</sub>O and HFCs are nontrivial, considering the high GWP for each of these types of GHGs, however, the magnitude

of emissions from these pollutants, in terms of total volume, is less significant when compared to CO<sub>2</sub> and, therefore, addressing these drivers may justifiably be less urgent in the context of tackling the issue of global climate change in a timely manner.

Additionally, while emissions from CH<sub>4</sub> and SF<sub>6</sub> have waned in recent years, in the case of CH<sub>4</sub>, new awareness regarding the magnitude of emissions from various sources has contributed to a recent emergence of policy efforts to address the anthropogenic causes of emissions among members of the environmental policymaking community at various levels of governance (Bradbury et al. 2013; Hickenlooper 2013; Hristov, Johnson and Kebreab 2014; NCSL 2014; The White House 2014; Stafford 2015). In March 2014 President Obama issued the President's Climate Action Plan, which directed the U.S. EPA to develop new rules to reduce methane emissions from the oil and gas sector (The White House 2014). In March 2016, the U.S. EPA issued three final rules to update the 2012 New Source Performance Standards to curb methane and volatile organic compound emissions from new, modified, and reconstructed sources of release from the oil and gas industry. (Oil and Natural Gas Sector: Emission Standards for New, Reconstructed, and Modified Sources 2016; Utech 2016). Therefore, an analysis of the results of these efforts will be most fruitful once formal rules have been established and implemented. With regard to SF<sub>6</sub> and PFCs, emissions are generally produced from a relatively small group of stakeholders who, in the case of SF<sub>6</sub>, have an economic interest in limiting emissions, therefore voluntary partnerships and outreach directed

towards emissions reductions have proven to be successful (USEPA 2015b; Wines 2013). Without question, the most comprehensive plan to address anthropogenic climate change ought to include policies directed towards a reduction of all GHG emissions, however, a logical policy approach to addressing environmental issues such as climate change, in which there are multiple forms of pollution that contribute to the environmental quality problem, often involves the prioritization of policy efforts based on the relative threat that each type of pollution poses. Thus, an effective and efficient strategy to tackle the issue of anthropogenic climate change is to focus immediate policy efforts on the most pervasive climate change driver, CO<sub>2</sub> emissions.

### **Energy and Climate Change**

Having established the importance of CO<sub>2</sub> emissions in the context of climate change mitigation, the focus of this chapter now shifts to an analysis concerning the significance of energy and primary energy consumption to the climate change policy discussion. The national and state-level energy analyses included in the current and the following chapter focus on energy consumption, rather than production, in order to understand how each state may or may not be individually contributing to climate change mitigation. Energy production can be divided between mining (e.g., fossil fuels or uranium extraction) or capturing (e.g., wind, solar, or hydropower) primary sources, and transformation of primary sources into secondary sources (e.g., fossil fuels-to-electricity). While state-level production of the primary fuel types is an important area of inquiry, the production of a particular fuel type within a state is a



function of in state, out-of-state, and, in some cases, international demand for the resource. The oil extraction activity in an oil exporting state, for example, generally occurs in response to the demand for this resource to support economic activity within importing regions. Therefore, state-level comparisons based upon energy consumption can account for how each state's economy contributes to the production of CO<sub>2</sub> emissions. For example, states in which the demand for fossil fuels to support economic activity is relatively high can be recognized as low performing states, rather than those states in which fossil fuel production and exportation occurs. A wide range of policy options are available to states to influence the mix of fuel types consumed within a state. This offers fertile ground for evaluating state policy actions related to energy.

A pitfall of focusing on energy consumption rather than instate production is the inability to differentiate imported electricity consumption by fuel type. The data on total energy consumption used in this study is composed of the aggregate consumption of each fossil fuel type, renewable energy resources, nuclear energy, and net electricity imports. The net electricity imports variable does not indicate the type of fuel that is used to produce the imported electricity or the state of origin (EIA 2015d).<sup>40</sup> While the data facilitate accurate accounting of instate energy consumption by fuel type, a determination of the type of fuel that is used to produce imported electricity cannot be made. However this limitation only applies to energy consumed by the electric power sector and, from 1980 to 2013, state-level electricity imports

---

<sup>40</sup> Total Energy Consumption = Total Fossil Fuel Consumption + Total Renewable Energy Consumption + Total Nuclear Energy Consumption + Net Imports of Electricity

accounted for, on average, 0.3 percent of total state-level energy consumption (EIA 2013b).<sup>41</sup> Although energy consumption provides an imperfect measure of overall state-level energy use by the electric power sector by fuel type, the data provide an accurate depiction of state-level energy consumption trends.

The vast majority of policy efforts to address the issue of anthropogenic climate change in the U.S., thus far, have focused on addressing various aspects of energy consumption as a strategy to reduce CO<sub>2</sub> emissions (see Chapter 4). At the federal level, command-and-control regulation, such as the Corporate Average Fuel Economy (CAFE) standards, and market-based instruments, such as the Energy Tax Act of 1978 (ETA), have been enacted to reduce the demand for carbon intensive fuels via improvements in energy efficiency and incentives for renewable energy development (Lazzari 2008; McConnell 2013; McDonald 1979; DOT 2014; Energy Tax Act of 1978; Sherlock 2011). At the state level, a suite of voluntary and mandatory policy instruments have been legislated to improve energy efficiency and increase the portion of energy provided from renewable sources across a range of economic sectors (see Chapter 4).

In contrast to policies that are designed to achieve a direct reduction in CO<sub>2</sub> emissions, the motivation behind policies that are designed to alter energy consumption is not exclusively tied to addressing the issue of anthropogenic global climate change. Reducing U.S. reliance on nonrenewable resources to meet energy demand has a number of potential benefits, including an increase in national energy

---

<sup>41</sup> Vermont had the highest overall record of imported electricity, 31 percent, while the next highest state, North Dakota, imported 8 percent of its electricity.

security, by alleviating reliance on imported supplies of nonrenewable fossil fuels, and a decrease in the cost of electricity production and energy consumption for industrial, commercial, and residential consumers. Federal policies to increase the consumption of ethanol, wind, and solar energy were initiated during the late 1970s and early 1980s, a time when U.S. energy security was unstable due to the depletion of economic reserves of domestic natural gas and oil supply shocks from the 1973 Oil Embargo and civil unrest in the Middle East during the early 1980s (McConnell 2013; Hamilton 2013; Sherlock 2011). While the initial motivation behind policies designed to improve energy efficiency and expand renewable energy production may primarily have been market-oriented, energy policies that reduce the demand for fossil fuels have important environmental implications, particularly with respect to the amount of anthropogenic CO<sub>2</sub> emissions that are produced via energy consumption. It is germane to this study therefore, to establish the significant role that primary energy consumption plays in addressing the issue of anthropogenic global climate change.

The combustion of fuel during the energy production process is the primary distinction among the various types of primary energy sources with respect to climate change impacts. The generation of energy from renewable resources such as solar, wind, and geothermal relies upon harnessing energy that is produced from the Earth's natural processes, whereas energy produced from fossil fuels and biomass requires the physical transformation, via combustion, of these in order to produce thermal heat

and generate energy.<sup>42</sup> Traditionally, an important byproduct of fuel combustion is the release of various pollutants, including CO<sub>2</sub>, into local air basins, and eventually the atmosphere, while energy produced from nuclear fission and renewable resources, other than biomass, does not result in direct emissions of GHGs.<sup>43</sup> The CO<sub>2</sub> emissions that are produced from the consumption of energy have consistently accounted for the nation's largest share of total GHG emissions, accounting for approximately 77 percent of GWP-weighted emissions since 1990 and nearly 94 percent of total CO<sub>2</sub> emissions in 2013 (USEPA 2015a). Thus, in the context of climate change, the demand for energy and the role of fossil fuels as a primary energy source is an important dimension of climate change mitigation efforts.

Since the American Industrial Revolution the U.S. has predominantly relied upon the consumption of fossil fuel to power economic growth and advance the quality of life for American citizens (see Figure 5.2). Therefore, to appreciate the fundamental challenge of reducing CO<sub>2</sub> emissions from energy consumption in the U.S. it is critical to view the relationship between economic development and fossil fuels from a historical perspective. During the second-half of the 19<sup>th</sup> century, coal emerged as the first “king” of U.S. energy in the industrial era. During this period, the development of the nation's first coal-driven locomotive and construction of the first coal-fired power plant, fostered in a new epoch of U.S. energy history in which fossil fuels would become the lifeblood of the American economy, providing the means for

---

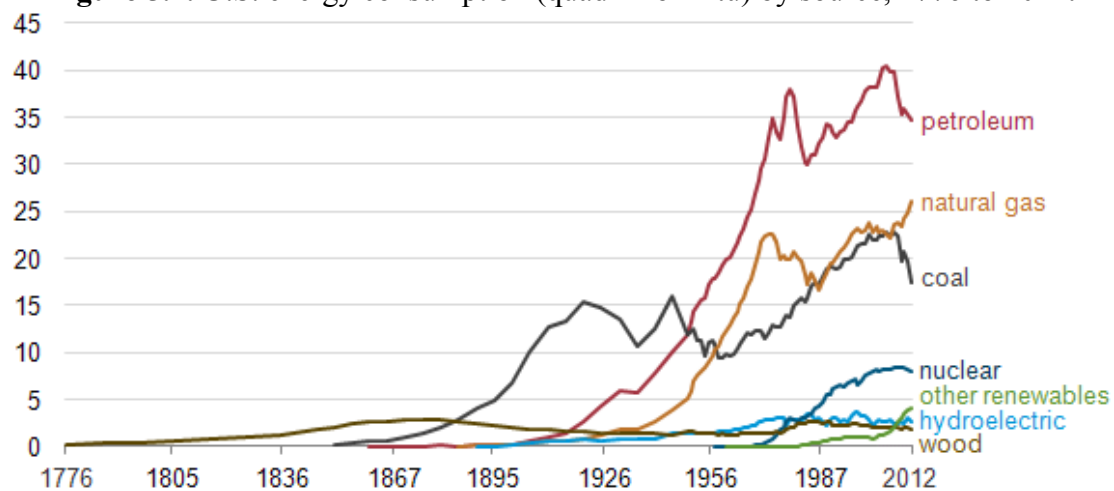
<sup>42</sup> Biomass includes wood and ethanol produced from plant matter.

<sup>43</sup> While forms of renewable energy other than biomass do not result in direct emissions during the energy production process, emissions are produced during various stages of each source's lifecycle (IPCC 2011; NREL 2013)

industrial production activities, electricity generation, and transportation (DOE 2013a). Soon after the rise of coal, the discovery of subterranean oil fields in Pennsylvania combined with development of methods to create kerosene from distilled crude oil produced an increase in supply and created a new market for petroleum resources as an illuminating fuel (Hamilton 2013; Owen 1974). However, the discovery of additional oil fields in the American west along with the production and mass distribution of the first American-made car at the turn of the 20<sup>th</sup> century initiated a steady rise in the consumption of oil as a primary energy source for the nation's new and expanding automobile-driven transportation sector (Hamilton 2013; Owen 1974). Unprecedented economic growth following the end of World War II coupled with the creation of the interstate highway system during the 1950s contributed to rapid growth in the number of passenger vehicles sold in the U.S. and total petroleum consumption surpassed coal as the nation's dominant source of energy (Hamilton 2013). Natural gas was the last of the fossil fuels to become an important primary energy source for the U.S. economy. Prior to the 20<sup>th</sup> century, broad transportation of the fuel was limited due to a lack of distribution infrastructure and the fuel was largely used as an illuminant for municipal streetlights and a source of energy for cooking and home heating in places where supplies were locally available and easily accessible (DOE 2013b; EIA 2007). After World War II, however, advances in the quality and efficiency of pipeline construction improved the economic feasibility of natural gas conveyance networks and led to the construction of thousands of miles of pipeline along with the development of the first gas-fueled

power plants in North America, increasing the market for natural gas consumption throughout the second half of the 20<sup>th</sup> century (DOE 2013b; EIA 2008a, 2008b, 2015b). In addition to improvements in accessibility to natural gas from the development of distribution infrastructure, the 1987 repeal of the Power Plant and Industrial Fuel Use Act, which prohibited the use of natural gas by new electric generating units, contributed to a large increase in the demand for natural gas by the industrial and electric power sectors through into the 21<sup>st</sup> century (EIA 2011; Powerplant and Industrial Fuel Use Act 1978; Figure 5.2).

**Figure 5.2.** U.S. energy consumption (quadrillion Btu) by source, 1776 to 2012.



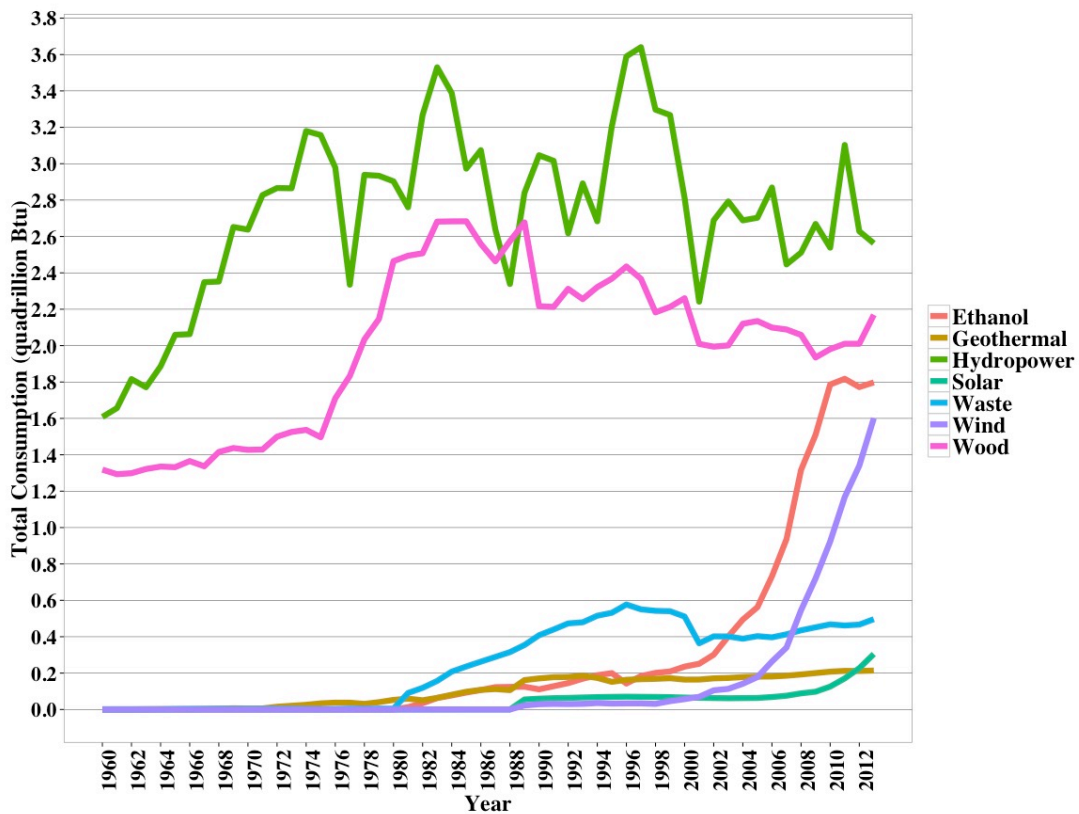
Source: EIA 2013a.

Among the nonrenewable sources of primary energy, nuclear power is the only source that does not rely upon the combustion of fossil fuel to produce energy and, therefore, does not produce CO<sub>2</sub> emissions as a result of the energy production process. In 1957 the nation's first commercial electricity-generating nuclear energy power plant was constructed in Shippingport, Pennsylvania, and by 1989, the nuclear power industry expanded to include 109 nuclear reactors producing 19 percent of the

electricity in the U.S., second only to coal in terms of energy consumed by the electric power sector (DOE 1994; NRC 2016). However, an expansion of the nuclear power industry during this period was thwarted as plans for the construction of new nuclear power plants slowed considerably during the 1970s and 1980s in response to the relatively high capital costs for new facilities and an increase in investment risks, a consequence of modifications to the facility licensing process (DOE 1994). Additionally, events such as the nuclear melt down at Three Mile Island in Pennsylvania (1979) and the accident at the Chernobyl nuclear power plant in the Ukraine (1986) raised concern regarding the safety of nuclear power, fueling anti-nuclear sentiments among the American public further reducing demand for the energy source and constraining the development of new nuclear power plants in the U.S. (Csereklyei 2014; DOE 1994). More recently, events such as the 2011 nuclear meltdown at Fukushima Daiichi in Japan and the conflict over establishing a nationwide repository for nuclear waste in Yucca Mountain, Nevada have perpetuated concern regarding the safety of nuclear power plant facilities and introduced new challenges with respect to the disposal of nuclear waste (Rascoe 2012; Cahn et al. 2016). Despite these issues there are four new nuclear units currently under construction in South Carolina and Georgia, and seven active nuclear power reactor applications under review by the Nuclear Regulatory Commission (NRC). The reactors currently under construction are among the country's first to be approved by the NRC in over 30 years and, with an expected completion date of 2020, will be the first plants to be completed since the 1990s (NRC 2016; Rascoe 2012).

In contrast to the extensive history of fossil fuel consumption, with the exception of energy produced from wood (biomass), geothermal, and hydropower, the consumption of energy from renewable resources has only begun to increase since the 1980s with the introduction of ethanol as a fuel supplement for the transportation sector and the development of modern solar and wind-driven power technologies (see Figure 5.3). One important outcome of the fossil fuel shortages of the 1970s and 1980s was an increased interest in the development of alternative sources of energy such as ethanol, solar, and wind to power the U.S. economy.<sup>44</sup>

**Figure 5.3** Renewable energy consumption by source, 1960 to 2013.



<sup>44</sup> Photovoltaic and concentrated-solar (solar thermal energy) systems are the two most common forms of solar energy production within the U.S. PV devices change sunlight directly into electricity while solar thermal/electric power plants generate electricity by concentrating solar energy to heat fluids, producing steam that is then used to power a generator.



Source: EIA 2015c.

The first solar cell capable of converting the sun's energy into electrical power was developed in the U.S. in 1954 using a silicon photovoltaic cell at Bell Labs. However, the relatively high production costs associated with solar energy production constrained the commercial market from investing in large-scale solar electricity facilities (DOE 2003). Research from government agencies and private companies throughout the 1970s led to advancements in solar energy technology and improvements in the economic feasibility of solar energy facilities, and in 1979 Atlantic Richfield Company (ARCO) Solar began construction of the world's largest photovoltaic (PV) manufacturing facility in Camarillo, California followed by the first 1 megawatt (MW) PV power plant in Hesperia, California, in 1982, and the completion of a 6 megawatt PV facility in central California's Carrizo Plain in 1983. The 120-acre unmanned Carrizo Plain facility supplied the Pacific Gas and Electric Company's utility grid with enough power for approximately 2,500 homes (DOE 2003; Go Solar California 2016).<sup>45</sup> In addition to the decline in the overall costs of solar energy production from technological improvements, the implementation of policies such as the ETA and the Public Utility Regulatory Policy Act (1978) encouraged investment in small-scale solar energy development by providing tax credits and the ability for private producers of solar energy to sell surplus power back to the grid at avoided cost rates (Public Utility Regulatory Act 1978).

---

<sup>45</sup> California has continued to lead the way in the development and consumption of solar energy. In 1993, Pacific Gas and Electric Company installed the first grid-supported, "distributed power" PV system in Kerman, California, and the state has passed multiple laws aimed at incentivizing expansion of solar energy production in the state (Go Solar California 2016).

As with solar energy development, expansion of the wind energy industry began during the late 1970s primarily in response to the provision of federal incentives established by the ETA and federally supported research and development that focused on large wind turbine technology (DOE 2015; Sherlock 2011). In the early 1980s, California became the vanguard state with respect to wind energy production following the installation of wind turbines in San Gorgino Pass. Since 1983, the adoption of wind energy facilities has continued to expand as states throughout the U.S. began to integrate wind-produced energy into the electricity grid. Following a brief expansion during the early 1980s, wind turbine construction experienced a decline following a phase-out of the ETA during the Reagan presidency and a decrease in the price of fossil fuels. However, the Congress enacted a federal electricity production tax credit (PTC) in 1992 and, following a relatively stable level of wind energy consumption from 1989 to 1998, the expansion of wind generated energy contributed to a steady rise in total consumption and an overall increase of 5,090 percent from 1998 to 2013 (DOE 2015; Figure 5.3). The PTC has been renewed and expanded nine times on four occasions since 1992, with the most recent update introduced with the Consolidated Appropriations Act (2015) (Sherlock 2015). The PTC has been the wind industry's primary incentive from the federal government and, in addition to improvements in the cost and performance of wind power technology, has consistently supported continued expansion of wind-generated energy in the U.S. (DOE 2015).

Among the various sources of renewable energy, ethanol represents the only form that has primarily been used to power the transportation sector. The modern ethanol industry has roots in the 1970s when production of the biofuel increased in response to a series of federal policies that were designed to provide financial incentives and economic protection for the production of domestic ethanol resources (Figure 5.3; Sherlock 2011; Tyner 2008). While ethanol is known to be a cleaner burning fuel relative to petroleum-based gasoline, the primary goal of federal government-led efforts to expand the nation's supply of fuel-ethanol was to decrease the nation's vulnerability to oil shortages and improve the price of corn for producers who had been negatively impacted by agricultural subsidies, rather than address emissions related impacts (EIA 2015a; Schnepf 2003).<sup>46</sup> During this time, corn became the dominant domestic input for ethanol production, largely due to the abundance of the crop and the cost-effectiveness of the production process. In the 1980s, subsidies supported the continued production of ethanol from corn, supporting consumption despite a drop in the price of biofuels in response to a decrease in the price of crude oil and gasoline (Moschini, Cui and Lapan 2012). The Clean Air Act Amendments of 1990 established new rules to control carbon monoxide emissions from motor vehicles contributing to an increase in the demand for ethanol as an oxygenate and a steady rise in consumption continued throughout the 1990s (Clean

---

<sup>46</sup> The production of ethanol as a source of energy in the U.S. dates back to the mid 19<sup>th</sup> century, when the biofuel was used as primarily as an illuminating fuel, consumption by the transportation sector began in the early 20<sup>th</sup> century when the fuel was used by Henry Ford to power the Model T automobile. The first application of the biofuel as an octane-boosting agent occurred in the 1920s when the first ethanol blended gasoline was produced, however, widespread consumption of ethanol by the transportation sector during the 20<sup>th</sup> century was generally limited by competition from alternative fuel sources (EIA 2015a).

Air Act Amendments of 1990). The greatest increase in total consumption of ethanol, however, occurred following the adoption of the Energy Policy Act 2005, which established the National Renewable Fuel Standard (NRFS). The NRFS mandated the production of 4 billion gallons of biofuel in 2006 with an increase to 7.5 billion gallons by 2012, creating a reliable market for the production of ethanol for the transportation sector (Schnepf and Yacobucci 2013). The Energy Independence and Security Act of 2007 signed by President Bush expanded the NRFS, requiring renewable fuel usage to increase to 36 billion gallons annually by 2022 (Energy Independence and Security Act of 2007; USEPA 2016a; Schnepf and Yacobucci 2013).<sup>47</sup>

In terms of climate change mitigation, the notable benefit of replacing petroleum-based fuel with ethanol is a reduction in overall emissions achieved through the consumption of the cleaner burning, plant-based fuel. However, there are important aspects related to the life cycle of ethanol production that affect the overall advantage of ethanol-based fuels in terms of climate change mitigation. For example, the process of producing fuel from corn-based ethanol requires careful planning and land use management in order to provide a truly a renewable, carbon-neutral, source of energy (EIA 2015a; Rajagopal and Zilberman 2007). The corn production process alone is historically an energy-intensive endeavor that relies upon the combustion of fossil fuels and consumption of petroleum-based fertilizer and pesticides to power the

---

<sup>47</sup> The new NRFS which currently guides national ethanol policy states that only 15 billion gallons of production should be produced from corn grain (starch) —the remaining 22 billion should come from other advanced and cellulosic feedstock sources.

ethanol production, transport, and manufacturing process (Farrell et al. 2006; Giampietro, Ulgiati and Pimentel 1997; Lal 2005; Pimentel and Patzek 2005).

Research on the relative carbon footprint of fuels produced from biomass versus those produced from petroleum have reported conflicting results with respect to the overall advantage of ethanol production in terms of CO<sub>2</sub> emissions reduction, however, it has been argued that the production of corn-based ethanol can be made carbon-neutral by ensuring that soils and replanting practices are managed such that the emissions produced from ethanol consumption can be offset via sequestration by new and existing biomass (EIA 2015a; Gelfand et al. 2013; Rajagopal and Zilberman 2007; Searchinger et al. 2009).<sup>48</sup> Therefore, with respect to climate change mitigation, a sustainable path forward for ethanol production ought to focus on improvements in energy efficiency with respect to emissions produced during the manufacturing process and land use management with respect to the sequestration of emissions from ethanol combustion.

While modern renewable energy technologies have experienced rapid development since the late 1980s, the expansion of other forms of renewable energy, such as geothermal and hydropower, has generally been limited by factors related to cost-effectiveness, resource availability, and political feasibility (see Table 5.3). With respect to economic feasibility, geothermal and hydropower are two of the oldest forms of modern energy and, therefore, have undergone a relatively substantial history of technological development, limiting opportunities for cost-cutting

---

<sup>48</sup> A similar argument has been made with respect to the consumption of wood-based fuels (Nepal, Wear and Skog 2015).

innovations (Billington, Jackson and Melosi 2005; DOE 2016b; Brown et al. 2015). Consequently, in locations in which resources are available for exploitation, and are cost-competitive relative to other energy alternatives, development of generation facilities is likely to have already occurred or is expected to occur incrementally (EIA 2014c; Brown et al. 2015; Lopez et al. 2012).

**Table 5.3** Renewable energy consumption by source.

<b>Source</b>	<b>Consumption, 2013 (Billion Btu)</b>	<b>Percent of Total</b>	<b>Change 1988-2013</b>	<b>Percent Change</b>
Ethanol	1,797,894	19.66	1,673,839	1,349.27
Geothermal	213,987	2.34	107,648	101.23
Hydropower	2,562,380	28.01	223,574	9.56
Solar	304,902	3.33	304,808	324,263.83
Waste	496,433	5.43	181,107	57.43
Wind	1,601,356	17.51	1,601,346	16,013,460.00
Wood	2,169,519	23.72	-404,764	-15.72

Source: EIA 2015c.

In terms of resource availability, access to geothermal energy is limited to the proximate presence of magmatic systems, which are generally found in the western U.S. (Williams et al. 2008). Unlike conventional thermal power plants, which burn fuel to heat water and generate steam to drive turbines and produce electricity, conventional geothermal resources use heat or steam tapped from underground reservoirs of hot water to generate electricity. As opposed to other renewable sources of energy, such as water, wind, and solar, whose energy production capabilities are

reliant upon the adequate availability of water, sunlight, and wind, geothermal plants are capable of providing a reliable baseload source of power that is consistently available and generally uninfluenced by external factors related to environmental conditions.

Despite this unique advantage over other forms of renewable energy, the physical constraints associated with the availability of geothermal resources has limited development to areas in which favorable geologic conditions exist (EIA 2014c; Lopez et al. 2012). As of 2014, there were 64 operating conventional geothermal power plants in the U.S. As of 2013, California accounted for more than three-quarters of U.S. geothermal power generation, largely because of favorable geothermal resources, policy, and market conditions within the state (Blodgett 2014; EIA 2014c; Lopez et al. 2012; Williams et al. 2008). Since 2001, 30 new geothermal plants have been constructed in states throughout the western U.S., contributing to the 30 percent increase in geothermal consumption from 2001 to 2013. Seven of the 30 new plants exceeding 1 MW have been built in California, while 16 are located in Nevada, with the remaining plants located in Oregon, Idaho, Utah, and Hawaii (EIA 2014c).

In terms of climate change mitigation, renewable energy resources offer the primary solution to reducing emissions while maintaining a productive economy. However, each of the renewable energy options has the potential to produce negative externalities, which may not be associated with the issue of GHG emissions. For example, the development of solar energy has led to some concern regarding potential

negative impacts associated with various aspects of the life cycle of PV systems, including the environmental impacts associated with land and resource use and the disposal of potentially toxic materials at the end of the product's life (Tsoutsos, Frantzeskaki and Gekas 2005; Union of Concerned Scientists 2013). Hydropower, along with biomass, is one of the oldest sources of renewable energy within the U.S. During the 20<sup>th</sup> century, contention regarding the negative environmental impacts of large-scale hydropower projects has reduced the political feasibility of developing new facilities, constraining the expansion.

The first hydroelectric power plant opened on the Fox River near Appleton, Wisconsin, on September 30, 1882 and by the 1940s hydropower accounted for more than 40 percent of the U.S. electric power supply (Billington, Jackson and Melosi 2005). In the U.S., there are three types of facilities that are traditionally used to produce electricity: hydroelectric facilities that are incorporated into dammed reservoirs, "run-of-river" operations, and pumped storage plants. While the first two types of facilities strictly rely upon the gravitational force of water to produce electricity, pumped storage facilities rely upon the flow of water to produce energy, but also have the ability to use power from the grid to pump water into a reservoir, allowing for release and electricity generation at a later time. While pumped storage plants generally rely upon the consumption of low-cost off-peak electric power used to operate the pumps, the energy losses from the pumping process makes the plant a net consumer of energy overall and is therefore considered an unconventional source of hydroelectric energy. Facilities located in dams and within streams, however, are



classified as conventional sources. Conventional hydroelectric facilities are the primary source of energy from hydropower in the U.S. As of 2014, there were more than 1,400 conventional facilities, whereas there were only 41 pumped storage plants (EIA 2016a).

Many of the large dams within the U.S. have hydroelectric generators, although most were constructed to provide water supplies and flood control. Dams that create a reservoir or divert water to a “run-of-river” hydropower plant often impact the ecological and physical characteristics of a river system by obstructing fish migration, changing natural water temperatures, water chemistry, river flow characteristics, and silt loads (Bunn and Arthington 2002; Ligon, Dietrich and Trush 1995; Reisner 1993). Reservoirs may also have social impacts by covering important natural areas, agricultural land, or archeological sites, or forcing the relocation of a population (Tilt, Braun and He 2009). The debate regarding the economic benefits versus the social and environmental costs associated with large-scale dam construction ascended to the national stage during the 1950s with the proposed construction of a dam along the Utah-Colorado border that would inundate Echo Park, a scenic valley located within Dinosaur National Monument. The project, which was one component of the broader Colorado River Storage Project that began in the 1940s, ignited vocal opposition from local and regional groups with an interest in the conservation and preservation of the nation’s designated wilderness areas that led the political campaign against construction of the dam (Harvey 2000; Reisner 1993). For the first time, the American public began to question the metrics used by the U.S.

Bureau of Reclamation and the Army Corps of Engineers to balance the benefits of economic growth against the social and environmental costs of dam construction and the precedent that development in a national park would have for other locations designated for preservation. Following a series of national political battles, in 1956 President Dwight Eisenhower signed Public Law 485, which authorized the Colorado River Storage Project without the Echo Park dam (Harvey 2000; Nicholson-Crotty 2005; Tilt, Braun and He 2009; Colorado River Storage Project Act 1956).

Despite the recent emergence of modern renewable energy technologies fossil fuels have continued to play a dominant role as a source of energy for the U.S. economy. From 1990 to 2013 total energy consumption in the U.S. increased by 15 percent (12,638,038 billion Btu), of which fossil fuel consumption accounted for nearly 57 percent (7,199,441 bBtu), followed by renewable energy 25 percent (3,105,087 bBtu), and nuclear energy 17 percent (2,140,083 bBtu), with the remaining 1 percent acquired from imported electricity. As of 2013 fossil fuels accounted for 82 percent of total energy consumption, followed by energy consumed from renewable sources (9.4 percent), and nuclear energy (8.5 percent) (see Figure 5.2). From 2007 to 2013, total consumption of fossil fuels declined by 7 percent (6,401,222 billion Btu) while consumption of renewable energy, particularly solar, wind and geothermal, increased by 41 percent (2,660,481 bBtu). Although a portion of the decrease in fossil fuel energy consumption in recent years can perhaps be attributed to the direct substitution of fossil fuels with sources of renewable energy, the change in consumption is also a function of a decrease in economic productivity

as result of the Great Recession (2007-2009) as well as improvements in energy efficiency (Feng et al. 2015; Greening, Greene and Difiglo 2000; Hayes, Baum and Herndon 2013). For example, as of 2013 total petroleum consumption was below 1996 levels, a decrease of nearly 12 percent (4,828,551 billion Btu) from a 2005 peak in total consumption (Hughes et al. 2008; Office of the President 2015). The recent trend in national oil demand has largely been attributed to a reduction in consumption from the transportation sector as a consequence of an increase in the fuel economy of light-duty vehicles, in response to the federal CAFE standards, and a decrease in household vehicle miles travelled (VMT), in response to the Great Recession (Office of the President 2015).<sup>49</sup>

While the U.S. may be at the beginning stages of an energy transition away from long-term dependence on fossil fuels, recent growth in energy consumption has primarily been fostered by increased consumption of fossil fuels. An important distinction among the fossil fuels is the relative amount of CO<sub>2</sub> that is released from each source during the energy production process. Therefore, in the context of climate change mitigation, it is worthwhile to consider how the various types of fossil fuels, coal, natural gas, and petroleum, vary in terms of their relative climate change impacts.

### **Fossil Fuels and Emissions Intensity**

In terms of the relative effect of fossil fuel combustion concerning CO<sub>2</sub> emissions, the various fuel types (coal, petroleum, natural gas, and biomass) can be

---

<sup>49</sup> Light-duty vehicles, refers to vehicles that weigh less than 8,500 pounds.

ranked via a comparison of the carbon intensity of each individual source of energy (see Table 5.4). Carbon intensity refers to the amount of CO<sub>2</sub> produced from the combustion of a particular fuel in relation to the amount of energy that is produced. In terms of its carbon intensity, coal is the most inefficient source of energy among the fossil fuels with anthracite, the highest quality of coal, being the most carbon intensive of the coal varieties. The second-most carbon intensive fossil fuels are those derived from the refining of petroleum (e.g., diesel fuel, heating oil, and gasoline). These fuels are generally consumed by the transportation and industrial sectors, but are also common sources of electric power and residential and commercial energy consumption in some regions of the U.S. (discussed below). Finally, natural gas and propane, a derivative of natural gas, are the least carbon intensive of the fossil fuels. In recent years, an argument for an increase in the consumption of natural gas as a substitute for coal-fired energy has emerged, in part, because of the differences in carbon intensity between the two energy sources and the suitability for natural gas as a source of electric power (Krupnick, Wang and Wang 2013; Nalbandian 2015). With little exception, coal and natural gas are the two primary energy sources that are used to produce electricity, which is the largest source of CO<sub>2</sub> emissions among the economic sectors (discussed below). Therefore, natural gas has often been referred to as the “bridge fuel” that can serve as a substitute for coal-fired power plants, allowing the U.S. to transition away from more carbon intensive electricity and towards a low-carbon economy (Bryce 2011; Feng et al. 2015; Hayhoe et al. 2002; Nalbandian 2015; Ridley 2011).

**Table 5.4** Carbon intensity by fuel type.

<b>Fuel Type</b>	<b>lbs. of CO<sub>2</sub> per MBtu</b>
Coal (anthracite)	228.6
Coal (bituminous)	205.7
Coal (lignite)	215.4
Coal (subbituminous)	214.3
Diesel fuel and heating oil	161.3
Gasoline	157.2
Propane	139.0
Natural gas	117.0

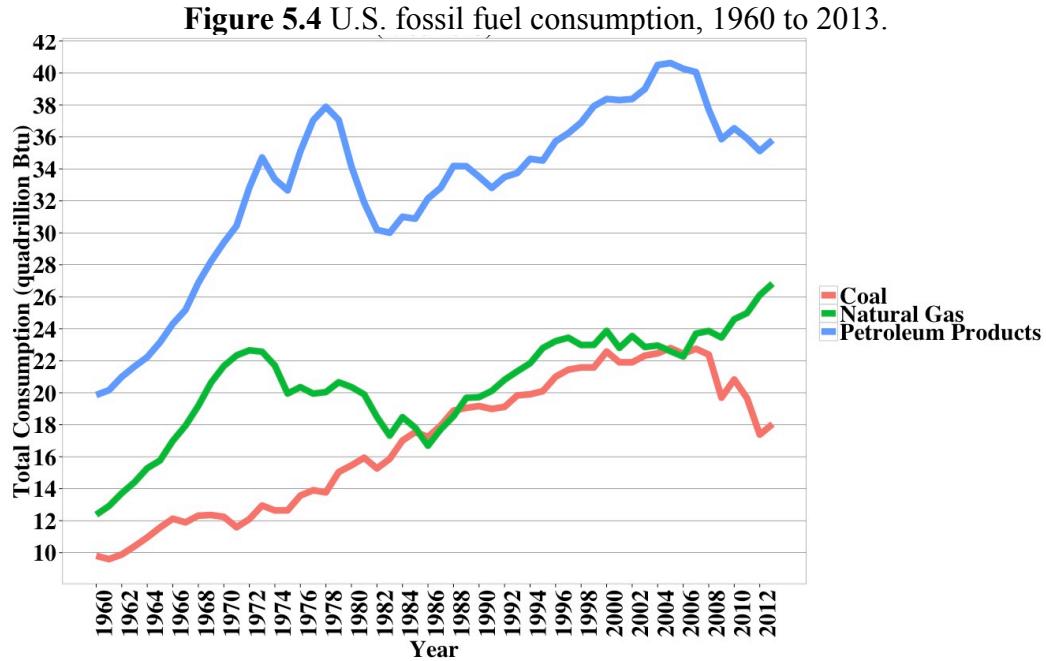
Source: EIA 2016.

As of 2013, coal accounted for nearly 19 percent of total energy consumption in the U.S. and 23 percent of total consumption from fossil fuels. As a cornerstone of the electric power sector, the fossil fuel accounted for 43 percent of total energy consumption by the nation's electric utilities (EIA 2015c). Despite the significant role of coal as a source of energy in the U.S., in recent years, demand for the fossil fuel has declined. From 2005 to 2013, total consumption experienced a nearly 21 percent reduction (4,756,129 bBtu), largely due to a decrease in demand resulting from the Great Recession, a decrease in the price of natural gas, and the introduction of new regulations, such as the EPA's Mercury and Air Toxics Standards (Mufson 2012; Roston and Migliozi 2015; EIA 2014a, 2014b, 2015b; See Figure 5.4). As of 2014, there were 491 coal power plants located in 48 states throughout the U.S., a 21 percent decrease from 10 years prior when there were more than 600 plants in operation. In contrast, from 2005 to 2013, total natural gas consumption has increased by nearly 19 percent (4,226,268 bBtu) (EIA 2016a; Figure 5.2).

Beginning in 2006, the production of shale gas using unconventional production methods such as hydraulic fracturing and horizontal drilling stimulated an

overall increase in natural gas consumption in the U.S. resulting in a decrease in the market price of the fossil fuel and, consequently, an increase in demand for natural gas as a source of energy (Krupnick, Wang and Wang 2013; Wang and Krupnick 2013). From 2004 to 2014, the number of power plants at which natural gas provides the primary energy source has increased by 4 percent (79 plants) in part as a result of the downward trend in the market price of the fossil fuel and in response to the increased costs of producing electricity from coal (EIA 2015b). As of 2013, the fossil fuel accounted for nearly 28 percent of total energy consumption and nearly 34 percent of total consumption from fossil fuels, the highest portion since 1971. Unlike coal, the demand for natural gas is relatively evenly distributed across the electric power, industrial, commercial, and residential sectors, accounting for 22 percent, 29 percent, and 19 percent of total consumption, respectively. The physical properties of natural gas coupled with the extensive transportation network of inter and intrastate pipelines have enabled the fossil fuel to become an important source of energy across all economic end-use sectors. The industrial sector accounted for 34 percent of total natural gas consumption, followed by the electric power (31 percent), residential (19 percent), commercial (13 percent), and transportation (3 percent) sectors. Thus, in the short-term, the ability for existing power plant facilities to transition away from coal to natural gas as a primary source of fuel in the energy production process can reduce the carbon intensity of electricity generation and contribute to a reduction in climate change impacts by reducing the magnitude of CO<sub>2</sub> emissions released from energy

production (Bryce 2011; Feng et al. 2015; Hayhoe et al. 2002; Krupnick, Wang and Wang 2013; Nalbandian 2015).



Despite the recent downward trend in petroleum consumption, the fossil fuel remains a critical source of energy for the U.S. economy, accounting for more than a third (36 percent) of total energy consumption and nearly half (44 percent) of total consumption from fossil fuels. Demand from the transportation sector accounted for 74 percent of total petroleum consumption, and the fossil fuel accounted for 96 percent of total energy consumption by this sector. Meanwhile, the industrial sector accounted for 24 percent of total petroleum consumption where the resource provides an important input for various agricultural and manufacturing activities. While policy action at the national and subnational level has no doubt contributed to the recent expansion of renewable energy consumption throughout the U.S., the nation’s long history of reliance on fossil fuels has proven to be a significant obstacle for a

complete transition of the energy economy. Some sources of renewable energy (e.g., hydropower, geothermal, onshore wind), under conditions of availability, are cost competitive with the production of energy from conventional facilities (Lazard 2015; World Energy Council 2013). However, the long-term presence of government subsidies for fossil fuel producers have distorted the energy market, impairing the competitiveness of some forms of renewable energy and providing an economic edge for energy supplied from fossil fuel combustion (Moomaw et al. 2011; Müller, Brown and Ölz 2011; U.S. Department of the Treasury 2016; Verbruggen et al. 2010). For example, tax code provisions that lower the cost of investing in oil, gas, and coal development projects, such as the expensing of intangible drilling costs, domestic manufacturing tax deductions for oil and gas, and percentage depletion for oil and gas wells, have supported fossil fuel development and investment within the U.S. for more than a century (Aldy 2014; U.S. Department of the Treasury 2016). Federal subsidies to support renewable energy development, such as the PTC, have contributed to growth in wind and solar energy infrastructure, these federal tax preferences have sunset dates, whereas federal fossil fuel tax provisions do not, which may affect long-term investment decisions in renewable energy development.

The economic barrier produced by fossil fuel subsidies contributes to a market failure, in which the true costs of fossil fuels are not internalized into the price of energy consumption. In terms of public policy, the goal of a subsidy is to increase the quantity supplied of a particular good or service to improve societal welfare by reducing the costs of production or consumption. In the context of energy



development, fossil fuel producers and the electric power sector have been the beneficiaries of various upstream tax breaks, direct government expenditures, and below market financial services designed to incentivize the exploration, development, and extraction of fossil fuel reserves and support the expansion of large thermal generation facilities since the early 20<sup>th</sup> century (Aldy 2013, 2014; Sherlock 2011; U.S. Department of the Treasury 2016). The rationale of such policies was to improve social welfare by ensuring the domestic production of relatively abundant sources of energy and to promote economic development through the stable provision of energy security. An important consequence of long-term government intervention to support the production and consumption of fossil fuels has been the development of a national electric power system designed to accommodate the consumption of fossil fuels, producing institutional barriers to renewable energy development (Moomaw et al. 2011).

The provision of fossil fuel energy inputs at below market rates has contributed to the rapid development of fossil fuel-based thermal generation facilities and electricity distribution infrastructure, exacerbating the national dependence on nonrenewable, carbon-intensive energy. To protect the American economy and to provide consumers with affordable electricity, in times of market volatility, electricity generators have also become the beneficiaries of government and private sector support via direct budgetary transfers to cover electricity sector losses, tax relief policies, and the provision of financial capital for the development of infrastructure (Moomaw et al. 2011; Pfund and Healey 2011; Sher 2011; Sherlock 2011; U.S.

Department of the Treasury 2016). Widespread capital investments, coupled with a history of financial security in the form of various government subsidies, have provided the conventional electric power sector with an incumbent advantage over renewable energy, as new large-scale solar and wind energy projects tend to be more decentralized and, in some cases, are located far from urban centers requiring the development of new infrastructure for distribution (Bridle and Kitson 2014; Müller, Brown and Ölz 2011). Therefore, existing energy infrastructure has often provided an initial economic advantage with respect to the short-term cost of energy production when considering the relative capital investment required to produce electricity from renewable sources. Furthermore, the history of federal support and investments in existing thermal generation facilities are likely to affect public and private sector investment opportunities for renewable energy infrastructure, which can be viewed as uncertain and risky by potential investors (Bridle and Kitson 2014).

A second consequence of the long history of financial support for energy produced from fossil fuels is the policy barrier that has been produced by the powerful and wealthy political constituency that has developed with the nation's conventional electricity sector. While federal subsidies to support the production of renewable energy infrastructure have increased in recent years, efforts to remove financial support for the production and consumption of fossil fuels, in light of an increasing awareness regarding the negative social costs of fossil fuel combustion, have failed (see Chapter 1). During his second term as President, Barack Obama made several attempts to remove a number of tax preferences that have subsidized the

fossil fuel industry in order to improve the cost competitiveness of less harmful renewable energy technology. However, the removal of federal tax preferences requires approval from Congress and, to date, such efforts have been unsuccessful (Aldy 2013; McGowan 2011).

The fossil fuel driven electric power sector is composed of various stakeholder groups with an interest in preserving all aspects of the energy production process. Interest groups composed of businesses involved in the production, transportation, and refinement of fossil fuels, as well as those employed by fossil fuel-based electricity generators, electricity grid operators, and developers all have a vested interest in protecting the status quo and, therefore, often organize powerful political opposition to efforts to remove existing fossil fuel subsidies and the implementation of support for renewable energy development (see Chapter 1). For example, small-scale residential and commercial rooftop solar energy may be able to overcome the physical and financial barriers to entry via federal tax credit programs and state-level net metering and feed-in-tariff policies. However, the fossil fuel industry and conventional electric utilities are often in opposition to the implementation of such programs, claiming that the loss of demand produced by customers who receive energy from distributed solar will reduce utility earnings, while operating costs remain (EIA 2013; Gunther 2013; Halper 2014; Sommer and Samuel 2016). Such arguments have, in some cases, produced powerful political arguments with respect to the adoption of policies to encourage decentralized

renewable energy development, allowing existing power plant facilities to maintain a competitive advantage.

### **State-level Emissions and Energy Consumption**

Thus far, the chapter has established the two most significant drivers of the climate change issue. Among the GHGs, CO<sub>2</sub> has historically accounted for the largest portion of total GWP produced within the U.S., which has consistently been a top contributor to global CO<sub>2</sub> emissions. The widespread consumption of fossil fuel energy has been the primary driver of CO<sub>2</sub> emissions, as coal, petroleum, and natural gas have become a primary source of energy across all major economic sectors since the Industrial Revolution. While renewable energy consumption has increased in recent decades, fossil fuels have benefitted from a number of incumbent advantages that have proven to be a significant obstacle for a rapid transition towards a low-carbon economy. A national-scale analysis of the prevailing emissions and energy consumption trends within the U.S. has provided a valuable lens for understanding the key drivers and primary challenges associated with addressing the issue of anthropogenic climate change. However, such a perspective fails to capture the diversity that exists among the states in terms of CO<sub>2</sub> emissions and primary energy consumption. Hence, the focus of the chapter now shifts to a state-level analysis of the two physical dimensions of climate change, beginning with an overview of CO<sub>2</sub> emissions.

## State-level Emissions

While the U.S. has consistently placed among the world's top producers of CO<sub>2</sub> emissions, each of the fifty states contribute to the national emissions total to varying degrees. As of 2013, the average per capita emissions of CO<sub>2</sub> among the states was 22.07 mt CO<sub>2</sub> Eq. per person (see Table 5.5).<sup>50</sup> New York reported the lowest per capita emissions with 8.15 mt CO<sub>2</sub> eq. per person, while Wyoming reported the largest, 117.74 mt CO<sub>2</sub> eq. per person. Among the various source of CO<sub>2</sub> emissions, coal accounted for the largest source of emissions overall, 8.89 mt CO<sub>2</sub> Eq. per person on average, followed by petroleum (8.14 mt CO<sub>2</sub> eq. per person), and natural gas (5.04 mt CO<sub>2</sub> eq. per person). However, in terms of the share of per capita emissions produced from each fuel type, the combustion of petroleum products accounted for the largest portion among the fifty states, accounting for an average of 44.31 percent of per capita emissions on average, followed by coal combustion (30 percent), and natural gas (25 percent). The fact that coal, on average, accounts for the largest amount of per capita emissions among the states, followed by emissions produced from the combustion of petroleum products and natural gas, respectively, is a reasonable result, considering the relative carbon intensity of each fuel type. Additionally, the finding that petroleum accounts for the largest share of total emissions among the states is not surprising given that much of the U.S. population

---

<sup>50</sup> Emissions and energy are offered in per capita terms to control for changes in energy consumption based upon changes in the state population.

generally relies upon the use of passenger vehicles as a primary source of transportation.

A notable observation with respect to per capita emissions and the portion of emissions produced from each of the three fuel types is the amount of variation that exists among the states, with respect to each. Per capita consumption of natural gas and petroleum, each exhibit a comparatively low amount of variation relative to emissions from coal, however, all three fuel types share a similar level of median per capita emissions, an indication that, in some states, per capita emissions from coal are relatively large, whereas per capita emissions from natural gas and petroleum are more evenly distributed among the states. In comparison, the states exhibit substantial variation with respect to the portion of total emissions produced from each fuel. The median portion across fuel types is more broadly distributed than those found with per capita emissions; an indication that the states rely upon each fossil fuel for energy to varying degrees.

**Table 5.5** State-level CO<sub>2</sub> emissions by fuel type, 2013.

	<b>Per Capita Emissions (mt per person)</b>				<b>Percent of Total</b>		
	<b>Total</b>	<b>Coal</b>	<b>Natural Gas</b>	<b>Petroleum</b>	<b>Coal</b>	<b>Natural Gas</b>	<b>Petroleum</b>
Average	22.07	8.89	5.04	8.14	30.22	25.47	44.31
Max	117.74	84.44	23.94	23.26	78.00	48.75	92.31
Min	8.15	0.00	0.00	4.26	0.00	0.00	13.30
Median	16.75	4.90	4.35	6.80	30.58	24.26	43.36
SD	18.86	14.36	3.94	4.18	21.25	10.89	16.63

Source: EIA 2015c; Census Bureau 2016.

Among the fuel types, emissions of CO<sub>2</sub> from coal combustion exhibited the largest variation, likely a result of the fuel's dominant role as a primary source of

energy for the electric power sector, which accounted for an average of 87 percent of total coal emissions among the states followed by the Industrial sector (11.48 percent), and commercial sector (1.29 percent) (see Table 5.7). While all but two states (Rhode Island and Vermont) have at least one coal-fired power plant, the magnitude of consumption of coal across the fifty states varies considerably (discussed below), and, therefore, the level of emissions from coal combustion by the electric power sector shows relatively large variation. In comparison, per capita emission from petroleum exhibited less variation among the states, and emissions were predominantly produced from the transportation sector, which accounted for an average 77.12 percent of total emissions from the fuel type and an average of nearly 97 percent of emissions from transportation activities (see Table 5.6). In contrast to coal and petroleum, the distribution of emissions from the combustion of natural gas was distributed relatively evenly across the electric power, industrial, commercial, and residential sectors in most states. Variation in state-level per capita emissions from natural gas was even less than petroleum, an indication of a general increase in demand for this fuel type across the states, relative to coal, and with the exception of the transportation sector, natural gas emissions represented a significant portion of total emissions from all economic sectors. In particular, the fossil fuel accounted for more than 70 percent of total emissions from the commercial and residential sectors.

**Table 5.6** Emissions by fuel type and sector, 2013.

		<b>Average</b>	<b>Max</b>	<b>Min</b>	<b>Median</b>	<b>SD</b>
<b>Distribution of Emissions by Fuel</b>						
Coal	Electric Power	87.23	100.00	0.00	94.34	20.35
	Transportation	0.00	0.00	0.00	0.00	0.00
	Industrial	11.48	100.00	0.00	5.20	19.33
	Commercial	1.29	57.14	0.00	0.00	8.24
	Residential	0.00	0.00	0.00	0.00	0.00
Natural Gas	Electric Power	27.53	84.39	0.00	27.43	20.37
	Transportation	3.85	20.99	0.00	2.49	4.34
	Industrial	32.27	78.41	4.70	30.08	17.91
	Commercial	15.66	50.00	2.08	15.91	8.38
	Residential	20.69	42.83	1.21	20.52	10.77
Petroleum	Electric Power	1.35	32.14	0.00	0.15	4.65
	Transportation	77.12	91.53	44.00	79.59	10.91
	Industrial	14.28	50.47	1.68	11.71	10.20
	Commercial	2.44	9.80	0.21	1.60	2.22
	Residential	4.81	23.08	0.10	2.55	6.19
<b>Percent of Emissions by Sector</b>						
Electric Power	Coal	65.56	100.00	0.00	80.22	32.85
	Natural Gas	31.46	100.00	0.00	18.98	31.56
	Petroleum	2.98	80.60	0.00	0.15	11.73
Transportation	Coal	0.00	0.00	0.00	0.00	0.00
	Natural Gas	3.01	15.89	0.00	2.10	3.25
	Petroleum	96.99	100.00	84.11	97.90	3.25
Industrial	Coal	16.12	56.00	0.00	12.53	15.67
	Natural Gas	47.51	80.00	0.00	47.87	16.26
	Petroleum	36.37	93.33	15.49	32.63	16.07
Commercial	Coal	1.73	33.33	0.00	0.00	5.07
	Natural Gas	75.79	92.86	0.00	82.92	19.06
	Petroleum	22.48	100.00	6.67	15.74	18.38
Residential	Coal	0.00	0.00	0.00	0.00	0.00
	Natural Gas	74.17	97.50	0.00	81.93	23.19
	Petroleum	25.83	100.00	2.50	18.07	23.19

Source: EIA 2015c



## State-level Energy Consumption

The amount and distribution of CO<sub>2</sub> emissions produced across the states exhibit considerable variation with respect to the type (coal, natural gas, or petroleum) and source (electric power, transportation, industrial, commercial, or residential) of emissions. The demand for fossil fuel energy, as well as the economic activity supported by energy produced from fossil fuel combustion, is the primary driver of state-level emissions. While at the national level, fossil fuels represent the primary source of energy for each of the five primary end-use sectors, at the state level, the amount and type of primary energy consumed to support economic activity is considerably diverse. To highlight the substantial variation among the states with respect to state-level energy, the discussion now turns to an investigation of state-level energy consumption. The purpose of the following analysis is to exhibit the wide range of state-level energy profiles that exist within the U.S. with respect to the amount of energy consumed and the source of primary energy. The section begins with an overview of primary energy consumption across nonrenewable and renewable resources, followed by a closer examination of state-level consumption across the various types of nonrenewable and renewable energy sources.

In 2013, average per capita consumption of energy was 384 MBtu per person (see Table 5.7). Rhode Island had the lowest per capita consumption of energy while Wyoming had the largest among the fifty states.<sup>51</sup> While a number of states rely upon renewable and nuclear energy for significant portions of total consumption, the states

---

<sup>51</sup> Rhode Island also had the lowest per capita consumption of renewable energy, 5.43 MBtu per person.

that reported the highest per capita consumption of renewable (151.16 MBtu per capita, South Dakota) and nuclear energy (118.72 MBtu per capita, South Carolina) were still lower than the state that had the lowest per capita consumption of fossil fuels (135.90 MBtu per person, New York) which remains the predominant source of energy throughout the U.S.

With respect to the share of total energy provided by each of the primary energy sources, fossil fuels accounted for the largest share of per capita consumption, on average contributing 80.41 percent of total consumption, followed by energy produced from renewable sources (11.75 percent) and nuclear power (7.83 percent). Fossil fuels accounted for more than 90 percent of total energy consumption in fifteen states and more than 95 percent in five states.<sup>52</sup> In all fifty states, fossil fuel consumption accounted for 50 percent or more of total energy consumption. Meanwhile, renewable energy accounted for a much smaller share, on average, with the exception of states such as Washington and Oregon in which renewable energy accounted for 43.28 percent and 42.73 percent of total consumption, respectively.<sup>53</sup> Among the three sources of primary energy, fossil fuels exhibited the greatest variation in both per capita and percent of total energy consumption. Variation among the states with respect to the share of total energy provided by each source was less pronounced than per capita consumption, indicating that while variation in total per

---

<sup>52</sup> States that received more than 90 percent of energy consumption from fossil fuels include: Oklahoma (90.05 percent), Missouri (90.33 percent), Ohio (90.94 percent), Colorado (91.38 percent), Louisiana, (91.56 percent), Texas (92.59 percent), Wyoming (93.88 percent), New Mexico (94.37 percent), Indiana (94.62 percent), West Virginia (94.86 percent), Kentucky (95.06 percent), Delaware (96.61 percent), Alaska (96.64 percent), Rhode Island (96.68 percent), Utah (97.32 percent).

<sup>53</sup> Vermont received 49 percent from fossil fuels.

capita consumption is rather significant, the portion of energy provided by each source is more evenly distributed across the states.

**Table 5.7** Energy consumption by primary energy source, 2013.

	Per Capita (MBtu per person)				Percent of Total		
	Total	Fossil Fuel	Renewable	Nuclear	Fossil Fuel	Renewable	Nuclear
<b>Average</b>	384.80	317.29	43.10	24.41	80.41	11.75	7.83
<b>Max</b>	1,532.70	1,439.22	151.16	118.72	97.34	43.28	33.16
<b>Min</b>	166.60	135.90	5.43	0.00	50.21	2.66	0.00
<b>Median</b>	311.53	249.57	25.27	14.85	81.23	8.49	4.65
<b>SD</b>	244.53	236.61	39.72	28.79	12.60	10.27	9.01

Source: EIA 2015c; Census Bureau 2016.

Nuclear energy ranked the lowest among the states in both per capita energy consumption and the overall share of energy consumed. The relatively less significant role of nuclear energy as a source of primary consumption among the states is generally a function of suitability and feasibility. As opposed to fossil fuels and various source of renewable energy, the energy production process for nuclear power requires large-scale facilities. Therefore, consumption of nuclear energy is limited to the electric power sector. In addition, as discussed above, the development of new nuclear power plants is typically highly scrutinized by the general public, and projects generally require significant upfront capital investments, thus limiting the economic and political feasibility of nuclear energy as a source of primary energy consumption. Among the 31 states with active nuclear reactors, per capita consumption of nuclear energy was 39.37 MBtu per person and accounted for an average of 12.63 percent of total energy consumption, and 29.29 percent of total consumption by the electric

power sector.<sup>54</sup> South Carolina received the largest portion of energy consumption from nuclear power. The state operates five nuclear reactors and is home to three nuclear power plants, which accounted for nearly 60 percent of the state's total electricity consumption. California had the lowest per capita consumption (nearly 5 MBtu per person) with 11 percent of the state's total electricity provided by nuclear energy. California's coastal location, which provides access to water for reactor cooling, contributed to the development of nuclear energy facilities within the state. However, the state's emerging renewable energy market, coupled with the high costs associated with nuclear power plant maintenance and upgrades to protect against seismic risks have contributed to a steady decline in electricity provided from nuclear energy (Hiltzik 2016). In June 2013, one of California's two remaining nuclear power plants, the San Onofre nuclear plant located south of Los Angeles, shut down due to equipment failure (Penn 2016). In June 2016, Pacific Gas and Electric, the owner of the state's last operating nuclear power plant facility located in Diablo Canyon, near San Luis Obispo, announced that the plant will shut down in 2025, following the expiration of the facility's operating license (EIA Hiltzik 2016).

In most states, fossil fuel consumption is predominantly distributed across the transportation and electric power sectors, which, on average, accounted for 35.10 percent and 31.40 percent of total fossil fuel consumption, respectively (see Table 5.8). The industrial sector accounted for an average of 18.96 percent of total fossil fuel consumption. However, the portion of total fossil fuel consumption by this sector

---

<sup>54</sup> In 2013, 31 states had active nuclear power plants.

was generally much larger in states where economic activity is closely linked to the consumption and production of fossil fuels (discussed below). In Louisiana and Texas, for example, the industrial sector accounted for 62.77 percent and 45.45 percent of fossil fuel consumption, respectively, primarily as a result of the large concentration of petrochemical manufacturing facilities located in these regions (Louisiana Department of Natural Resources 2016). Additionally, states such as Alaska and North Dakota, with a high reliance upon extractive industries such as oil production and mining, as well as states in which a significant portion of the economy is reliant upon agricultural production, tend to rank above the national average with respect to the share of fossil fuel consumption allocated to the industrial sector.<sup>55</sup>

---

<sup>55</sup> Alaska, 52.79 percent, North Dakota, 30.46 percent.

**Table 5.8** Consumption by primary energy source and sector, 2013.

		Average	Max	Min	Median	SD
<b>Distribution of Consumption by Sector</b>						
Fossil Fuel	Electric Power	31.40	65.47	0.10	33.45	13.88
	Transportation	35.10	56.21	13.60	32.28	10.60
	Industrial	18.96	62.77	6.02	17.51	11.48
	Commercial	5.85	14.79	0.96	5.43	3.15
	Residential	8.69	21.98	0.57	7.48	5.78
Renewable	Electric Power	45.78	92.34	0.18	40.42	24.42
	Transportation	15.10	53.27	1.91	12.92	11.25
	Industrial	23.80	73.93	0.58	16.03	21.63
	Commercial	2.26	11.27	0.29	1.83	1.97
	Residential	13.05	36.45	1.10	10.30	10.31
<b>Percent of Consumption by Sector</b>						
Electric Power	Fossil Fuel	63.99	98.86	0.08	66.24	24.85
	Renewable	16.46	81.14	0.03	7.58	20.60
	Nuclear	18.16	59.71	0.00	13.56	18.94
Transportation	Fossil Fuel	96.18	99.00	94.47	96.08	0.96
	Renewable	3.82	5.53	1.00	3.92	0.96
Industrial	Fossil Fuel	84.98	99.94	39.15	90.96	14.48
	Renewable	15.02	60.85	0.06	9.04	14.48
Commercial	Fossil Fuel	95.43	99.21	64.11	96.65	5.17
	Renewable	4.57	35.89	0.79	3.35	5.17
Residential	Fossil Fuel	83.59	97.87	13.18	88.49	15.90
	Renewable	16.41	86.82	2.13	11.51	15.90

Source: EIA 2015c; Census Bureau 2016.

With respect to renewable energy, the electric power sector accounted for the majority of consumption among the states, accounting for an average of 45.78 percent of total consumption followed by the industrial, transportation, residential, and commercial sectors. With the exception of the commercial sector, states generally exhibited greater variation with respect to the distribution of renewable energy

consumption across economic sectors, relative to fossil fuels. Perhaps this is an indication that some states have been more successful than others with respect to the incorporation of renewable energy consumption across the various economic sectors as well as a reflection of regional differences in terms of the availability and suitability of renewable energy sources as well as the economic structure of particular states (discussed below).

### **Fossil Fuels**

As discussed above, fossil fuel combustion is the primary driver of anthropogenic global climate change, however, not all fossil fuels are equivalent in terms of their relative warming effects. Among the states, fossil fuels continue to play a dominant role as a primary source of energy across economic sectors. However, the extent to which each fuel type is relied upon for various economic activities varies across regions. On average petroleum accounted for the largest per capita consumption in 2013 (127.43 MBtu per person) followed by natural gas (95.68 MBtu per person), and coal (94.18 MBtu per person). Similarly, in terms of the share of total fossil fuel consumption provided by each fuel, petroleum provided the largest portion, 45.59 percent on average, followed by natural gas (31.50 percent), and coal (22.91 percent) (see Table 5.9).

**Table 5.9** Fossil fuel consumption by fuel type, 2013.

	Per Capita (MBtu per person)			Percent of Total		
	Coal	Natural Gas	Petroleum	Coal	Natural Gas	Petroleum
Average	94.18	95.68	127.43	22.91	31.50	45.59
Max	893.66	452.93	370.72	69.25	56.40	92.85
Min	0.00	2.04	65.15	0.00	1.13	17.16
Median	52.01	81.70	105.75	21.59	31.78	45.07
SD	152.06	75.05	65.45	17.74	11.47	14.69

Source: EIA 2015c; Census Bureau 2016.

### Petroleum

Petroleum-based fuels play a critical role in the nation's transportation sector. Among the states, 75.16 percent of petroleum consumption was allocated to the transportation sector, where the fossil fuel accounted for 96.32 percent of total consumption (see Table 5.10). Variation, in terms of the transportation sector's fossil fuel portfolio is quite small, relative to the other economic sectors, an indication that the all states are generally reliant on petroleum products to provide energy for passenger, freight, and air transport. Per capita oil consumption from the transportation sector was the greatest in Alaska, primarily as a result of the state's role as a major fueling stop for military aircraft as well as commercial, and passenger air travel between the U.S. and Asian countries (Bradner 2012). Meanwhile, New York (which had the lowest overall per capita consumption of petroleum in 2013, 36.08 MBtu), Rhode Island, Connecticut, and Delaware are among the four states with the lowest per capita consumption (50.2, 53.7, and 61.6 MBtu per person, respectively) and are within the top ten most densely populated states in the nation. Given the role of petroleum as a key input for transportation, variation in state-level oil consumption can be explained by a number of factors related to travel such as the



relative density of a population, the price of fuel, and the availability of transportation alternatives. For instance, states that have densely populated urban areas and relatively abundant public transportation networks are likely to have less demand for petroleum consumption relative to more diffusely populated states in which VMT are greater and passenger vehicles serve as the primary mode of transportation. For example, Alaska, North Dakota, and Wyoming are among the four least densely populated states in the nation, and had the highest per capita petroleum consumption from the transportation sector in 2013 (233.8, 168.9 MBtu, and 168.2 MBtu per person, respectively) (Census Bureau 2015; EIA 2015c).

**Table 5.10** Fossil fuel consumption by fuel type and sector, 2013.

		Average	Max	Min	Median	SD
<b>Distribution of Consumption by Fuel</b>						
Coal	Electric Power	87.24	100.00	0.00	94.40	20.26
	Transportation	0.00	0.00	0.00	0.00	0.00
	Industrial	11.36	98.95	0.00	5.13	18.96
	Commercial	1.39	60.32	0.00	0.00	8.69
	Residential	0.00	0.00	0.00	0.00	0.00
Natural Gas	Electric Power	26.93	84.36	0.00	25.39	20.51
	Transportation	3.77	21.06	0.03	2.46	4.18
	Industrial	31.97	78.13	4.84	30.02	17.96
	Commercial	16.64	65.87	1.96	16.09	10.85
	Residential	20.69	42.82	1.25	20.47	10.72
Petroleum	Electric Power	1.14	29.63	0.00	0.22	4.20
	Transportation	75.16	91.18	36.08	77.83	11.47
	Industrial	16.88	60.77	3.55	15.32	11.74
	Commercial	2.30	9.58	0.21	1.50	2.07
	Residential	4.53	21.15	0.11	2.57	5.66
<b>Percent of Consumption by Sector</b>						
Electric Power	Coal	57.46	99.81	0.00	68.01	34.50
	Natural Gas	38.74	100.00	0.00	29.66	32.75
	Petroleum	3.80	83.37	0.00	0.29	13.68
Transportation	Coal	0.00	0.00	0.00	0.00	0.00
	Natural Gas	3.68	18.73	0.00	2.55	3.88
	Petroleum	96.32	100.00	81.27	97.45	3.88
Industrial	Coal	10.29	41.11	0.00	7.26	10.48
	Natural Gas	50.34	83.47	1.78	51.89	15.86
	Petroleum	39.37	92.03	16.52	34.98	15.59
Commercial	Coal	1.27	25.08	0.00	0.00	3.74
	Natural Gas	80.15	93.80	32.72	85.90	15.51
	Petroleum	18.58	67.28	5.01	13.56	14.88
Residential	Coal	0.00	0.00	0.00	0.00	0.00
	Natural Gas	77.95	97.07	5.71	85.05	20.41
	Petroleum	22.05	94.29	2.93	14.95	20.41

Source: EIA 2015c; Census Bureau 2016.

In addition to the consumption of petroleum to provide energy for the transportation sector, a number of states also rely upon petroleum to fuel industrial activity. The industrial sector accounted for the second largest portion of petroleum consumption, 16.88 percent, and states in which industrial activity remains an

important component of economic activity related to petroleum consumption generally reported the highest per capita consumption of the fossil fuel. Louisiana, Alaska, North Dakota, Wyoming, and Texas reported the highest overall per capita consumption of petroleum. The high level of per capita petroleum consumption in Louisiana and Texas is primarily a result of the large concentration of petrochemical manufacturing facilities located in these states, in addition to the historical role of oil production within these regions (Cahn et al. 2016; EIA 2016e, 2016d; Louisiana Department of Natural Resources 2016). North Dakota and Wyoming are states with extensive extractive industries such as oil production and mining, and, therefore, the fossil fuel provides an abundant and cost-effective source of energy. Alaska, in addition to its role as a fuel source for air travel, is widely known for oil production activity (Cahn et al. 2016; EIA 2016d). Petroleum consumption also tends to be above the national average in terms of per capita petroleum consumption from the industrial sector in states where a significant portion of the economy is reliant upon agricultural production.

While only a small portion of petroleum consumption was used to produce energy for the electric power, commercial, and residential sectors, in some regions, petroleum provides an important input for the generation of heat and electricity. Hawaii, for example, is the only state that depends upon petroleum as a primary source of energy for the electric power sector. In 2013, petroleum accounted for 70 percent of the state's total electricity production and the electric power sector accounted for 30 percent of the state's total petroleum consumption. As an island

state, Hawaii became reliant upon the importation of fossil fuel resources to support economic development, and due to its relative accessibility petroleum imports from Alaska and California, became the primary energy source for the state's electric power sector. Similarly, the northeastern region of the U.S. accounts for nearly 80 percent of the households in the U.S. that rely upon petroleum as a source of residential and commercial energy consumption for heating (DOE 2016a). In Maine, Vermont, New Hampshire, Connecticut, Rhode Island, Massachusetts, and New York, combined consumption of petroleum by the residential and commercial sectors accounts for the second largest portion of total consumption behind transportation. In 2000, the Northeast Home Heating Oil Reserve (NEHHOR) was created under the direction of President Bill Clinton in order to protect homes in the northeast that are reliant on petroleum for home heating from supply disruptions, particularly during the winter months (DOE 2016a; Energy Policy and Conservation Act 2000). The NEHHOR is overseen by the U.S. Department of Energy. As directed by the Energy Policy and Conservation Act, it maintains a one million barrel supply of ultra-low sulfur distillate (diesel) in reserve, and it provides protection for homes and businesses in the northeastern U.S. should a disruption in supplies occur (DOE 2016a).

### Natural Gas

Among the states, natural gas has provided more than 50 percent of total energy from fossil fuels in Alaska (56.40 percent) and Rhode Island (52.26 percent), and also plays a substantial role in New York and Nevada, which rely upon natural

gas for 49 percent of all energy consumed. Alaska has the highest per capita consumption of natural gas, 452.93 MBtu per person, followed by Louisiana (324.53 MBtu per person), and Wyoming (268.06 MBtu per person). Hawaii has the lowest per capita consumption (0.133 MBtu per person) followed by Vermont (15.5 MBtu per person) and Maryland (35.3 MBtu per person).

The physical properties of natural gas, coupled with the extensive transportation network of inter and intrastate pipelines, and the recent expansion of domestic supplies, have enabled the fossil fuel to become an important source of energy across the all end-use sectors. Demand for natural gas is perhaps the most diverse of the three fuel types and, unlike petroleum and coal, is relatively evenly distributed across the electric power, industrial, commercial, and residential sectors which, on average, accounted for 26.93 percent, 31.97 percent, 20.69 percent, and 16.64 percent of consumption, respectively. As indicated by the distribution of natural gas consumption across the economy, with the exception of the transportation sector, the fossil fuel generally provided a substantial portion of energy from fossil fuel consumption. Natural gas is particularly significant to the commercial and residential sectors where the fuel accounted for 80.15 percent and 77.95 percent of total consumption from fossil fuels, respectively. These sectors generally rely upon the fossil fuel as a source of energy for space heating and cooking, a function that can also be provided via the combustion of petroleum products generally excluding coal.

Natural gas also provides an important source of energy for the industrial and electric power sectors, accounting for 50.34 percent and 38.74 percent of total

consumption, respectively. Recent declines in the price of natural gas as a result of the increase in domestic supplies has contributed to the role of natural gas as a source of energy for the industrial sector, where the fossil fuel is used for a number of purposes that include firing boilers for steam needs, direct heating for melting, baking, or drying commodities, such as in steel, paper, glass, and food, and operating combined heat and power facilities, which provide both heat and local electricity to run a factory. In the electric power sector, the decline in natural gas prices has also contributed to an increase in the overall demand for the fossil fuel as a source of electricity. From 2004 to 2014, the number of power plants at which natural gas provides the primary energy source has increased by 4 percent (79 plants). In general, natural gas and coal are the two primary sources of fossil fuel energy for the electric power sector. States in which the portion of electric power provided from natural gas is high, there also tends to be a low portion provided from coal, and vice versa.

### Coal

In 2013, the electric power sector accounted for 87.24 percent of total coal consumption, while the industrial and commercial sectors, accounted for an average of 11.36 percent and 1.39 percent of total consumption, respectively. Per capita coal consumption, and the portion of fossil fuel energy consumption from coal, was the greatest in West Virginia (415.89 MBtu per person, 69.25 percent), Wyoming (893.66 MBtu per person, 62.09 percent), North Dakota (543.54 MBtu per person, 55.89

percent), and Kentucky (209.13 MBtu per person, 52.58 percent).<sup>56</sup> Only two states, Rhode Island and Vermont, reported no coal consumption in 2013, while California experienced the lowest per capita consumption among the states, 0.995 MBtu per person. (see Table 5.9). As with the consumption of coal by the electric power sector, the amount of fossil fuel energy provided from coal for the industrial sector tended to increase in regions where coal extraction activities are commonplace. As discussed above, the recent trends in the price of natural gas has contributed to an increase in consumption of natural gas overall. However, in regions where coal has historically played an important economic role, the price competitiveness of natural gas may be less pronounced, thus limiting the substitution of coal with natural gas. Nonetheless, overall, the economic competitiveness of coal consumption, particularly as a source of electricity, has waned in recent years, contributing to the recent downward trend in demand for the fossil fuel. As of 2014, there were 491 coal power plants located in 48 states throughout the U.S., a 21 percent decrease from ten years prior when there were more than 600 plants in operation.

### **Renewable Energy**

Although fossil fuels remain an important source of energy across the states, in some regions, renewable resources account for a sizeable portion of total energy consumption. On average, the electric power sector accounts for the largest share of overall consumption from renewable resources among the states (see Table 5.11), however, there are seven general types of renewable energy and each has contributed

---

<sup>56</sup> West Virginia, Wyoming, and Kentucky are the nation's top three coal producing states (EIA 2016f).

to overall consumption from renewable resources across the five end-use sectors to varying degrees. In 2013, renewable energy consumption, on average, accounted for just over 10 percent of total energy consumption among the states. Among the various types of renewable energy, hydropower accounted for the largest per capita consumption across the states, with an average of 12.85 MBtu per person, followed by consumption of wood (9.45 MBtu per person), and wind (9.19 MBtu per person). Geothermal accounted for the lowest per capita consumption from renewable sources, accounting for 0.62 MBtu per person, preceded by solar energy, which accounted for an average of 0.75 MBtu per person (see Table 5.11).

**Table 5.11** Renewable energy consumption by source, 2013.

<b>Per Capita (MBtu per person)</b>							
	<b>Ethanol</b>	<b>Geothermal</b>	<b>Hydropower</b>	<b>Solar</b>	<b>Waste</b>	<b>Wind</b>	<b>Wood</b>
Average	8.76	0.62	12.85	0.75	1.48	9.19	9.45
Max	69.51	9.68	106.96	6.60	5.48	72.79	80.49
Min	2.14	0.01	0.00	0.01	0.00	0.00	0.32
Median	4.08	0.19	3.42	0.14	1.09	2.55	4.41
SD	14.89	1.45	23.22	1.38	1.23	16.42	13.09
<b>Percent of Total</b>							
	<b>Ethanol</b>	<b>Geothermal</b>	<b>Hydropower</b>	<b>Solar</b>	<b>Waste</b>	<b>Wind</b>	<b>Wood</b>
Average	22.80	2.36	21.19	4.09	6.44	16.49	26.64
Max	75.28	35.73	79.92	32.38	29.24	77.66	77.01
Min	1.95	0.01	0.00	0.01	0.00	0.00	0.73
Median	19.17	0.73	12.34	0.68	3.61	7.81	22.51
SD	16.27	5.73	21.98	7.67	7.16	20.88	21.54

Source: EIA 2015c; Census Bureau 2016.

### Hydropower

In 2013, hydropower accounted for 6.7 percent of total energy consumption by the electric power sector in the U.S., and 21.19 percent of total consumption from



all renewable energy sources. Electric utilities (the electric power sector) are the primary consumers of hydroelectric power accounting for 96.66 percent of total hydropower consumption. However, independent producers from the industrial and commercial sectors also exist, accounting for 3.27 percent and 0.06 percent of total hydropower consumption on average (see Table 5.12). For example, in Hawaii and West Virginia, the industrial sector accounts for more than 50 percent and 30 percent of hydroelectric energy consumption, respectively. Among the states, Washington had the highest per capita consumption (106.96 MBtu per person) in 2013, followed by Montana (90.59 MBtu per person) and Oregon (80.35 MBtu per person). Among renewable energy sources used to produce electricity, hydropower provided an average of 41.62 percent of total energy consumption by the electric power sector in 2013 and only two states, Mississippi and Delaware, received no energy from hydropower. More than half of total electric power consumption in Washington, Idaho, and Oregon was produced from hydropower, 71 percent, 61 percent, and 59 percent, respectively, while Washington (745,678 billion Btu), New York (315,785 billion Btu), and Oregon (238,270 billion Btu), had the highest total consumption of hydropower among the states and, together, accounted for more than half of total U.S. hydroelectric energy demand. Eighteen states received more than 50 percent of total renewable electricity from hydropower, six of which received more than 90 percent of their renewable electricity from hydropower.<sup>57</sup>

---

<sup>57</sup> Tennessee, 98.67; Alabama, 96.78; Kentucky, 96.21; Arkansas, 94.83; Washington, 90.92; Alaska, 90.81.

**Table 5.12** Renewable energy consumption by source and sector, 2013.

		Average	Max	Min	Median	SD
<b>Distribution of Consumption by Sector</b>						
Ethanol	Transportation	78.24	99.10	5.28	96.25	29.22
	Industrial	21.55	94.70	0.83	3.05	29.24
	Commercial	0.22	3.51	0.01	0.09	0.51
Geothermal	Electric Power	8.95	99.70	0.00	0.00	26.44
	Industrial	6.28	71.59	0.00	0.00	15.67
	Commercial	23.61	93.95	0.00	15.37	27.00
	Residential	61.16	100.00	0.00	66.33	36.75
Hydropower	Electric Power	96.66	100.00	43.51	100.00	10.17
	Industrial	3.27	56.49	0.00	0.00	10.19
	Commercial	0.06	1.48	0.00	0.00	0.24
Solar	Electric Power	12.70	72.28	0.00	1.52	19.09
	Industrial	0.04	1.67	0.00	0.00	0.24
	Commercial	0.52	8.50	0.00	0.00	1.42
	Residential	86.74	100.00	27.72	98.48	19.82
Waste	Electric Power	49.37	99.53	0.00	54.88	33.19
	Industrial	42.88	100.00	0.47	31.83	34.03
	Commercial	7.75	86.73	0.00	0.00	15.54
Wind	Electric Power	97.16	100.00	0.00	100.00	16.01
	Industrial	0.07	2.56	0.00	0.00	0.41
	Commercial	2.77	100.00	0.00	0.00	16.02
Wood	Electric Power	6.69	61.02	0.00	0.00	12.50
	Industrial	34.59	96.73	0.20	21.99	33.01
	Commercial	6.35	11.27	0.35	6.88	3.77
	Residential	52.37	89.23	2.93	54.72	31.01

Source: EIA 2015c; Census Bureau 2016.

**Table 5.12 Continued.** Renewable energy consumption by source and sector, 2013.

		Average	Max	Min	Median	SD
<b>Percent of Consumption by Sector</b>						
Electric Power	Geothermal	2.31	42.11	0.00	0.00	8.24
	Hydropower	41.62	98.67	0.00	36.66	33.09
	Solar	2.87	40.06	0.00	0.01	7.36
	Waste	15.72	97.56	0.00	3.98	25.83
	Wind	31.44	98.91	0.00	15.11	33.93
	Wood	6.04	48.49	0.00	0.01	11.38
Transportation	Ethanol	100	100	100	100	0
Industrial	Ethanol	32.12	99.63	0.11	15.11	35.81
	Geothermal	4.07	68.65	0.00	0.00	13.64
	Hydropower	2.73	89.75	0.00	0.00	12.88
	Solar	0.10	4.13	0.00	0.00	0.59
	Waste	13.16	89.42	0.25	5.87	18.24
	Wind	0.02	0.55	0.00	0.00	0.09
	Wood	47.80	98.92	0.11	57.59	36.62
Commercial	Ethanol	2.32	26.11	0.12	0.94	4.23
	Geothermal	19.93	86.24	0.00	9.47	25.45
	Hydropower	0.36	6.35	0.00	0.00	1.20
	Solar	1.94	27.93	0.00	0.00	5.72
	Waste	16.59	98.23	0.00	0.02	24.36
	Wind	0.82	19.37	0.00	0.00	3.09
	Wood	58.04	99.85	1.46	58.07	28.43
Residential	Geothermal	6.38	49.67	0.00	3.57	8.68
	Solar	15.64	95.85	0.35	5.23	22.88
	Wood	77.98	99.26	4.15	85.03	22.90

Source: EIA 2015c; Census Bureau 2016.

Solar

As of 2013, solar energy accounted for less than 1 percent of total per capita energy consumption and 4.09 percent of total consumption from renewable sources.

Despite the small portion of total consumption provided from solar power, the source

of energy is the second fastest growing in the nation with a 392 percent increase in total consumption from 2003 to 2013. The majority of solar energy consumption, 86.74 percent, was produced by small-scale (less than 1 megawatt) residential systems where solar accounted for an average of 15.64 percent of total consumption from renewables; meanwhile utility-scale facilities accounted for 12.70 percent of total solar consumption, on average, among the states. Many states are laggards in terms of constructing utility-scale solar power plants for the generation of electricity. In 2013, every state reported consumption of solar energy from small-scale generation facilities, while only 27 states reported solar energy produced by the electric power sector. California and Florida are the nation's top states with regard to total consumption and, together, accounted for 51 percent of the nation's total consumption in 2013, Hawaii (6.60 MBtu per person), Arizona (5.33 MBtu per person), and Nevada (3.80 MBtu per person) lead the nation in terms of per capita consumption of solar energy.

### Wind

Wind power accounted for 2.39 percent of total energy consumption in the U.S. and 16.49 percent of total consumption from renewable energy. In general, wind energy is primarily consumed by the electric power sector, which accounted for 97.16 percent of total wind energy consumption, where the renewable source accounted for an average of 31.44 percent among renewable consumption, with the remaining portion produced in the commercial and industrial sectors. Wind energy accounted for more than 10 percent of total energy consumed by the electric power sector in nine

states, with Iowa and South Dakota each consuming more than 25 percent of in-state electricity generation from wind power. Texas, Iowa, California, and Oklahoma were the nation's top wind energy consumers, accounting for 45 percent of total U.S. consumption, while, North Dakota, Wyoming, and Iowa reported the highest per capita consumption, 72.79 MBtu per person, 72.59 MBtu per person, and 48.06 MBtu per person, respectively. With respect to regional distribution, four of the top five states in terms of per capita consumption were located in the Midwest, which accounted for 38 percent of total wind consumption. Southern states accounted for 29 percent of total consumption from wind, followed by states located in the west, 28 percent, and the northeast, 5 percent.

### Geothermal

As of 2013, per capita consumption of geothermal energy accounted for less than 1 percent of total energy consumption in the U.S. Given the rapid increase in consumption from solar and wind, the proportion of renewable energy provided by geothermal energy has decreased from a high of 3 percent in 2001 to 2.36 percent in 2013. The residential sector accounts for 61.15 percent of total geothermal consumption followed by the commercial sector, 23.61 percent, the electric power sector, 8.95 percent, and the industrial sector, 6.28. While geothermal consumption from the electric power sector accounted for less than 1 percent of the national total, Nevada, California, and Hawaii received 9 percent, 7 percent and 3 percent of total electric power sector consumption from geothermal energy. All fifty states reported some amount of geothermal energy consumption, although only six states, California,

Hawaii, Idaho, Nevada, Oregon, and Utah reported consumption from utility-scale facilities. California leads the nation in terms of total geothermal energy consumption (119,556 billion Btu) followed by Nevada (27,022 billion Btu), which consumes only 22 percent of California's consumption, and Florida (10,056 billion Btu). Nevada led the nation in per capita consumption, 9.68 MBtu per person, followed by California (3.12 MBtu per person), South Dakota (2.21 MBtu per person), and Hawaii (1.87 MBtu per person). From 2007 to 2013 Nevada's per capita consumption has increased by 84 percent, primarily as a result of the construction of the state's 16 new geothermal facilities which now provide 42.11 percent of the state's total renewable energy consumption from the electric power sector.

#### Ethanol

As of 2013, ethanol accounted for 2.28 percent of total per capita energy consumption and an average of 22.80 percent of consumption from renewable energy sources. From 2005 to 2013, total consumption of ethanol has increased by 225 percent. The transportation sector accounted for 78.24 percent of total ethanol consumption. In Rhode Island and Delaware, consumption of ethanol accounted for more than half of each state's total renewable energy consumption, while in New Jersey, Utah, and Maryland, ethanol consumption accounted for more than 30 percent of total renewable consumption. California, Texas, and Florida each reported the highest consumption of fuel ethanol in 2013, 124,077 billion Btu, 95,589 billion Btu, and 65,448 billion Btu, respectively; North Dakota experienced the highest per capita consumption of fuel ethanol (5 MBtu per person) followed by Minnesota (4.7 MBtu

per person), and Mississippi (4.6 MBtu per person). Hawaii (2.1 MBtu per person) reported the lowest per capita consumption of ethanol, followed by New York (2.2 MBtu per person), and Alaska (2.4 MBtu per person).

### Wood and Waste

Prior to 1885, when coal became the king of U.S energy, wood served as the primary source of fuel for the national economy. Despite the emergence of nonrenewable resources during the 19<sup>th</sup> century and, more recently, the expansion of renewable sources such as wind and solar, the combustion of wood has remained a steady and important source of energy for the U.S. economy.<sup>58</sup> As of 2013, per capita consumption of wood accounted for 2.46 percent of total consumption and 26.64 percent of total consumption from renewable resources. Wood used for energy generation is obtained directly from forests (e.g., residues from timber harvesting operations, and forest-derived biomass from removal or thinning of trees), indirectly from primary and secondary wood product manufacturing (e.g., chips, briquettes, mill residues, pellets), or recovered post-consumption (e.g., urban residues from demolition, packaging materials) (Goerndt, Aguilar, Skog 2013b; Malmshheimer et al. 2008). As of 2011, indirect sources supplied 78.9 percent, direct sources 19.3 percent, and recovered sources 1.8 percent of all wood energy consumed in the U.S. (Aguilar 2015; Goerndt, Aguilar, Skog 2013b). Energy from woody biomass is generally produced through the process of direct firing or co-firing (e.g., burning wood with coal to generate electricity), transformation of the resource to liquid biofuels, or

---

<sup>58</sup> Sources of wood energy include raw firewood, processed charcoals, pellets, briquettes, residual fibers and black pulping liquors.

gasification (Basu P. 2013; Goerndt, Aguilar, Skog 2013a, 2013b; Hamelinck, van Hooijdonk & Faaij 2005; Kumabe et al. 2007; Ran and Li 2012).<sup>59</sup> Consumption of woody biomass via direct firing is common in the residential sector, where firewood and pellets are consumed via direct firing for home heating. In the industrial sector, forest- and wood-based producers (e.g., paper and pulp manufacturers) can take advantage of the availability of wood-waste and wood by-products by burning the material to generate electricity or heat, supporting internal production (Aguilar et al. 2012; Aguilar 2014).

The demand for wood as a source of energy is predominantly located in the residential and industrial sectors, which accounted for 52.37 percent and 34.59 percent of total consumption, respectively. Consumption of wood by the electric power and commercial sectors to generate electricity, via co-firing, or through combined heat and power, has also been an important end-use, particularly during periods of fossil fuel shortages and more recently as a low-cost alternative to meet renewable portfolio standards in various states (Aguilar et al. 2012; Goerndt, Aguilar, Skog 2013a). As of 2013, 89 coal-fired power plants in the U.S. had been modified to include the consumption of biomass via co-firing, an increase of 345 percent (69 power plants) from 2004 (EIA 2016a). Among the renewable resources, wood is generally the most ubiquitous source of energy. Wood consumption accounted for more than half of renewable energy consumption by the residential and commercial

---

<sup>59</sup> In the U.S., the production of energy from wood via direct firing and co-firing requires relatively minor modifications to the resource, and therefore, is generally a more cost-effective source of fuel (EERE 2004).



sectors, 77.98 percent and 58.04 percent, respectively, and a significant portion of consumption by the industrial sector, 47.80 percent. While the wood consumption only accounted for 6.01 percent of renewable energy demand from the electric power sector, 25 states relied upon wood for some consumption from the electric power sector, with Maine, Vermont, New Hampshire, and California receiving the highest portions of energy consumption from wood resources, 24 percent, 9 percent, 6 percent, and 3 percent, respectively. Among the states, Alabama had the highest total consumption (170,810 billion Btu), followed by Georgia (167,492 billion Btu), Florida (123,868 billion Btu), and California (121,297 billion Btu). Maine reported the highest per capita consumption of energy derived from the combustion of wood, 80.49 MBtu per person, where the renewable resource accounted for 26 percent of the state's total energy consumption and 66.26 percent of consumption from renewable sources. In contrast, Arizona (0.8 MBtu per person), Utah (0.5 MBtu per person), Hawaii (0.3 MBtu per person) each reported the lowest per capita consumption of wood-based energy.

Various forms of waste have also provided a nontrivial source of renewable energy for each of the four economic end-use sectors.<sup>60</sup> The first waste-to-energy facility in the U.S. was constructed in 1885 on Governors Island in New York. Prior to concern regarding the environmental impacts of municipal waste incineration, management of waste materials through combustion was a pragmatic method of

---

<sup>60</sup> Energy recovery from waste generally includes the conversion of non-recyclable waste materials into heat, electricity, or fuel via combustion, gasification, pyrolyzation, anaerobic digestion, or landfill gas recovery.

addressing the issue of waste disposal (USEPA 2016b). Hundreds of waste incinerators were made operational by mid-20<sup>th</sup> century. However, with the passage of the Clean Air Act of 1970, existing facilities were subjected to new standards regarding the type of waste that could be burned and the emissions of particulate matter that resulted from the incineration process and facilities that did not adopt the technological requirements to meet the new standards closed. An additional wave of regulation during the 1990s, this time to regulate the emissions of mercury and dioxin from waste burning required the adoption of Maximum achievable Control Technology, leading to the closure of more facilities that did not install the Maximum Achievable Control Technology required by the new regulations (USEPA 2016b).

While the magnitude of emissions produced from waste-to-energy facilities has decreased, relative to those that operated throughout the 20<sup>th</sup> century, the production of energy from waste material requires combustion. Therefore, the process is considered to be net-negative with respect to CO<sub>2</sub> emissions. However, waste-to-energy facilities can result in a reduction of total emissions by reducing the demand for energy produced from fossil fuels. As of 2014, there were more than 80 waste-to-energy plants distributed across 25 states (USEPA 2016c). Per capita consumption of waste accounts for less than 1 percent of total consumption and 6.44 percent of total consumption from renewables. Waste consumption is largely used by the electric power sector, which accounted for nearly 50 percent of consumption in 2013, followed by industrial and commercial sector consumption, 42.88 percent and 7.75 percent, respectively. Florida, Pennsylvania, and California reported the highest total

consumption with 64,945 billion Btu, 40,574 billion Btu, and 40,406 billion Btu, respectively. The highest per capita consumption was reported by Hawaii (5.48 MBtu per person, followed by Iowa (3.92 MBtu per person) and New Hampshire (3.61 MBtu per person). Waste consumption accounted for more than 10 percent of total consumption from renewables in 10 states, with Connecticut and Hawaii receiving more than 25 percent of their total renewable consumption from waste, 27 percent and 29 percent, respectively. On average, waste accounted for 13 to 16 percent of total consumption from renewable sources across the industrial, commercial, and electric power sectors. Each state received a portion of energy consumption in the industrial sector, while the commercial sector in 25 states consumed waste energy, and 45 states consumed waste in the electric power sector. In Hawaii and New Hampshire, waste accounted for more than 5 percent of total energy consumption from industry, while the electric power sector in Massachusetts received more than 6 percent of its energy from waste, and Hawaii's commercial sector received 8 percent of total consumption from waste.

### **Conclusion**

Effectively addressing the issue of anthropogenic climate change will require a global effort to reduce GHG emissions. As one of the largest national producers of such emissions, the U.S. is among the greatest contributors to the proliferation of the human-enhanced greenhouse effect. At the national level, a number of GHGs are emitted as a result of various economic activities. However, CO<sub>2</sub> emissions have historically been the dominant source of anthropogenic climate forcing produced

within the U.S., and, thus represent a primary focus of government policies designed to address the climate change issue. The combustion of fossil fuels for the production of energy is the primary driver of CO<sub>2</sub> emissions. Consequently, a decrease in dependence on fossil fuel energy and CO<sub>2</sub> emissions via improvements in energy efficiency and the expansion of energy produced from renewable resources represents a second priority for climate change policymakers. The historical relationship between fossil fuel energy and economic development within the U.S. has contributed to a number of significant institutional and economic barriers to a national transition away from carbon-based energy. However, as with climate change policy, an analysis of state-level energy and CO<sub>2</sub> emissions profiles has revealed the presence of substantial diversity at the subnational level with respect to the two primary factors of anthropogenic climate change. Having established the two most important dimensions of climate change mitigation, CO<sub>2</sub> emissions and primary energy consumption, Chapter 6 provides a comparative assessment of climate change performance among the states.

## References

- Aguilar, F. X., Goerndt, M. E., Song, N. F., & Shifley, S. (2012). Internal, external and location factors influencing cofiring of biomass with coal in the U.S. northern region. *Energy Economics*, 34(6), 1790-1798.  
doi:10.1016/j.eneco.2012.07.005
- Aguilar, Francisco X., ed. 2014. *Wood Energy in Developed Economies: Resource Management, Economics, and Policy*. New York: Routledge.
- Aguilar, F. (2015). Wood Energy in Developed Economies: An Overlooked Renewable. *Resources Magazine*, 188, 20-27
- Aldy, J. (2013). Proposal 5: Eliminating Fossil Fuel Subsidies. *The Hamilton Project*. Retrieved from:  
[http://www.hamiltonproject.org/papers/eliminating\\_fossil\\_fuel\\_subsidies/](http://www.hamiltonproject.org/papers/eliminating_fossil_fuel_subsidies/)
- Aldy, J. (2014). *Money for Nothing: The Case for Eliminating US Fossil Fuel Subsidies*. Washington, D.C.: Resources for the Future. Retrieved from:  
[http://www.hamiltonproject.org/papers/eliminating\\_fossil\\_fuel\\_subsidies/](http://www.hamiltonproject.org/papers/eliminating_fossil_fuel_subsidies/)
- Allen, D. T., Torres, V. M., Thomas, J., Sullivan, D. W., Harrison, M., Hendler, A., Herndon, S.C., Kolb, C.E., Fraser, M.P., Hill, A.D., Lamb, B.K., Miskimins, J., Sawyer, R.F., & Seinfeld, J. H. (2013). Measurements of methane emissions at natural gas production sites in the United States. *Proceedings of the National Academy of Sciences of the United States of America*, 110(44), 17768-17773. doi:10.1073/pnas.1304880110

- Alvarez, R. A., Pacala, S. W., Winebrake, J. J., Chameides, W. L., & Hamburg, S. P. (2012). Greater focus needed on methane leakage from natural gas infrastructure. *Proceedings of the National Academy of Sciences of the United States of America*, *109*(17), 6435-6440. doi:10.1073/pnas.1202407109
- Basu, P. (2013). *Biomass gasification, pyrolysis and torrefaction: practical design and theory*. 2nd Edition. London, UK: Academic Press.
- Beyer, J., Trannum, H. C., Bakke, T., Hodson, P. V., & Collier, T. K. (2016). Environmental effects of the Deepwater Horizon oil spill: A review. *Marine Pollution Bulletin*, *110*(1), 28-51. doi:10.1016/j.marpolbul.2016.06.027
- Billington, D.P., Jackson, D.C., & Melosi, M.V. (2005). *The History of Large Federal Dams: Planning, Design, and Construction in the era of Big Dams*. Denver, CO: U.S. Department of the Interior, Bureau of Reclamation.
- Bradbury, J., Obeiter, M., Draucker, L., Wang, W., & Stevens, A. (2013). *Clearing the Air: Reducing Upstream Greenhouse Gas Emissions From U.S. Natural Gas Systems*. Washington, D.C.: World Resources Institute
- Bradner, T. (2012 May 24). International cargo off, but Alaska's airports still hold edge. *Alaska Journal of Commerce*. Retrieved from:  
<http://www.alaskajournal.com/business-and-finance/2012-05-24/international-cargo-alaskas-airports-still-hold-edge#.V5LOaTmAoko>
- Brandt, A. R., Heath, G. A., Kort, E. A., O'Sullivan, F., Petron, G., Jordaan, S. M., Tans, P., Wilcox, J., Gopstein, A.M., Arent, D., Wofsy, S., Brown, N.J., Bradley, R., Stucky, G.D., Eardley, D., & Harriss, R. (2014). Methane Leaks

from North American Natural Gas Systems. *Science*, 343(6172), 733-735.

doi:10.1126/science.1247045

Bridle, R., & Kitson, L. (2014). *The Impact of Fossil-Fuel Subsidies on Renewable Electricity Generation*. New York, NY: International Institute for Sustainable Development.

Brown, A., Beiter, P., Heimiller, D., Davidson, C., Denholm, P., Melius, J., Lopez, A., Hettinger, D., Mulcahy, D., & Porro, G. (2015). *Estimating Renewable Energy Economic Potential in the United States: Methodology and Initial Results*. Golden, CO: National Renewable Energy Laboratory

Bryce, R. (2011). Ten Reasons Why Natural Gas Will Fuel the Future. *Energy Policy & the Environment Report*. Center for Energy Policy and the Environment

Bunn, S. E., & Arthington, A. H. (2002). Basic principles and ecological consequences of altered flow regimes for aquatic biodiversity. *Environmental management*, 30(4), 492-507.

Cahn, M.A., Kamieniecki, S., McCain-Tharnstrom, D., & Fiack, D. (2016). "The Bureaucracy and Politics of Energy and Environmental Policy in the Western States," In *Environmental Politics and Policy in the West*. 3rd Edition. eds. Zachary Smith and John Freemuth, 27-54. Boulder, CO:University Press of Colorado.

CAIT Climate Data Explorer. (2015). Washington, DC: World Resources Institute.

Retrieved from: <http://cait.wri.org>

- Chase, R., Gibson, R., & Marks, J. (2005). PFC emissions performance for the global primary aluminum industry. *Light Metals 2005*, 279-282.
- Clean Air Act Amendments of 1990 Pub. L. No. 101– 549, Stat. 2399 (1990).
- Colorado River Storage Project Act Pub. L. No. 84-485, Stat. 105 (1956).
- Conley, S., Franco, G., Faloon, I., Blake, D. R., Peischl, J., & Ryerson, T. B. (2016). Methane emissions from the 2015 Aliso Canyon blowout in Los Angeles, CA. *Science*, 351(6279), 1317-1320. doi:10.1126/science.aaf2348
- Csereklyei, Z. (2014). Measuring the impact of nuclear accidents on energy policy. *Ecological Economics*, 99, 121-129.  
doi:10.1016/j.ecolecon.2014.01.010
- Davidson, E. A., & Kanter, D. (2014). Inventories and scenarios of nitrous oxide emissions. *Environmental Research Letters*, 9(10). doi:10.1088/1748-9326/9/10/105012
- Denman, K.L., Brasseur, G., Chidthaisong, A., Ciais, P., Cox, P.M., Dickinson, R.E., Hauglustaine, D., Heinze, C., Holland, E., Jacob, D., Lohmann, U., Ramachandran, S., da Silva Dias, P.L., Wofsy, S.C., & Zhang, X. (2007). Couplings Between Changes in the Climate System and Biogeochemistry. In: *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. eds. Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller. New York, NY: Cambridge University Press.



- Energy Tax Act of 1978, Pub. L. No. 95-618, 92 Stat. 3174 (1978).
- Energy Policy and Conservation Act of 2000. Pub. L. No. 106 – 63, Stat. 510 (2000).
- Energy Independence and Security Act of 2007. Pub. L. No. 110-140, Stat. (2007
- Environmental Defense Fund (EDF). (2016). *Aliso Canyon leak sheds light on national problem: Gaping holes in U.S. regulatory safety net allow methane leaks to go unchecked*. Retrieved from: <https://www.edf.org/climate/aliso-canyon-leak-sheds-light-national-problem>
- Executive Order 13514. (2009). *Federal Leadership in Environmental, Energy, and Economic Performance*.
- Farrell, A. E., Plevin, R. J., Turner, B. T., Jones, A. D., O'hare, M., & Kammen, D. M. (2006). Ethanol can contribute to energy and environmental goals. *Science*, *311*(5760), 506-508.
- Feng, K. S., Davis, S. J., Sun, L. X., & Hubacek, K. (2015). Drivers of the US CO2 emissions 1997-2013. *Nature Communications*, *6*. doi:10.1038/ncomms8714
- Forster, P., Ramaswamy, V., Artaxo, P., Berntsen, T., Betts, R., Fahey, D.W., Haywood, J., Lean, J., Lowe, D.C., Myhre, G., Nganga, J., Prinn, R., Raga, G., Schulz, M., & Van Dorland, R. (2007). Changes in Atmospheric Constituents and in Radiative Forcing. In: *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. eds. Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller. New York, NY: Cambridge University Press.

- Gelfand, I., Sahajpal, R., Zhang, X. S., Izaurrealde, R. C., Gross, K. L., & Robertson, G. P. (2013). Sustainable bioenergy production from marginal lands in the US Midwest. *Nature*, 493(7433), 514-+. doi:10.1038/nature11811
- Giampietro, M., Ulgiati, S., & Pimentel, D. (1997). Feasibility of large-scale biofuel production. *BioScience*, 47(9), 587-600.
- Go Solar California (2016). *History of Solar Energy in California*. Retrieved from: <http://www.gosolarcalifornia.ca.gov/about/gosolar/california.php>
- Goerndt, M. E., Aguilar, F. X., & Skog, K. (2013a). Drivers of biomass co-firing in US coal-fired power plants. *Biomass & Bioenergy*, 58, 158-167. doi:10.1016/j.biombioe.2013.09.012
- Goerndt, M. E., Aguilar, F. X., & Skog, K. (2013b). Resource potential for renewable energy generation from co-firing of woody biomass with coal in the Northern US. *Biomass & Bioenergy*, 59, 348-361. doi:10.1016/j.biombioe.2013.08.032
- Greening, L. A., Greene, D. L., & Difiglio, C. (2000). Energy efficiency and consumption - the rebound effect - a survey. *Energy Policy*, 28(6-7), 389-401.
- Gunther, M. (2013 September 3). With Rooftop Solar on Rise, U.S. Utilities Are Striking Back. *Yale Environment 360*. Retrieved from: [http://e360.yale.edu/feature/with\\_rooftop\\_solar\\_on\\_rise\\_us\\_utilities\\_are\\_striking\\_back/2687/](http://e360.yale.edu/feature/with_rooftop_solar_on_rise_us_utilities_are_striking_back/2687/)
- Halper, E. (2014 August 9). Rules prevent solar panels in many states with abundant sunlight. *Los Angeles Times*. Retrieved from: <http://www.latimes.com/nation/la-na-no-solar-20140810-story.html>

- Hamelinck, C. N., van Hooijdonk, G., & Faaij, A. P. C. (2005). Ethanol from lignocellulosic biomass: techno-economic performance in short-, middle- and long-term. *Biomass & Bioenergy*, 28(4), 384-410.  
doi:10.1016/j.biombioe.2004.09.002
- Hamilton, J.D. (2013). "Historical Oil Shocks." In Routledge *Handbook of Major Events in Economic History*, 239-265. New York, NY: Routledge
- Harvey, M.W.T. (2000). *A Symbol of Wilderness: Echo Park and the American Conservation Movement*. Seattle, WA: University of Washington Press.
- Hayes, S., Baum, N., & Herndon, G. (2013). *Energy Efficiency: Is the United States Improving?*. Washington, D.C.: American Council for an Energy-Efficient Economy.
- Hayhoe, K., Kheshgi, H. S., Jain, A. K., & Wuebbles, D. J. (2002). Substitution of natural gas for coal: Climatic effects of utility sector emissions. *Climatic Change*, 54(1-2), 107-139. doi:10.1023/a:1015737505552
- Hester, M. W., Willis, J. M., Rouhani, S., Steinhoff, M. A., & Baker, M. C. (2016). Impacts of the Deepwater Horizon oil spill on the salt marsh vegetation of Louisiana. *Environmental Pollution*, 216, 361-370.  
doi:10.1016/j.envpol.2016.05.065
- Hickenlooper, J. (2013). *Colorado Set to Become First State to Regulate Detection, Reduction of Methane Emissions Associate with Oil and Gas Drilling*. Denver, CO: Press Release Retrieved from: <https://votesmart.org/public-statement/828991/colorado-set-to-become-first-state-to-regulate-detection->

reduction-of-methane-emissions-associated-with-oil-and-gas-  
drilling#.WB5RH7wrLuU

- Hiltzik, M. (2016 June 24). The Diablo Canyon deal marks the death of nuclear power in the U.S. – or does it? *Los Angeles Times*. Retrieved from: <http://www.latimes.com/business/hiltzik/la-fi-hiltzik-diablo-nukes-20160623-snap-story.html>
- Howarth, R.W., Santoro, R., & Ingraffea, A. (2011). Methane and the greenhouse-gas footprint of natural gas from shale formations. *Climatic Change*, 106(4), 679-690. doi:10.1007/s10584-011-0061-5
- Hristov, A. N., Johnson, K. A., & Kebreab, E. (2014). Livestock methane emissions in the United States. *Proceedings of the National Academy of Sciences of the United States of America*, 111(14), E1320-E1320. doi:10.1073/pnas.1401046111
- Hughes, J. E., Knittel, C. R., & Sperling, D. (2008). Evidence of a Shift in the Short-Run Price Elasticity of Gasoline Demand. *The Energy Journal*, 29: 93-114.
- Kang, M., Kanno, C. M., Reid, M. C., Zhang, X., Mauzerall, D. L., Celia, M. A., Chen, Y., & Onstott, T. C. (2014). Direct measurements of methane emissions from abandoned oil and gas wells in Pennsylvania. *Proceedings of the National Academy of Sciences of the United States of America*, 111(51), 18173-18177. doi:10.1073/pnas.1408315111
- Karion, A., Sweeney, C., Kort, E. A., Shepson, P. B., Brewer, A., Cambaliza, M., Conley, S.A., Davis, K., Deng, A., Hardesty, M., Herndon, S.C., Lauvaux, T.,

- Lavoie, T., Lyon, D., Newberger, T., Pétron, G., Rella, C., Smith, M., Wolter, S., Yacovitch, T.I., & Tans, P. (2015). Aircraft-Based Estimate of Total Methane Emissions from the Barnett Shale Region. *Environmental Science & Technology*, 49(13), 8124-8131. doi:10.1021/acs.est.5b00217
- Karion, A., Sweeney, C., Petron, G., Frost, G., Hardesty, R. M., Kofler, J., Miller, B.R., Newberger, T., Wolter, S., Banta, R., Brewer, A., Dlugokencky, E., Lang, P., Montzka, S.A., Schnell, R., Tans, P., Trainer, M., Zamora, R., & Conley, S. (2013). Methane emissions estimate from airborne measurements over a western United States natural gas field. *Geophysical Research Letters*, 40(16), 4393-4397. doi:10.1002/grl.50811
- Kort, E. A., Eluszkiewicz, J., Stephens, B. B., Miller, J. B., Gerbig, C., Nehrkorn, T., Daube, B.C., Kaplan, J.O., Houweling, S., & Wofsy, S. C. (2008). Emissions of CH<sub>4</sub> and N<sub>2</sub>O over the United States and Canada based on a receptor-oriented modeling framework and COBRA-NA atmospheric observations. *Geophysical Research Letters*, 35(18). doi:10.1029/2008gl034031
- Krupnick, A., Wang, Z., & Wang, Y. (2013). *Sector Effects of the Shale Gas Revolution in the United States*. Washington, D.C.: Resources for the Future.
- Kumabe, K., Hanaoka, T., Fujimoto, S., Minowa, T., & Sakanishi, K. (2007). Co-gasification of woody biomass and coal with air and steam. *Fuel*, 86(5-6), 684-689. doi:10.1016/j.fuel.2006.08.026

- Lal, R. (2005). World crop residues production and implications of its use as a biofuel. *Environment International*, 31(4), 575-584.
- Lamb, B. K., Edburg, S. L., Ferrara, T. W., Howard, T., Harrison, M. R., Kolb, C. E., Townsend-Small, A., Dyck, W., Possolo, A., & Whetstone, J. R. (2015). Direct Measurements Show Decreasing Methane Emissions from Natural Gas Local Distribution Systems in the United States. *Environmental Science & Technology*, 49(8), 5161-5169. doi:10.1021/es505116p
- Lazard. (2015). *Lazard's Levelized Cost of Energy Analysis-Version 9.0*. Retrieved from: [https://www.lazard.com/media/1777/levelized\\_cost\\_of\\_energy\\_-\\_version\\_90.pdf](https://www.lazard.com/media/1777/levelized_cost_of_energy_-_version_90.pdf)
- Lazzari, S. (2008). *Energy Tax Policy: History and Current Issues*. Washington, D.C.: Congressional Research Service.
- Ligon, F. K., Dietrich, W. E., & Trush, W. J. (1995). Downstream ecological effects of dams. *BioScience*, 45(3), 183-192.
- Lopez, A., Roberts, B., Heimiller, D., Blair, N., & Porro, G. (2012). *U.S. Renewable Energy Technical Potentials: A GIS-Based Analysis*. Golden, CO: National Renewable Energy Laboratory
- Louisiana Department of Natural Resources. (2016). *Louisiana Energy Facts Annual 2015*. Louisiana Department of Natural Resources, Technology Assessment Division.

- Lovett, I. (2016 February 18). A Gas Leak Is Capped, but Neighbors Are Wary. *The New York Times*. Retrieved from: <http://www.nytimes.com/2016/02/19/us/a-gas-leak-is-capped-but-neighbors-are-wary.html>
- Lovett, I., & Wines, M. (2016 March 4). California Gas Leak Threatens Jerry Brown's Image as a Climate Change Hero. *The New York Times*. Retrieved from: <http://www.nytimes.com/2016/03/05/us/california-gas-leak-threatens-jerry-browns-image-as-a-climate-change-hero.html>
- Malmsheimer, R. W., Heffernan, P., Brink, S., Crandall, D., Deneke, F., Galik, C., Gee, E., Helms, J.A., McClure, N., Mortimer, M., Ruddell, S., Smith, M., & Stewart, J. (2008). Forest management solutions for mitigating climate change in the United States. *Journal of Forestry*, 106(3), 115-117.
- Matthews, H. D., Graham, T. L., Keeverian, S., Lamontagne, C., Seto, D., & Smith, T. J. (2014). National contributions to observed global warming. *Environmental Research Letters*, 9(1). doi:10.1088/1748-9326/9/1/014010
- McConnell, V. (2013). *The New CAFÉ Standards: Are They Enough on Their Own?*. Washington, D.C.: Resources for the Future
- McDonald, S.L. (1979). Energy Tax Act of 1978. *Nat. Resour. J.; (United States)*, 19:4.
- McGarry, J., & Flamm, C., "U.S. Methane Leakage from Natural Gas System: A Literature Review", Chesapeake Climate Action Network, June 12, 2014.
- McGowan, E. (2011 January 14). Obama Can Cut Fossil Fuel Subsidies and Save \$39 Billion, But Will Congress Go Along? *Inside Climate News*. Retrieved from:

<https://insideclimatenews.org/news/20110114/obama-can-cut-fossil-fuel-subsidies-and-save-39-billion-will-congress-go-along>

McGrath, M. (2016 February 26). California methane leak ‘largest in US history’.

*BBC News*. Retrieved from: <http://www.bbc.com/news/science-environment-35659947>

McKain, K., Down, A., Raciti, S. M., Budney, J., Hutyra, L. R., Floerchinger, C., Herndon, S.C., Nehkorn, T., Zahniser, M.S., Jackson, R.B., Phillips, N., & Wofsy, S. C. (2015). Methane emissions from natural gas infrastructure and use in the urban region of Boston, Massachusetts. *Proceedings of the National Academy of Sciences of the United States of America*, 112(7), 1941-1946. doi:10.1073/pnas.1416261112

Miller, S. M., Wofsy, S. C., Michalak, A. M., Kort, E. A., Andrews, A. E., Biraud, S. C., Dlugokencky, E.J., Eluszkiewicz, J., Fischer, M.L., Janssens-Maenhout, G., Miller, B.R., Miller, J.B., Montzka, S.A., Nehrkorn, T., & Sweeney, C. (2013). Anthropogenic emissions of methane in the United States. *Proceedings of the National Academy of Sciences of the United States of America*, 110(50), 20018-20022. doi:10.1073/pnas.1314392110

Moomaw, W., Yamba, F., Kamimoto, M., Maurice, L., Nyboer, J., Urama, K., & Weir, T. (2011) Introduction. In IPCC Special Report on Renewable Energy Sources and Climate Change Mitigation. eds. O. Edenhofer, R. Pichs-Madruga, Y. Sokona, K. Seyboth, P. Matschoss, S. Kadner, T. Zwickel, P.



Eickemeier, G. Hansen, S. Schlömer, C.von Stechow. New York, NY:  
Cambridge University Press.

Mooney, C., & Dennis, B (2016 May 12). Obama administration announces historic new regulations for methane emissions from oil and gas. *The Washington Post*. Retrieved from <https://www.washingtonpost.com/news/energy-environment/wp/2016/05/12/obama-administration-announces-historic-new-regulations-for-methane-emissions-from-oil-and-gas/>

Moschini, G.C., Cui, J., & Lapan, H. (2012). Economics of Biofuels: An Overview of Policies, Impacts and Prospects. *Bio-based and Applied Economics*, 1(3): 269-296

Mufson, S. (2012 November 23). The demise of coal-fired power plants. *The Washington Post*. Retrieved from:  
[https://www.washingtonpost.com/business/economy/the-demise-of-coal-fired-power-plants/2012/11/21/e7ca1e6e-fdda-11e1-b153-218509a954e1\\_story.html](https://www.washingtonpost.com/business/economy/the-demise-of-coal-fired-power-plants/2012/11/21/e7ca1e6e-fdda-11e1-b153-218509a954e1_story.html)

Müller, S., Brown, A., & Ölz, S. (2011). *Renewable Energy: Policy Considerations for Deploying Renewables*. Paris, France: International Energy Agency

Murawski, S. A., Fleeger, J. W., Patterson, W. F., Hu, C. M., Daly, K., Romero, I., & Toro-Farmer, G. A. (2016). How Did the Deepwater Horizon Oil Spill Affect Coastal and Continental Shelf Ecosystems of the Gulf of Mexico? *Oceanography*, 29(3), 160-173. doi:10.5670/oceanog.2016.80

- Myhre, G., Shindell, D., Bréon, F.-M., Collins, W., Fuglestedt, J., Huang, J., Koch, D., Lamarque, J.-F., Lee, D., Mendoza, B., Nakajima, T., Robock, A., Stephens, G., Takemura, T., & Zhang, H. (2013). Anthropogenic and Natural Radiative Forcing. In: *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. eds. Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley. New York, NY: Cambridge University Press.
- Nalbandian, H. (2015). *Climate implications of coal-to-gas substitution in power generation*. London, UK: IEA Clean Coal Centre.
- National Conference of State Legislatures (NCSL). (2014). *State Methane Policies*. Retrieved from: <http://www.ncsl.org/research/environment-and-natural-resources/state-methane-policies.aspx>
- National Renewable Energy Laboratory (NREL). (2013). *Life Cycle Greenhouse Gas Emissions from Electricity Generation*. Golden, CO: National Renewable Energy Laboratory. Retrieved from: <http://www.nrel.gov/docs/fy13osti/57187.pdf>
- Nepal, P., Wear, D. N., & Skog, K. E. (2015). Net change in carbon emissions with increased wood energy use in the United States. *Global Change Biology Bioenergy*, 7(4), 820-835. doi:10.1111/gcbb.12193
- Nicholson-Crotty, S. (2005). Bureaucratic competition in the policy process. *Policy Studies Journal*, 33(3), 341-361. doi:10.1111/j.1541-0072.2005.00119.x

- Oil and Natural Gas Sector: Emission Standards for New, Reconstructed, and Modified Sources, 81 Fed. Reg. 35824 C.F.R. Part 60 (2016).
- Olivier, J.G.J., Janssens-Maenhout, G., Muntean, M. and Peters, J.A.H.W. (2015) Trends in global CO2 emissions: 2015 Report. PBL Netherlands Environmental Assessment Agency, The Hague; European Commission, Joint Research Centre (JRC), Institute for Environment and Sustainability (IES). JRC98184, PBL1803, Internet: [http://edgar.jrc.ec.europa.eu/news\\_docs/jrc-2015-trends-in-global-co2-emissions-2015-report-98184.pdf](http://edgar.jrc.ec.europa.eu/news_docs/jrc-2015-trends-in-global-co2-emissions-2015-report-98184.pdf), November 2015
- Owen, E.W. (1974). *Trek of the Oil Finders: A History of Exploration for Petroleum*. Tulsa, OK: American Association of Petroleum Geologists
- Park, S., Croteau, P., Boering, K. A., Etheridge, D. M., Ferretti, D., Fraser, P. J., Krummel, P.B., Langenfelds, R.L., van omen, T.D., Steele, L.P., & Trudinger, C. M. (2012). Trends and seasonal cycles in the isotopic composition of nitrous oxide since 1940. *Nature Geoscience*, 5(4), 261-265.  
doi:10.1038/ngeo1421
- Penn, I. (2016 May 9). State regulators reopen case on San Onofre nuclear plant. *Los Angeles Times*. Retrieved from: <http://www.latimes.com/business/la-fi-san-onofre-20160509-snap-story.html>
- Pétron, G., Frost, G., Miller, B. R., Hirsch, A. I., Montzka, S. A., Karion, A., Trainer, M., Sweeney, C., Andrews, A.E., Miller, L., Kofler, J., Bar-Ilan, A., Dlugokencky, E.J., Patrick, L., Moore Jr., C.T., Ryerson, T.B, Siso, C., Kolodzey, W., Lang, P.M., Conway, T., Novelli, P., Masarie, K., Hall, B.,

- Guenther, D., Kitzis, D., Miller, J., Welsh, D., Wolfe, D., Neff, W., & Tans, P. (2012). Hydrocarbon emissions characterization in the Colorado Front Range: A pilot study. *Journal of Geophysical Research-Atmospheres*, 117. doi:10.1029/2011jd016360
- Pfund, N., & Healey, B. (2011). *What Would Jefferson Do? The Historical Role of Federal Subsidies in Shaping America's Energy Future*. San Francisco, CA: DBL Investors
- Pimentel, D., & Patzek, T. W. (2005). Ethanol production using corn, switchgrass, and wood; biodiesel production using soybean and sunflower. *Natural resources research*, 14(1), 65-76.
- Powerplant and Industrial Fuel Use Act 1978, Pub. L. 95-620, Stat. 3318 (1978).
- Public Utility Regulatory Policies Act of 1978, Pub. L. 95-617, Stat. 3117 (1978).
- Rajagopal, D., & Zilberman, D. (2007). Review of environmental, economic and policy aspects of biofuels. *Economic and Policy Aspects of Biofuels (September 1, 2007)*. World Bank Policy Research Working Paper, (4341).
- Ran, J. Y., & Li, C. Z. (2012). High temperature gasification of woody biomass using regenerative gasifier. *Fuel Processing Technology*, 99, 90-96. doi:10.1016/j.fuproc.2012.01.002
- Rao, S., & Riahi, K. (2006). The role of Non-CO2 greenhouse gases in climate change mitigation: Long-term scenarios for the 21st century. *Energy Journal*, 177-200.

- Rascoe, A. (2012 February 9). U.S. approves first new nuclear plant in a generation. *Reuters*. Retrieved from: <http://www.reuters.com/article/us-usa-nuclear-nrc-idUSTRE8182J720120209>
- Raupach, M. R., Marland, G., Ciais, P., Le Quere, C., Canadell, J. G., Klepper, G., & Field, C. B. (2007). Global and regional drivers of accelerating CO<sub>2</sub> emissions. *Proceedings of the National Academy of Sciences of the United States of America*, 104(24), 10288-10293. doi:10.1073/pnas.0700609104
- Reisner, M. (1993). *Cadillac Desert*. 2<sup>nd</sup> ed. New York, NY: Penguin.
- Ridley, M. (2011). *The Shale Gas Shock*. London: The Global Warming Policy Foundation.
- Roston, E., & Migliozi, B. (2015 April 13). Obama's EPA Rule Is Redrawing the U.S. Coal Map. *Bloomberg News*. Retrieved from: <http://www.bloomberg.com/graphics/2015-coal-plants/>
- Searchinger, T. D., Hamburg, S. P., Melillo, J., Chameides, W., Havlik, P., Kammen, D. M., Likens, G.E., Lubowski, R.N., Obersteiner, M., Oppenheimer, M., Robertson, G.P., Schlesinger, W.H., & Tilman, G. D. (2009). Fixing a Critical Climate Accounting Error. *Science*, 326(5952), 527-528. doi:10.1126/science.1178797
- Schnepf, R. (2003). *Biodiesel Fuel and U.S. Agriculture*. Washington, D.C.: Congressional Research Service.
- Schnepf, R., & Yacobucci, B.D. (2013). *Renewable Fuel Standard (RFS): Overview and Issues*. Washington, D.C.: Congressional Research Service.

- Shabecoff, P. (1988 June 24). Global Warming Has Begun, Expert Tells Senate. *New York Times*. Retrieved from <http://www.nytimes.com/1988/06/24/us/global-warming-has-begun-expert-tells-senate.html>
- Sher, D. (2011). *Fossil fuel Subsidies: A Closer Look at Tax Breaks, Special Accounting, and Societal Costs*. Washington, D.C.: Environmental and Energy Study Institute. Retrieved from:  
[http://www.eesi.org/files/fossil\\_fuel\\_subsidies\\_062311a.pdf](http://www.eesi.org/files/fossil_fuel_subsidies_062311a.pdf)
- Sherlock, M.F. (2011). *Energy Tax Policy: Historical Perspectives on and Current Status of Energy Tax Expenditures*. Washington, D.C.: Congressional Research Service.
- Sherlock, M.F. (2105). *The Renewable Electricity Production Tax Credit: In Brief*. Washington, D.C.: Congressional Research Service.
- Sommer, L., & Samuel, M. (2016 January 1) Like Night and Day: How Two States' Utilities Approach Solar. *NPR*. Retrieved from:  
<http://www.npr.org/2016/01/01/460960961/like-night-and-day-how-two-states-utilities-approach-solar>
- Stafford, C. (2015). The Great Escape: Addressing the Problem of Fugitive Methane Emissions from the Conventional Natural Gas System Under the Clean Air Act. *Colorado Natural Resources, Energy & Environment Law Review*, 26(2): 351-382.
- The White House (2014). *Climate Action Plan: Strategy to Reduce Methane Emissions*. Washington, D.C.

- Tilt, B., Braun, Y., & He, D. (2009). Social impacts of large dam projects: A comparison of international case studies and implications for best practice. *Journal of environmental management*, 90, S249-S257.
- Tsoutsos, T., Frantzeskaki, N., & Gekas, V. (2005). Environmental impacts from the solar energy technologies. *Energy Policy*, 33(3), 289-296.  
doi:10.1016/s0301-4215(03)00241-6
- Tyner, W. E. (2008). The US ethanol and biofuels boom: Its origins, current status, and future prospects. *Bioscience*, 58(7), 646-653. doi:10.1641/b580718
- Union of Concerned Scientists. (2013). *Environmental Impacts of Solar*. Retrieved from: [http://www.ucsusa.org/clean\\_energy/our-energy-choices/renewable-energy/environmental-impacts-solar-power.html#references](http://www.ucsusa.org/clean_energy/our-energy-choices/renewable-energy/environmental-impacts-solar-power.html#references)
- U.S. Census Bureau. (2015). Annual Estimates of the Resident Population for the United States, Regions, States, and Puerto Rico. Retrieved from: <http://www.census.gov/popest/data/state/totals/2015/>
- U.S. Department of Energy (DOE). (1994). *The History of Nuclear Energy*. Retrieved from: [http://www.energy.gov/sites/prod/files/The%20History%20of%20Nuclear%20Energy\\_0.pdf](http://www.energy.gov/sites/prod/files/The%20History%20of%20Nuclear%20Energy_0.pdf)
- U.S. Department of Energy (DOE). (2003). *The History of Solar*. Retrieved from: [https://www1.eere.energy.gov/solar/pdfs/solar\\_timeline.pdf](https://www1.eere.energy.gov/solar/pdfs/solar_timeline.pdf)
- U.S. Department of Energy (DOE). (2013). *A Brief History of Coal*. Retrieved from: [http://www.fossil.energy.gov/education/energylessons/coal/coal\\_history.html](http://www.fossil.energy.gov/education/energylessons/coal/coal_history.html)

- U.S. Energy Information Administration (EIA). (2013a). Energy sources have changed throughout the history of the United States. *Today in Energy*. Retrieved from: <https://www.eia.gov/todayinenergy/detail.php?id=11951>
- U.S. Energy Information Administration (EIA). (2013b). State Energy Data System 2013 Consumption Technical Notes. Retrieved from: [https://www.eia.gov/state/seds/sep\\_use/notes/use\\_technotes.pdf](https://www.eia.gov/state/seds/sep_use/notes/use_technotes.pdf)
- U.S. Department of Energy (DOE). (2015). *2014 Wind Technologies Market Report*. Energy Efficiency & Renewable Energy.
- U.S. Department of Energy (DOE). (2016a). *Heating Oil Reserve*. Retrieved from: <http://energy.gov/fe/services/petroleum-reserves/heating-oil-reserve>
- U.S. Department of Energy (DOE). (2016b). *A History of Geothermal Energy in America*. Retrieved from: <http://energy.gov/eere/geothermal/history-geothermal-energy-america>
- U.S. Department of Transportation (DOT). (2014). *Corporate Average Fuel Economy (CAFÉ) Standards*. Retrieved from: <https://www.transportation.gov/mission/sustainability/corporate-average-fuel-economy-cafe-standards>
- U.S. Department of Treasury. (2016). *Progress Report on Fossil Fuel Subsidies*. Retrieved from: <https://www.treasury.gov/open/Documents/USA%20FFSR%20progress%20report%20to%20G20%202014%20Final.pdf>



- U.S. Energy Information Administration (EIA). (2007). Transporting. *About U.S. Natural Gas Pipelines*. Retrieved from:  
[https://www.eia.gov/pub/oil\\_gas/natural\\_gas/analysis\\_publications/ngpipeline/index.html](https://www.eia.gov/pub/oil_gas/natural_gas/analysis_publications/ngpipeline/index.html)
- U.S. Energy Information Administration (EIA). (2008a). *About U.S. Natural Gas Pipelines*. Retrieved from:  
[https://www.eia.gov/pub/oil\\_gas/natural\\_gas/analysis\\_publications/ngpipeline/index.html](https://www.eia.gov/pub/oil_gas/natural_gas/analysis_publications/ngpipeline/index.html)
- U.S. Energy Information Administration (EIA). (2008b). *Natural Gas Market Centers: A 2008 Update*. Retrieved from:  
[https://www.eia.gov/pub/oil\\_gas/natural\\_gas/feature\\_articles/2009/ngmarketcenter/ngmarketcenter.pdf](https://www.eia.gov/pub/oil_gas/natural_gas/feature_articles/2009/ngmarketcenter/ngmarketcenter.pdf)
- U.S. Energy Information Administration (EIA). (2011). *Most electric generating capacity additions in the last decade were natural gas-fired*. Retrieved from:  
<http://www.eia.gov/todayinenergy/detail.php?id=2070>
- U.S. Energy Information Administration (EIA). (2013a). Most new residential solar PV projects in California program are not owned by homeowners. *Today in Energy*. Retrieved from:  
<http://www.eia.gov/todayinenergy/detail.cfm?id=12991>
- U.S. Energy Information Administration (EIA). (2013b). State Energy Data System 2013 Consumption Technical Notes. Retrieved from:  
[https://www.eia.gov/state/seds/sep\\_use/notes/use\\_technotes.pdf](https://www.eia.gov/state/seds/sep_use/notes/use_technotes.pdf)

- U.S. Energy Information Administration (EIA). (2014a). AEO2014 projects more coal-fired power plant retirements by 2016 than have been scheduled. *Today in Energy*. Retrieved from:  
<http://www.eia.gov/todayinenergy/detail.cfm?id=15031>
- U.S. Energy Information Administration (EIA). (2014b). Planned coal-fired power plant retirements continue to increase. *Today in Energy*. Retrieved from:  
<http://www.eia.gov/todayinenergy/detail.cfm?id=15491.#>
- U.S. Energy Information Administration (EIA). (2014c). Geothermal resources used to produce renewable electricity in western states. *Today in Energy*. Retrieved from: <http://www.eia.gov/todayinenergy/detail.cfm?id=17871>
- U.S. Energy Information Administration (EIA). (2015a). *Biofuels: Ethanol and Biodiesel Explained*. Retrieved from:  
[https://www.eia.gov/energyexplained/index.cfm?page=biofuel\\_ethanol\\_environment](https://www.eia.gov/energyexplained/index.cfm?page=biofuel_ethanol_environment)
- U.S. Energy Information Administration (EIA). (2015b). Power generation from coal and natural gas expected to temporarily converge this spring. *Today in Energy*. Retrieved from:  
<http://www.eia.gov/todayinenergy/detail.cfm?id=21232>
- U.S. Energy Information Administration (EIA). (2015c). *State Energy Data System*. Retrieved from <http://www.eia.gov/state/seds/>
- U.S. Energy Information Administration (EIA). (2016a). *Count of Electric Power Industry Power Plants, by Sector, by Predominant Energy within Plant, 2004*

*through 2014*. Retrieved from:

[https://www.eia.gov/electricity/annual/html/epa\\_04\\_01.html](https://www.eia.gov/electricity/annual/html/epa_04_01.html)

U.S. Energy Information Administration (EIA). (2016b). *State Profile and Energy*

*Estimates: Alaska*. Retrieved from: <http://www.eia.gov/state/?sid=AK>

U.S. Energy Information Administration (EIA). (2016c). *State Profile and Energy*

*Estimates: Alaska*. Retrieved from: <http://www.eia.gov/state/?sid=CA>

U.S. Energy Information Administration (EIA). (2016d). *State Profile and Energy*

*Estimates: Louisiana*. Retrieved from: <http://www.eia.gov/state/?sid=LA>

U.S. Energy Information Administration (EIA). (2016e). *State Profile and Energy*

*Estimates: Texas*. Retrieved from: <http://www.eia.gov/state/?sid=TX>

U.S. Energy Information Administration (EIA). (2016f). *Weekly Coal Production*.

Retrieved from: <http://www.eia.gov/coal/production/weekly/>

U.S. Environmental Protection Agency (USEPA). (2015a). *Inventory of U.S.*

*Greenhouse Gas Emissions and Sinks: 1990-2013*. U.S. Environmental

Protection Agency. Washington, D.C.

U.S. Environmental Protection Agency (USEPA). (2015b). *SF<sub>6</sub> Emissions Reduction*

*Partnership for Electric Power Systems: 2014 Annual Report*. U.S.

Environmental Protection Agency. Washington, D.C.

U.S. Environmental Protection Agency (USEPA). (2016a). *Renewable Fuel Standard*

*Program: Program Overview for Renewable Fuel Standard Program*.

Retrieved from: <https://www.epa.gov/renewable-fuel-standard-program/program-overview-renewable-fuel-standard-program>

- U.S. Environmental Protection Agency (USEPA). (2016b). *Energy Recovery from the Combustion of Municipal Solid Waste (MSW)*. Retrieved from:  
<https://www.epa.gov/smm/energy-recovery-combustion-municipal-solid-waste-msw>
- U.S. Environmental Protection Agency (USEPA). (2016c). *Landfill Methane Outreach Program (LMOP)*. Retrieved from:  
<https://www.epa.gov/lmop/benefits-landfill-gas-energy-projects#one>
- U.S. Nuclear Regulatory Commission (NRC). (2016). *Location of Projected New Nuclear Power Reactors*. Retrieved from: <http://www.nrc.gov/reactors/new-reactors/col/new-reactor-map.html>
- U.S. Office of the President (Office of the President). (2015). *Explaining the U.S. Petroleum Consumption Surprise*. Washington, D.C.
- Utech, D. (2016 May 12). Administration Takes Historic Action to Reduce Methane Emissions for the Oil and Gas Sector. *The White House*. Retrieved from:  
<https://www.whitehouse.gov/blog/2016/05/12/administration-takes-historic-action-reduce-methane-emission-oil-and-gas-sector>
- Velders, G. J. M., Fahey, D. W., Daniel, J. S., McFarland, M., & Andersen, S. O. (2009). The large contribution of projected HFC emissions to future climate forcing. *Proceedings of the National Academy of Sciences of the United States of America*, 106(27), 10949-10954. doi:10.1073/pnas.0902817106

- Verbruggen, A., Fishedick, M., Moomaw, W., Weir, T., Nadai, A., Nilsson, L. J., Nyboer, J., & Sathaye, J. (2010). Renewable energy costs, potentials, barriers: Conceptual issues. *Energy Policy*, 38(2), 850-861.
- Wang, Z., & Krupnick, Al. (2013). *A Retrospective Review of Shale Gas Development in the United States: What Led to the boom?* Washington, D.C.: Resources for the Future.
- Ward, D. S., & Mahowald, N. M. (2014). Contributions of developed and developing countries to global climate forcing and surface temperature change. *Environmental Research Letters*, 9(7). doi:10.1088/1748-9326/9/7/074008
- Williams, C.F., Reed, M.J., Mariner, R.H., DeAngelo, J., & Galanis Jr., S.P. (2008). Assessment of moderate- and high-temperature geothermal resources of the United States: U.S. Geological Survey Fact Sheet 2008-3082, 4 p.
- Wines, M. (2013 June 13). Department of Energy's Crusade Against Leaks of a Potent Greenhouse Gas Yields Results. *The New York Times*. Retrieved from: <http://www.nytimes.com/2013/06/14/us/departments-of-energys-crusade-against-leaks-of-a-potent-greenhouse-gas-yields-results.html>
- World Energy Council. (2013). *World Energy Perspective: Cost of Energy Technology*. London, UK: World Energy Council.
- Wunch, D., Wennberg, P. O., Toon, G. C., Keppel-Aleks, G., & Yavin, Y. G. (2009). Emissions of greenhouse gases from a North American megacity. *Geophysical Research Letters*, 36. doi:10.1029/2009gl039825

Zavala-Araiza, D., Lyon, D. R., Alvarez, R. A., Davis, K. J., Harriss, R., Herndon, S. C., Karion, A., Kort, E.A., Lamb, B.K., Lan, X., Marchese, A.J., Pacala, S.W., Robinson, A.L., Shepson, P.B., Sweeney, C., Talbot, R., Townsend-Small, A., Yacovitch, T.I., Zimmerle, D.J., & Hamburg, S. P. (2015). Reconciling divergent estimates of oil and gas methane emissions. *Proceedings of the National Academy of Sciences of the United States of America*, *112*(51), 15597-15602. doi:10.1073/pnas.1522126112

## **Chapter 6 - State Rankings in Climate Change Performance & Policy Adoption**

While the record of state-level climate change policy action is significant, an important component of the policy process includes the evaluation of whether a policy has actually achieved the intended result following implementation. A major question is whether climate change action produces a discernable reduction in CO<sub>2</sub> emissions in the states. Perhaps an equally important question is whether states that have made little or no effort to address the climate change issue have shown divergent trends in terms of CO<sub>2</sub> emissions relative to states that have. The initial step towards climate change mitigation is acknowledging the issue as a policy problem; however, acknowledgement without deliberate and carefully designed action may diminish efforts to reduce emissions to mere political grandstanding. The next step in the study is to develop and apply a quantitative method for comparing state performance with respect to climate change mitigation in terms of climate change policy action and climate change performance.

The chapter begins with an overview of the methodology that is used to analyze state-level climate change performance and policy action, followed by the introduction of a conceptual framework for the evaluation of these two areas. The chapter continues with the development and application of two indices designed to assess climate change performance and climate change policy action across the states. The outcome of the following analysis serves two purposes that are germane to moving the study forward. First, designing a method to rank the states based on their relative climate change performance and policy action provides a logical policy

tool for determining how changes in climate change performance and policy have occurred across the states, while highlighting potential areas for improvement by individual polities. Second, the results of the analysis are used to select four case studies for further investigation regarding the role of collaboration and stakeholder engagement in the climate change policy process using the theoretical framework developed in Chapter 2.

### **The Composite Index Methodology**

To produce a climate change performance and policy action score for each of the fifty states, quantitative and qualitative data related to the three dimensions of anthropogenic climate change are measured and integrated using a composite indicator (CI). A CI is essentially a standardized measure of performance with respect to a particular phenomenon that is derived from the aggregation of a series of unique indicators. Policy issues are often influenced by multiple factors and, therefore, an assessment of performance in a particular area frequently calls for the analysis of a range of indicators in order to establish a robust depiction of the existing state of affairs within a particular region (OECD 2008; Saisana and Tarantola 2002). Thus, the underlying motivation for designing a CI stems from the belief that certain concepts are independent and multidimensional in nature, and, therefore, an assessment of performance cannot be accurately captured through the observation of only a single indicator or variable.

The general structure of a CI can be divided into three levels, thematic groupings or dimensions, individual indicators, and the final CI. Typically, the



process of designing a CI begins with the development of a conceptual framework that adequately explains and organizes the various dimensions that contribute to the occurrence of a particular phenomenon. The development of a conceptual framework can occur via a process of logical deduction or through a comprehensive analysis of existing evidence and previous research to determine the primary components that affect the phenomenon of interest (OECD 2008). The Human Development Index (HDI), for example, is a CI developed from a conceptual framework of national development that is composed of three dimensions: length of life (longevity), knowledge, and standard of living (Haq, 1995; Jahan et al. 2015). Thus, the HDI, and each of its three dimensions, can be used as an informational tool for policymakers, and the general public, by first identifying the relative performance of a particular polity with respect to social wellbeing, and then highlighting specific areas in which improvements can be made through policy intervention.

Once the underlying model of the particular phenomenon has been vetted, and the dimensions have been explicated, the next step in the CI design process is the identification of individual indicators. The individual indicators represent the crux of the CI analytical design, bridging the gap between theory and application by operationalizing the key dimensions of the phenomenon under investigation and facilitating the empirical examination of the conceptual model. Each dimension of the phenomenon being studied represents the general category, and perhaps starting point, for indicator identification. For example, in the HDI, the average life expectancy within a particular region is a logical and practical way to measure the

health of individuals and, even more so, the longevity of life within a particular nation (Haq, 1995; Jahan et al. 2015). Individual indicators guide the data selection process, and, therefore, each indicator should be selected based upon their relevance to the phenomenon being assessed, measurability, coverage among the entities that are being compared, and relationship with other indicators chosen for inclusion in the CI (OECD 2008). In some cases, particularly in areas that may necessitate the inclusion of qualitative data, operationalization of a particular indicator may present measurement challenges. Additionally, measurement of a particular phenomenon may be a challenge if data to observe a particular dimension is unavailable in some or all of the regions being assessed and compared in the analysis. Thus, when choosing appropriate indicators for inclusion in a CI, the issue of measurability and coverage ought to be carefully considered *ex ante*.

The CI methodology is intended to measure a phenomenon that cannot be captured through the observation of a single variable. However, the final CI should also be parsimonious and minimize the number of individual indicators used without sacrificing the explanatory power of the index. For example, in the context of the HDI, it may be that access to health care in addition to life expectancy can be potential indicators of longevity, however, access to health care is likely to be highly correlated with life expectancy. Such a relationship can be revealed through a

correlational analysis of the variables, and, therefore, the access to health care variable can be omitted without sacrificing the accuracy of the final CI.<sup>61</sup>

Once the final indicators have been chosen, construction of the CI requires an aggregation of the data collected for each individual indicator. Therefore, normalization of the data is an important step prior to completing the aggregation process (OECD 2008; Saisana and Tarantola 2002).<sup>62</sup> An additional consideration prior to the completion of the CI is the assignment of individual weights to each indicator or dimension. It may be that some factors are likely to have a greater influence on the outcome of a particular phenomenon, relative to all others, and, therefore, it may be desirable to assign a greater weight to associated values. Weight assignment can occur through logic, theory, or statistical analysis (OECD 2008). The assignment of weights is a nontrivial component of the CI design process, in addition to the observed data weighted indicators will affect the overall measurement outcome. In general, it is best to avoid weighting unless you have a very clear reason to do so theoretically and empirically.

### **A Composite Index for Climate Change Performance**

While a number of studies have focused on the role of particular policies, such as climate action plans or renewable portfolio standards, in producing particular outcomes, no study to date has taken a large-n, comparative approach to analyzing American state-level trends with respect to climate change mitigation and policy

---

<sup>61</sup> In general, when determining which indicators to retain for a CI, it is desirable for the included variables to contain a moderate level of correlation (Tabachnick and Fidell 2007).

<sup>62</sup> There is a range of methods for data normalization, see OECD 2008 for examples.

action (Asensio and Delmas 2015; Carley 2009; Delmas and Montes-Sancho 2011; Menz and Vachon 2006; Millard-Ball 2012, 2013; William, Morgenstern and Shih 2011). One exception is the Germanwatch/CAN Europe Climate Change Performance Index (CCPI) which, beginning in 2006, has been used to produce annual reports that evaluate and compare the performance of nations that are, collectively, responsible for more than 90 percent of global energy-related CO<sub>2</sub> emissions (Burck, Marten and Bals 2015). Each year, the CCPI is presented to the UNFCCC to provide an evaluation of national progress towards the prevention of dangerous climate change as outlined in the Framework Convention on Climate Change.

The most recent CCPI evaluated 58 nations and is composed of five thematic groups, Emissions Level, Development of Emissions, Renewable Energies, Energy Efficiency, and Climate Policy, in which seventeen indicators are utilized (see Table 6.1, Burck, Marten and Bals 2015).<sup>63</sup> The CI is formed by combining indicator results and assigning the following weights to each dimension or thematic grouping: emissions trends 60 percent, energy efficiency 10 percent, renewable energy 10 percent, and climate change policy 20 percent.<sup>64</sup>

---

<sup>63</sup> The CCPI indicators are measured using quantitative energy and emissions data from the International Energy Agency and qualitative data on climate change policy.

<sup>64</sup> By providing an overall weight of 40 percent to climate change policy, energy efficiency, and renewable energy, Germanwatch/CAN Europe argue that “achievements in reducing emissions and promoting mitigation technologies are adequately included in the index” (Burck, Hermwille and Bals 2015, 5). Similarly, the CCPI sets a maximum weight of 30 percent for the level of current emissions to allow the indicator to be “responsive enough to adequately capture ambitious climate policy” (Burck, Hermwille and Bals 2015, 5).

**Table 6.1.** Components of the Climate Change Performance Index.

<b>Thematic Group (weight as %)</b>	<b>Indicator</b>	<b>Weight (%)</b>
Emissions Level (30)	• Primary energy supplied per capita	7.5
	• CO <sub>2</sub> emissions per capita	7.5
	• Target-performance comparison	10
	• Emissions from deforestation per capita	5
Development of Emissions (30)	CO <sub>2</sub> emissions from:	10
	• Electricity and heat production	8
	• Manufacturing and industry	4
	• Transportation	4
	• Residential use and buildings	4
	• Aviation	4
Efficiency (10)	• Efficiency trend	5
	• Efficiency level	5
Renewable Energy (10)	• Share of renewable energy in total primary energy supply	2
	• Development of energy supply from renewable energy sources	8
Climate Change Policy (20)	• National climate policy	10
	• International climate policy	10

Source: Burck, Hermwille and Bals 2015; Burck, Marten and Bals 2015.

The Emissions Level group is composed of three separate indicators: primary energy consumption per capita, CO<sub>2</sub> emissions per capita, and emissions reduction target-performance (target-performance comparison). The indicators provide a current profile for each nation in terms of energy consumption, CO<sub>2</sub> emissions, and performance with respect to each nation's contribution to addressing the issue of anthropogenic global climate change in the context of international goals established by the Kyoto Protocol (Burck, Hermwille and Bals 2015).

The Development of Emissions group is used to describe the recent trend in CO<sub>2</sub> emissions within each nation. The group is disaggregated into five economic

activities, electricity and heat production, manufacturing and industry, transportation, residential and buildings (commercial), and aviation. Each country's individual score is calculated from the percent change and overall change in emissions for each sector.<sup>65</sup> Determining each region's recent development of emissions across each of the four sectors provides a closer look at the institutional characteristics that may be contributing to a particular country's performance in this category. The Renewable Energies thematic group includes two indicators to measure consumption of renewable energy for each country, share of renewable energy and development of renewable energy which are measured using the current share of energy supplied from renewable sources and the percent change and overall change in emissions for each sector, respectively.

One strategy to address the causes of anthropogenic climate change is to promote economic development that reduces the environmental impacts of energy generation and economic output in terms of CO<sub>2</sub> emissions via improvements in efficiency. The CCPI's Efficiency group includes two indicators, Efficiency Level and Efficiency Trend, which measure two approaches to promote a low-carbon economy via improvements in both energy and CO<sub>2</sub> emissions efficiency. The Efficiency Level indicator is a measure of state emissions intensity in terms of metric tons of CO<sub>2</sub> (MT CO<sub>2</sub>) emissions per billion British thermal units (Btu) of energy consumption. The indicator reflects the structure and efficiency of the energy

---

<sup>65</sup> The CCPI methodology determines these changes in percent of emissions and overall change in emissions using a three-year average of emissions (e.g., 2002-2004 and 2007-2009), where the first three-year average serves as the base period.

generation system and the chosen fuel mix for each nation. The Efficiency Trend indicator is a measure of each nation's energy intensity and is determined by the total primary energy consumption (thousand Btu) per dollar of gross domestic product (GDP). This indicator provides a rough comparison regarding the structure of the general economic system and its efficiency with regards to energy required per unit of economic output.

The final thematic grouping of the CCPI is Climate Policy. Two separate indicators, National Climate Policy and International Climate Policy, operationalize this dimension of the CCPI. Data for the national and international climate policy indicators are collected via surveys disseminated to local climate change experts from nongovernmental organizations within each country (Burck, Hermwille and Bals 2015). Survey respondents identified by Germanwatch are asked to complete a questionnaire which includes queries regarding the presence or absence of climate change policies designed to reduce CO<sub>2</sub> emissions via the promotion of renewable energy development and energy efficiency. Respondents are asked to list up to three of the most important policy measures for each sector, and rank the nation's current policy in each area using a 5-point Lykert scale ranging from "very good" to "very poor" (Burck, Marten and Bals 2015). The survey also addresses national policy related to the protection of peat land and forest ecosystem biodiversity using the same performance criteria. Respondents are also asked to rank their respective nation's performance in International Climate Policy with respect to participation in UNFCCC

conferences as well as participation in other international conferences and multilateral climate policy agreements (Burck, Marten and Bals 2015).

The CCPI applies the Min-Max methodology to normalize the value of each individual indicator to facilitate the aggregation and ranking process (Burck, Hermwille and Bals 2015).<sup>66</sup> The Min-Max normalization approach sets the country that is the best performer for a particular indicator as the highest possible score. Thus, any country's individual score will indicate climate performance relative to that of all other countries. The CCPI's final country ranking is calculated by aggregating the weighted indicator scores within each thematic grouping and then aggregating the thematic groupings for each country.<sup>67</sup> The resulting CCPI places each individual country in a performance ranking relative to the performance indicators of all other countries. While the CCPI score places the highest performing nation(s) at the top of the performance "ladder," the aggregate score does not necessarily indicate that a particular country performed better than all countries below it in all areas evaluated.

---

<sup>66</sup> Min-Max normalization equation

$$X_{ic} = 100 \cdot \left( \frac{x_{ic} - \min(x_i)}{\max(x_i) - \min(x_i)} \right)$$

X = Normalized indicator score; x = Measured value; c = country, 1, ..., 58; i = individual indicator, 1, ..., 15

<sup>67</sup> Climate Change Protection Index Formula

$$I = \sum_{i=1}^n w_i X_{ic}$$

I = Climate Change Performance Index

X<sub>ic</sub> = Normalized indicator for indicator, i, in country, c

W<sub>i</sub> = weighting of indicator i,  $\sum_{i=1}^n w_i = 1$  and  $0 \leq w_i \leq 1$

i = individual indicator, 1, ..., 15



Thus, each thematic grouping, and individual indicator, can be separately analyzed to rank performance on specific climate change areas and individual sectors.

This study draws upon the methodological approach employed by Germanwatch/Can Europe to develop a systematic ranking of the fifty U.S. states by developing two CIs, a State-Level Climate Change Performance Index (SLCCPI) and State-Level Climate Change Policy Adoption and Implementation Index (SLCCPAII), to assess state-level performance with respect to climate change mitigation and climate change policy action. While the CCPI offers a novel application of the CI methodology in developing a structured and systematic method to assess national climate change performance, there are a number of potential shortcomings in the CI design which are likely to distort measures of performance and, at least in the context of U.S. state-level climate change performance, provide erroneous conclusions with respect to the relative climate change mitigation performance among the states. Thus, while the SLCCPI and SLCCPAII are produced from the same underlying question developed in the CCPI, the conceptual framework used for the following analysis is unique in a number of important areas.

The first digression from the CCPI begins with the general definition regarding the concept of climate change performance and a critical assessment regarding the inclusion of climate change policy as a dimension of performance. While the logical expectation of policies that are adopted to address the issue of anthropogenic climate change is a subsequent reduction in CO<sub>2</sub> emissions, an ex ante assessment of how such policies will produce actual change is difficult to measure.

The CCPI is not designed to identify the direct impacts to emissions and energy from climate change policy and, although the policy indicators do include some measurement of effectiveness as interpreted by third party climate change experts, such appraisals are based upon the explicit policy goals within the context of a particular region, are subject to various potential biases, and are not necessarily supported by quantitative evidence (Podsakoff et al. 2003). Related to the challenge of accurately measuring the effectiveness of climate change policy using this methodological approach is the issue of rewarding states that may have a suite of climate change policies in place, yet are underperforming in terms of emissions reductions. While government intervention to mitigate the primary drivers of anthropogenic climate change may be necessary to achieve a timely reduction in emissions, economic factors unrelated to such policy may also contribute to a reduction of emissions. For example, a recent decrease in the price of natural gas has contributed to an overall decline in the demand for coal as a source for energy across multiple economic sectors, which would produce a decline in overall emissions, *ceteris paribus* (EIA 2016a). Therefore, simply rewarding states for having policy in place while disregarding the potential effect of other policy or economic factors which may contribute to a state's decline in emissions may distort the true relative performance of states in terms of actual environmental change and unfairly reward states that have enacted climate change policy without direct observation of the actual effectiveness of such policies.

Furthermore, in the absence of a more complex model to identify the relationship between climate change policy adoption and environmental change, the only true measure of climate change performance is the direct observation of temporal changes to the primary drivers of anthropogenic climate change (e.g., emissions, energy efficiency, and renewable energy consumption). Therefore, a measure of climate change performance ought to limit the scope of evaluation to the inclusion of observed changes in the physical factors that contribute to both the proliferation and mitigation of the anthropogenic climate change issue. Reducing climate change performance to the physical dimensions associated with the issue widens the scope of assessment, eliminates the measurement challenges associated with determining the effectiveness of policy outcomes *ex ante*, and allows for factors unrelated to government intervention to be accounted. Therefore, this study uses a conceptual framework for climate change performance that strictly relies upon observations associated with the physical dimensions of climate change, anthropogenic CO<sub>2</sub> emissions and energy consumption (see Chapter 5).

In spite of the limitations of operationalizing climate change policy adoption as a measure of climate change performance, from a policymaking perspective, there is value in understanding the level of policy-oriented action that states have taken to address climate change. As Chapter 4 has illuminated, the states have employed a range of policy tools to reduce CO<sub>2</sub> emissions that span each of the five primary energy end-use sectors. The actions range from voluntary goals and incentives to direct command-and-control regulation of energy consumption and emissions.

Applying the CI methodology to conduct an analysis of the various policies that have been implemented across the states provides a systematic approach that can improve our understanding of the various dimensions of climate change policy action and the relative trends among the states in terms of policy adoption. The CI tool is also useful for identifying areas of action that are commonplace among the states as well as areas in which policy action is lacking. Finally, the CI approach facilitates an opportunity to rank the states based upon their relative level of action across the various dimensions of climate change policy. Developing a state-level ranking in terms of policy action can be a useful tool for state-level policy actors who may be interested in identifying areas of potential improvement within their respective regions as well as a starting point for policy learning among the states. From an academic perspective, the large-n assessment of state-level policy action can serve as a starting point for a deeper investigation via case study analysis.

While the CCPI provides an important starting point for assessing regional climate change mitigation performance, it is worthwhile to take a critical look at how policymakers and scientists ought to define “climate change performance.” For the purposes of this study, an assessment of state-level climate change performance with respect to the mitigation of anthropogenic climate change can be limited to an evaluation of recent trends in the primary drivers that contribute to the climate change issue. Chapter 5 provided a general introduction to the primary drivers of climate change, CO<sub>2</sub> emissions and primary energy consumption, establishing a theoretical foundation for consideration of the most important factors of the climate change issue

within the U.S. While an assessment of climate change policy adoption is relevant to discussions related to climate change performance, given the abundance of quantitative data related to emissions and energy, such a dimension is unnecessary for inclusion in a CI designed to assess overall performance with respect to climate change mitigation. Nonetheless, an understanding and evaluation of climate change policy adoption can provide opportunities for comparisons and produce valuable insight for both policymakers and policy researchers. An assessment of climate change policy performance and climate change policy action is germane to this study, and, therefore, the analysis proceeds with the development of two separate CIs to evaluate state-level climate change policy performance and policy action.

### **State-Level Climate Change Indices**

Chapter 4 reviewed the diverse array of policies that have been designed to establish both direct and indirect constraints on emissions of CO<sub>2</sub> to date and provides an analysis of state-level efforts to address the issue of anthropogenic climate change. Chapter 5 established two critical dimensions of climate change, CO<sub>2</sub> emissions and primary energy consumption, and provided an analysis of the current state-of-play with respect to each among the states. While climate change policy, CO<sub>2</sub> emissions, and primary energy consumption are three important areas of the climate change mitigation conversation, there are a number of ways in which various aspects of these three dimensions contribute to a particular state's relative progress towards addressing the issue of anthropogenic climate change. For example, with respect to energy consumption, one can focus on the amount of energy provided from fossil fuel

resources, or the amount of energy provided from renewable energy. Additionally, one must consider the interactions between dimensions, for example, the relationship between CO<sub>2</sub> emissions and fossil fuel consumption, and determine how a measure of performance can be simplified without sacrificing variation and explanatory power in an overall assessment of performance. The following section draws upon the information provided in previous chapters to develop two conceptual frameworks that can be used to operationalize the dimensions of climate change mitigation in order to solidify an approach for assessing state-level trends in climate change performance and policy action.

#### A Conceptual Framework for Climate Change Performance

In terms of climate change mitigation, the ultimate goal is to achieve a reduction in CO<sub>2</sub> emissions. Therefore, one might argue that the definitive measure of climate change performance is the observed change in a particular polity's overall or per capita emissions. The observed change in emissions within a particular region can be indicative of an overall change in a number of important factors related to climate change mitigation. For example, a decline in per capita emissions may be the result of a transition from carbon intensive fossil fuels, such as coal, towards more carbon efficient sources of energy such as natural gas, or renewable energy. However, there is empirical evidence of a positive, causal relationship between economic growth and CO<sub>2</sub> emissions within the U.S. (Chen et al. 2016; Menyah and Wolde-Rufael 2010). Therefore, while changes in CO<sub>2</sub> emissions are undoubtedly a necessary component of measures related to climate change performance, an analysis that relies solely upon

observed changes in CO<sub>2</sub> emissions across a particular time period is likely to be affected by exogenous factors unrelated to deliberate, structural changes within a particular region that will result in long-term emissions reductions.

The Great Recession (2007-2009), for example, resulted in a decline in economic productivity throughout the U.S., which led to an overall reduction in CO<sub>2</sub> emissions, among other things (Grusky, Western and Wimer 2011). From 2007 to 2009, the per capita CO<sub>2</sub> emissions among the states decreased by 11 percent (0.114 MT CO<sub>2</sub> per person), yet in states where economic activity relies heavily upon the consumption of fossil fuels (e.g., petrochemical manufacturing) the change was generally much greater (EIA 2015b). For example, in 2007 Louisiana, Alaska, and Texas were ranked 1<sup>st</sup>, 2<sup>nd</sup>, and 5<sup>th</sup> in the U.S. in fossil fuel consumption per capita by the industrial and commercial economic sectors and experienced a decrease in MT of CO<sub>2</sub> emissions per capita of 15.42 percent, 16.82 percent, and 12.92 percent, respectively, from 2007 to 2009 (EIA 2015b). In the absence of structural changes in the type of energy consumed to support economic activity, it is reasonable to expect that following an economic recovery, emissions will once again increase in these states. Thus, an assessment of climate change performance that only relies upon observed changes in CO<sub>2</sub> emissions is likely to unfairly reward states that have experienced an abnormally large decrease in emissions as a result of a decrease in economic activity. In contrast, states that have perhaps worked to reduce economic dependence on fossil fuels via structural changes to the economy are less likely to experience dramatic declines in emissions. Consequently, these states will be ranked

lower in terms of the change in emissions from periods of economic decline. Thus, while CO<sub>2</sub> emissions are a necessary component of any measure related to climate change performance, the metric is insufficient on its own for capturing an overall understanding of how structural changes to a region's energy economy have contributed to the mitigation of anthropogenic climate change.

Therefore, a conceptual framework for evaluating state-level climate change performance ought to include factors that contribute to emissions reduction, are indicative of structural and behavioral changes related to climate change mitigation, and are generally addressed by climate change mitigation policy efforts. Two important factors that meet these criteria are the development of energy provided from alternative resources and improvements in energy efficiency (Moomaw et al. 2011; Pacala and Socolow 2004; Sims et al. 2007).<sup>68</sup> Alternative energy development and increases in energy efficiency offer a means for emissions reduction by addressing supply and demand side aspects of energy production and consumption through substitution and conservation, respectively. Additionally, each of these components provide a unique perspective for understanding state-level trends in energy consumption and, therefore, the inclusion of these components in an assessment of climate change performance contributes to a broader understanding of how changes have occurred among the states.

As discussed in Chapter 5, in terms of climate change mitigation, the most notable benefit of alternative energy development is a reduction in the economic

---

<sup>68</sup> Alternative energy sources include renewable sources of energy as defined in Chapter 5 and nuclear energy.



reliance on fossil fuels as a source of energy, and a subsequent reduction in emissions from energy consumption. With the exception of the consumption of biomass in co-fired power plants, an increase in the amount of energy produced from alternative energy sources requires the construction of new energy production facilities and infrastructure that is often unique from the traditional energy grid (Jacobson et al. 2015a, 2015b). Thus, the substitution of carbon-based sources of energy with alternative sources is indicative of a change to the infrastructure of a region's energy economy, and has direct implications with respect to the amount of emissions produced from energy consumption. Although the uneven distribution of some renewable energy resources within the U.S. contributes to some differentiation with respect to the relative economic and technical efficiency and feasibility of producing energy from certain renewable sources among the states, the levelized cost of producing energy from renewable as opposed to fossil fuel sources is generally greater across all forms of renewable energy technology (EIA 2016b; Lazard 2015). Therefore, in addition to the potential impacts to emissions from renewable energy development, an observed increase in the amount of energy consumption provided from renewable sources can generally be attributed to a deliberate policy effort to promote renewable energy development.

An important caveat with respect to the inclusion of alternative energy development in an assessment of climate change performance is the potential for an increase in alternative energy consumption to coincide with an overall increase in total energy consumption. For example, North Dakota experienced an average

increase in renewable energy consumption per capita of 3.55 million Btu (MBtu) from 1988 to 2013 (EIA 2015b). However, the state experienced an average annual increase in total energy consumption per capita of 11.65 MBtu (EIA 2015b). Thus, while alternative energy development plays an important role as a source of fossil fuel substitution, the overall effectiveness of alternative energy development, in the context of climate change mitigation, is contingent upon an associated decrease in consumption of energy produced from fossil fuels. The potential for growth in alternative energy consumption to be proportional to overall growth in energy consumption within a particular region is an important factor in the development of policies such as renewable portfolio standards. This type of policy generally mandates that a specific portion of total energy produced within a state be purveyed from renewable sources (see Chapter 4), therefore, limiting the likelihood that a positive change in renewable energy consumption would be offset by a proportional change in fossil fuel consumption in response to an overall increase in energy demand.

A third component of the conceptual framework for climate change performance, energy efficiency, can achieve a reduction in overall emissions through demand side management of energy consumption across multiple end-use sectors (Moomaw et al. 2011). In the residential and commercial sectors, improvements in energy efficiency can be achieved through an increase in the consumption of energy efficient appliances, building weatherization and lighting retrofits (Pew Center 2011). In the transportation sector, improvements in vehicle fuel efficiency and land use planning that reduces vehicle miles traveled (VMT) and improves access to public

transportation can contribute to emissions reduction via a decline in the demand for petroleum (U.S. Office of the President 2015). As discussed in Chapter 4, the co-benefit provided from improvements in energy efficiency in terms of a reduced demand for energy and a reduction in the relative price of consumption has facilitated the adoption of a number of policies across a diverse array of states within the U.S. The effect of energy efficiency improvements on CO<sub>2</sub> emissions will generally be stronger in states that are also transitioning towards less carbon intensive or alternative energy sources, although such efforts are not a necessity to achieve overall emissions reduction from energy conservation.

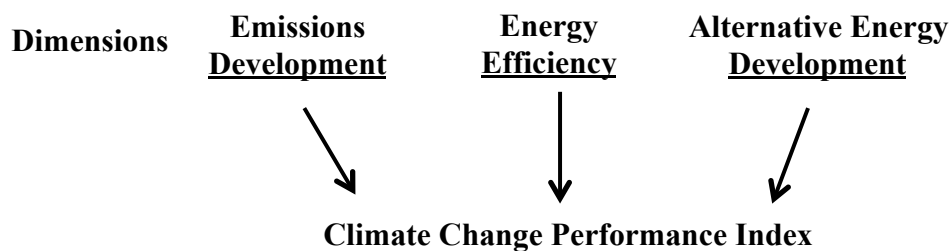
One possible pitfall of improvements in energy efficiency is the potential for a decrease in the price of energy in response to a change in the cost of the production of manufactured goods and a decrease in demand from consumers is an eventual increase in overall consumption. The so-called “boomerang effect” has been the subject of recent research in the literature that calls into question the long-term effectiveness of energy efficiency to mitigate CO<sub>2</sub> emissions (Ayres, Raseman and Shih 2013; Shen, Cui and Fu 2015; Schultz et al. 2007; Sælen and Westskog 2013). However, the results of empirical investigations on this topic have provided mixed conclusions regarding the effect of energy efficiency on total energy consumption (Greening, Greene and Difiglio 2000). One way to address the potential presence of such an effect is to measure energy efficiency improvements in terms of energy consumption per capita, rather than energy consumption per GDP, for example,

which may fail to identify a concurrent increase in overall consumption as a result of efficiency improvements.

Figure 6.1 presents a conceptual framework for evaluating climate change performance across the American states based upon three dimensions: Emissions Development, Energy Efficiency, and Alternative Energy Development. Aside from the direct relevance of each of the three components of the conceptual model of climate change performance to climate change mitigation, the inclusion of these three facets also account for undesirable aspects that cannot be identified from observations of any single component. As discussed above, for example, the level of emissions within a particular region is closely associated with overall economic activity, particularly in areas that are highly dependent upon industrial activity. Therefore, observed changes in emissions coupled with changes in alternative energy consumption and energy efficiency can control for exogenous factors that produce emissions reduction that may be caused by temporary changes in economic activity. Therefore, a state that experiences a decline in emissions in addition to an increase in alternative energy consumption and improvements in energy efficiency will receive a higher performance score than states in which changes in the former occur without experiencing any observable change in the latter. With respect to alternative energy development, a measure of changes in energy efficiency can control for inaccurate measures of performance from growth in alternative energy consumption that occur alongside growth in fossil fuel consumption. Lastly, there is the potential for states to achieve improvements in energy efficiency, while also experiencing an increase in the

consumption of a more carbon intensive fuel type (e.g., a transition from natural gas to coal consumption), which may offset the benefits of energy conservation in terms of achieving an overall decrease in emissions. Observed changes in emissions can control for this phenomenon, whereby states that experience improvements in energy efficiency while also experiencing a reduction in emissions receive a higher performance rating than states that experience an increase in emissions despite achieving improvements in energy efficiency.

**Figure 6.1** Conceptual framework for the SLCCPI.



With respect to the conceptual framework for state-level climate change performance, a second digression from the CCPI model is the exclusion of the current level of emissions and energy consumption as a facet of performance. Three thematic groupings (Emissions Level, Efficiency, and Renewable Energies) of the CCPI rely upon the most recent nation-level energy and emissions data as an indication of performance in these respective areas (see Table 6.1). A snapshot of current state- and sector-level emissions and energy portfolios, as provided in the CCPI and in the discussion of state-level emissions and energy trend in Chapter 5, is valuable for the provision of benchmarks for emissions reduction and renewable energy development moving forward. However, such a metric is not practical for evaluating how state-

level emissions and energy consumption has evolved since the issue of anthropogenic climate change was introduced to the national political agenda.

In addition to issues related to human health and environmental quality, the decision to consume one source of primary energy over another is dependent upon multiple factors, including availability, suitability, and the related costs of development (Brown et al. 2015; de Vries, van Vuuren and Hoogwijk 2007; Hoogwijk, de Vries and Turkenburg 2004; Lopez et al. 2012, 2015; WEC 1994). Many states have an established history of reliance upon various forms of renewable energy that predates the issue of anthropogenic climate change, simply as a result of regional location. Therefore, the current level of renewable or alternative energy consumption is not necessarily indicative of efforts to mitigate anthropogenic climate change. Hydropower and geothermal energy, for example, are among the oldest forms of renewable energy in the U.S., however, the feasibility of harnessing these resources for the generation of energy is generally constrained by geographic location (Brown et al. 2015; Lopez et al. 2012; Williams et al. 2008). Therefore, consumption of such resources tends to be limited to states in which supplies are abundant and relatively accessible. In contrast, regions where access to hydropower and geothermal energy is limited may be disproportionately reliant on sources such as wind and solar power, which have only become widely available since the 1980s (see Chapter 5). Consequently, when evaluating climate change performance based upon each state's current level of emissions and energy consumption, those that have an extensive history of alternative energy consumption but perhaps a slow rate of alternative

energy development in recent years may tend to rank higher than states that have historically relied upon nonrenewable sources of energy but have experienced a fast rate of development of renewable sources in recent years. Therefore, to control for the potential advantage awarded to states with an extensive history of alternative energy consumption, and reward states that have recently increased efforts to expand renewable energy consumption, an analysis of state-level climate change performance with respect to emissions and energy consumption ought to measure the relative changes in CO<sub>2</sub> emissions and energy consumption that have occurred among the states following the 1988 testimony of Dr. James Hansen before Congress (Shabecoff 1988).

#### A Conceptual Framework for Climate Change Policy Adoption and Implementation

Perhaps the most effective strategy with respect to state-level mitigation of anthropogenic climate change would occur through a comprehensive pollution standard designed to reduce emissions across all sectors of an economy. However, to date, no such policy has been adopted within the U.S. While the CCPI divides climate change policy into two separate groupings, national and international policy, state-level climate change policy action has been characterized by the implementation of various sector- and source-specific policies designed to mitigate anthropogenic climate change through a combination of command-and-control and incentive-based regulations. The mechanisms for achieving reductions in CO<sub>2</sub> emissions include both direct emissions reduction mandates (e.g., emissions standards) and indirect, energy conservation- and substitution-based approaches, such as the adoption of Energy

Efficiency Resource Standards (EERS) and Renewable or Alternative Energy Portfolio Standards, respectively.<sup>69</sup> The variety of policy strategies that have been designed to address the climate change issue suggest that climate change policy action is multidimensional, in that a measure of policy action based upon a specific approach (e.g., cap and trade, renewable energy development, vehicle emissions standards, etc.) cannot effectively capture the overall effort made by a particular state. Therefore, to develop a method for comparative analysis of state-level climate change policy action, and to guide the assessment process, a conceptual framework that considers the various aspects of climate change policy must be developed. An approach that includes multiple dimensions of state-level climate change policy action not only provides a more comprehensive depiction of how state-level mitigation efforts have occurred in the U.S., but also accommodates the opportunity to evaluate how states have performed within particular policy areas.

The suite of climate change policies that have been adopted at the state level can generally be placed into five broad thematic groupings: Emissions, Energy Efficiency, Renewable Energy, Multistate Agreements, and Climate Change Policy Planning. Table 6.2 shows how each of the climate change policies introduced in Chapter 4 can be distributed across the five types of climate change policy action. The climate change policies within each of these five groupings can be further disaggregated based upon the economic sector for which the policy has a direct impact. For example, an LCFS directly effects the level of emissions produced from

---

<sup>69</sup> See Chapter 4 for a detailed description of each climate change policies.



the transportation sector, and would fall within the Emissions grouping. Similarly, with respect to Energy Efficiency, a number of states have enacted state-level policies that exceed the minimum federal appliance energy efficiency standards, which generally affects energy consumption from the residential and commercial sectors, as well as requirements for improvements in energy efficiency from the electric power sector via EERS. The SLCCPAII is intended to provide an overall assessment and ranking of the states based upon efforts to address the general challenges presented by the issue which include the implementation of policies designed to address the physical drivers of the climate change issue, CO<sub>2</sub> emissions produced from fossil fuel combustion, as well as the ability to overcome the institutional, social, and political challenges of the issue, which generally requires deliberate planning and collaboration among relevant stakeholder groups to achieve an effective policy outcome. The five thematic groupings presented in Table 6.2 account for each of these dimensions of climate change policy and, therefore, provide a reasonable starting point for a state-level assessment of climate change policy action. The remainder of the section provides a discussion of how each thematic grouping contributes to an understanding of climate change action at the state level.

**Table 6.2** Dimensions of the Climate Change Policy Adoption and Implementation Index.

<b>Emissions</b>	<b>Energy Efficiency</b>	<b>Renewable Energy</b>	<b>Multistate Agreements</b>	<b>Climate Change Policy Planning</b>
1. California Vehicle Emissions Standards	1. Appliance Efficiency Standards	1. Net Metering	1. Regional Agreements	1. Climate Action Plan
2. Greenhouse Gas Emissions Targets	2. Commercial Building Codes	2. Renewable or Alternative Fuels Mandates		2. Climate Change Adaptation Plan
3. Greenhouse Gas Reporting Requirements	3. Energy Efficiency Resource Standards	3. Renewable or Alternative Energy Portfolio Standards		3. Climate Legislative Commissions And Executive Branch Advisory Groups
4. Low Carbon Fuel Standard	4. Residential Building Codes			4. Greenhouse Gas Inventory
5. Emissions Standards for the Electric Power Sector	5. Smart Growth/Vehicle Miles Travelled			
6. Cap and Trade				
7. Zero Emissions Vehicle Program	6. State Building Standards			

The primary purpose of climate change policy is to achieve a reduction in emissions within a particular region, although effective climate change mitigation is not limited to mandates that require a direct reduction of CO<sub>2</sub> emissions. The conceptual framework for climate change performance, discussed above, highlighted two areas, energy conservation and fossil fuel substitution, that can also be an effective approach to achieve emissions reductions. While a number of states have implemented policies designed to achieve direct reductions in CO<sub>2</sub> emissions, the adoption of policies that focus on energy conservation and substitution as a means to reduce emissions have generally been more popular among the states (see Chapter 4). Policies that can mandate or incentivize a direct reduction in emissions are placed

within the Emissions dimension of the conceptual framework, while policies that achieve emissions reductions indirectly, via energy conservation and substitution, are placed within the Energy Efficiency and Renewable Energy dimensions. All three types of climate change policies, emissions, efficiency, and renewable energy standards, can be implemented to accomplish an overall reduction in emissions and each addresses a unique aspect of climate change mitigation (i.e., direct or indirect emissions reduction). Therefore, each of these three policy types represent a unique dimension of the SLCCPAII as an evaluation of state-level climate change policy action ought to account for the implementation of policies that can produce a direct reduction in emissions as well as those that reduce emissions indirectly via improvements in energy conservation and the substitution of fossil fuels with alternative energy sources.

A fourth dimension of climate change policy action, Multistate Agreements, represents state-level efforts to form regional coalitions intended to address the various drivers of anthropogenic climate change. Analogous to the International Policy dimension of the CCPI, the Multistate Agreements dimension of the SLCCPAII signifies the ability for some states to overcome the political and economic barriers to multilateral agreements and establish a collaborative and cooperative policy networks to reduce CO<sub>2</sub> emissions. A number of states have entered into cross-state partnerships through regional agreements intended to reduce emissions produced from various economic activities (see Table 6.3). Although the collection of multistate climate change agreements that have been established in

recent years include various types of policies that fall within the first three dimensions of climate change policy action, multistate climate change policy agreements represent a distinct dimension of policy action. The formation of policy partnerships and cross-state policy coordination faces a unique set of challenges. Therefore, the survival of such initiatives is indicative of participant states' abilities to overcome the various challenges associated with the provision of a public good (climate change mitigation) through interstate collaboration, such as the associated transaction costs of organizing regional policies and the potential for free riding (Coase 1974; Olson 1965).

**Table 6.3** State multistate initiative participation.

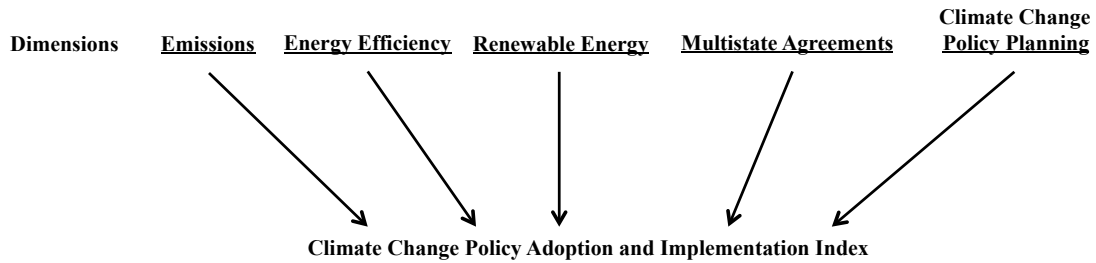
<b>Regional Agreement</b>	<b>Year Initiated</b>	<b>Participant States</b>	<b>Status</b>
New England Governors/Eastern Canadian Premiers: Climate Change Action Plan	2000	Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont	Active
West Coast Governor's Global Warming Initiative	2004	California, Oregon, Washington	Inactive
Regional Greenhouse Gas Initiative	2005	Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island, Vermont	Active
Southwest Climate Change Initiative	2006	Arizona, New Mexico	Inactive
Western Climate Initiative	2007	Arizona, California, Montana, New Mexico, Oregon, Utah, Washington	Inactive
Midwest Greenhouse Gas Reduction Accord	2007	Illinois, Iowa, Kansas, Michigan, Minnesota, Wisconsin	Inactive
Pacific Coast Collaborative	2008	Alaska, California, Oregon, Washington	Active
Northeast and Mid-Atlantic Low Carbon Fuel Standard	2009	Connecticut, Delaware, Maine, Maryland, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, Washington	Active
Transportation Climate Initiative	2010	Connecticut, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont	Active
North America 2050	2012	Arizona, California, Connecticut, Delaware, Illinois, Maine, Maryland, Massachusetts, Minnesota, Montana, New Jersey, New Mexico, Oregon, Rhode Island, Vermont, Washington	Inactive
State Zero-Emission Vehicle Programs	2013	California, Connecticut, Maryland, Massachusetts, New York, Oregon, Rhode Island, Vermont	Active

The fifth dimension of the SLCCPAII, Climate Change Policy Planning, represents the efforts initiated by states to plan for climate change mitigation policy efforts. This aspect of policy action includes the initial steps of the policy process that states have taken towards addressing the issue of anthropogenic climate change. In the context of state-level climate change mitigation, understanding the magnitude of the problem, both in terms of the predicted regional impacts associated with a change to the global climate and the distribution of emissions across the various sectors within an economy, is a necessary first step in determining whether policy action is warranted and how effective policy ought to be designed (Kingdon 1995). The distribution of emissions within a particular state not only influences the effectiveness of policy action, in terms of the relative impact of emissions reduction, but can also affect the political feasibility of emissions regulation. For example, policies designed to reduce emissions from the electric power sector will have the greatest effect in states where coal provides a primary source of energy for electricity production. However, the significant role that coal production may play within a state's economy may contribute to political challenges with respect to the adoption of standards to regulate emissions from coal combustion. A second component of the Climate Change Policy Planning dimension includes the formulation of potential policy solutions. This aspect of the policy process may include consultation with relevant public, private, and government stakeholders as well as scientific experts in an effort to identify and develop appropriate policy tools that are politically feasible and provide meaningful environmental outcomes. Following an evaluation of the potential

magnitude of the climate change problem, and the relative role that each economic sector plays in the promulgation of CO<sub>2</sub> emissions, policymakers are provided with a more organized understanding of the issue and can prioritize opportunities for government intervention to achieve mitigation.

Figure 6.2 presents a conceptual framework for evaluating climate change policy action among the states based upon five dimensions: Emissions, Energy Efficiency, Renewable Energy, Multistate Agreements, and Climate Change Policy Planning. As with climate change performance, an assessment of climate change policy action cannot be effectively captured via the observation of a single variable. A number of unique state-level actions can signify both a deliberate effort to address anthropogenic climate change as well as the ability to overcome and address some of the complex economic and political challenges that may be associated with effective mitigation. Each dimension of the SLCCPAII represents a unique aspect of state-level climate change policy that can contribute to an understanding and assessment of how each state has sought to address the climate change issue. The next section of the chapter takes a closer look at the conceptual frameworks presented above by introducing potential indicators for the SLCCPI and the SLCCPAII and performing an empirical analysis to determine which variables and dimensions are suitable for inclusion in each respective CI.

**Figure 6.2** Conceptual framework for the SLCCPAII.



### **Indicators of Climate Change Performance**

The next step stage in the CI process is to establish the final dimensions and individual indicators that will be used to operationalize the SLCCPI and SLCCPAII. The selection of individual indicators is a critical component in the CI design process. Potential variables are generally assessed based on three criteria: relevance to the phenomenon being assessed, measurability, coverage among the entities that are being compared, and relationship with other indicators chosen for inclusion in the CI (OECD 2008). The CCPI developed by Germanwatch/Can Europe includes fifteen individual indicators to measure performance across the five dimension of climate change performance: Climate Policy, Development of Emissions, Emissions Level, Renewable Energies, and Efficiency, identified in the study's conceptual model (see Table 6.1). As discussed above, two dimensions of the CCPI (Climate Change Policy and Emissions Level) offer insightful information regarding important aspects of the climate change issue. However, these dimensions are less suited for a temporal assessment of actual climate change mitigation in the American states. Therefore, the SLCCPI is composed of three dimensions (Emissions Development, Energy Efficiency, and Alternative Energy Development) that represent temporal trends in state-level CO<sub>2</sub> emissions and energy consumption.



Six separate indicators are included in the SLCCPI: CO<sub>2</sub> emissions per capita, emissions-GDP intensity, total energy consumption per capita, emissions-energy intensity, energy-GDP intensity, and alternative energy consumption per capita. In order to determine how the level of each prospective indicator has changed over time, the average annual change for each variable from 1988 to 2013 was estimated for each of the fifty states using six linear regression models in which the dependent variable was represented by one of the indicators described above and the independent variable was represented by the year of each observation.<sup>70</sup> Table 6.4 provides a description of each of the six indicators, including units of measurement and the dimension for which they were chosen to represent.

---

<sup>70</sup> Prior to the regression analysis, data for each of the states were assessed for linearity. While a subset of states exhibited potential nonlinearity for some indicators, trends predominantly exhibited a linear relationship. The issue of anthropogenic climate change was first presented before national policymakers in 1988; therefore this year was selected as the initial year of observation.

**Table 6.4** Potential indicators of state-level climate change performance.

<b>Dimension</b>	<b>Indicator</b>	<b>Units</b>	<b>Source</b>
Emissions Development	CO <sub>2</sub> Emissions Per Capita	MT CO <sub>2</sub> Per Person	EIA 2015a; Census Bureau 2015
	Emissions-GDP Intensity	MT CO <sub>2</sub> Per U.S. Dollar	EIA 2015a; BEA 2015a
Energy Efficiency	Total Energy Consumption Per Capita	MBtu Per Person	EIA 2015b; Census Bureau 2015
	Energy-GDP	Thousand Btu (MMBtu) Per U.S. Dollar	EIA 2015b; BEA 2015a
	Emissions-Energy Intensity	MT CO <sub>2</sub> Per MBtu	EIA 2015a, 2015b
Alternative Energy Development	Alternative Energy Consumption Per Capita	MBtu Per Person	EIA 2015b; Census Bureau 2015

The Emissions Development dimension of the SLCCPI is intended to characterize a particular region's role in contributing to the issue of climate change via CO<sub>2</sub> emissions. While the inclusion of CO<sub>2</sub> emissions per capita is a practical indicator of emissions performance, an assessment of state-level performance with respect to the amount of emissions produced from economic activity (emissions-GDP intensity) may also provide a relevant measure of Emissions Development.<sup>71</sup>

Observed changes in a state's emissions-GDP intensity can provide insight into how

<sup>71</sup> The Development of Emissions group from the CCPI is operationalized by the observed change in emissions across five end-use sectors: electric power, industry, road transportation, aviation, and residential and commercial. While determining each state's recent development of emissions across each of these primary economic sectors provides a closer look at the institutional characteristics that may be contributing to a particular state's performance in this category, this study is not concerned with distinguishing the development of emissions at such a scale. Therefore, the SLCCPI includes total per capita emissions of CO<sub>2</sub>, across end-use sectors, to determine each state's emissions.

closely economic activity is linked to the combustion of fossil fuels, and, consequently, the proliferation of climate change. As discussed in Chapter 5, the consumption of fossil fuels has historically provided an important source of energy for economic activity across end-use sectors throughout the U.S. Therefore, trends in the relationship between emissions and economic activity may serve as an indication of overall emissions performance, where a decoupling of economic activity and energy consumption from CO<sub>2</sub> emissions would be considered desirable in terms of climate change mitigation. However, while a decoupling of economic activity from emissions is desirable, particularly within the context of sustainable development, it is possible for the rate of economic growth to exceed the rate of change in emissions while per capita emissions increase concurrently (Gupta 2015; OECD 2002; Van Canegham 2010; Van der Voet et al. 2014). While economic growth in spite of climate change mitigation is socially and politically desirable, the result is not a necessary condition for mitigation to be achieved, given the definition of climate change provided above. However, the inclusion of a measure of CO<sub>2</sub> emissions per capita, together with a measure of emissions-GDP intensity in the Emissions Development thematic grouping will reward states that have performed well in both areas more than states that have only achieved desirable trends in one indicator.

The Energy Efficiency dimension of climate change performance is intended to exemplify state-level changes in the demand for energy. Three indicators, total energy consumption per capita, and two measures of energy intensity, emissions produced from energy consumption (emissions-energy intensity) and energy

consumption in relation to GDP (energy-GDP intensity), were considered as representative measures of this dimension of climate change performance. As with CO<sub>2</sub> emissions per capita, observed changes in energy consumption per capita is a practical approach for operationalizing energy efficiency trends within a particular region, where an observed decrease in individual energy consumption over time signifies a reduction in the overall demand for energy within an economy, and subsequently the amount of emissions produced per person. The energy-GDP intensity indicator also represents a unique measure that can be used to assess energy efficiency trends within a particular region by directly linking energy consumption to economic activity. The consumption of energy is integral to all economic end-use sectors. Therefore, a decrease in the amount of energy consumed relative to economic output is indicative of an overall change in the demand for energy within a state's economy and an improvement in energy efficiency. Relatedly, given that fossil fuels are a primary source of energy throughout the U.S., a decrease in the amount of CO<sub>2</sub> emissions produced from the consumption of energy (emissions-energy intensity) may signify changes in the demand for energy over time.

As with the emissions-GDP intensity indicator, while the decoupling of energy consumption and economic growth may be desirable in terms of sustainability, such a metric does not necessarily indicate overall improvements in actual energy consumption as economic growth may exceed the growth of energy consumption, while overall energy consumption continues to increase (Iddrisu and Bhattacharyya 2015; Patlitzianas et al. 2008; Vera and Langlois 2007). Similarly, while emissions-

energy intensity couples the relationship between energy sources and associated emissions and a decrease in emissions per unit of energy consumption contributes to climate change mitigation, in the absence of a measure of changes in per capita energy consumption, a downward trend in emissions-energy intensity can potentially be offset by an increase in overall energy consumption (Iddrisu and Bhattacharyya 2015). Therefore, all three indicators are included in the Energy Efficiency thematic group of the SLCCPI as each measure captures a unique aspect of energy efficiency and, taken together, can control for undesirable performance related to climate change mitigation.

The Alternative Energy Development dimension of climate change performance represents supply side changes to a region's energy portfolio. In terms of climate change mitigation, a reduction in CO<sub>2</sub> emissions will require a transition away from carbon-based sources of energy (Moomaw et al. 2011). As such, a measure of alternative energy consumption per capita was selected as an indicator of state-level performance with respect to the development of alternative energy sources.<sup>72</sup> It is worth noting that while some sources of alternative energy such as hydro and nuclear power may be considered less desirable relative to others based upon environmental and social factors unrelated to the issue of climate change, each offers an opportunity to reduce CO<sub>2</sub> emissions via the substitution of fossil fuels (see Chapter 5). Therefore, all sources of alternative energy were included in the indicator.

---

<sup>72</sup> The measure of alternative energy development includes an aggregate measure of consumption for each state as the various sources of alternative energy offer opportunities for fossil fuel substitution across economic sectors.

Another prospective measure of alternative energy development is the share of total energy consumption provided from alternative sources. The decision to exclude this variable was based on the inclusion of energy consumption per capita in the Energy Efficiency group. Together, a measure of the change in total alternative energy consumption and energy consumption, per capita, provide an indirect measure of changes in the share of alternative energy consumption within a particular state.<sup>73</sup>

### **Indicators of Climate Change Policy Adoption and Implementation**

Twenty-one indicators were chosen for inclusion in the SLCCPAII (see Table 6.5). Primary and secondary qualitative data for each policy were collected from various databases and state legislative records (e.g., C2ES 2014, DSIRE 2016, ACEEE 2016). Indicators for the Emissions, Energy Efficiency, and Renewable Energy dimensions of state-level policy action, which address the primary drivers of climate change and climate change mitigation, were determined based upon the general focus and design of each type of climate change policy. For example, Renewable Portfolio and Alternative Energy Standards and Renewable Fuel Standards and Mandates, each provide explicit targets regarding the amount of renewable energy that should be consumed by the electric power and transportation sectors, respectively. These types of policies are designed to increase the substitution of fossil fuels with less carbon intensive fuel types and are therefore considered

---

<sup>73</sup> Final indicators for the SLCCPI were examined empirically using correlation analysis. The indicators selected for inclusion in each dimension of the SLCCPI generally exhibited a moderate to high level of correlation amongst each other. The “share of total energy from alternative energy sources” indicator was highly correlated with per capita energy consumption, and, therefore, alternative energy per capita was selected for inclusion in the SLCCPI as the indicator takes into account population size (see Appendix 1).

representative of the Renewable Energy dimension of the SLCCPAII. While many climate change mitigation policies establish specific, quantitative goals for achieving emissions reductions, energy efficiency improvements, and renewable energy development, a number of policies do not establish specific targets for these areas.<sup>74</sup> For example, zero emissions vehicle (ZEV) mandates and Smart Growth and VMT policies are designed to address transportation sector emissions and energy efficiency via an increase in electric vehicle purchases and a reduction in vehicle miles travelled, respectively. Although neither policy type establishes a specific target for achieving emissions reductions or energy efficiency improvements, the ultimate goal of these policies is to achieve advancements in these areas, and therefore contribute to climate change mitigation. Greenhouse emissions reporting policies are also included as an indicator for the Emissions dimension of the SLCCPAII. Although reporting policies do not mandate a direct reduction in emissions, reporting requirements can be used to reveal excessive polluters, which can incentivize mitigation to avoid criticism from policymakers and the general public (Bui 2005; Kraft, Stephan and Abel 2011; Niles and Lubell 2012). In 2009 the U.S. EPA published a rule (40 CFR Part 98) that established the Greenhouse Gas Reporting Program, which requires mandatory reporting of GHG emissions from sources that emit 25,000 metric tons or more of CO<sub>2</sub> equivalent per year. Therefore, state-level GHG reporting requirements that occurred prior to 2009 are considered in this study. Overall, 21 indicators were

---

<sup>74</sup> These policies include: zero emissions vehicle (ZEV) mandates, Smart Growth and VMT policies, building standards (state, residential, and commercial), net metering policies, and GHG reporting policies.

identified across the five dimensions of SLCCPAII related to the physical drivers of climate change and climate change mitigation. Table 6.5 provides a summary of each of the policies identified as potential indicators for each of the three dimensions, as well as a brief description of the general policy design.



**Table 6.5** State climate change policies included in the SLCCPAII.

Appliance Efficiency Standards	Standards that specify the minimum energy efficiency levels of specific products that exceed federal standards.
California Vehicle Emissions Standards	Emissions standards for vehicles that exceed federal standards.
Cap and Trade	Emissions standards for stationary sources that assign emissions permits to emissions sources and allow trading between entities to occur.
Climate Action Plan	A set of strategies to guide efforts for climate change mitigation.
Climate Change Adaptation Plan	A set of strategies to guide efforts for climate change adaptation.
Climate Legislative Commissions And Executive Branch Advisory Groups	A formal advisory committee, generally composed of various stakeholder groups, and charged with formulating policies recommendations related to climate change mitigation and adaptation.
Commercial Building Codes	Design standards for new buildings constructed within the commercial sector to improve energy efficiency.
Emissions Standards for the Electric Power Sector	Emissions performance standards for emission produced from power plants.
Energy Efficiency Resource Standards	Standards to improve energy efficiency in electric power sector, including: generation, transmission, and consumption).
Greenhouse Gas Emissions Targets	Emissions reduction levels to be achieved by a specific time.
Greenhouse Gas Inventory	A summary of emissions produced from economic activity.
Greenhouse Gas Reporting Requirements	Establishes reporting requirements for various sources of emissions.
Low Carbon Fuel Standard	Standards to reduce the carbon intensity of transportation fuels.
Net Metering Policy	A billing mechanism that credits solar energy system owners for the electricity they add to the grid.
Regional Agreements	Interstate agreements to coordinate, design, and implement climate change mitigation policies.
Renewable or Alternative Energy Portfolio Standards	Standards designed to increase production of energy from renewable energy sources, usually a specific percentage of total energy generation within a specific timeframe.
Renewable or Alternative Fuels Mandates	Requires transportation fuel to contain a minimum volume of renewable fuels.
Residential Building Codes	Design standards for new buildings constructed within the residential sector to improve energy efficiency.
Smart Growth/Vehicle Miles Travelled Policies	Policies designed to reduce sprawl, increase access to alternative transportation networks, and improve overall transportation efficiency.
State Building Standards	Design standards for state-owned buildings to improve energy efficiency.
Zero Emissions Vehicle Program	Policies designed to increase the number of zero emissions vehicles within a region.

Climate change is a trans-boundary issue. Thus, an effective and efficient strategy for mitigation efforts is through the development of coordinated policy adoption via regional agreements, which expand the geographic range of climate change policies. However, interstate policy efforts are perhaps more challenging to implement due to the increased transaction costs associated with an expansion of the population base regulated by such policies and the effected stakeholders (Lubell et al. 2002; Ostrom 2007; Sabatier et al. 2005). The Multistate Agreements dimension of the SLCCPAII signifies the ability for states to overcome the various political, institutional, and economic challenges that may impede interstate collaboration with respect to climate change policy.

An appropriate indicator of a state's ability to overcome the challenges to addressing the trans-boundary issue of climate change is the level of participation in regional agreements. Chapter 4 provided a description of eleven regional agreements that have been formed between states that apply a number of policy tools to address various aspects of the climate change issue. Some of these agreements have been unsuccessful with respect to producing long-term policy commitments that translate into effective change within the particular region of focus while others have dissolved or transitioned into new partnerships (Klinsky 2013; WCI 2011). The fluidity of such regional agreements and the perceived challenges of producing discernible policy outcomes as a result of cross-state collaborations imply that an assessment of a state's overall participation in a regional climate change policy partnership would provide a measure of how successful it has been in overcoming various challenges related to

trans-boundary policy agreements. Therefore, the total number of agreements in which each state is actively participated, past and present, were used to measure state-level participation in regional climate change policy agreements.

The final dimension of the SLCCPAII, Climate Change Policy Planning, represents state-level initiatives that can be used to inform the development of climate change mitigation policy. Designing effective climate change mitigation efforts requires policymakers to consider the overall magnitude of emissions produced within a particular region, the distribution of emissions across the regional economy, and the potential socioeconomic effects of targeted emissions reduction efforts. An important political challenge to the successful implementation and survival of state-level climate change policy has been a general concern regarding the economic impacts of emissions reduction mandates (Layzer 2007; McCright 2011; McCright and Dunlap 2000, 2003). Consequently, effective policymaking may necessitate the prioritization of climate change mitigation efforts based upon the potential to achieve emissions reductions, the relative cost-effectiveness of each policy option, and the distribution of economic impacts that may result from mandates to reduce emissions. Therefore, potential indicators of the Climate Change Policy Planning dimension of the SLCCPAII ought to account for both the physical and socioeconomic aspects associated with the policy design process.

One way to evaluate systematically how a particular state contributes to anthropogenic climate change is to commission a GHG inventory. Generally, a GHG inventory tracks the total annual emissions that occur as a result of economic activity.

Emissions data are typically reported by the source of emissions and the economic sector in which they occur, which can provide a better understanding of the sources of emissions within a particular policy and guide the development of emissions reduction policies and programs (USEPA 2016). A second component of climate change policy planning includes the deliberate effort by states to establish a comprehensive strategy for the implementation of policies to achieve emissions reductions. While a GHG inventory provides an important starting point for evaluating and prioritizing efforts to reduce CO<sub>2</sub> emissions, state-led initiatives to push reduction efforts farther along in the policy process should be included in an assessment of climate change policy action. Two indicators of state-level efforts to develop a strategic plan for climate change mitigation policy is the completion of climate action and climate change adaptation plans. A climate action plan builds upon the information gathered from the completion of a GHG inventory by outlining specific activities and policies that can be undertaken to reduce emissions, while an adaptation plan considers the region-specific impacts of anthropogenic climate change and recommends policies to plan for the expected environmental changes associated with a change in average global temperatures, which may also include recommended strategies for mitigation (C2ES 2011). Climate action and adaptation plans can merge the relationship between emissions and economic activity by providing a structured plan for climate change policy action that prioritizes emissions reduction efforts based upon overall mitigation and cost effectiveness. Thus, the completion of such reports can benefit the policy planning process by providing

policymakers with an overview of potential emissions reduction policies that consider both environmental and socioeconomic impacts of implementation as well as the consequences of inaction.

A third indicator of state-level efforts to initiate climate change policy planning is the formation of advisory committees to vet opportunities for climate change mitigation. Many states have established formal legislative commissions and executive branch advisory groups charged with investigating opportunities for state-level climate change mitigation. Often these committees are composed of representatives from various stakeholder groups, including scientists, street-level bureaucrats, private sector companies, nongovernmental organizations, and the general public. The input provided from a panel of relevant stakeholders can be used to inform the prioritization of policy efforts based upon the consideration of stakeholder preferences (Ansell and Gash 2008). Understanding the socioeconomic impacts of climate change policy may provide important information regarding the political feasibility, bureaucratic challenges, and economic impacts of various policy options, each of which can be used to inform the efficiency and cost-effectiveness of emissions reduction policy options.

For the SLCCPAII, indicators were measured using primary and secondary qualitative data related to each state's participation in the twenty-one policies discussed above. With the exception of Regional Agreements and Residential and Commercial Building Codes, each indicator was assigned a score of -1, 0, 1, 2, or 3, depending upon the current status of each policy within a particular state. For the

analysis, it is assumed a state that has repealed a climate change policy has taken a step backwards in terms of policy action, and is therefore assigned a negative score (-1). States that have not adopted or implemented a particular policy are assigned a score of 0 for each respective indicator, a score of 1 for a particular policy is assigned to states where a particular policy has been recommended by a legislative or executive body, was adopted and implemented but is currently inactive, or where a policy is currently under development but has not been implemented. In the case of policy actions that are fulfilled with the completion of a formal document such as a Climate Action Plan or GHG Inventory, states are assigned a score of 0 for the absence of such a report or 1, indicating the completion of a report. For some policies, a score of 2 represents the formal adoption and implementation of a particular policy within a state, while for others the score represents the adoption and implementation of voluntary goals (e.g., voluntary renewable or alternative portfolio standards) or less comprehensive policy approaches (e.g., cap and trade for the electric power sector vs. a statewide cap and trade program). When applicable, a score of 3 represents the adoption and implementation of mandatory or comprehensive policies, such as mandatory Renewable or Alternative Energy Standards and a statewide cap and trade program.

The Multistate Agreements score for each state is based upon an aggregation of a state's level of participation in each of the eleven multistate climate change policy initiatives that have been undertaken in the U.S. to date. The range of possible scores for each regional agreement range from 0 to 2, where a score of 0 indicates the

absence of state-level involvement, a score of 1 indicates that a state had previously been involved in a particular initiative, but is no longer active, and a score of 2 indicates active involvement in a particular regional agreement. Residential and Commercial Building Code scores were based upon the status of state-level energy codes related to each economic sector. In the U.S., the IECC and the ASHRAE guidelines are a commonly applied approach for establishing building construction requirements with respect to energy efficiency for residential and commercial buildings, respectively (see Chapter 4). The IECC and ASHRAE regularly publish updated codes that provide new opportunities for improving energy efficiency via building design (IECC 2016). The most recent IECC and ASHRAE standards were established in 2015 and 2013, respectively, however, state-level adoption of the IECC and ASHRAE codes generally ranges from the 2006 to 2015 and 2007 to 2013, respectively. Therefore, state-level Residential and Commercial building Code scores range from 0 to 5, where a score of 0 indicates the absence of IECC or ASHRAE standards at the state level and a score of 5 indicates the adoption of building energy efficiency standards that are more efficient than either the 2015 IECC or 2013 ASHRAE guidelines, with scores of 1 to 4 indicating state adoption of an earlier IECC or ASHRAE building energy code guidelines. Table 6.6 provides a summary of the policies included in the SLCCPAII and a description of the scores that were applied to each state based upon the level of policy action.

**Table 6.6** Scoring criteria for the indicators included in the SLCCPAII.

Policy	Score				
	-1	0	1	2	3
Appliance Efficiency Standards	Policy Repealed	No Action	Recommended, In Development, or Inactive	Active or Implemented	-
California Vehicle Emissions Standards					-
Emissions Standards for the Electric Power Sector					-
Greenhouse Gas Emissions Targets					-
Low Carbon Fuel Standard					-
Net Metering					-
Regional Agreements <sup>1</sup>					-
State Building Standards					-
Zero Emissions Vehicle Program					-
Energy Efficiency Resource Standards				Voluntary Goal	Mandatory
Greenhouse Gas Reporting Requirements				Voluntary	Mandatory
Renewable or Alternative Energy Portfolio Standards				Goal	Mandatory Standard
Renewable or Alternative Fuels Mandates				Sector-Specific	Statewide
Smart Growth/Vehicle Miles Travelled Policies				VMT Policy Only	Smart Growth and VMT
State Cap and Trade	Utility Sector Only	Statewide			
Climate Action Plan	-	Completed	-		
Climate Change Adaptation Plan	-	Completed	-		
Climate Legislative Commissions And Executive Branch Advisory Groups	-	Active	-		
Greenhouse Gas Inventory	-	Completed	-		
Commercial Building Codes	Scores for the Residential and Commercial Building Codes indicators were based upon the current state-level requirements for energy efficiency as defined by the IECC and ASHRAE guidelines, respectively. Potential scores ranged from 0 to 5 and were based upon the currently implemented IECC and ASHRAE guidelines.				
Residential Building Codes					

1. Regional Agreements scores were based on the aggregate scores for state-level participation in each of the eleven multistate agreements that have been established within the U.S. to date.



The ordinal scoring approach applied for each indicator included in the SLCCPAII provides a simple process for ranking state-level adoption and implementation for each state with respect to the 21 climate change policies identified above. A more detailed ranking of state-level policy indicators may include a measure of the stringency of a particular policy relative to all other states. However, given the variation among state-level emissions and energy characteristics, a comparison of policy stringency is not applied for this analysis. The ordinal measurement approach assumes that certain levels of policy adoption and implementation are more likely to produce climate change mitigation progress than others and, therefore, states should be rewarded for achieving higher levels of policy action. For example, while the adoption of voluntary goals for improvements in energy efficiency from the electric power sector signifies political acknowledgement regarding the importance of promoting energy conservation, mandates for efficiency improvements via an EERS establish a firm requirement for achieving energy conservation and often include a specific timeframe for action (Steinberg and Zinaman 2014). Therefore, while state-level action within a particular policy area ought to be rewarded, those states that have taken the most significant steps towards achieving climate change mitigation via policy adoption ought to be recognized and rewarded accordingly.

This method differs from the CCPI climate change policy evaluation method, which operationalizes climate change policy variables by collecting survey data from climate change experts within nongovernmental organizations in each respective

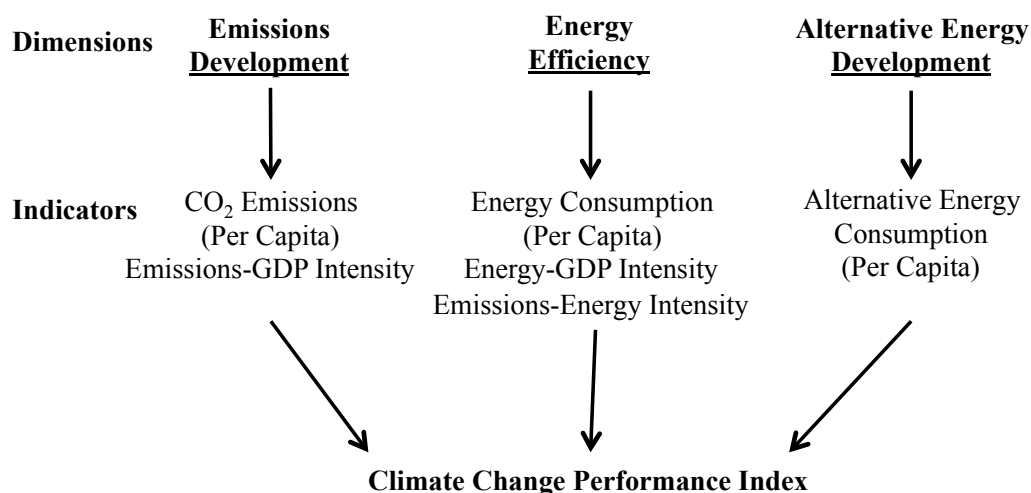
country (Burck, Hermwille and Bals 2015).<sup>75</sup> The use of survey data to determine climate change policy performance may introduce measurement biases into the results where survey respondents may be incentivized to over- or underestimate country performance. The method employed in the SLCCPAII avoids the potential for such biases by simply relying upon a determination of the current status of policy action within each state for each policy type.

Final indicators for the SLCCPI and the SLCCPAII were chosen based upon the theoretical and logical relationship that each indicator has with the respective dimensions of each index. Each indicator selected for the SLCCPI and SLCCPAII provides a unique measure of climate change performance and policy adoption and implementation, respectively. Figures 6.3 and 6.4 present the conceptual framework for evaluating climate change policy performance and policy action among the states and include the respective indicators for each index. The next section provides a summary of the scores for indicators for both the SLCCPI and the SLCCPAII, followed by the construction of the final CIs.

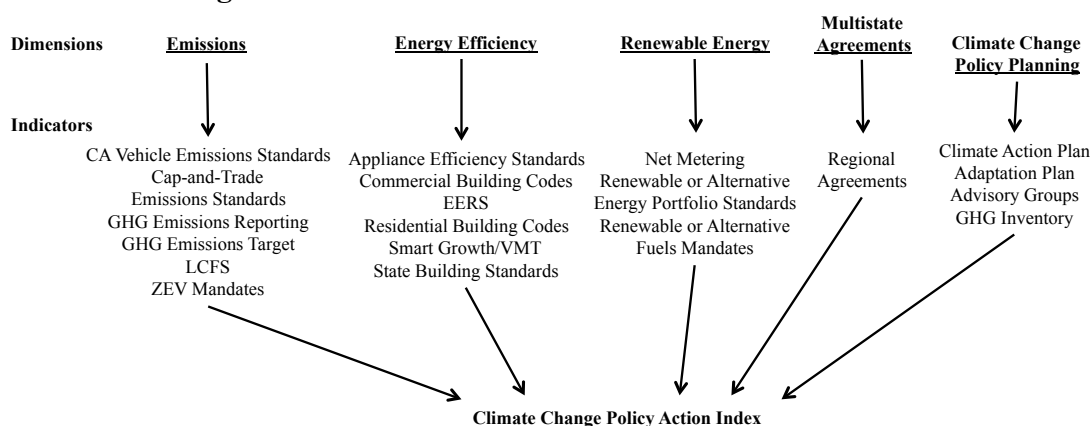
---

<sup>75</sup> The surveys ask respondents to, “give a judgment and ‘rating’,” on the most important climate change policy measures of their governments (Burck, Hermwille and Bals 2015, 12).

**Figure 6.3** Dimensions and indicators of the SLCCPI.



**Figure 6.4** Dimensions and indicators of the SLCCPAII.



## Analysis and Results

The SLCCPI is composed of six indicators, average annual change in CO<sub>2</sub> emissions per capita, CO<sub>2</sub> emissions-GDP intensity, energy consumption per capita, energy-GDP intensity, emissions-energy intensity, and alternative energy consumption per capita. Each indicator is representative of the various aspects of climate change performance. Table 6.7 provides a summary of state-level

performance with respect to each indicator (see Appendix 2 for the complete table of indicator values for the SLCCPI for all states). Among the states, Nevada experienced the largest average annual decrease in emissions, -0.631 MT CO<sub>2</sub> per capita, from 1988 to 2013 while North Dakota experienced the largest average annual increase, 0.415 MT CO<sub>2</sub> per capita during the study period. There is relatively less variation among the states in terms of the average annual change in emissions from 1988 to 2013 while, on average, the states have experienced a decline in emissions (-0.103 MT CO<sub>2</sub> per capita) with only ten states experiencing an average increase.<sup>76</sup>

In terms of emissions decoupling, all states experienced an average annual decrease in the amount of emissions produced from economic activity, -0.0000131 MT CO<sub>2</sub> per dollar of GDP, on average.<sup>77</sup> North Dakota had the largest rate of decrease with respect to the amount of emissions produced relative to economic activity (-0.0000684 MT CO<sub>2</sub> per dollar of GDP) and Illinois had the smallest rate of decoupling (-0.00000344 MT CO<sub>2</sub> per dollar of GDP). Although all states experienced an average annual decrease in emissions-GDP intensity, as discussed above, such a trend does not necessarily imply a decrease in emissions overall. North Dakota exemplifies this phenomenon, where the state has the greatest decrease in emissions per dollar of GDP, however, the state has had the largest average annual

---

<sup>76</sup> States that experienced an annual increase in emissions on average include: Oklahoma, Arkansas, Kentucky, Illinois, South Dakota, Missouri Mississippi, Iowa, Nebraska, and North Dakota (see Appendix 2).

<sup>77</sup> GDP is reported in chained 2009 dollars. Observed state-level trends in Emissions-GDP intensity and Energy-GDP intensity trends are from 1997 to 2013, as the source of this data changed the calculation method for state-level GDP in 1997, therefore, observed GDP from 1988 to 1996 were excluded from the dataset (see BEA 2015b for more information).

increase in emissions.<sup>78</sup> This occurrence can, in part, perhaps be explained by the recent boom in oil production in the state with the development of the Bakken shale, which has contributed to a dramatic increase in the state's economic output (75 percent increase in GDP from 2003 to 2013, in chained 2009 dollars) (BEA 2015). Meanwhile, Illinois, which experienced the smallest rate of emissions decoupling, ranked seventh among the states in emissions per capita, with an average annual increase of 0.040 MT CO<sub>2</sub> per capita (see Appendix 2).

As with emissions, on average, the states experienced a decline in the amount of energy consumed per capita, -0.681 MBtu, although eleven states experienced an average annual increase in energy consumption per capita, and changes in energy efficiency had a relatively large amount of variation.<sup>79</sup> Alaska experienced the largest annual decrease in energy consumption per capita, -6.545 MBtu per capita, while North Dakota had the largest increase in energy consumption, 11.647 MBtu per capita. Coincidentally, the two states are among the nation's top oil producing states, and have experienced divergent trends in production in recent years. While Alaska's oil production has generally been declining since the 1990s, North Dakota, which is currently ranked second in oil production among the states, experienced a recent boom in state oil production (EIA 2016c, 2016d). These divergent trends in each state's economy are likely to have played a primary role in their respective trends in

---

<sup>78</sup> Nine other states experienced an average annual increase in per capita emissions while experiencing a decrease in emissions-GDP intensity, on average. These states include: Arkansas, Illinois, Iowa, Kentucky, Mississippi, Missouri, Nebraska, Oklahoma, and South Dakota.

<sup>79</sup> Eleven states experienced an annual increase in energy consumption per capita on average. The states include: West Virginia, Wisconsin, Colorado, Missouri, Minnesota, Kentucky, Wyoming, Nebraska, Iowa, South Dakota, and North Dakota.

energy consumption per capita. All of the states, with the exception of South Carolina, experienced an average annual decrease in the amount of energy consumed relative to GDP, with an average decrease of -0.144 thousand Btu (MMBtu) per dollar of GDP. While South Carolina also experienced an increase in energy consumption per capita each year (7.033 MBtu per capita), nine states experienced an average annual increase in energy consumption per capita and a decrease in energy-GDP intensity.<sup>80</sup> Alaska, experienced the most significant energy consumption decoupling among the states (-0.5512 MMBtu per dollar of GDP), which coincides with the state's relative large decrease in energy consumption per capita, and implies that economic activity has not decreased at a rate greater than the rate of decrease in energy consumed within the state. With respect to emissions-energy intensity, most states experienced an average annual decrease in the amount of emissions produced per unit of energy consumed (-0.000181 MT CO<sub>2</sub> per MBtu).<sup>81</sup> Nevada experienced the largest average annual decrease in emissions-energy intensity, -0.00065 MT CO<sub>2</sub> per MBtu, while Oregon experienced the greatest average annual increase, 0.00018 MT CO<sub>2</sub> per MBtu.

On average, per capita consumption of alternative energy among the states experienced an average annual increase, 0.307 MBtu per person. Iowa experienced the largest rate of increase, 3.639 MBtu per capita, while Oregon was the lowest performing state in terms of alternative energy consumption, experiencing an average

---

<sup>80</sup> These states include: Colorado, Iowa, Kentucky, Minnesota, Missouri, Nebraska, West Virginia, Wisconsin, and Wyoming.

<sup>81</sup> Eleven states experienced an average annual increase in emissions-energy intensity. These states include: Alaska, Arkansas, Hawaii, Idaho, Louisiana, Maine, Mississippi, Missouri, Montana, Oregon, and South Carolina.

decrease in consumption per capita of 2.934 MBtu per person. Overall, the average annual change in alternative energy consumption among the states had a moderate level of variation, relative to emissions and energy efficiency trends. Notably, Washington which, with Oregon, is among the top states in terms of the amount and portion of energy consumption supplied from renewable sources ranked third in alternative energy development, experiencing an average annual decrease of 2.3060 MBtu per person (see Appendix 2). The results imply that the relatively large portion of renewable energy consumed in these states is primarily the result of historical development, while recent development of alternative energy sources has not kept pace with the rest of the U.S.

**Table 6.7** SLCCPI value summary.

	Emissions Development		Energy Efficiency			Alternative Energy Development
	Emissions Per Capita	Emissions-GDP	Energy Per Capita	Energy-GDP	Emissions-Energy	Alternative Energy Per Capita
Min.	-0.631 (NV)	-0.0000684 (ND)	-6.545 (AK)	-0.551 (AK)	-0.000655 (NV)	-2.934 (OR)
Median	-0.106 (ME/AZ)	-0.00000918 (DE/WI)	-0.923 (SC/M I)	-0.114 (IN/RI)	-0.000161 (OH/TX)	0.214 (LA/WI)
Mean	-0.103	-0.0000131	-0.681	-0.144	-0.000181	0.307
Max.	0.415 (ND)	-0.00000344 (IL)	11.647 (ND)	0.00365 (SD)	0.000183 (OR)	3.639 (IA)
SD	0.180	0.0000130	3.236	0.105	0.000183	1.325

The SLCCPAII is composed of twenty-one individual indicators distributed across five policy dimensions: Emissions, Energy Efficiency, Renewable Energy, Multistate Agreements, and Climate Change Policy Planning. Tables 6.8 through 6.12

provide a summary of the number of states that received a particular score for each policy indicator included in the Emissions, Energy Efficiency, and Renewable Energy dimensions of the SLCCPAII. (Appendix 3 for the complete table of indicator values for the SLCCPAII for all states.) While all fifty states have implemented at least one of the policies included across the three dimensions, in terms of the relative level of climate change policy adoption and implementation, California is the only state to have received the highest possible score for each of these dimensions. In general, policies designed to improve energy efficiency and promote renewable energy development have been more commonly adopted among the states than policies designed to produce a direct reduction in emissions. Overall, policies intended to promote energy efficiency through the implementation of building standards and net metering policies, which allow decentralized producers of renewable energy to sell energy back to the grid, and consequently promote renewable energy development, were the most popular types of policies among the states. Additionally, policies designed to reduce emissions experienced the largest number of repeals, eleven overall, whereas energy efficiency and renewable energy policies have only experienced one and four policy repeals, respectively. Arizona, Florida Hawaii, New Jersey, New Mexico, Washington, and West Virginia, have each repealed at least one climate change policy. Florida has reversed six policies to date, accounting for the largest number of rollbacks among the states. The least popular policies among the states were emissions performance standards, which are designed to reduce emissions from the electric power sector.



With respect to the indicators included in the Emissions dimension of the SLCCPAII, the most popular policy type among the states is the implementation of GHG reporting programs. GHG reporting requirements are among the most commonly implemented climate change policies with 40 state-level policies throughout the U.S., although only 16 states had implemented mandatory emissions reporting policies prior to the establishment of the U.S. EPA's mandatory emissions reporting rule in 2009. Nineteen states have also implemented GHG emissions targets. Neither of these policy approaches requires emissions to be reduced, which may contribute to the popularity among the states. With respect to policies designed to reduce emissions in the transportation sector, 13 states have adopted California's vehicle emissions standards and 10 states have established mandates to increase the amount of zero emissions vehicles sold within state boundaries. The LCFS, which establishes requirements for a reduction in the carbon intensity of transportation fuels, is the only climate change policy that is currently active in one state, although a number of policies are currently in development in a number of states.<sup>82</sup> With the exception of the LCFS, policies designed to reduce emissions from the electric power sector are the least common approaches among the states. Eleven states have also enacted a cap and trade program to regulate emissions, although California and Washington are the only states to have adopted a statewide cap and trade program for large, stationary emitters of CO<sub>2</sub> emissions, while nine states have adopted cap and

---

<sup>82</sup> The first LCFS mandate in the world was enacted by California in 2007, and currently remains the only state in the U.S. with an LCFS.

trade programs for emissions from the electric power sector only. Only six states have implemented emissions performance standards for the electric power sector.<sup>83</sup>

**Table 6.8** SLCCPAII emissions policy indicator value summary.

Policy	Score				
	-1	0	1	2	3
Greenhouse Gas Emissions Targets	1	27	3	19	-
Greenhouse Gas Reporting Requirements	2	8	0	24	16
Emissions Standards for the Electric Power Sector	0	44	0	6	-
Cap and Trade	2	37	0	9	2
California Vehicle Emissions Standards	3	34	0	13	-
Low Carbon Fuel Standard	1	36	12	1	-
Zero Emissions Vehicle Program	2	38	0	10	-

Energy efficiency policies have a higher level of participation among the states relative to policies that focus on direct reduction of emissions. The most commonly implemented energy efficiency policies are those that establish efficiency requirements for new residential, commercial, and state-owned buildings. Although, with respect to commercial and residential building codes, some states have higher standards than others, nearly every state has adopted policies that require new buildings to comply with codes designed to improve energy efficiency. Nearly half of the states have adopted mandatory energy efficiency standards for the electric power sector, while one fifth have implemented voluntary standards to improve energy conservation efforts from electric utilities. Half of the states have adopted Smart Growth/ VMT policies, which encourage improvements in the efficiency of transportation networks through urban planning and development mandates that

<sup>83</sup> California, New York, Oregon, Washington, Illinois, and Montana are the only states to have enacted emissions performance standards for the electric power sector.

reduce urban sprawl, among other things. State-level Appliance Efficiency Standards are the least most active energy efficiency policy type, 14 states currently have at least one appliance efficiency standard that exceed federal requirements.

**Table 6.9** SLCCPAII energy efficiency policy indicator value summary.

Policy	Score						
	-1	0	1	2	3	4	5
Energy Efficiency Resource Standards	1	12	5	11	21	-	-
Smart Growth/Vehicle Miles Travelled Policies	0	25	0	19	6	-	-
Appliance Efficiency Standards	0	36	0	14	-	-	-
State Building Standards	0	3	0	47	-	-	-
Commercial Building Codes	0	8	1	13	16	9	3
Residential Building Codes	0	9	2	16	12	8	3

The adoption of state-level policies designed to promote the development of renewable energy are relatively common among the states. Renewable and Alternative Portfolio Standards are the most popular policy approaches that have been implemented to address emissions produced from the electric power sector. Twenty-nine states have adopted mandatory Renewable or Alternative Portfolio Standards, while nine have implemented voluntary standards. Net metering policies are the second most commonly adopted policies that have been implemented among the states with 47 active policies. More than half the states have also implemented renewable fuel mandates, although a majority of the policies that have been adopted only apply to a subset of the transportations sector (i.e. state/municipal owned vehicles), and only eight states have implemented a statewide Renewable Fuel Standard.

**Table 6.10** SLCCPAII renewable energy policy indicator value summary.

Policy	Score				
	-1	0	1	2	3
Renewable or Alternative Energy Portfolio Standards	2	10	0	9	29
Renewable or Alternative Fuels Mandates	2	13	0	27	8
Net Metering Policy	0	3	0	47	-

The indicator chosen to operationalize the Multistate Agreement dimension of the SLCCPAII, regional agreements, is composed of an aggregate score for each state based upon participation in interstate policies to address various aspects of the climate change issue. Table 6.11 provides a summary of state-level involvement in regional agreements. Twenty-five states have not engaged in interstate climate change policy initiatives while 21 states have been involved in regional initiatives that are no longer active.<sup>84</sup> New Jersey is the only state to have exited a regional agreement that is currently active. Fifteen states are actively involved in regional climate change initiatives, of which, thirteen states are involved in multiple regional agreements. Connecticut, Rhode Island, and Vermont received the highest score for regional agreement participation; each are currently involved in five regional initiatives.

---

<sup>84</sup> The twenty-five states that have not participated in regional agreements include: Alabama, Arkansas, Colorado, Florida, Georgia, Hawaii, Idaho, Indiana, Kentucky, Louisiana, Mississippi, Missouri, Nebraska, Nevada, North Carolina, North Dakota, Ohio, Oklahoma, South Carolina, South Dakota, Tennessee, Texas, Virginia, West Virginia, and Wyoming.

**Table 6.11** SLCCPAII summary of multistate agreements.

<b>Regional Agreement</b>	<b>Status</b>	<b>Participants</b>
New England Governors/Eastern Canadian Premiers: Climate Change Action Plan	Active	CT, MA, ME, NH, RI, VT
West Coast Governor's Global Warming Initiative	Inactive	CA, OR, WA
Regional Greenhouse Gas Initiative	Active	CT, DE, MA, MD, ME, NH, NY, RI, VT
Southwest Climate Change Initiative	Inactive	AZ, NM
Western Climate Initiative	Inactive	AZ, CA, MT, NM, OR, UT, WA
Midwest Greenhouse Gas Reduction Accord	Inactive	IA, IL, KS, MI, MN, WI
Pacific Coast Collaborative	Active	AK, CA, OR, WA
Northeast and Mid-Atlantic Low Carbon Fuel Standard	Active	CT, DE, MD, ME, NH, NJ, NY, PA, RI, VT
Transportation Climate Initiative	Active	CT, MA, MD, ME, NH, NJ, NY, PA, RI, VT
North America 2050	Inactive	AZ, CA, CT, DE, IL, MA, MD, ME, MN, MT, NJ, NM, OR, RI, VT, WA
State Zero-Emission Vehicle Programs	Active	CA, CT, MA, MD, NY, OR, RI, VT

State-level participation in Climate Change Policy Planning is among the most active dimensions of the SLCCPAII (see Table 6.12). To date, 44 states have completed at least one GHG inventory, while 37 have completed a climate change action plan, and nearly half of the states have carried out the completion of a climate adaptation plan. All but 15 states have created formal advisory committees to assist in the development of climate change mitigation efforts, although there are only 8 states

in which such committees are currently active. The level of state participation in efforts related to policy planning is in some ways counterintuitive to the state-level record with respect to mitigation policy adoption. Although a vast majority of the states have taken steps to investigate opportunities to mitigate climate change, relatively few have taken broad steps towards reducing emissions directly. In the absence of a more in depth investigation, it is difficult to interpret the relationship between climate change policy planning and policy adoption.

**Table 6.12** SLCCPAII climate change policy planning indicator value summary.

Policy	Score		
	0	1	2
Greenhouse Gas Inventory	6	0	44
Climate Action Plan	13	0	37
Climate Change Adaptation Plan	23	4	23
Climate Legislative Commissions And Executive Branch Advisory Groups	15	27	8

To construct the final SLCCPI and SLCCPAII, each indicator is normalized using the Min-Max methodology. The final index values for each state are determined using the additive aggregation method.<sup>85</sup> One potential pitfall of the CCPI is the assignment of weights to each of the 15 indicators, which should be weighted according to some underlying theoretical framework or for an empirical reason (OECD 2008). Burck, Marten, and Bals (2014) do not explicitly state the theoretical basis or method of calculation used to derive the weights employed in the CCPI. The subjective nature of weight selection for the CCPI may affect the robustness of the results, by over- or underestimating the importance of a particular indicator in

---

<sup>85</sup> See footnote 7.

determining overall climate change performance. For the SLCCPI and the SLCCPAII, individual indicators are not weighted; as it is assumed that all variables hold equal value with respect to their contribution to climate change policy performance and climate change policy action, respectively, and, therefore, including a weight for each indicator does not contribute to the final CI score for each state. Tables 6.13 and 6.14 provide a summary of the thematic groupings and individual indicators assigned to each indicator for the SLCCPI and SLCCPAII.

**Table 6.13** Components of the SLCCPI.

<b>Thematic Group</b>	<b>Indicator</b>
Emissions Development	<ul style="list-style-type: none"> <li>• CO<sub>2</sub> emissions per capita, Average Annual Change</li> <li>• Emissions-GDP Intensity, Average Annual Change</li> </ul>
Energy Efficiency	<ul style="list-style-type: none"> <li>• Energy Consumption per capita, Average Annual Change</li> <li>• Energy-GDP Intensity, Average Annual Change</li> <li>• Emissions-Energy Intensity, Average Annual Change</li> </ul>
Alternative Energy Development	<ul style="list-style-type: none"> <li>• Alternative Energy Consumption per capita, Average Annual Change</li> </ul>

**Table 6.14** Components of the SLCCPAII.

Thematic Group	Indicator
Emissions	<ul style="list-style-type: none"> <li>• California Vehicle Emissions Standards</li> <li>• Cap and Trade</li> <li>• Emissions Performance Standards for the Electric Power Sector</li> <li>• GHG Emissions Targets</li> <li>• GHG Reporting</li> <li>• Low Carbon Fuel Standard</li> <li>• ZEV Mandates</li> </ul>
Energy Efficiency	<ul style="list-style-type: none"> <li>• Appliance Efficiency Standards</li> <li>• Commercial Building Codes</li> <li>• Energy Efficiency Resource Standards</li> <li>• Residential Building Codes</li> <li>• Smart Growth/ VMT</li> <li>• State Building Standards</li> </ul>
Renewable Energy	<ul style="list-style-type: none"> <li>• Net Metering Policy</li> <li>• Renewable or Alternative Energy Portfolio Standards</li> <li>• Renewable or Alternative Fuels Mandates</li> </ul>
Multistate Agreements	<ul style="list-style-type: none"> <li>• Regional Agreements</li> </ul>
Climate Change Policy Planning	<ul style="list-style-type: none"> <li>• Climate Action Plan</li> <li>• Climate Change Adaptation Plan</li> <li>• Climate Legislative Commissions And Executive Branch Advisory Groups</li> <li>• Greenhouse Gas Inventory</li> </ul>

The final state-level CIs produce a state-level performance “ladder” that ranks each individual state a based on an assessment of overall performance across indicators for all other states. Tables 6.15 and 6.16 show the state rankings for the



SLCCPI and the SLCCPAII based upon each state's respective scores. (Appendices 2 and 3 provide a breakdown of the SLCCPI and SLCCPAII by individual indicator and state.) Although the highest performing states are placed at the top of the "performance ladder" for each index, the aggregate score does not necessarily indicate that a particular state performed better than all states below it in all areas. For example, the summary of the indicator values included in the SLCCPI show that Wyoming, the highest performing state with respect to overall climate change performance. While Wyoming ranked first in overall emissions development, the state ranked sixth with respect to emissions per capita and second with respect to emissions-GDP intensity (see Appendix 2). The state ranked 27<sup>th</sup> in overall energy efficiency (46<sup>th</sup> in energy consumption per capita, 7<sup>th</sup> in energy-GDP intensity, and 20<sup>th</sup> in emissions-energy intensity) and 4<sup>th</sup> with respect to alternative energy development (see Appendix 2). Similarly, although the lowest performing state was Missouri, the results do not indicate that the state was the lowest performer in all aspects of the SLCCPI. Missouri ranked 48<sup>th</sup> in Emissions Development (46<sup>th</sup> in emissions per capita and 48<sup>th</sup> in emissions-GDP intensity), 49<sup>th</sup> in Energy Efficiency (43<sup>rd</sup> in energy consumption per capita, 46<sup>th</sup> in energy-GDP intensity, and 47<sup>th</sup> in emissions-energy intensity), and 24<sup>th</sup> in Alternative Energy Development (see Appendix 2).

**Table 6.15** SLCCPI rankings and scores.

<b>State</b>	<b>Rank</b>	<b>CI Value</b>	<b>State</b>	<b>Rank</b>	<b>CI Value</b>
WY	1	379.264	MN	26	240.260
TX	2	370.490	FL	27	237.974
AK	3	367.048	KS	28	236.391
NV	4	357.579	GA	29	234.852
DE	5	333.508	OH	30	234.137
ND	6	316.470	WA	31	232.864
AL	7	315.302	RI	32	232.778
TN	8	291.427	CT	33	230.123
UT	9	288.855	ID	34	229.836
WV	10	287.230	CA	35	223.502
NH	11	286.765	MT	36	222.906
PA	12	280.301	WI	37	221.960
LA	13	275.097	AR	38	218.411
MD	14	274.826	IA	39	218.010
NM	15	273.156	CO	40	211.767
MA	16	263.854	HI	41	211.294
NY	17	263.005	ME	42	207.313
NC	18	257.940	IL	43	204.900
VT	19	256.956	OR	44	202.469
SD	20	252.305	AZ	45	201.382
NJ	21	251.902	SC	46	191.807
IN	22	246.886	MS	47	191.171
OK	23	244.114	KY	48	184.682
VA	24	242.793	NE	49	169.451
MI	25	241.263	MO	50	164.877

The results of the SLCCPAII show that California has experienced the greatest overall level of climate change policy action among the states, while Mississippi has experienced the lowest (see Table 6.16). As with the SLCCPI, although California received the highest possible score for 20 of the 21 indicators included in the SLCCPAII, the state is ranked 9<sup>th</sup> with respect to participation in regional initiatives and, consequently, none of the states receive a score of 100 for the

SLCCPAII. The lowest ranking state in terms of policy adoption and implementation was Mississippi, which has only adopted three mitigation policies designed to produce improvements in energy efficiency and renewable energy, commercial and state-owned building codes and net metering, respectively. Although Arizona, Florida, Hawaii, New Jersey, New Mexico, Washington, and West Virginia each received at least one score of -1 for repealing various climate change policies, participation in other policy initiatives improved their overall scores. The remaining states have participated in each of the SLCCPAII indicators to varying degrees.

**Table 6.16** SLCCPAII rankings and scores.

State	Rank	CI Value	State	Rank	CI Value
CA	1	2,063.64	NV	26	1,078.33
NY	2	1,949.39	UT	27	1,077.42
OR	3	1,850.30	SC	28	1,038.33
MA	4	1,848.48	NM	29	990.61
WA	5	1,828.79	TX	30	968.33
MD	6	1,825.15	OH	31	958.33
CT	7	1,803.33	FL	32	953.33
RI	8	1,773.33	AR	33	913.33
VT	9	1,768.33	KY	34	908.33
NJ	10	1,579.70	MO	35	908.33
DE	11	1,490.45	AK	36	876.52
NH	12	1,477.73	KS	37	850.76
ME	13	1,445.15	ID	38	778.33
IL	14	1,403.18	AL	39	768.33
PA	15	1,349.70	LA	40	763.33
IA	16	1,312.42	GA	41	755.00
WI	17	1,292.42	TN	42	755.00
MN	18	1,288.18	OK	43	743.33
MI	19	1,250.76	IN	44	663.33
AZ	20	1,202.27	WV	45	638.33
VA	21	1,195.00	SD	46	608.33
HI	22	1,176.67	WY	47	508.33
NC	23	1,175.00	NE	48	488.33
MT	24	1,146.52	ND	49	475.00
CO	25	1,125.00	MS	50	448.33

Figures 6.5 and 6.6 present a breakdown of each state’s position in the SLCCPI and SLCPAII, respectively, across thematic groupings and individual indicators. The figures illustrate the variation among states with respect to the distribution of indicator scores and the overall score across states. For the SLCCPI, energy efficiency accounted for the largest portion of climate change performance, 55 percent on average, followed by Emissions Development, 25 percent, and Alternative

Energy Development, 20 percent (see Figure 6.5). Generally, there is little differentiation between higher and lower-ranking states with respect to the distribution of their overall score across the three dimensions of the SLCCPI index. With respect to the individual indicators, energy consumption, emissions, and alternative energy consumption per capita account for the largest portion of the SLCCPI among the states (an average of 28 percent, 20 percent, and 20 percent of total scores, respectively). Emissions-energy intensity accounted for 17 percent of total SLCCPI scores among the states, followed by energy-GDP intensity and emissions-GDP intensity, which accounted for 10 percent and 5 percent of total scores on average, respectively. Lower ranking states tend to have a greater portion of their overall scores accounted for by performance in emissions, energy consumption, and alternative energy consumption per capita, whereas higher ranking states exhibit a more even distribution across the six indicators of the SLCCPI (see Figure 6.5). The results suggest that while most states have made improvements in each of the three dimensions of the SLCCPI, lower performing states, performance is disproportionately accounted for by changes in emissions and energy consumption per capita while improvements in emissions- and energy-intensity are generally lacking.

Figure 6.5 SLCCPI rankings and scores.

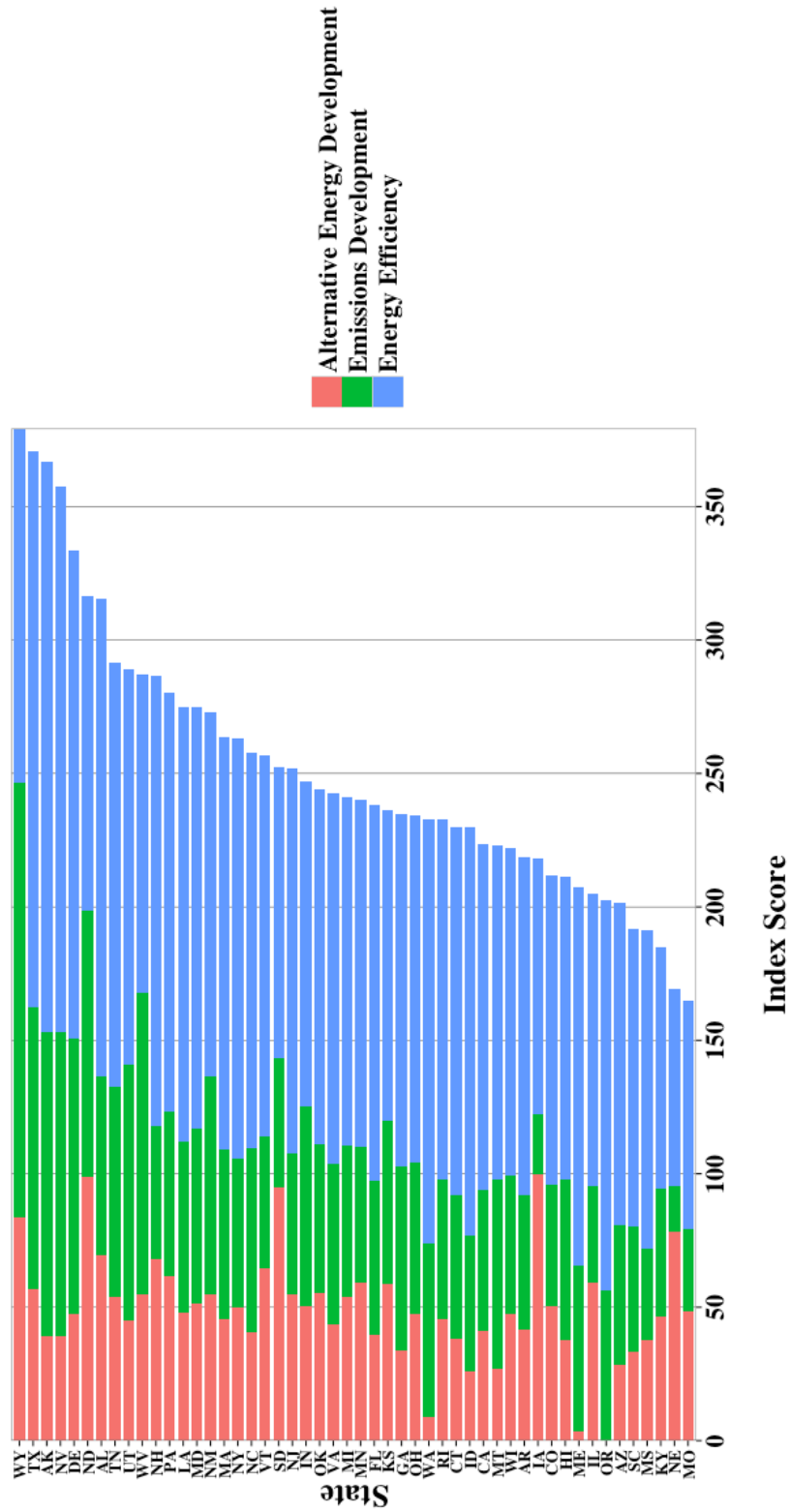
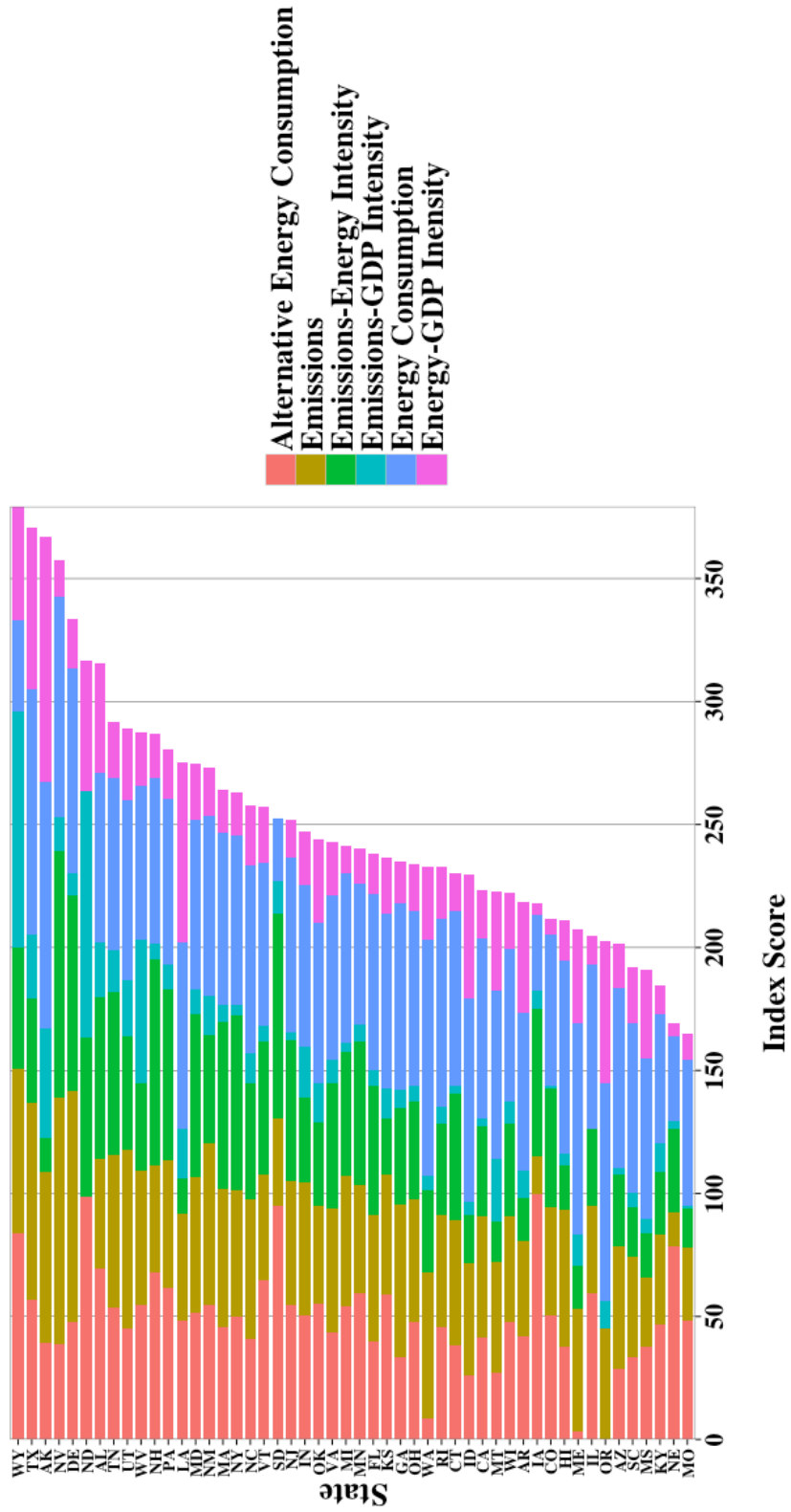


Figure 6.5 Continued.



The results of the SLCCPAII also exhibit some important characteristics with respect to state-level climate change policy activity. With respect to the five dimensions of the SLCCPAII, energy efficiency and emissions-based policies accounted for the largest portions of state-level scores, an average of 28 percent each. Renewable energy policies accounted for the next largest portion of SLCCPAII scores among the states, 22 percent on average, followed by policy planning and multistate agreements, 21 percent and 1 percent, respectively. While renewable energy policies and multistate agreements tend to account for a smaller portion of state-level SLCCPAII scores overall, states that ranked higher in terms of policy adoption and implementation tend to have a higher portion of their overall SLCCPAII scores accounted for by the policy planning dimension of the CI, relative to lower ranking states. The proportion of the overall scores accounted for by each dimension of the SLCCPAII indicates that policy planning may be an important component of policy action; states that have adopted and implemented a greater number of policies related to energy efficiency, emissions reduction, renewable energy development, and multistate initiatives tend to have also initiated policies related to climate change policy planning.

With respect to the individual indicators of the SLCCPAII Building Standards for State-owned buildings and Net Metering policies accounted for the largest share of the SLCCPAII across the states, on average, nine percent each. The high proportion of state-level climate change action accounted for by these indicators is



not surprising given that these are the most widely adopted policies among the states (see Tables 6.9 and 6.10). GHG Inventories and Renewable or Alternative Energy Portfolio Standards each accounted for the next highest percentage of the SLCCPAII scores, on average, eight percent and seven percent, respectively, followed by Climate Action Plans, EERS, Renewable Fuel Mandates, and GHG Reporting Requirements each accounted for six percent of total SLCCPAII scores on average. GHG emission targets accounted for five percent, while Climate Change Adaptation Plans, Residential and Commercial Building Codes, ZEV mandates, LCFS, and Vehicle Emissions Standards each accounted for four percent of the total SLCCPAII score on average while Climate Change Advisory Committees, Smart Growth/VMT, and Cap and Trade policies each accounted for three percent of the total SLCCPAII scores, on average. Appliance Efficiency Standards, Multistate Agreements, and Emissions Performance Standards for the Electric Power Sector accounted for the lowest portions of SLCCPAII scores, on average accounting for only two percent, one percent, and one percent of total scores among the states, respectively, on average.

One important observation from the results of the SLCCPAII is that, in some cases, relatively widespread state policies may account for a smaller portion of overall scores on average, compared to less widely implemented policies. Smart Growth/VMT policies and Multistate Agreements, for example, have been implemented in half of the states. However, these indicators only account for three percent and one percent, respectively, of the average portion of the SLCCPAII index scores across the states. In contrast, the LCFS and Vehicle Emissions Standards are

only currently active in one and thirteen states, respectively, although twelve states are currently developing an LCFS. On average, these policies accounted for four percent of the total SLCCPAII scores. This result is produced because a number of policy types have had at least one policy reversal. Arizona, Florida, and New Mexico have repealed previously adopted standards for vehicle emissions, while Washington repealed an LCFS policy. Consequently, the Min-Max normalization method assigns states that have repealed policies as the lowest score, “rewarding” states that have not taken action with a positive indicator score. The effect of this occurrence can be observed visually where, despite the fact that 13 states have adopted or taken steps towards implementing an LCFS and vehicle emissions standards, all states, with the exception of those that have repealed each respective policy, received a positive score for each of these indicators.

Figure 6.6 SLCCPAII rankings and scores.

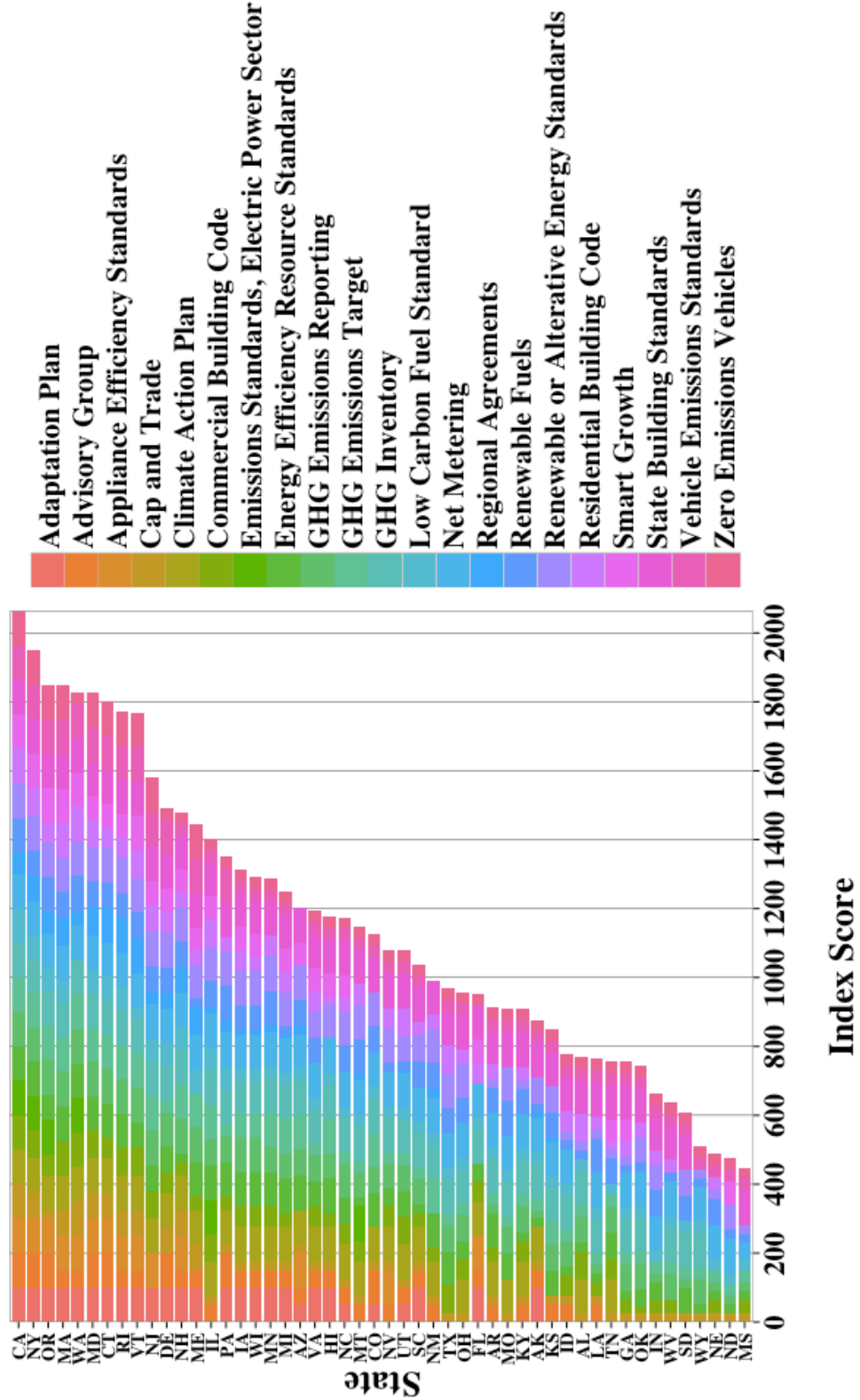
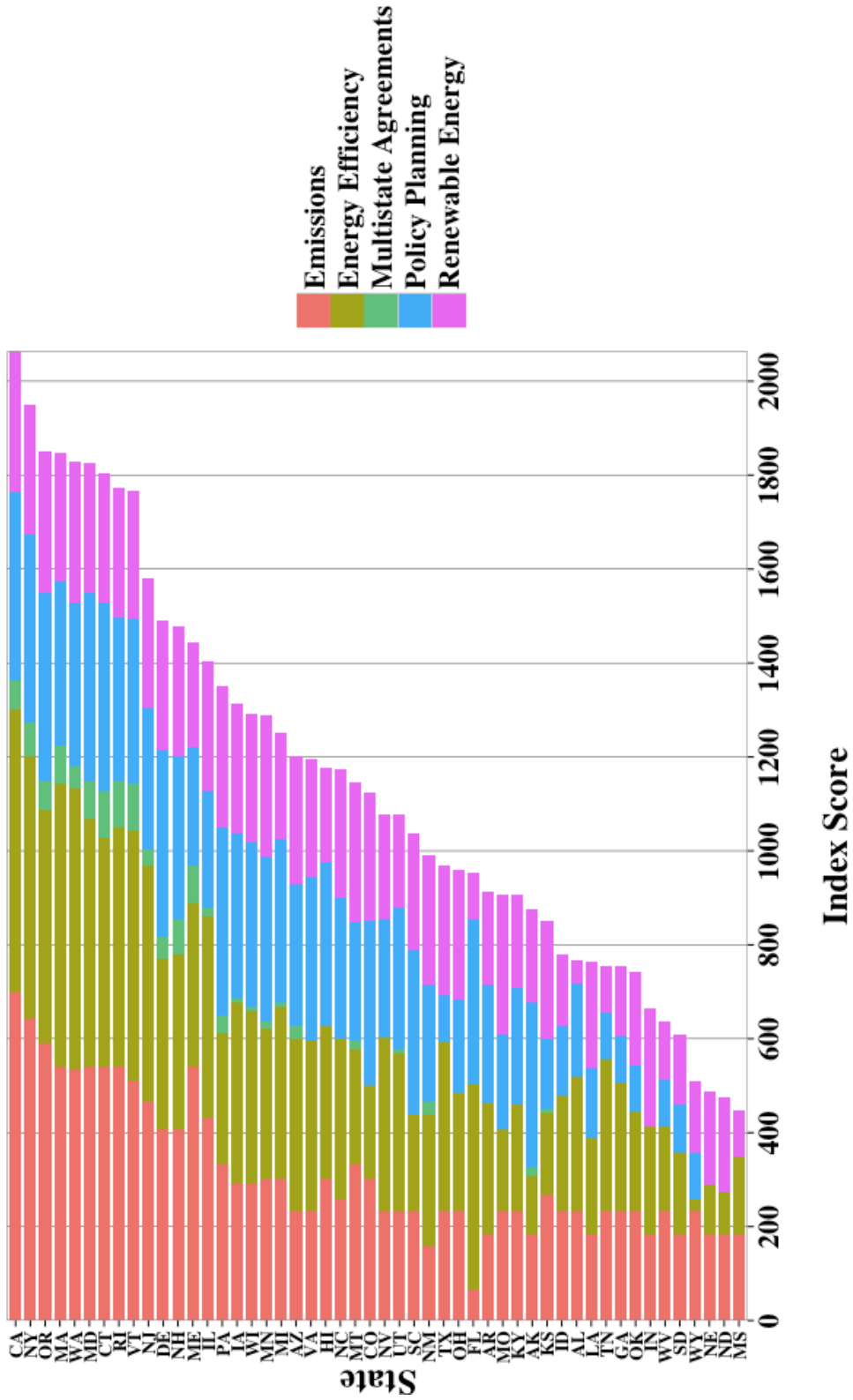


Figure 6.6 Continued.



## **Discussion**

The previous chapter introduced the CI methodology as a practical approach for analyzing state-level climate change performance and climate change policy action as an assessment of each concept cannot accurately be captured by one variable. Two conceptual frameworks were developed to guide the evaluation process and outline the primary dimensions of climate change performance and climate change policy action. The results of the SLCCPI suggest that, overall, energy efficiency improvements have occurred in states that are both ranked highly in terms of climate change performance, as well as for states that have not exhibited a high performance. States that have ranked highly with respect to climate change performance have experienced improvements in energy efficiency, as well as an average increase in alternative energy consumption, and an average annual reduction in CO<sub>2</sub> emissions. The results of the SLCCPI suggest, as indicated by the conceptual framework discussed in Chapter 6, that energy efficiency improvements are one way to reduce emissions. However, a more effective climate mitigation strategy would be to improve energy conservation while substituting fossil fuel consumption with alternative energy sources. Conversely, an increase in the alternative energy consumption does not necessarily imply an increase in climate change performance. Iowa and North Dakota, for example, were ranked first and second among the states with respect to the average annual increase in alternative energy consumption, however, the two states also experienced a relatively large increase in energy consumption per capita (a decrease in energy efficiency), with North Dakota ranking

last overall for energy efficiency. Both states also experienced an overall average annual increase in CO<sub>2</sub> emissions per capita, an indication that any potential climate change mitigation produced from an increase in alternative energy consumption was negated by a concurrent increase in fossil fuel consumption, as total energy consumption increased overall, contributing to an average annual increase in emissions.

With respect to the results of the SLCCPAII, policies designed to improve energy efficiency and promote renewable energy development were the most widespread among the states. In contrast, policies that mandate a direct reduction in emissions (e.g., cap and trade, emissions performance standards, vehicle emissions standards, and LCFS) have only been adopted by a relatively small number of states. Prior to 2009, many states had implemented policies designed to reveal information regarding CO<sub>2</sub> emissions through GHG reporting requirements. However, this policy approach does not have direct implications for emissions reductions and, therefore, may be considered to be a more politically feasible approach to incentivizing emissions reductions. Additionally, mandatory (e.g., mandatory GHG gas reporting, EERS, and renewable or alternative energy standards) and comprehensive (e.g., statewide cap and trade policies, smart growth and VMT policies, a statewide renewable fuel standards) policies to address the various drivers of anthropogenic climate change were ranked among the highest states in terms of policy action. Consequently, lower ranking states tend to have a higher portion of the overall SLCCPAII score accounted for by indicators related to energy efficiency and

renewable energy development, while states that are placed towards the top of the SLCCPAII generally have taken a comprehensive approach to climate change mitigation and, therefore, the total SLCCPAII score for these states is evenly distributed across each of the 21 indicators.

Participation in regional agreements was also a common policy approach among the states that ranked highly in terms of climate change policy action. While 25 states have been involved in a regional policy initiative at one time or another, currently, only 15 states are actively involved in regional policy initiatives, of which, 13 states are involved in more than one regional agreement. The implications of these findings suggest that regional initiatives are perhaps challenging to maintain and that states that can successfully participate in interstate policies are likely to participate in multiple agreements.

## **Conclusion**

This chapter developed and applied a quantitative method for comparing state-level performance with respect to climate change policy action and climate change mitigation performance. The study drew from the analyses and data provided in Chapter 4 and Chapter 5 to establish two conceptual models concerning the primary characteristics associated with climate change mitigation and policy adoption and implementation in the U.S. The conceptual models were then used to select a series of indicators to construct and operationalize two CIs, the SLCCPI and SLCCPAII, that can be applied to assess state-level climate change performance. Individually and collectively, the SLCCPI and SLCCPAII offer practical and meaningful tools for

conducting a comparative assessment of state-level experiences with respect to climate change mitigation and policy action. Each CI can be used to illuminate the various facets of climate change performance within individual states, as well as the shared and divergent trends amongst the states. Such an approach offers the opportunity for state-level policymakers to identify opportunities for improvement, and can facilitate policy learning across the states by highlighting unique state-level experiences.

An important limitation of the methodological approach that has been applied in this chapter is the inability to establish a clear relationship between policy adoption and climate change performance. As discussed above, a CI is most practical for providing a broad assessment of performance to facilitate opportunities for a deeper investigation into particular policy areas. Therefore, in the absence of a more complex investigation regarding the relationship between policy implementation and subsequent mitigation, a definitive conclusion regarding the effectiveness of state-level climate change policies cannot be divulged from the analysis. The next chapter applies the SLCCPI and the SLCCPAII to select four states that vary with respect to their climate change mitigation and policy adoption experiences. The framework for collaborative climate change policymaking, developed in Chapter 2, is then applied to investigate the role of stakeholder engagement and collaborative policymaking processes in state-level climate change policy development and implementation.



## References

- American Council for an Energy-Efficient Economy (ACEEE). (2016). *State and Local Policy Database*. Retrieved from: <http://database.aceee.org/>
- Ansell, C., & Gash, A. (2008). Collaborative Governance in Theory and Practice. *Journal of Public Administration Research and Theory*, 18:543-571.
- Asensio, O. I., & Delmas, M. A. (2015). Nonprice incentives and energy conservation. *Proceedings of the National Academy of Sciences of the United States of America*, 112(6), E510-E515. doi:10.1073/pnas.1401880112
- Ayres, I., Raseman, S., & Shih, A. (2013). Evidence from Two Large Field Experiments that Peer Comparison Feedback Can Reduce Residential Energy Usage. *Journal of Law Economics & Organization*, 29(5), 992-1022. doi:10.1093/jleo/ews020
- Brown, A., Beiter, P., Heimiller, D., Davidson, C., Denholm, P., Melius, J., Lopez, A., Hettinger, D., Mulcahy, D., & Porro, G. (2015). *Estimating Renewable Energy Economic Potential in the United States: Methodology and Initial Results*. Golden, CO: National Renewable Energy Laboratory
- Bui, Linda. 2005. *Public Disclosure of Private Information as a Tool for Regulating Environmental Emissions: Firm-Level Responses by Petroleum Refineries to the Toxics Release Inventory*. Waltham, MA: Brandeis University International Business School.

- Burck, J., Hermwille, L., & Bals, C. (2015). *The Climate Change Performance Index: Background and Methodology*. Germanwatch/CAN Europe. Retrieved from: <https://germanwatch.org/en/download/8579.pdf>
- Burck, J., Marten, F., & Bals, C. (2015). *The Climate Change Performance Index: Results 2016*. Germanwatch/CAN Europe. Retrieved from: <https://germanwatch.org/en/download/8599.pdf>
- Carley, S. (2009). State renewable energy electricity policies: An empirical evaluation of effectiveness. *Energy Policy*, 37(8), 3071-3081.  
doi:10.1016/j.enpol.2009.03.062
- Center for Climate and Energy Solutions (C2ES). (2014). *U.S. Climate Policy Maps*. Retrieved from: <http://www.c2es.org/us-states-regions/policy-maps>
- Center for Climate and Energy Solutions (C2ES). (2016). *Climate Change 101: Understanding and Responding to Global Climate Change*. Arlington, VA: C2ES
- Chen, P. Y., Chen, S. T., Hsu, C. S., & Chen, C. C. (2016). Modeling the global relationships among economic growth, energy consumption and CO2 emissions. *Renewable & Sustainable Energy Reviews*, 65, 420-431.  
doi:10.1016/j.rser.2016.06.074
- Coase, R. H. (1974). Lighthouse in Economics. *Journal of Law & Economics*, 17(2), 357-376. doi:10.1086/466796
- Database of State Incentives for Renewables & Efficiency (DSIRE). (2016). *Programs*. Retrieved from: <http://programs.dsireusa.org/system/program>

- de Vries, B. J. M., van Vuuren, D. P., & Hoogwijk, M. M. (2007). Renewable energy sources: Their global potential for the first-half of the 21st century at a global level: An integrated approach. *Energy Policy*, 35(4), 2590-2610.  
doi:10.1016/j.enpol.2006.09.002
- Delmas, M. A., & Montes-Sancho, M. J. (2011). US state policies for renewable energy: Context and effectiveness. *Energy Policy*, 39(5), 2273-2288.  
doi:10.1016/j.enpol.2011.01.034
- Geck, M., Weng, X. X., Bent, C., Okereke, C., Murray, T., & Wilson, K. (2013). Breaking the impasse: towards a new regime for international climate governance. *Climate Policy*, 13(6), 777-784.  
doi:10.1080/14693062.2013.823308
- Greening, L. A., Greene, D. L., & Difiglio, C. (2000). Energy efficiency and consumption - the rebound effect - a survey. *Energy Policy*, 28(6-7), 389-401.
- Grusky, D. B., Western, B., & Wimer, C. (2011). The Consequences of the Great Recession. *Great Recession*, 3-20.
- Gupta, J. (2015). "The North-South divide." In *Research Handbook on Climate Governance*, eds. K. Bäckstrand and E. Lövbrand, 142-152. Northampton, MA: Edward Edgar Publishing, Inc.
- Haq, M.U. (1995). *Reflections on Human Development*, New York, NY: Oxford University Press.

- Hoogwijk, M., de Vries, B., & Turkenburg, W. (2004). Assessment of the global and regional geographical, technical and economic potential of onshore wind energy. *Energy Economics*, 26(5), 889-919. doi:10.1016/j.eneco.2004.04.016
- Iddrisu, I., & Bhattacharyya, S. C. (2015). Sustainable Energy Development Index: A multi-dimensional indicator for measuring sustainable energy development. *Renewable & Sustainable Energy Reviews*, 50, 513-530. doi:10.1016/j.rser.2015.05.032
- International Code Council (ICC). (2016). *International Code Adoptions*. Retrieved from <http://www.iccsafe.org/about-icc/overview/international-code-adoptions/>
- International Energy Conservation Code. (2016). *Overview of the IECC*. Retrieved from <http://www.iccsafe.org/codes-tech-support/codes/2015-i-codes/iecc/>
- Jacobson, M. Z., Delucchi, M. A., Bazouin, G., Bauer, Z. A. F., Heavey, C. C., Fisher, E., Morris, S.B., Piekutowski, D.J.Y., Vencill, T.A., Yeskoo, T. W. (2015a). 100% clean and renewable wind, water, and sunlight (WWS) all-sector energy roadmaps for the 50 United States. *Energy & Environmental Science*, 8(7), 2093-2117. doi:10.1039/c5ee01283j
- Jacobson, M. Z., Delucchi, M. A., Cameron, M. A., & Frew, B. A. (2015b). Low-cost solution to the grid reliability problem with 100% penetration of intermittent wind, water, and solar for all purposes. *Proceedings of the National Academy of Sciences of the United States of America*, 112(49), 15060-15065. doi:10.1073/pnas.1510028112

- Jahan, S., Jespersen, E., Mukherjee, S., Kovacevic, M., Bonini, A., Calderon, C., Cazabat, C., Hsu, Y-C., Lengfelder, C., Lucic, S., Mukhopadhyay, T., Nayyar, S., Roca, T., Tapia, H., Teksoz, K., & Zampino, S. (2015). *Human Development Report 2015: Work For Human Development, Technical Notes*. New York, NY: United Nations Development Program
- Kingdon, J.W. (1995). *Agendas, Alternatives, and Public Policies*. New York, New York: HarperCollins.
- Klinsky, S. (2013). Bottom-up policy lessons emerging from the Western Climate Initiative's development challenges. *Climate Policy*, 13(2), 143-169.  
doi:10.1080/14693062.2012.712457
- Kraft, Michael E., Mark Stephan, and Troy D. Abel. 2011. *Coming Clean: Information Disclosure and Environmental Performance*. Cambridge, MA: The MIT Press.
- Layzer, J. A. (2007). "Deep Freeze: How Business Has Shaped the Global Warming Debate in Congress." In *Business and Environmental Policy: Corporate Interests in the American Political System*, eds. M. Kraft and S. Kamieniecki. Cambridge, Massachusetts: MIT Press.
- Lubell, M., Mete, M., Schneider, M., & Scholz, J. (2002). Watershed Partnerships and the Emergence of Collective Action Institutions. *American Journal of Political Science*, 46(1):148-163.

- McCright, A. M. (2011). Political orientation moderates Americans' beliefs and concern about climate change. *Climatic Change*, *104*(2), 243-253. doi: 10.1007/s10584-010-9946-y
- McCright, A. M., & Dunlap, R. E. (2000). Challenging global warming as a social problem: An analysis of the conservative movement's counter-claims. *Social Problems*, *47*(4), 499-522. doi: 10.1525/sp.2000.47.4.03x0305s
- McCright, A. M., & Dunlap, R. E. (2003). Defeating Kyoto: The conservative movement's impact on U.S. climate change policy. *Social Problems*, *50*(3), 348-373. doi: 10.1525/sp.2003.50.3.348
- Menz, F. C., & Vachon, S. (2006). The effectiveness of different policy regimes for promoting wind power: Experiences from the states. *Energy Policy*, *34*(14), 1786-1796. doi:10.1016/j.enpol.2004.12.018
- Menyah, K., & Wolde-Rufael, Y. (2010). CO2 emissions, nuclear energy, renewable energy and economic growth in the US. *Energy Policy*, *38*(6), 2911-2915. doi:10.1016/j.enpol.2010.01.024
- Millard-Ball, A. (2012). Do city climate plans reduce emissions? *Journal of Urban Economics*, *71*(3), 289-311. doi:10.1016/j.jue.2011.12.004
- Millard-Ball, A. (2013). The Limits to Planning: Causal Impacts of City Climate Action Plans. *Journal of Planning Education and Research*, *33*(1), 5-19. doi:10.1177/0739456x12449742
- Moomaw, W., Yamba, F., Kamimoto, M., Maurice, L., Nyboer, J., Urama, K., & Weir, T. (2011) Introduction. In IPCC Special Report on Renewable Energy

Sources and Climate Change Mitigation, eds. O. Edenhofer, R. Pichs-Madruga, Y. Sokona, K. Seyboth, P. Matschoss, S. Kadner, T. Zwickel, P. Eickemeier, G. Hansen, S. Schlömer, C.von Stechow. New York, NY: Cambridge University Press

Lazard. (2015). *Lazard's Levelized Cost of Energy Analysis-Version 9.0*. Retrieved from: [https://www.lazard.com/media/1777/levelized\\_cost\\_of\\_energy\\_-\\_version\\_90.pdf](https://www.lazard.com/media/1777/levelized_cost_of_energy_-_version_90.pdf)

Lopez, A., Roberts, B., Heimiller, D., Blair, N., & Porro, G. (2012). *U.S. Renewable Energy Technical Potentials: A GIS-Based Analysis*. Golden, CO: National Renewable Energy Laboratory

Navarro, M. (2011 May 26). Christie Pulls New Jersey From 120-State Climate Initiative. *The New York Times*. Retrieved from: <http://www.nytimes.com/2011/05/27/nyregion/christie-pulls-nj-from-greenhouse-gas-coalition.html>

Niles, M. T., & Lubell, M. (2012). Integrative Frontiers in Environmental Policy Theory and Research. *Policy Studies Journal*, 40, 41-64. doi:10.1111/j.1541-0072.2012.00445.x

Okereke, C. (2008). Equity norms in global environmental governance. *Global Environmental Politics*, 8(3), 25-+. doi:10.1162/glep.2008.8.3.25

Okereke, C. (2010). Climate justice and the international regime. *Wiley Interdisciplinary Reviews-Climate Change*, 1(3), 462-474. doi:10.1002/wcc.52

- Olson, M. (1965). *The Logic of Collective Action: Public Goods and the Theory of Groups*. Cambridge, Massachusetts: Harvard University Press.
- Organization for Economic Co-operation and Development (OECD). (2002). *Indicators to measure decoupling of environmental pressure from economic growth*. Paris: OECD. Retrieved from:  
[http://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=sg/sd\(2002\)1/final&doclanguage=en](http://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=sg/sd(2002)1/final&doclanguage=en)
- Organization for Economic Co-operation and Development (OECD). (2008). *Handbook on Constructing Composite Indicators: Methodology and User Guide*. Retrieved from:  
<http://www.oecd.org/els/soc/handbookonconstructingcompositeindicatorsmethodologyanduserguide.htm>
- Ostrom, E. (2007). "Institutional Rational Choice: An Assessment of the Institutional Analysis and Development Framework." In *Theories of the Policy Process*, 2nd ed., ed. P.A. Sabatier. 35-72. Boulder, CO: Westview Press.
- Pacala, S., & Socolow, R. (2004). Stabilization wedges: Solving the climate problem for the next 50 years with current technologies. *Science*, 305(5686), 968-972. doi:10.1126/science.1100103
- Patlitzianas, K. D., Doukas, H., Kagiannas, A. G., & Psarras, J. (2008). Sustainable energy policy indicators: Review and recommendations. *Renewable Energy*, 33(5), 966-973. doi:10.1016/j.renene.2007.05.003



- Pew Center on Global Climate Change (Pew Center). (2011). *Climate Techbook: Building Envelope*. Retrieved from:  
<http://www.c2es.org/technology/factsheet/BuildingEnvelope>
- Pizer, W.A., Morgenstern, R., Shih, J-S. (2011). The performance of industrial sector voluntary climate programs. *Energy Policy*, 39(12): 7907-7916,  
<http://dx.doi.org/10.1016/j.enpol.2011.09.040>
- Podsakoff, P. M., MacKenzie, S. B., Lee, J. Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. *Journal of Applied Psychology*, 88(5), 879-903.  
doi:10.1037/0021-9101.88.5.879
- Regional Greenhouse Gas Initiative (RGGI). (2016). *The Investment of RGGI Proceeds through 2014*. RGG, Inc. Retrieved from  
[https://www.rggi.org/rggi\\_benefits](https://www.rggi.org/rggi_benefits)
- Sabatier, P.A., Leach, W.D., Lubell, M., & Pelkey, N.W. (2005). "Theoretical Frameworks Explaining Partnership Success." In *Swimming Upstream: Collaborative Approaches to Watershed Management*. ed. P.A. Sabatier, W. Focht, M. Lubell, Z. Trachtenberg, A. Vedlitz and M. Matlock, 73-200, Cambridge, Massachusetts: MIT Press.
- Sælen, H., Westskog, H. (2013). A multi-method evaluation of the potential for using the electricity bill to encourage energy savings in Norwegian households  
*Energy Environ. Res.*, 3 (1): p. 135

- Saisana, M. & Tarantola, S. (2002). State-of-the-art Report on Current Methodologies and Practices for Composite Indicator Development. Ispra, Italy: European Commission, Joint Research Centre
- Schultz, P. W., Nolan, J. M., Cialdini, R. B., Goldstein, N. J., & Griskevicius, V. (2007). The constructive, destructive and reconstructive power of social norms. *Psychological Science*, 18(5), 429-434. doi:10.1111/j.1467-9280.2007.01917.x
- Selin, H. and VanDeveer, S. D. (2007), Political Science and Prediction: What's Next for U.S. Climate Change Policy?. *Review of Policy Research*, 24: 1–27. doi:10.1111/j.1541-1338.2007.00265.x
- Shabecoff, P. (1988 June 24). Global Warming Has Begun, Expert Tells Senate. *New York Times*. Retrieved from <http://www.nytimes.com/1988/06/24/us/global-warming-has-begun-expert-tells-senate.html>
- Shen, M., Cui, Q. B., & Fu, L. P. (2015). Personality traits and energy conservation. *Energy Policy*, 85, 322-334. doi:10.1016/j.enpol.2015.05.025
- Steinberg, D.C. and Zinaman, O. (2014). State Energy Efficiency Resource Standards – design, status, and impacts. Golden, CO: National Renewable Energy Laboratory
- R.E.H. Sims, R.N. Schock, A. Adegbululgbé, J. Fenhann, I. Konstantinaviciute, W. Moomaw, H.B. Nimir, B. Schlamadinger, J. Torres-Martínez, C. Turner, Y. Uchiyama, S.J.V. Vuori, N. Wamukonya, X. Zhang, 2007: Energy supply. In *Climate Change 2007: Mitigation. Contribution of Working Group III to the*

- Fourth Assessment Report of the Intergovernmental Panel on Climate Change [B. Metz, O.R. Davidson, P.R. Bosch, R. Dave, L.A. Meyer (eds)], Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.
- Tabachnick, B. G. & Fidell, L. S. (2007). *Using multivariate statistics* (5th ed.). Boston, MA: Allyn & Bacon
- U.S. Bureau of Economic Analysis (BEA). (2015a). *Regional Economic Accounts*. Retrieved from: <http://www.bea.gov/regional/>
- U.S. Bureau of Economic Analysis (BEA). (2015b). *Regional Economic Accounts: Methodologies*. Retrieved from: <http://www.bea.gov/regional/methods.cfm>
- U.S. Census Bureau (Census Bureau). (2015). Annual Estimates of the Resident Population for the United States, Regions, States, and Puerto Rico. Retrieved from: <http://www.census.gov/popest/data/state/totals/2015/>
- U.S. Energy Information Administration (EIA). (2015a). *State Carbon Dioxide Emissions*. Retrieved from: <https://www.eia.gov/environment/emissions/state/>
- U.S. Energy Information Administration (EIA). (2015b). *State Energy Data System*. Retrieved from <http://www.eia.gov/state/seds/>
- U.S. Energy Information Administration (EIA). (2016a). *Today in Energy: Natural gas expected to surpass coal in mix of fuel used for U.S. power generation in 2016*. Retrieved from <http://www.eia.gov/todayinenergy/detail.php?id=25392>
- U.S. Energy Information Administration (EIA). (2016b). *Levelized Cost and Levelized Avoided Cost of New Generation Resources in the Annual Energy*

*Outlook 2016*. Retrieved from:

[https://www.eia.gov/forecasts/aeo/electricity\\_generation.cfm](https://www.eia.gov/forecasts/aeo/electricity_generation.cfm)

U.S. Energy Information Administration (EIA). (2016c). *Petroleum & Other Liquids: Alaska Field Production of Crude Oil*. Retrieved from:

<http://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?f=A&n=PET&s=MCRFP>  
AK2

U.S. Energy Information Administration (EIA). (2016d). *Petroleum & Other Liquids: North Dakota Field Production of Crude Oil*. Retrieved from:

<http://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?f=M&n=PET&s=MCRFP>  
ND1

U.S. Environmental Protection Agency (USEPA). (2016). *Inventory of U.S.*

*Greenhouse Gas Emissions and Sinks: 1990-2014*. U.S. Environmental Protection Agency. Washington, D.C.

U.S. Office of the President. (2015). *Explaining the U.S. Petroleum Consumption Surprise*. Washington, D.C.

Van Caneghem, J., Block, C., Van Hooste, H., & Vandecasteele, C. (2010). Eco-efficiency trends of the Flemish industry: decoupling of environmental impact from economic growth. *Journal of Cleaner Production*, 18(14), 1349-1357.  
doi:10.1016/j.jclepro.2010.05.019

Van der Voet E., Van Oers L., Moll S., Schutz H, Bringezu S., De Bruyn S., Sevenster M., Warringa G. (2014). Policy review on decoupling: development of indicators to assess decoupling of economic development and

environmental pressure in the EU-25 and AC-3 countries. Retrieved from:  
[http://ec.europa.eu/environment/natres/pdf/fin\\_rep\\_natres.pdf](http://ec.europa.eu/environment/natres/pdf/fin_rep_natres.pdf). Sustainability,  
6:6747.

Vera, I., & Langlois, L. (2007). Energy indicators for sustainable development. *Energy*, 32(6), 875-882.

Verfaillie A, Bidwell R. (2000). Measuring eco-efficiency: a guide to reporting company performance. World Business Council for Sustainable Development. Retrieved from: [http://oldwww.wbcsd.org/web/publications/measuring\\_eco\\_efficiency.pdf](http://oldwww.wbcsd.org/web/publications/measuring_eco_efficiency.pdf)

Western Climate Initiative (WCI). (2011). *North America 2050 Fact Sheet*. Western Climate Initiative. Retrieved from:  
<http://www.westernclimateinitiative.org/document-archives/general/North-America-2050-Fact-Sheet/SW>

Williams, C.F., Reed, M.J., Mariner, R.H., DeAngelo, J., Galanis, S.P. Jr. (2008). Assessment of moderate- and high-temperature geothermal resources of the United States: U.S. Geological Survey Fact Sheet 2008-3082, 4 p.

World Energy Council (WEC) New Renewable Energy Resources—A Guide to the Future Kogan Page Limited, London (1994)

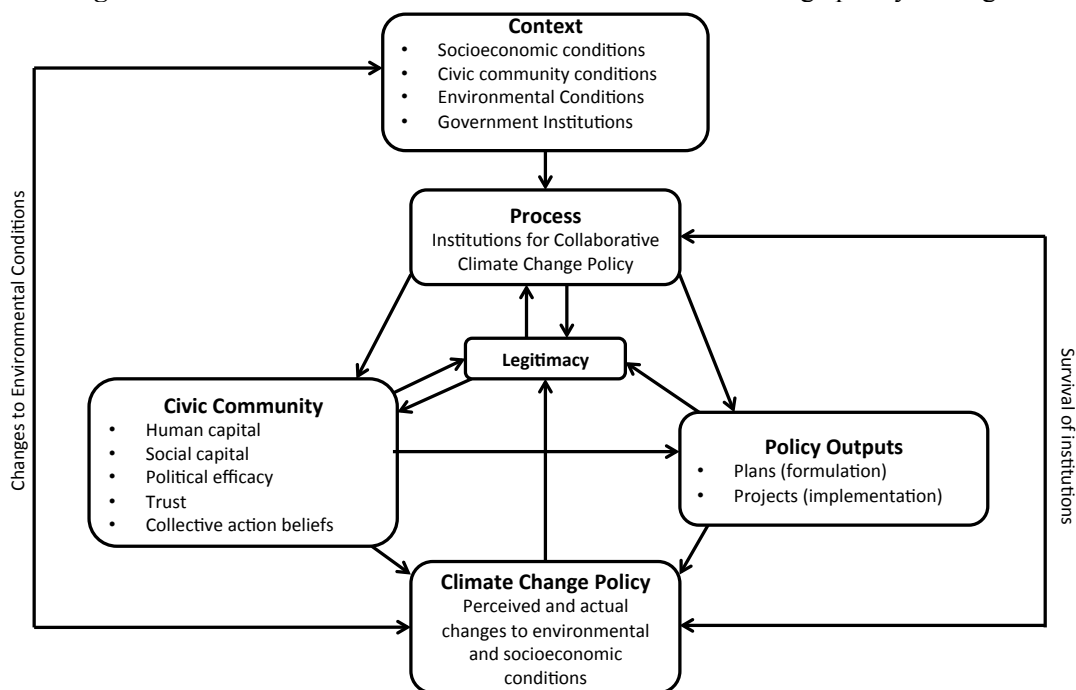
## **Chapter 7 - Climate Change Policymaking in Four American States**

In the context of climate change policymaking, and environmental policy more generally, a history of mistrust between environmental and industry interests exists as a result of conflict over previous policy issues (Weech-Maldonado and Merrill 2000). In such instances, establishing trust incrementally via collaborative policymaking processes may be essential prior to undertaking important policy negotiations (Ansell and Gash 2008). Where the issue of anthropogenic climate change has been plagued by deep disagreement over desired states and preferred outcomes, collaborative policymaking processes may offer an effective approach to the development of policies designed to reduce GHG emissions (Elgin 2015; Elgin and Weible 2013; Fiack and Kamieniecki 2017). While a number of studies have applied theories related to stakeholder engagement in the policy process to understand and evaluate policy and environmental outcomes (e.g., Cheng and Mattor 2006; Heikkila and Gerlak 2005; Layzer 2008; Leach, Pelkey and Sabatier 2002; Smith 2009; Weber, Lovrich and Gaffney 2005), the application of such theories to climate change policy has yet to be analyzed by researchers.

This chapter expands the literature on collaborative governance by examining the role of stakeholder engagement processes in the state-level climate change policymaking process. Specifically, the chapter analyzes the state-level climate change policy development and adoption experiences in four states. Chapter 2 introduced a potentially valuable framework for analyzing the role of stakeholder engagement in climate change policymaking at the state level (see Chapter 2; see

Figure 7.1). Chapter 2 also drew from a series of theoretical orientations, including the IAD Framework, the ACF, SCF, and ADR theory, to develop a series of hypotheses regarding the causal relationships between each of the variables included in Figure 7.1 (see Chapter 2, Table 2.5, Table 2.6, and Table 2.7). This chapter applies the framework to an analysis of four case studies that have achieved climate change policy adoption and climate change performance to varying degrees. The discussion begins by selecting four states, based upon their relative climate change mitigation and policy action performance, using the results from the SLCCPI and the SLCCPAII. The chapter continues with an analysis of the antecedent variables associated with each state, followed by an analysis of the institutions for collaborative climate change management that were identified during the case study investigation. The analysis continues with an examination of the factors that have contributed to the adoption of climate change policy in each state, followed by a cross-case comparison to draw conclusions regarding the hypotheses related to collaborative management institutions formation and climate change policy adoption.

**Figure 7.1** Potential framework for collaborative climate change policymaking.



Adapted from Sabatier et al. (2005a, 286)

### **State State-Level Climate Change Performance & State-Level Climate Change Policy Adoption and Implementation Characteristics**

The four states that were chosen for case study analysis were selected based upon their relative ranking in the SLCCPI and SLCCPAII. One vanguard state was chosen for analysis by selecting the top ranking state from among those that scored above the 75<sup>th</sup> percentile in both the SLCCPI and SLCCPAII. One “laggard” state was chosen by selecting the lowest ranking state from those that scored below the 25<sup>th</sup> percentile in both climate change policy action and climate change performance. One state that has ranked relatively high with respect to climate change policy action and low in terms of climate change performance was selected by choosing a state that placed above the 75<sup>th</sup> percentile for climate change policy action and below the 25<sup>th</sup>



percentile for climate change performance and had the greatest difference between each score, relative to all other states with scores in these two quartiles. The final case study consists of one state that ranked below the 25<sup>th</sup> percentile for climate change policy action and above the 75<sup>th</sup> percentile for climate change performance and had the greatest difference between each score, relative to all other states with scores in these two quartiles.

Table 7.1 shows the states that are located within the 75<sup>th</sup> and 25<sup>th</sup> percentiles in the SLCCPI and SLCCPAII, as well as their respective index scores. The four states that were selected for case study investigations based upon the criteria described above are bolded. Delaware and New Hampshire are the only state that placed above the 75<sup>th</sup> percentile in both SLCCPI and the SLCCPAII and, therefore, both are considered to be leaders among the states with respect to climate change policy action and climate change performance. Based upon the conceptual framework for collaborative climate change policymaking the state is considered to be a “most-likely” case where collaboration and stakeholder engagement has contributed to successful climate change policy implementation and emissions mitigation. Between the two states, Delaware had the highest cumulative index scores and, therefore, was selected for case study analysis. In contrast, Nebraska and Mississippi each placed below the 25<sup>th</sup> percentile for both the SLCCPI and SLCCPAII. Although each of these states are considered “laggards” in terms of climate change mitigation and policy implementation, Mississippi had the lowest cumulative score among the four, and, therefore, was selected for case study analysis, as a “least-likely” case where,

based upon the conceptual framework, collaboration and stakeholder engagement regarding the climate change issue is not expected to have occurred.

**Table 7.1** States considered for case study analysis.

States Placed Above the 75 <sup>th</sup> Percentile			
SLCCPI		SLCCPAII	
State	CI Score	State	CI Score
<b>WY</b>	<b>379.26</b>	CA	2,063.64
TX	370.49	NY	1,949.39
AK	367.05	<b>OR</b>	<b>1,850.30</b>
NV	357.58	MA	1,848.48
<b>DE</b>	<b>333.51</b>	WA	1,828.79
ND	316.47	MD	1,825.15
AL	315.30	CT	1,803.33
TN	291.43	RI	1,773.33
UT	288.86	VT	1,768.33
WV	287.23	NJ	1,579.70
NH	286.76	<b>DE</b>	<b>1,490.45</b>
PA	280.30	NH	1,477.73
LA	275.10	ME	1,445.15

States Placed Below the 25 <sup>th</sup> Percentile			
SLCCPI		SLCCPAII	
State	CI Score	State	CI Score
AR	218.41	ID	778.33
IA	218.01	AL	768.33
CO	211.77	LA	763.33
HI	211.29	GA	755.00
ME	207.31	TN	755.00
IL	204.90	OK	743.33
<b>OR</b>	<b>202.47</b>	IN	663.33
AZ	201.38	WV	638.33
SC	191.81	SD	608.33
<b>MS</b>	<b>191.17</b>	<b>WY</b>	<b>508.33</b>
KY	184.68	NE	488.33
NE	169.45	ND	475.00
MO	164.88	<b>MS</b>	<b>448.33</b>

Oregon and Maine are the only two states to have placed above the 75<sup>th</sup> percentile in the SLCCPAII and below the 25<sup>th</sup> percentile in the SLCCPI. These states are considered candidates for analysis as a “deviant” case, in which the relatively high climate change policy action scores suggest that stakeholder engagement in the

polycymaking process has contributed to the implementation of policy. However, the low performance in terms of climate change mitigation suggests that policy implementation has been unsuccessful. Between the two, Oregon's index scores had the greatest range and, therefore, the state was selected as the third case study. A second "deviant" case is selected from among the states that were ranked highly (above the 75<sup>th</sup> percentile) with respect to climate change performance and low (below the 25<sup>th</sup> percentile) in terms of climate change policy action. Alabama, Louisiana, North Dakota, Tennessee, West Virginia, and Wyoming each met these criteria and were considered candidates for the fourth case study, where the relatively high climate change mitigation that has occurred within these states is considered unlikely based on their low scores with respect to climate change policy action. Among these states, Wyoming, had the greatest range between the state's SLCCPI and SLCCPAII scores, and was therefore selected as the fourth and final case study. Table 7.2 provides a summary of the climate change policies, grouped by area of focus, that have been adopted in each of the four states.

**Table 7.2.** Climate change policy adoption and implementation in the four cases.

<b>Planning</b>	<b>MS</b>	<b>WY</b>	<b>OR</b>	<b>DE</b>
Greenhouse Gas Inventory		•	•	•
Climate Change Advisory Group			•	•
Climate Change Adaptation Plan			•	•
Climate Action Plan			•	•
<b>Energy Efficiency</b>				
Residential Building Codes			•	•
State Building Standards	•		•	•
Commercial Building Codes	•		•	•
Appliance Efficiency Standards			•	•
Smart Growth/ Vehicle Miles Travelled			•	•
Energy Efficiency Resource Standards			•	•
<b>Renewable Energy Development</b>				
Net Metering	•	•	•	•
Renewable Fuels			•	•
Renewable or Alternative Energy Portfolio Standards			•	•
<b>Emissions Regulation</b>				
Greenhouse Gas Target			•	
Greenhouse Gas Reporting		•	•	•
Emissions Standards, Electric Power Sector			•	•
Cap and Trade				•
CA Vehicle Emissions Standards			•	•
Low Carbon Fuel Standard			•	•
Zero Emissions Vehicle Mandates			•	
<b>Multistate Agreements</b>				
			•	•

### **Case Study Analysis Methodology**

The intent of this research is to evaluate the contingency model for collaborative governance shown in Figure 7.1 to assess the role of stakeholder engagement in the climate change policymaking process in the American states. When viewed as a hierarchical model of policy and environmental outcomes, the collaborative governance framework depicted in Figure 7.1 identifies two dependent

variables of concern, institutions for collaborative climate change policy and climate change policy outcomes. The focus of the investigative process is to examine and explain the causal mechanisms that are hypothesized to contribute to collaborative governance institutions and subsequently lead to successful climate change policy outcomes.

As discussed in Chapter 3, states offer a useful unit of analysis for explaining the various characteristics of collaborative climate change processes and policy outcomes depicted in the conceptual framework because they offer a diverse and potentially large number of possible collaborators. Additionally, the fifty states do not differ significantly insofar as government institutions and legislative processes are structured. Thus, interstate diversity across social, economic, and environmental variables, and the interstate homogeneity of governing structures, facilitates the opportunity to undertake within-case and across-case comparisons that examine the framework for collaborative climate change policy institutions.

The most-likely case, Delaware, presents a vanguard state in which, given the successful achievement of climate change mitigation and policy action, one would expect to find the existence of collaborative stakeholder engagement processes. King, Keohane, and Verba argue that, “When observations are selected on the basis of a particular value of the dependent variable, nothing whatsoever can be learned about the causes without taking into account other values [of the dependent variable]” (King, Keohane and Verba 1994, 129). Thus, in addition to Delaware, the analysis includes three additional cases that vary with respect to climate change policy

outcomes. Mississippi represents a “laggard” state in which little climate change mitigation or policy action has occurred, and therefore it is unlikely that collaboration has transpired. While the deviant cases, Oregon and Wyoming, represent “grey area” cases in which, based upon the divergent trends with respect to climate change performance and policy action exhibited in these states, the in-depth analysis of the hypothesized relationship between collaborative governance institutions and policy outcomes may provide important insight into the validity of the proposed framework and the role of alternative hypotheses in explaining climate change policy outcomes.

To examine the intermediate steps in the policymaking process presented in the conceptual framework, and test hypotheses on how climate change policymaking takes place, the case study investigation relies on process tracing techniques. George and Bennett (2005) define process tracing as the use of “histories, archival documents, interview transcripts, and other sources to see whether the causal process a theory hypothesizes or implies in a case is in fact evident in the sequence and values of the intervening variables in that case.” In general, process tracing is conducted by examining the intermediate steps in a process to make inferences about hypotheses on how that process took place and whether and how it generated the outcome of interest. The process tracing research design is distinct from alternative single and small-n case study methods in that the approach enables the researcher to identify the intervening causal process and study the causal mechanisms that link a hypothesized causal condition (or set of conditions) that facilitate or constrain the occurrence of a particular outcome (George and Bennett 2005).

The process tracing method focuses on the mechanisms, processes and dynamics that produce a particular event, rather than building arguments that are structural in nature. The general goal of process tracing, as a qualitative analytical tool, is to organize preexisting generalizations regarding a particular event or phenomenon with specific observations from within a single case in order to then make causal inferences about the case being studied. While both process tracing and structural case study designs offer important contributions to the academic community as well as individuals who work within the policy arena, case study research conducted on the observable implications of mechanisms can provide decisionmakers with new insight on a range of factors that contribute to producing effective policy outputs. Thus, some have argued that process tracing techniques are better suited for capturing the complex world within which policymakers interact (Bennett and Checkel 2014).

Nesting each of the four case studies into a cross-case design for comparative analysis provides the opportunity to investigate deviant cases and develop insight into the policy and political processes that either drive or prevent climate change policy via collaborative policy institutions and stakeholder engagement. Cross-case comparisons of the four states that differ in terms of climate change performance and climate change policy action provides the opportunity to determine whether the presence or absence of the independent and intervening variables under investigation are indeed related to the development of collaborative climate change policy institutions and policy outcomes. Additionally, the cross-case comparison may

elucidate how alternative explanations might contribute to differences regarding the policy and environmental outcomes amongst the cases included in the investigation.

As most-similar cases rarely control for all but one potentially causal factor, process tracing can also establish that other differences between the cases do not account for the difference in their outcomes. Thus, the inclusion of least-likely and deviant cases in the investigation is also valuable for evaluating the proposed causal mechanisms and building a theoretical framework that explains the development of climate change policy. For example, most-similar case comparison, in which two cases differ on one independent variable and on the dependent variable, process tracing can help establish that the one independent variable that differs is related through a convincing hypothesized causal process to the difference in the outcomes of the cases. Similarly, process tracing can help affirm that the one independent variable that is the same between two least-similar cases accounts for the similarity in their outcomes, and that similarities in other potentially causal factors do not explain the common outcome of the cases. Each of these contributions is critical for developing a theory that explains climate change policymaking in American states.

To evaluate the proposed collaborative climate change policy framework inference must be made regarding the causal mechanisms within the policymaking process and the conditions in which they operate. This study employs a definition of causal mechanisms provided by George and Bennett (2005) where causal mechanisms are “social...processes through which agents with causal capacities operate, but only in specific contexts or conditions, to transfer... information... to



other entities. In doing so, the causal agent changes the affected entities' characteristics, capacities, or propensities in ways that persist until subsequent causal mechanisms act upon them" (George and Bennett 2005, 137). The "context" or scope "conditions" allow a given mechanism to function and can be defined as the "...relevant aspects of a setting (analytical, temporal, spatial, or institutional) in which a set of initial conditions leads...to an outcome of a defined scope and meaning via a specified causal mechanism or set of causal mechanisms" (Falletti, Tulia and Lynch, 2009, 1152). For example, the formation of collaborative climate change policy processes (outcome) is affected by the context (causal mechanism) of the state in which policy is being formulated, and the environmental, social, and institutional conditions (scope conditions) of the state determine the effect of the context on the collaborative process.

Identifying the presence of causal mechanisms and testing the effect that these variables have on a particular outcome is facilitated by the analysis of the scope conditions defined by the theoretical framework. The scope conditions are operationalized using quantitative and qualitative data, which serve as observable implications or causal process observations (CPOs) and represent the link between the causal mechanism of interest and the outcome under investigation. The predicted value or content of the CPO is dependent upon the hypothesis being tested and should hold true if the causal relationship under investigation exists (Mahoney 2012).

The analysis process evaluates the significance of proposed causal mechanisms by conducting a sequence of tests designed to investigate whether and

how an explanatory variable affects the dependent variable under investigation (Beach and Pedersen 2012, 2013; George and Bennett 2005; Gerring 2007). Hoop and smoking gun tests are two types of empirical checks that are used to evaluate hypotheses regarding causal mechanisms in process tracing (Van Evera 1997, 31-32; see also Bennett 2008a:706; Collier 2011). Hoop tests and smoking guns tests are defined by whether passing a test is necessary for confirming a given explanation (i.e., a hoop test) or whether passing a test is sufficient for confirming a given explanation (i.e., a smoking gun test). To the extent that the tests cannot draw on generalizations about necessary or sufficient conditions, but rather must use probabilistic generalizations, they become straw in the wind tests. Straw in the wind tests point in the direction of a hypothesis being supported or not, but can neither be confirmed nor eliminated (Bennett 2008a; Collier 2011).

An important goal of the current study is to conduct an initial assessment of the applicability of the conceptual framework depicted in Figure 7.1 to the analysis of collaborative management institutions within the context of the state-level climate change policymaking process. Therefore, the IRC, SCF, and ACF hypotheses regarding the formation of collaborative management institutions and climate change policy outputs presented in Chapter 3 are evaluated using hoop tests, where the CPOs associated with each causal mechanism must be observed to confirm relevancy. However, the presence of the CPO does not necessarily provide sufficient evidence for confirming the hypothesis. Additionally, throughout the investigation, evidence of alternative explanations for the development of climate change policy outputs, such

as the role of policy entrepreneurs and policy “mobilizers” (e.g., media outlets, interest groups, etc.) are considered. Alternative explanation related to the formation of collaborative management institutions, and their effect on climate change policy adoption, can offer valuable insight into the development of state-level climate change policy, and build upon the proposed conceptual framework.

### **Antecedent Variables**

In the proposed framework, the initial societal, institutional, and environmental conditions represent the causal mechanisms that influence the formation of institutions for collaborative climate change policy processes within a particular polity. The scope conditions include the severity of the environmental problem, the social and economic structure of the community, and the presence of state-level resources to facilitate collaboration governmental institutions. According to IRC theory, these conditions are likely to influence or constrain the type of collaborative climate change management approach that will surface, as well as its likelihood of success. The causal mechanisms include the nature of the climate change problem, civic community attributes, and state-level institutions related to climate change mitigation. These mechanisms are operationalized using 22 CPOs.

The environmental condition CPOs are operationalized by the observed and predicted state-level environmental impacts associated with climate change, as well as public opinion regarding the severity, scientific basis, and the spatial and temporal impacts of the issue (see Table 7.3). Anthropogenic climate change is a unique environmental problem relative to other environmental quality or resource

management issues. Whereas environmental conditions related to water quality or resource depletion, for example, can be scientifically assessed with relative certainty, the scientific basis for climate change and associated impacts is stochastic in nature and, therefore, generally involves higher levels of uncertainty. Moreover, the immediate effects of a changing climate have in many places been relatively subtle, while the greatest impact to society are predicted to occur 50 to 100 years from the present (USGCRP 2014; IPCC 2013). Therefore, public opinion regarding the issue is a reasonable proxy for evaluating environmental conditions, where individual experiences and beliefs affect an individual's perception regarding the urgency and magnitude of climate change impacts. Furthermore, given the integral role of epistemic communities in defining the climate change problem, individual interpretation of the scientific basis for climate change is likely to determine how communities relate to observed environmental change that may also be attributed to short-term weather anomalies (Akerlof 2013; Kaufmann et al. 2016; Kempton et al. 1995; Leiserowitz 2006).

**Table 7.3** Environmental conditions.

	Mississippi	Wyoming	Oregon	Delaware		
<b>Observed Impacts</b>						
1. Sea level rise (1 in. every 7 years)		1. Warmer climate (+1 to 3 °F)	1. Early snowpack melt	1. Sea level rise (1 in every 7 years)		
2. Cooler climate (-1.0 °F)		2. Earlier snowpack melt	2. Reduced snowpack (20% since 1950)	2. Saltwater intrusion of coastal aquifers		
3. Drier soils			3. Warmer climate (+2 °F)	3. Warmer climate (+2 °F)		
4. Increase in rainfall (27% since 1958)						
<b>Predicted Impacts</b>						
1. Sea level rise (20 in. to 4 ft. in next 100 yrs.)		1. Decrease in water availability	1. Ocean acidification	1. More frequent storm events		
2. Increased hurricane, rainfall events, and droughts		2. Increased risk of wildfires	2. Less water availability	2. Shift in Precipitation patterns		
3. Change in forest ecosystem		3. Twice as many days above 100 °F by 2050	3. More frequent forest fires	3. Impacts to estuarine habitat		
4. 2-3 times more days above 95 °F in 70 years						
Source: U.S. Environmental Protection Agency 2016, b, c, d, e						
<b>County-level Public Opinion Regarding Climate Change<sup>1</sup></b>						
<b>Severity</b>		<b>MS (n=82)</b>	<b>WY (n=23)</b>	<b>OR (n=36)</b>	<b>DE (n=3)</b>	<b>U.S. Avg.</b>
Believe climate change is happening (%), Avg. (Std. Dev.)		57.09 (3.12)	55.26 (3.58)	64.64 (3.72)	63.67 (1.15)	59.10 (4.91)
Think global warming will harm them personally (%), Avg. (Std. Dev.)		32.89 (3.13)	30.30 (1.84)	34.06 (3.03)	36.00 (1.00)	32.06 (3.64)
Somewhat/very worried about global warming (%), Avg. (Std. Dev.)		46.81 (2.94)	44.39 (2.73)	54.72 (4.31)	56.67 (3.21)	48.85 (5.14)
<b>Scientific Knowledge</b>						
Believe most scientists think global warming is happening (%), Avg. (Std. Dev.)		32.09 (2.79)	34.00 (3.54)	43.53 (4.90)	42.67 (2.31)	36.42 (5.52)
<b>Spatial and Temporal Impacts</b>						
Think global warming will harm people in the U.S. (%), Avg. (Std. Dev.)		46.62 (2.57)	43.74 (1.79)	51.72 (3.23)	54.33 (1.53)	47.81 (4.02)
Think global warming will harm future generations (%), Avg. (Std. Dev.)		54.38 (1.92)	50.78 (2.00)	64.47 (2.68)	65.00 (1.73)	58.12 (4.67)
1. Public opinion estimates produced using a statistical model based on national survey data gathered from 2008-2014						
Source: Howe et al. 2015						

The findings related to environmental conditions indicate that Delaware and Oregon have each experienced a more significant and uniform increase in temperatures relative to Mississippi, which has actually experienced a 1°F decrease in average temperatures, and Wyoming, which has experienced varying levels of temperature increase throughout the state (see Table 7.3). Additionally, Delaware and Oregon have already begun to experience direct impacts that pose potentially significant economic and environmental challenges for their population. In Oregon, earlier snowmelt and reduced snowpack has begun to affect various aspects of the state's economy including businesses related to winter recreation, reliance on the hydroelectric power sector, and sensitive ecosystems for Chinook and sockeye salmon in the Columbia River Basin (GCCIG 2006; USEPA 2016d). In Delaware, which has the lowest average land elevation in the U.S. and a large portion of the population that lives along the state's 381 miles of shoreline, rising seas have contributed to an increase in the rate of saltwater intrusion of coastal aquifers and alterations of the salinity of estuarine ecosystems, posing challenges for residential and agricultural water users that rely on groundwater. Likewise, sea level rise has begun to pose a serious threat to estuarine ecosystem resilience (USEPA 2016b).

With respect to public opinion regarding various aspects of the climate change issue, the findings indicate that Oregon and Delaware each have a higher level of concern regarding the existence and severity of climate change impacts, relative to Wyoming and Mississippi, and the U.S. more generally (see Table 7.3). Similarly, the two states tend to have a deeper understanding of the scientific consensus regarding

climate change as well as concern regarding the spatial and temporal effects of a changing climate.

Table 7.4 presents the antecedent indicators for the civic community and socioeconomic conditions in each state. Variables that are likely to influence social capital include the density of a population, education level, access to health care, and economic wellbeing (Helliwell and Putnam 1999; Knack and Keefer 1997; Kumlin and Rothstein 2005; Veenstra 2000). The table also includes the portion of each state's economy supported by the service industry as well as the portion supported by industrial activity (e.g., farming, manufacturing, and extractive industries). Given that the economic costs of emissions reduction policies are generally perceived as disproportionately distributed to the electric power and industrial sectors, these economic conditions are likely to affect a state's willingness to participate in collaborative policy processes focused on climate change mitigation, and climate change policy efforts more generally (Dunlap and McCright 2011). Political ideology has also been found to have a significant effect on an individual's position regarding various aspects of the climate change issue. Therefore, trends in political ideology is also included and represents a measure of each state's belief system that is likely to influence the formation of collaborative policy processes (McCright and Dunlap 2011a, 2011b; Leiserowitz 2006). It is expected that states that exhibit a relatively high level of social capital (i.e., high education, high proportion of health care services, high income, and low poverty), a high portion of the economy employed by the service industry, and more liberal political ideology are more likely to have

formed collaborative policy institutions related to climate change policy, and, subsequently, higher levels of policy adoption.

**Table 7.4.** Civic Community and socioeconomic conditions.

	MS	WY	OR	DE	U.S.
<b>State-Level Education</b>					
Four Years of High School (%), 2011-15	82.3	92.3	89.9	88.4	88.2
Change from 1989	+14.6	+6.7	+6	+7.7	+10.5
Four Years of College or More (%), 2011-2015	20.7	25.7	30.8	30.0	29.0
Change from 1989	+5.1	+3.8	+10.6	+10.6	+8.6
<b>Population Density</b>					
Population Density (per sq. mi.), 2013	63.75	6.00	40.94	474.99	198.28
Change (%), 1988-2013	16	25	43	43	31
<b>Healthcare Services</b>					
Covered by Health Insurance (%), 2013	82.9	86.6	85.3	90.9	85.5
Change, 1988-2013	+4.4	+1.7	+1.9	+1	+0.6
<b>Income and Poverty</b>					
Median Household Income (2015 Dollars)	32,905	68,623	49,858	55,039	55,254
Change (%), 1988-2015	-22	+35	-7	-1	+7
Unemployment Rate (%), 2013	8.6	4.6	7.7	6.7	7.4
Change from 1992 (%)	+0.5	-1	+0.2	+1.4	0
Poverty (%), 2013	19.1	11.4	14.0	11.2	14.2
Change, 1988-2013	-8.1	+1.8	+3.6	+2.6	+1.4
<b>Political Ideology</b>					
Republican Lean (%), 2014	44	57	32	29	
Change, 1993-2014	+1.3	+5	-11.1	-8	
Independent (%), 2014	14	18	21	17	
Change, 1993-2014	+6.7	+3.5	+12.5	+6.5	
Democrat Lean (%), 2014	42	25	47	55	
Change, 1993-2014	-8	-8.5	-1.4	+2.5	
<b>Socioeconomic Conditions</b>					
GDP from Private Services Industries (%), 2013	57	45	58	79	67
Change, 1997-2013	+1	-5	-1	+5	+2
GDP from Extractive Activity (%), 2013	2	29	0	1	12
Change, 1997-2013	+1	+9	0	-1	-4
GDP from Agriculture, Forestry, Fishing and Hunting (%), 2013	4	2	2	1	1
Change, 1997-2013	+1	-1	-1	0	0
GDP from Manufacturing (%), 2013	16	5	24	6	3
Change, 1997-2013	-4	-1	+5	-6	+2

Sources: Gallup 2003; Pew Research Center 2014; U.S. Bureau of Economic Analysis 2016; U.S. Bureau of Labor Statistics 1993, 2014; U.S. Census Bureau 1991, 2006, 2015a,b,c, 2016



The data in Table 7.4 show mixed results with respect to the expected relationship between community conditions and state policy adoption. Mississippi and Delaware each exhibit trends that support the hypotheses related to community conditions and the adoption of climate change policy. The former has below average education levels, healthcare services, household income, high levels of poverty, a large portion of the economy supported by the manufacturing industry, and an increasingly conservative political climate. Delaware exhibits opposite conditions in each of these areas. In contrast, Oregon and Wyoming show divergent trends, particularly with respect to conditions related to income and poverty. Wyoming has relatively high income levels and low poverty and unemployment rates, while Oregon has a below average median household income, high unemployment rate, and high level of poverty.

Two areas in which these states differ are the existing and recent trends in political ideology and economic activity. In Wyoming, a relatively low portion of the state's economy is supported by service-based industries while extractive industries (e.g., fossil fuel production and uranium mining) account for nearly one-third of the state's economic output. In contrast, Oregon's economy is predominantly supported by service-based industries. Although nearly one quarter of the state's economy is accounted for by the manufacturing industry, most of this income is produced from computer and electronic product manufacturing (Lehner 2016). Additionally, Wyoming is predominantly a politically conservative state, and it has grown more

conservative in recent years. Oregon, in contrast, is predominantly liberal, with most recent trends showing an increase in independent voters and a decrease in conservative voters. In terms of the study hypotheses, the conditions in Oregon and Wyoming indicate that economic activity and political ideology may have a stronger effect on a state's decision to pursue policies related to climate change mitigation relative to factors associated with a state's socioeconomic conditions.

A third aspect of the contextual conditions that are likely to affect the formation of collaborative policy processes include the existence of institutional structures that allow and support stakeholder engagement associated with climate change mitigation. Prior to 1988, very few states had taken action to address the physical drivers of anthropogenic climate change, and none of the four states included in this study had taken substantial policy action associated with emissions reduction. Additionally, each of the fifty states houses an office or department that is generally charged with addressing policy matters related to environmental quality, including the facilitation of rulemaking for newly adopted laws, the enforcement of existing rules, and the monitoring of environmental conditions. These organizations often work closely with policymakers and bureaucrats at various levels of government as well as scientific experts and nongovernment stakeholder groups. These types of institutions can serve as an important link between public interests and public policy on issues related to environmental quality and can provide a venue for a collaborative policy process by reducing the transaction costs associated with organization and information gathering. Therefore, each state has the potential to facilitate

collaborative climate change management institutions.

### **Collaborative Policy Processes**

In their analysis of collaborative watershed management, Sabatier et al. (2005) note four general variants of the collaborative management process as they apply to watershed management. The four types of collaborative management institutions are distinguished by the duration of the collaboration (short-term versus long-term) and decision making power (informal advisory versus formal authority) and include: (1) collaborative engagement processes, (2) collaborative partnerships, (3) collaborative superagencies, and (4) collaborative panels (see Table 7.5). In the context of watershed management, collaborative policy processes associated with large-scale issues have often been characterized by superagencies, composed of stakeholders groups and local, state, and federal government representatives, that facilitate long-term planning and monitoring programs at the collective choice level and hold formal decision making power and legal authority to carryout policy implementation (Heikkila and Gerlak 2005). In contrast, small-scale collaborative management efforts often occur as short-term engagement processes in which policy planning and implementation occurs at the operational level through third party mediation and policy outputs that are carried out voluntarily (Lubell 2002).

**Table 7.5.** Variations of collaborative management institutions.

<b>Duration</b>	<b>Decision Power or Influence</b>	<b>Collaborative Management Institution</b>	<b>Characteristics</b>
Short-term	Informal	Engagement	Applies techniques for conflict resolution among diverse stakeholders, developed by outside actors and applied to specific planning exercises
	Formal	Panel	Consist of multi-level government representatives and nongovernment stakeholder partnerships
Long-term	Informal	Partnership	Involve a wide variety of governmental and nongovernmental stakeholders seeking to develop some form of environmental or resource management plan and implementation of projects to achieve the identified goals
	Formal	Superagency	Consist of multi-level government representatives and nongovernment stakeholder partnerships

Source: Sabatier et al. 2005a.

Delaware and Oregon have each convened a number of collaborative management institutions that have contributed to the development of state-level climate change policy. As Tables 7.6 and 7.7 show, the majority of these collaborative policy processes are structured as collaborative engagement processes, established through executive order or legislative action, and charged with developing plans and providing policy recommendations to state lawmakers and administrative agencies. While most of the collaborative management institutions include a diverse and representative collection of stakeholders groups, a number of the collaborative policy processes in each state have undertaken a rather complex structure composed of specialized workgroups and outreach processes in order to expand the level of stakeholder engagement within the policy design process.

The Delaware Governor's Energy Advisory Council (DGEAC), formed in 2007, consisted of a Chair, 15 voting members including environmental and public advocates, as well as members of the electric power sector (GEAC 2009). The DGEAC also surveyed more than 1,000 citizens to ascertain the energy priorities of Delawareans and obtain feedback on the energy issues identified by the Council. The survey results informed the formation of five workgroups that focused on various topics including energy efficiency, environmental impacts, transmission and distribution, and clean energy business. Each workgroup was composed of additional stakeholders and prepared a report with recommendations to the voting members of the DGEAC who prepared, in a consensus-based process, the final policy recommendations for the Governor and state legislature (GEAC 2009).

The Oregon Global Warming Commission (OGWC), established in 2007 by the state legislature, represents the most comprehensive and diverse collaborative climate change policy process in the state. The Commission is composed of 11 voting members who represent various interests from the Oregon community, including climate change scientists, 14 members from the state legislature and administrative agencies, and six committees composed of stakeholders to inform policy recommendations regarding areas such as public health, transportation and land use, communication and outreach, and natural resources (OGWC 2009). In addition to preparing a biannual report, the OGWC has facilitated public outreach projects and conducted public surveys to engage the general public and improve the state's

understanding of opinions regarding the climate change issue and policy approaches (OGWC 2009, 2013).

**Table 7.6** Delaware, collaborative engagement processes.

<b>Collaborative Policy Institution</b>	<b>Year Established</b>	<b>Duration</b>	<b>Charge</b>	<b>Membership</b>
Climate Change Consortium	U.S. EPA 1998	2 Years	Identify opportunities for reducing GHG emission, raise awareness of climate change, publish and disseminate an Action Plan.	2 Co-Chairs, 34 voting members; interest groups included: local, state, and federal agencies, private companies, scientists, energy companies, public advocate, environmental, waste management, transportation, labor unions.
Energy Task Force	Gov. Minner 2002	1 Year	Develop a plan to meet current and future energy needs, focus on conservation, energy infrastructure, and clean energy technologies.	1 Chair, 17 voting members, 6 working groups; voting member interest groups included: local, state, and federal agencies, elected officials, business, scientists, agriculture, environmental, chemical manufacturing, energy.
Sustainable Energy Utility Task Force	State Legislature 2006	1 Year	Research and report on the feasibility of a establishing a state sustainable energy utility.	2 Co-Chairs, 12 voting members, 1 technical consultant, 8 research staff members; voting member interest groups included: elected officials, environmental, public advocacy, energy, technical advisors.
Energy Advisory Council	State Legislature 2007	2 Years	Develop a short-term plan and long-term vision for the state's energy infrastructure. Focus on efficiency and conservation, environmental impact, transportation, clean energy development, reliability and security, reducing costs to citizens.	1 Chair, 15 voting members, 5 working groups, public surveys; voting member interest groups included: local, state, and federal agencies, business, scientists, environmental, energy.

---

**Table 7.6** Continued.

---

RGGI Workgroup	Dept. of Natural Resources and Environmental Control 2008	1 Year	Assist the Dept. of Natural Resources and Environmental Control with designing rules to comply with the Regional Greenhouse Gas Initiative program.	18 voting members; interest groups included; local government, state agencies, energy, legal, environmental, public advocate.
Energy Efficiency Standard Workgroup	State Legislature 2009	2 Years	Assess feasibility, identify potential economic impacts, and other potential issues from implementation of Energy Efficiency Resource Standard.	1 Chair, 25 voting members; interest groups included: state agencies, environmental, scientists, low-income, and public advocates.
Committee on Climate and Resiliency	Gov. Markell 2013	Ongoing	Called for state agencies to develop actionable recommendations related to GHG emissions reduction and climate change adaptation.	1 Chair, 11 voting members, 3 working groups; voting member interest groups included: state agencies.
Energy Efficiency Advisory Council	State Legislature 2014	Ongoing	Assist the state's electric and natural gas utilities with the development and deployment of energy efficiency programs and financing mechanisms.	1 Chair, 12 voting members; interest groups included: state agencies, energy, manufacturing, commercial, environmental, agricultural, low-income, residential.

---

Sources: Amirikian 2008; CCCR 2014; DEEAC 2015; DETF 2003a; EESWR 2011; GEAC 2009; SEUTF 2007

**Table 7.7** Oregon, collaborative engagement processes.

<b>Collaborative Policy Institution</b>	<b>Year Established</b>	<b>Duration</b>	<b>Charge</b>	<b>Membership</b>
Task Force on Global Warming	Gov. Goldschmidt 1988	2 Years	Analyze impact of global warming in Oregon, provide recommendations for state agency response.	1 Chair, 29 voting members; interest groups included: state agencies.
Energy Facility Siting Task Force	State Legislature 1996	1 Year	Review the public interest in the siting of energy facilities and develop a climate change standard.	7 voting members; interest groups included: local government, state, federal government agencies, elected officials, business, scientists.
Advisory Group on Global Warming	Gov. Kulongoski 2003	1 Year	Devise goals and policy recommendations to reduce Oregon's GHG gas emissions.	2 Co-Chairs, 26 voting members; interest group representatives included: local government, state and federal agencies, environmental, scientists, agriculture, energy, religious.
Renewable Energy Working Group	Gov. Kulongoski 2003	3 Years	Identify opportunities for improving energy efficiency and renewable energy development.	2 Co-chairs, 39 voting members; interest groups included: local, state and regional government, local and state elected officials, renewable and nonrenewable energy, environmental, agriculture, scientists, public advocates, labor unions, business.
Vehicle Emissions Workgroup	Gov. Kulongoski 2005	1 Year	Assess the costs, benefits, and impacts of implementing California's vehicle emission requirements.	1 Chair, 12 voting members; interest groups included: state agencies, citizens, environmental, automotive business.
Carbon Allocation Task Force	Gov. Kulongoski 2005	2 Years	Assess feasibility of, and develop a design for, a cap and trade standard.	21 members; interest groups included: local and state government agencies, electric power sector, industry, businesses, environmental.



**Table 7.7 Continued.**

Climate Change Integration Group	Gov. Kulongoski 2006	2 Years	Prepare mitigation and adaptation strategy for Oregon, implement and monitor recommendations from Advisory Group on Global Warming 2004 report, serve as a clearinghouse for Oregon climate change information, explore research possibilities for Oregon's universities.	2 Co-Chairs, 22 voting members, 12 state agency liaisons; interest groups included: local and state government agencies, energy, agricultural, environmental, scientific.
Oregon Global Warming Commission	State Legislature 2007	Ongoing	Provide policy recommendations to meet GHG reduction targets, develop outreach strategy, track Oregon climate change impacts.	1 Chair, 2 Vice-Chairs, 23 voting members; interest groups included: state and regional agencies, elected officials, business, manufacturing, energy, environmental, agriculture, scientists.
GHG Reporting Advisory Committee	Dept. of Environmenta l Quality 2007	2 Years	Give recommendations for GHG reporting rules. Reconvened in 2009 to provide input on rule amendments, implement recent legislation, and update reporting program.	1 Chair, 28 voting members; interest groups included: local government, state agencies, citizens, environmental, and business.
Low Carbon Fuels Standard Advisory Committee	Dept. of Environmenta l Quality 2010	1 Year	Provide recommendations for various design elements of state's low carbon fuel standards.	1 Chair, 28 voting members; interest groups included: local government, fuel producers, environmental, businesses, citizens, labor unions, transportation business, construction industry, agricultural.
Clean Fuels Program 2017 Rulemaking Advisory Committee	Dept. of Environmenta l Quality 2016	2 Years	Provide stakeholders an opportunity to comment on technical and policy issues, and the fiscal and economic impact of amendments to the state Clean Fuels Program.	1 Chair, 28 voting members; interest groups included: conventional and alternative fuel importers, electric utilities, biofuel producers, technical advisors, public advocates, environmental.

Sources: CATF 2005; GAGGW 2004; GCCIG 2008; GVEW 2005; ODE 2005; ODEQ 2010, 2011; OEFSTF 1996; OTFGW 1990; Wind 2016.

Delaware and Oregon have also participated in long-term, regional and international partnerships, such as The Climate Registry and North America 2050. Table 7.8 shows each of the multistate partnerships in which each of the states has held membership. These voluntary partnerships are designed to provide opportunities for policy learning and offer technical assistance with GHG emissions accounting and climate change mitigation policy development (TCR 2015; NA2050). Both states also have a history of interstate partnerships associated with policy coordination and planning. In 2003, Oregon Governor Ted Kulongoski joined Washington and California to form the West Coast Governor's Global Warming Initiative (WCGGWI) (WCGGWI 2004). The partnership eventually evolved into the Western Climate Initiative (WCI) in 2007, which, in addition to the WCGGWI partners, included four additional western states and four Canadian Provinces (WCI 2007). In 2008, the WCI was replaced by the Pacific Coast Collaborative (PCC), an ongoing consensus-based, voluntary partnership between the governors Alaska, California, Oregon, Washington and the Premier of British Columbia, to coordinate state-level policies and adopt resolutions related to climate change mitigation and sustainable development (Palin et al. 2008).

Delaware is a participant in what may be the most well-known climate change partnership to date, the RGGI. In 2003, at the request of New York Governor Georg Pataki (R), Delaware Governor Ruth Minner (D) along with the Governors of Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, Rhode Island, and

Vermont, began to discuss the development of a regional cap and trade program designed to address CO<sub>2</sub> emissions from electric power plant facilities (C2ES 2015; Fershee 2007). Following two years of negotiations the seven states signed a memorandum of understanding to stabilize emissions from 2009 to 2014 (based on 2000-2002 average annual emissions) followed by incremental, annual 2.5 percent reductions beginning in 2015 to achieve a 10 percent overall reduction in emissions by 2019 (Rell et al. 2005).<sup>86</sup> Maryland, Massachusetts, and Rhode Island joined the partnership in 2007, and the program became active in 2009. New Jersey is the only state to have exited the RGGI since its initiation.

---

<sup>86</sup> The program applies to any fossil fueled electric generating unit of greater than 25MW, if that unit sells more than 10 percent of the electricity it generates on the commercial market.

**Table 7.8.** Delaware and Oregon, collaborative partnerships.

<b>Collaborative Policy Institution</b>	<b>Year Established</b>	<b>Duration</b>	<b>Charge</b>	<b>Membership</b>
<b>Delaware Collaborative Partnerships</b>				
Regional Greenhouse Gas Initiative	2003	Ongoing	Regional effort to cap and reduce CO <sub>2</sub> emissions from the power sector.	Maryland, Delaware, New Jersey*, New York, Connecticut, Rhode Island, Massachusetts, Vermont, New Hampshire, Maine
The Climate Registry	Gov. Minner 2007	Ongoing	Designs and operates voluntary and compliance GHG reporting programs.	Non-profit organization governed by U.S. states and Canadian provinces and territories.
Northeast and Mid-Atlantic Low Carbon Fuel Standard	2008	Ongoing	Signatory states commit to evaluating a regional low carbon fuel program to reduce carbon intensity of transportation and heating fuels.	Connecticut, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont
North America 2050	2012	2 Years	Facilitates state and provincial efforts to design, promote and implement cost-effective policies that reduce GHG emissions and create economic opportunities.	Arizona, British Columbia, California, Connecticut, Illinois, Maine, Manitoba, Maryland, Massachusetts, Minnesota, Montana, New Jersey, New Mexico, Ontario, Oregon, Quebec, Rhode Island, Vermont, Washington
<b>Oregon Collaborative Partnerships</b>				
West Coast Governor's Global Warming Initiative	Gov. Kulongoski 2003	2 Years	Formed to develop joint policy recommendations for activities that require regional cooperation and action.	Washington, Oregon, and California
Western Climate Initiative	Gov. Kulongoski 2007	Inactive	Formed to identify, evaluate, and implement emissions trading policies to tackle climate change at a regional level.	Arizona, California, New Mexico, Montana, Oregon, Utah, and Washington, British Columbia, Manitoba, Ontario, and Quebec

<b>Table 7.8 Continued.</b>				
International Carbon Action Partnership	Gov. Kulongoski 2007	Ongoing	International forum for governments and public authorities that have implemented or are planning to implement emissions trading systems.	International forum for governments and public authorities
The Climate Registry	Gov. Kulongoski 2007	Ongoing	Designs and operates voluntary and compliance GHG reporting programs.	Non-profit organization governed by U.S. states and Canadian provinces and territories.
Pacific Coast Collaborative	Gov. Kulongoski 2008	Ongoing	Regional effort to align climate change policies.	Alaska, California, Oregon, Washington, British Columbia
North America 2050	Gov. Kulongoski 2009	Inactive	Facilitates state and provincial efforts to design, promote and implement cost-effective policies that reduce GHG emissions and create economic opportunities.	Arizona, British Columbia, California, Connecticut, Illinois, Maine, Manitoba, Maryland, Massachusetts, Minnesota, Montana, New Jersey, New Mexico, Ontario, Oregon, Quebec, Rhode Island, Vermont, Washington

Sources: ICAP 2014; NA2050 2011; OGWC 2009, 2013; Palin et al. 2008; Rell et al. 2005, 2009; TCR 2015; WCGGW 2004; WCI 2007.

The analysis of collaborative climate change management institutions in Delaware and Oregon has shown that each state has established a number of formal processes to initiate stakeholder engagement in the climate change policy process. The states have also participated in regional partnerships related to climate change mitigation policy coordination. The analysis also reveals some important distinctions between collaborative efforts related to GHG emissions reduction and those associated with watershed remediation. As noted above, large-scale collaborative watershed management institutions tend to operate at the collective choice level, and are often granted legal authority to generate mandatory rules to improve

environmental quality, while small-scale watershed management efforts are generally characterized by short-term, informal collaborative processes that rely upon voluntary implementation at the operational level.

While the collaborative management institutions in Delaware and Oregon all occur at the collective choice level, many of the collaborative processes associated directly with policy development are short-term, and none have been granted formal decision-making authority. Thus, the location of the decision-action arena is most similar to those found in large-scale watershed management. However, the structure is more closely related to a collaborative management process that takes place within the context of small-scale watershed management efforts. This finding is also unique from the types of collaborative policy processes that have been identified at the municipal level, where previous analysis of urban collaborative processes to address the climate change issue has found that local policymakers have convened formal collaborative panels as well as informal, long-term partnerships and engagement processes (Fiack and Kamieniecki 2017).

The collective choice focus of the collaborative management institutions associated with climate change policy in Delaware and Oregon is appropriate given the structural nature of the climate change problem. In the context of watershed management, voluntary, operational-level changes by actors involved in small-scale improvement efforts may be sufficient to address water quality and supply issues. However, in the context of state-level climate change mitigation, the causes of GHG emissions, particularly CO<sub>2</sub> emissions, at the regional level are predominantly tied to

existing infrastructural networks that exist across economic sectors. Thus, voluntary efforts to reduce emissions at the operational level may be limited and, therefore, effective mitigation will require more intensive structural change facilitated by the adoption of formal institutions. Similarly, the absence of state level collaborative climate change policymaking processes, with formal decision making power, is likely due to the existence of administrative agencies with formal regulatory oversight related to emissions and energy management in Delaware and Oregon. The Delaware Department of Natural Resources and Environmental Control, for example, is an umbrella agency that oversees the Division of Energy and Climate and the Division of Air Quality, which are charged with implementing and enforcing federal and state-level policies in these areas (DNREC n.d.). Therefore, while stakeholder engagement through collaborative policy processes may be valued, establishing a long-term collaborative management institution with formal rulemaking authority may be superfluous and could lead to political conflict regarding regulatory power and the allocation of state-level resources.

### **Collaborative Policy Processes and Policy Outputs**

Each of Delaware and Oregon's collaborative policy processes can be linked to the various climate change mitigation policies adopted by state-level policymakers. The contribution of each collaborative management institution to the policymaking process varies, from contributing to the establishment of additional stakeholder groups to the development of direct policy recommendations for legislative action and the evaluation and preparation of proposed rules for policy implementation. This

section provides an overview of collaborative management institutions in Delaware and Oregon that were found to provide a direct contribution to the adoption of state-level policies.

In Oregon, the WCGGWI and the Governor's Advisory Group on Global Warming (GAGGW) have played a particularly important role in facilitating the policy design and implementation process as well as the development of additional collaborative management institutions that have contributed to the state's climate change mitigation efforts. As discussed above, the Governors of California, Oregon, and Washington established the WCGGWI in September 2003. The goal of the collaborative partnership was to develop state and regional goals and strategies to address the climate change issue via cooperative GHG emissions reduction policies. To carry out the mission of the WCGGWI, the Governors agreed to establish state-level committees to develop cooperative policy recommendations that support regional action by September 2004 (WCGGWI 2004). To meet the goal of the WCGGWI, Oregon Governor Ted Kulongoski established the GAGGW to prepare a climate change strategy to achieve long-term sustainability within the state by compiling a set of policy recommendations to reduce GHG emissions while supporting economic growth (Grainey 2004; OGWC 2013). The group was comprised of nearly 30 members including local and state government agency representatives, environmental advocates, religious organizations, public advocates, members of the scientific community, and representatives from the agriculture and



electric power sectors. The Group met four times and produced a final report, Oregon Strategy for Greenhouse Gas Reductions, in December 2004 (GAGGW 2004).

The GAGGW report outlined 46 actions distributed across seven areas to help Oregon achieve cost-effective emissions reductions.<sup>87</sup> The recommended actions were also prioritized based upon their relative cost-effectiveness and potential level of emission reductions. The report included 19 “Category I” actions that can achieve significant, cost-effective GHG emissions reductions and 27 “Category II” actions that are more cost-effective, relative to Category I actions, but would achieve less significant reductions (GAGGW 2004). The recommendations provided in the GAGGW report contributed to the formal adoption of state-level appliance efficiency standards as well as new energy efficiency codes for residential and commercial buildings by the state legislature in 2005 (GCCIG 2006). The GAGGW supported the adoption of a formal state-level emissions reduction goal, as well as the establishment of collaborative policy processes to explore the feasibility of establishing a statewide renewable portfolio standard (RPS), and assess the potential impacts of implementing California’s vehicle emissions and Zero Emissions Vehicle standards. The GAGGW also recommended the creation of a successor to the GAGGW to carry out the unfinished agenda of the proposed legislative actions included in the Oregon Strategy for Greenhouse Gas Reductions and track climate change mitigation policy progress (GAGGW 2004).

---

<sup>87</sup> The seven areas include: policy planning, energy efficiency, electric power generation, transportation, carbon sequestration, waste management, and state government operations.

Following the adjournment of the GAGGW, Governor Kulongoski continued to pursue the policy goals established by the WCGGWI by convening a series of collaborative processes to carry out the major policy recommendations included in the Oregon Strategy for Greenhouse Gas Reductions. In 2005, the Governor formed the Governor's Vehicle Emissions Workgroup (GVEW) and the Renewable Energy Working Group (REWG) to explore issues surrounding the implementation of California vehicle standards and develop renewable energy policy goals, respectively (ODE 2005; OVEW 2005). A year later, the Governor also convened the Governor's Climate Change Integration Group (GCCIG) to implement and monitor mitigation measures outlined in the Oregon Strategy for Greenhouse Gas Reductions, and expand the work of the GAGGW by exploring research opportunities concerning the regional effects of climate change with Oregon universities, and developing an adaptation strategy for the state (GCCIG 2008). While the GGCIIG membership structure reflected the diverse and inclusive approach applied to the GAGGW, the GVEW and REWG were primarily composed of representatives from organizations with an interest in various aspects of the energy production and consumption process. The voting body of each group included members of conventional energy organizations (i.e., fossil fuel representatives and utility companies) and renewable energy advocates (ODE 2005; OVEW 2005). Therefore, in the context of energy policy, both collaborative panels included a reasonable level of stakeholder diversity in the policy process.

The second wave of collaborative policy processes established by Governor Kulongoski successfully carried forward the WCGGWI climate change policy agenda. The GVEW contributed to the successful adoption of California's vehicle emissions and ZEV standards while the REWG laid the groundwork for the establishment of the state's RPS and renewable fuel standards, as well as an update to the net metering program (OGWC 2009). In 2007, Oregon became a founding member of The Climate Registry and the members of the WCGGWI joined the Arizona, New Mexico, Montana, Utah, British Columbia, Manitoba, Ontario, and Quebec to establish the WCI. In the same year, at the request of the GCCIG, the Oregon legislature passed House Bill 3543. The legislation established the state-level GHG emissions target that had previously been recommended by the GAGGW, and created the OGWC to continue to provide policy recommendations to coordinate state and local efforts to achieve the state's emissions reduction goals and prepare for the effects of climate change (Keep Oregon Cool n.d.). The final recommendations also contributed to the adoption of a statewide LCFS (OGWC 2009).

While Oregon's collaborative policy efforts have largely been framed within the context of climate change mitigation, collaborative management processes in Delaware have primarily been framed within the context of energy efficiency and renewable energy development (see Table 7.6 and 7.7). To date, only two collaborative processes that focus explicitly on policy efforts related to emissions reduction have formed within the state. The Delaware Climate Change Consortium (DCCC), formed in 1998, was a collaborative engagement process supported by the

University of Delaware's Center for Energy and Environmental Policy (CEEP) and the U.S. EPA's State and Local Outreach Program (CEEP 2000; USEPA 2001). In addition to representatives from the CEEP and EPA, the DCCC consisted of more than 30 participants, including representatives from local and state government, environmental advocacy groups, the business community, and the electric power sector (CEEP 2000). The results of the DCCC collaboration culminated with the completion of the Delaware Climate Action Plan (DCAP) in 2000, which included a voluntary GHG emissions reduction target of 7 percent below 1990 emissions levels by 2010 and a collection of strategies and proposed policies for reducing emissions across the primary sectors of the states (CEEP 2000). The Cabinet Committee on Climate and Resiliency (CCCR), established by Governor Jack Markell (D) in 2014, is Delaware's most recent collaborative policy effort focused on the topic of climate change. The CCCR is a collaborative panel, chaired by the Secretary of the Department of Natural Resources and Environmental Control, and consists of 11 voting members from various state agencies charged with identifying cost-effective opportunities for state agencies to address the climate change issue in state government operations (see Table 7.6). The group also included three workgroups on the topics of climate change mitigation, adaptation, and flood avoidance. The CCCR met over the course of a year and submitted its final report to the Governor, Climate Framework for Delaware, in 2015.

Although the DCCC did not continue beyond the completion of the DCAP, the report has contributed to subsequent collaborative policy discussions held within

the state. The Delaware Energy Task Force (DETF) and Sustainable Energy Utility (SEU) Task Force, for example, each referenced the DCAP as a valuable starting point for understanding how improvements in energy efficiency and renewable energy development can contribute to improved environmental quality while supporting the state's energy sustainability goals (DETF 2003a; SEUTF 2007). The DETF, created by Governor Ruth Minner (D) in 2002, was tasked with addressing the state's short- and long-term energy challenges, and offering policy recommendations that provide a reliable, affordable, and efficient energy infrastructure for the state (DETF 2003a). The membership of the DETF consisted of 17 core members including representatives from the electric power sector, the fossil fuel industry, renewable energy companies, and environmental advocates and representatives from a number of state agencies. The task force also formed six working groups covering various topics including: energy conservation and efficiency, transmission and distribution, energy diversity, transportation fuels, economic development, and state procurement. The DETF completed a final report to the Governor, *Bright Ideas for Delaware's Energy Future*, in 2003, which, among other policy actions, recommended that the state update the codes for commercial, residential, and state-owned buildings to improve energy efficiency and reduce the costs of energy consumption (DETF 2003a). The report also recommended the adoption of a voluntary RPS. New building codes were adopted via state legislation in 2004, while a state-level RPS, following a series of delays, was adopted by the state legislature in 2005 (CEEP 2005).

In 2006 the Delaware legislature created the SEU Task Force to develop a policy agenda for the creation of a non-profit, independent, utility to provide programs and technical assistance related to public and private end-use sectors concerning energy efficiency improvements and distributed renewable energy development. The SEU Task Force was chaired by Senator Harris McDowell (D) and Dr. John Byrne of the CEEP, and consisted of 12 voting members including representatives from the Delaware Senate and House of Representatives, as well as energy providers and environmental and public advocates (SEUTF 2007). In 2007, the task force completed its final report to the legislature, *The Sustainable Energy Utility: A Delaware First*, which, in addition to an outline for the creation of a Sustainable Energy Utility, provided a number of legislative proposals including a proposed increase to the state's existing RPS and an update to the state's net metering policy, both of which were adopted by the state legislature that year (O'Mara, Cherry and Hodas 2010; SEUTF 2007).

The Governor's Energy Advisory Council (GEAC) formed in 2007 to begin preparing an update to the Delaware Energy Plan. As with the DETF, the council was composed of a broad group of representatives from the electric power sector, the fossil fuel industry, renewable energy companies, environmental advocates, and representatives from a number of state agencies. The council included five work groups that focused on energy conservation and efficiency, environmental impacts, transmission and distribution, transportation, and economic development. Although the primary charge of the council was to prepare a long-term energy plan for the state,

the council highlighted environmental quality and climate change as one of three major energy challenges that Delaware ought to address in its energy planning (GEAC 2009). The council's final report, Delaware Energy Plan 2009-2014, was completed in 2009 and provided a number of recommendations including the adoption of a mandatory, state-level energy efficiency resource standard (EERS), an additional update to the existing RPS and building energy efficiency codes (O'Mara, Cherry and Hodas 2010).

The Delaware Energy Plan 2009-2014 also included recommended actions to reduce emissions from the transportation sector such as policies to increase the consumption of alternative fuels and the adoption of vehicle emissions standards (GEAC 2009). The state subsequently took action on each of these items, by adopting an EERS and increasing the RPS, creating two of the most aggressive clean energy targets in the country, as well as increasing the energy efficiency requirements for new commercial and residential buildings, and directing the DNREC to adopt California's vehicle emissions standards (O'Mara, Cherry and Hodas 2010). In 2010, Governor Jack Markell issued Executive Order 18, which mandated state agencies to reduce energy consumption and emissions from state vehicles by only purchasing low emissions vehicles for state fleets and also requiring state buildings to increase energy efficiency standards (Executive Order 18).

### **Climate Change Policy Experiences in Mississippi and Wyoming**

Although Mississippi and Wyoming each rank among the lowest states in the nation in terms of climate change policy adoption and implementation, the two states

have taken some action associated with climate change mitigation. In 2001, Wyoming adopted a net metering program and, in 2007, the state produced a GHG inventory and joined 31 other U.S. states in establishing The Climate Registry (CCS 2007; Wilson 2007). Mississippi's policy efforts have occurred more recently, and include the adoption of federally recognized standards for commercial and state-owned buildings in 2013, and a net metering program in 2015 (Bishop 2013; MPSC 2015b). Given the contextual conditions within each state, it is unlikely that collaborative policy processes have contributed to the formulation and adoption of each state's respective policies.

As the nation's top producer of coal the fossil fuel industry is an important contributor to the Wyoming economy. Consequently, the state has a political interest in protecting both coal suppliers and coal users by limiting policies that would limit coal consumption (Cahn et al. 2016). The state has a history of conflict with federal lawmakers and the U.S. EPA regarding policies associated with the regulation of GHG emissions, most recently exemplified by the state's participation in a lawsuit that calls into question the U.S. EPA's authority to regulate CO<sub>2</sub> emissions under the Clean Air Act and President Barack Obama's Clean Power Plan, which calls for states to reduce emissions from the electric power sector by 32 percent below 2005 levels by 2030 (Magill 2016). In 1999, Wyoming adopted the "anti-Kyoto Protocol" law (House Bill 0170), perhaps the state's most powerful policy related to climate change mitigation to date. The law was developed as a response to the Kyoto Protocol, the world's first international agreement that set binding GHG emissions



reduction targets for industrialized nations. It also modified the Wyoming Environmental Quality Act to restrict the proposal or promulgation of state regulations intended to reduce GHG emissions from any sector (Barron 2012; Fershee 2007).<sup>88</sup> Additionally, although Wyoming has implemented a statewide net metering program, the state has more recently taken an unconventional approach with respect to renewable energy development. In 2010, Wyoming became the first state to implement a tax on wind energy production, a policy that has yet to be enacted by any other U.S. state. In 2015, Governor Matthew H. Mead (R) signed into law House Bill 0009, which established a tax rate on alternative fuels such as ethanol equal to those charged for conventional fuels (Kotrba 2015).

Despite Wyoming's outspoken opposition to emissions regulations and unique regulatory approach on renewable energy production and consumption, the state has participated in regional partnerships associated with climate change planning. The state is currently a member of the Western Regional Air Partnership (WRAP), a collaborative organization administered by the Western Governors Association and National Tribal Environmental Council, that was formed in 1997 to provide technical support and develop policy tools for local, state, tribal, and federal governments and agencies related to federal air quality standard compliance (WRAP 2009).

Wyoming's participation in WRAP can primarily be linked to the state's interest in preparing State Implementation Plans in order to address regional haze and air quality issues related to the state's fossil fuel production and consumption activities and

---

<sup>88</sup> The treaty was signed by President Bill Clinton (D) in 1997, however, the U.S. Senate could not acquire the two-thirds vote needed to ratify the treaty.

comply with Clean Air Act regulations (Davidson Jan Norbeck 2012). The WRAP also facilitated the completion of the state's 2007 GHG inventory in collaboration with the Center for Climate Strategies, a nonprofit organization that provides technical expertise in climate change planning and analysis (CCS 2007). That same year, Wyoming became a founding member of The Climate Registry, an organization developed to provide a uniform GHG emissions repository for public and private entities interested in emissions reduction.

Wyoming's participation in activities associated with climate change mitigation planning can primarily be attributed to the state's interest in pursuing carbon sequestration, rather than emissions reduction, as a strategy to address the climate change issue. These efforts can be traced to 2001, when the state legislature created the Carbon Sequestration Advisory Committee to assess the carbon sequestration potential of the state's agricultural and forest lands, identify research needs, and recommend policies or programs to support landowners to participate in carbon trading (Fershee 2007). The state's interest in carbon sequestration developed amidst global and federal policy discussions regarding emissions regulation, most notably the Kyoto Protocol. It was viewed as an alternative to emissions reduction mandates that would protect the state's fossil fuel-based economy by providing opportunities for emitters to offset, rather than reduce, emissions (Fershee 2007). However, federal pressure to pursue formal state policies concerning carbon sequestration subsided when, in 2001, President George W. Bush formally withdrew the U.S. from the Kyoto Protocol and, in 2003, the U.S. EPA denied a petition filed

by the International Center for Technology Assessment and 18 other organizations requesting that the agency regulate GHG emissions as a pollutant under the Clean Air Act (CAA) (Borger 2001; NACAA 2013; Saillan 2007).

The prospect of federal emissions regulations resurfaced in 2007 when the U.S. Supreme Court decided in *Massachusetts v. EPA* that the CAA indeed authorizes the U.S. EPA to regulate GHG emissions and, in 2008, began to review potential revisions under the CAA that may apply to the regulation of GHG emissions (NACAA 2013). In the same year, following the establishment of RGGI (2005) and California's successful adoption of a state-level cap and trade program (2006), federal lawmakers began serious discussions regarding the adoption of a national cap and trade program. Wyoming Governor, Dave Freudenthal (D), who acknowledged the significance of addressing the climate change issue, while also balancing Wyoming's resource-based economy, sought opportunity with federal lawmakers, as well as state officials and utility executives in the state of California, to advocate for carbon capture and storage as a mechanism to achieve emissions reduction while not constraining the market for fossil fuels (Fialka 2010; *The Future of Coal Under Carbon Cap and Trade* 2007; WGA 2007). To support this effort, in 2007, the Wyoming legislature established the Clean Coal Task Force, which consisted of the members of the University of Wyoming Energy Resources Council. The Task Force was allocated \$2.5 million to solicit proposals for research in clean coal technologies. In the following year, Wyoming became the first state in the nation to enact a formal, comprehensive carbon sequestration policy when Governor Freudenthal signed into

law House Bills 89 and 90. The two laws established a legal framework for the ownership and regulation of underground carbon sequestration and storage (CCTF 2008; Hayano 2009).

In Mississippi, the issue of anthropogenic climate change has not played a substantial role in the development of policy development. Although the state has implemented three policies that support climate change mitigation through improvements in energy efficiency and renewable energy development, collaborative policy processes have not contributed to the policy process in the state. The development of the state's efficiency requirements for new state- and commercial-owned buildings began in January 2013, when the Mississippi House of Representatives began deliberations on two bills, House Bill 1266 and House Bill 1281, that would require new state- and commercial-owned buildings to meet or exceed the 2010 building energy code standards designed by the American Society of Heating Refrigerating and Air-Conditioning Engineers (Bryant 2014). The proposed laws advanced from the House and were approved by the Senate before being signed into law by Governor Phil Bryant (R) in April 2013.

The motivation behind the state's adoption of efficiency standards for new buildings can primarily be attributed to federal incentives provided under Title III of the Energy Production and Conservation Act (EPCA) of 1975 (EPCA 1975). In May 2013, Governor Bryant received a letter from the Deputy Secretary of the U.S. Department of Energy (DOE) informing the Governor that the state's current building energy codes were not compliant with the DOE's recommended standards for

commercial and state-owned buildings and, if standards were not implemented by July 2013, the state would no longer be eligible for funding opportunities established under Title III of the EPCA (Hogan 2013). The role of federal incentives in driving the adoption of Mississippi's new building codes is supported by the legal requirements of the new laws which became active July 1 2013, at which time the Director of Energy and Natural Resources Division of the Mississippi Development Authority, Karen Bishop, submitted a letter to the DOE to inform the agency of the state's compliance with Title III of the EPCA (Bishop 2013).

Mississippi's most recent policy action occurred in 2015 when the Mississippi Public Service Commission (MPSC) adopted rules that established a statewide net metering program (PSC 2015). Mississippi became the 45<sup>th</sup> state to adopt a statewide net metering program, which is characterized by a billing mechanism that allows owners of renewable energy systems (e.g., rooftop solar photovoltaic) to distribute unused energy back into a grid, and credits the owner such that they are only charged for net energy consumption. Net metering is generally considered a critical component of renewable energy development by providing financial incentives for private investment in distributed energy systems. However, conventional electric utilities are often in opposition to the implementation of such programs, claiming that the loss of demand produced by customers who receive energy from distributed solar will reduce utility earnings, while operating costs remain (EIA 2013; Gunther 2013; Halper 2014; Sommer and Samuel 2016).

Mississippi's net metering policy began with the establishment of a docket in December 2010 to investigate the possible establishment of a statewide net metering program (MPSC 2011). The MPSC's net metering program was designed through a negotiated rulemaking process in which the MPSC facilitated multiple public comment periods and contracted a private consulting firm, Synapse Energy Economics, Inc., to conduct an independent cost-benefit analysis of various policy alternatives for establishing a net metering policy in the state (MPSC 2011, 2015a; Stanton et al. 2014). The study, which was submitted to the MPSC in 2014 and drew upon the experiences of other state net metering programs, found that a net metering program in Mississippi would provide a net benefit to the state. In April 2015 the MPSC released a draft of the proposed net metering rules for public comment and facilitated a series of public meetings (Docket 2015b; Stanton et al. 2014).

The proposed net metering rule drew public comments from various stakeholders including electric utility companies, solar and renewable energy advocates, the state's Sierra Club chapter, and representatives of the agriculture community (Docket 2015b). The most notable dispute regarding the proposed rule, centered on the MPSC's authority to establish rules requiring utilities to provide a credit to distributed energy producers, and the amount of the proposed credit that would be provided to solar energy purveyors (Weatherly 2015a). A number of the state's utility companies also conveyed concerns related to the lost revenue associated with the proposed rule and the potential impacts to customers who do not install renewable energy infrastructure and low-income households who may experience an

increased cost for electricity due to cost shifts resulting from the program (Weatherly 2015a).

The program's final rule was designed based upon the findings of Synapse Energy Economics, Inc.'s cost-benefit analysis, which recommended that the MPSC follow the net metering approach implemented by the state of Hawaii's Public Utility Commission. Although the final credit rate for distributed energy to net metering customers was an even compromise between the rates requested by state utilities and solar energy advocates, the rule took a conservative approach to net metering, relative to other state policies, that included requested amendments from Entergy Mississippi Inc. and the South Mississippi Electric Power Association (SMEPA), a collection of 11 member-owned electric cooperatives (MPSC 2015b; AP 2015). The MPSC addressed concerns related to the potential impacts to low-income communities by ordering the state's two investor-owned utility companies, Entergy Mississippi, Inc. and Mississippi Power Company, to offer an increased credit to the first 1,000 qualifying low-income customers who install net metered systems (Weatherly 2015a; MPSC 2015b).

The final rule resulted in dissatisfaction on the part of the SMEPA, which requested a rehearing on the matter in December 2015 (MPSC 2016; PV Magazine 2015; Pyper 2015; Trabish 2015; Weatherly 2015b, 2016). Among other things, SMEPA contested the MPSC's ability to implement a net metering program given that the Commission does not have legal authority to impose rates on the self-regulated cooperatives. The MPSC concluded, however, that net metering is not a

form of rate making and denied the call for a rehearing (Walton 2016; Weatherly 2015a; 2016). The dispute regarding the MPSC's regulatory oversight of utility cooperatives changed venues to the state legislature and, in March 2016, Mississippi lawmakers passed House Bill 1139, which eliminates MPSC oversight on a variety of activities including net metering (AP 2016; Stauffer 2016; Trabish 2016).<sup>89</sup> In spite of Solar advocates concerns regarding the effect that the law may have on distributed renewable energy development in the state, the bill was signed into law by Governor Phil Bryant (R) in April 2016 (Kraften 2016).

### **Civic Community, Legitimacy, and Climate Change Policy**

As Figure 7.1 demonstrates, the Sabatier et al. (2005) framework includes another causal process that leads from process and context to civic community, which includes human capital (e.g., knowledge about climate change conditions), social capital (e.g., networks of reciprocity), political efficacy, trust of others, and attitudes toward collective action. The study includes three CPOs that are likely to influence civic community, legitimacy, and policy outputs. These include the type of climate change policy institutions established (collaborative versus traditional-adversarial or negotiated rulemaking), stakeholder inclusiveness, and decision-making rules. The CPOs were analyzed by reviewing government and nongovernment reports that document the collaboration process, procedures, and ground rules for making policy decisions as well as media and stakeholder press releases.

---

<sup>89</sup> The bill was introduced by Mississippi House member, and Chair of the Public Utility Committee, Charles Beckett (R), who had received substantial campaign finance from many entities under MPSC oversight, including Entergy Mississippi Inc. (Stauffer 2016).



The collaborative policy processes implemented in both Delaware and Oregon were generally carried out using an Analysis and Deliberation Framework (Stern, Feinberg and the NRC Committee on Risk Characterization 1996). In each collaborative process, technical advisors and members of the scientific community were called upon to provide and present information related to climate change and energy dynamics within the context of each state. The policy recommendations were produced through a deliberative process in which stakeholders are provided the opportunity to exchange views and negotiate potential action areas and policy mechanisms. This decision making approach can facilitate the development of human capital and affect attitudes towards collective action by allowing collaborative learning to take place amongst participating stakeholder groups, and can ultimately reduce the barriers to collaboration and support the development of social capital across stakeholder groups (Daniels and Walker 2001).

To determine the contribution of stakeholder participation in collaborative watershed management, Sabatier et al. (2005) refer to the importance of procedural and structural legitimacy. For the purposes of this study, procedural legitimacy refers to the fundamental values of autonomy and self-rule and the notion that those who are bound by climate change policy must have direct influence on its formulation. Substantive legitimacy refers to the fundamental values of welfare and justice, the notion that climate change policy ought to improve the conditions of life for community stakeholders, and that the benefits and costs of these improved conditions are fairly distributed. The extent to which each of the state-level collaborative policy

institutions include effected stakeholder groups and integrate reflexivity into policy planning decisions would presumably have an effect on both forms of legitimacy.

With respect to procedural legitimacy, Tables 7.6 and 7.7 reveal that each of the collaborative policy institutions involved in the development of state-level climate change policy initiatives in Delaware and Oregon displayed a range of membership structures and incorporated community stakeholder engagement to varying degrees throughout the climate change policy planning and implementation stages. Each of the collaborative policy processes also led to final policy recommendations via a consensus-based process that required unanimous, or near unanimous, approval from the panel's voting body. In addition to stakeholder groups, such as the energy and electric power sector, that would be directly impacted by new energy and emissions regulations, the voting body of each collaborative process generally included representatives from the scientific community, environmental organizations, local government entities, and business interests (e.g., agriculture, automotive, labor unions). Delaware also included public and low-income advocates as voting members to provide input related to social equity and the distribution of the benefits and costs of potential policy initiatives in nearly all of the state's collaborative policy processes. The effectiveness, in terms of procedural legitimacy, of each state's collaborative policy processes may best be reflected by the continued reliance on such processes to inform policy design and implementation, which may also be an indication of an adequate level of trust amongst the various stakeholder groups included in the policy planning processes. Each state has continued to invest resources to support and

convene these collaborative processes, many of which have transferred information to subsequent collaborative efforts and have ultimately led to the adoption of formal policies.

In the context of substantive legitimacy, a thorough assessment of the distributional effects of climate change policy outcomes is beyond the scope of the current study. However, one indication of how collaborative policy processes can facilitate the development of policies that are mutually agreeable amongst major stakeholder groups is the longevity of adopted policies. The divergent experiences of Delaware and Oregon, relative to Mississippi, offer an exemplary representation of the potential pitfalls of not employing policy planning and implementation processes that rely upon stakeholder engagement and consensus-based decision making practices. Each of the final policies adopted by the legislature and implemented by regulatory agencies in both Delaware and Oregon has remained in place.

In contrast, Mississippi's experience with the formal adoption of the state's net metering program was pursued via a negotiated rulemaking process. Although stakeholder participation was facilitated via public comment, the final design of the program was determined by the MPSC based on the recommendations provided by an outside technical consultant. Two key stakeholder groups, renewable energy advocates and electric utility companies, were dissatisfied with the final rules and the state quickly enacted legislation to reduce the regulatory power of the MPSC with respect to enforcement of the net metering program. Although collaboration may be difficult given the contextual setting of the Mississippi region, a collaborative

engagement process with a consensus-based decision making structure may have alleviated some of dissatisfaction among advocacy coalitions and produced a more secure policy outcome.

### **Other Explanatory Variables**

While the results of the case study analyses suggest that collaborative management institutions have a positive effect on the development, adoption, and implementation of climate change mitigation policies, the investigation identified a number of other factors that also influenced the policy making process in all four cases. Policy learning via horizontal and vertical diffusion, for example, influenced policy design discussions in both collaborative and traditional decision-action arenas. The DCCC and the Oregon Task Force on Global Warming each referenced the Kyoto Protocol when establishing their initial voluntary goals for GHG emissions, using a baseline of 1990 emissions as the reference point for as the reference for short- and long-term emissions reduction goals.

Horizontal diffusion also played a significant role in the design of state-level policies in Delaware, Oregon, and Mississippi. In Delaware, for example, the RPS policymaking process included a review of other state-level RPS policies. For example, the three percent solar carve-out, which was added to the Delaware RPS in 2007, was a direct transfer of the policy applied in New Jersey, and the state's 2014 RPS update drew from policy designs that have been applied in Maryland (SEUTF 2005; Sol Systems 2014). In Mississippi, the consultant, Synapse Energy Economics, Inc., that completed the economic analysis for the MPSC's proposed net metering

program reviewed how the policy had been applied in other states. The consultant found that a program design similar to Hawaii would be an effective policy approach for the state (Stanton et al. 2014). Both Delaware and Oregon adopted vehicle emissions standards based on California's rule, and also examined how other states had implemented the policy (GVEW 2005).

Policy entrepreneurs were a second factor that was found to affect both the initial and latter stages of the process. In Wyoming, following California's adoption of a state cap and trade program, and in anticipation of federal legislation regarding emissions regulation, Governor Freudenthal played an important role in advancing the state's policy agenda on climate change policy by actively engaging federal and state policymakers in discussions regarding carbon sequestration as a path towards climate change mitigation. In the context of collaborative policy processes, policy entrepreneurs played a particularly significant role in initiating collaborative management institutions and supporting policy adoption. In Oregon, Governor Ted Kulongoski was a particularly influential figure in the state's climate change policy experience. The Governor initiated a number of the state's regional partnerships and convened multiple policy advisory groups to address the climate change issue. In Delaware, Governor Ruth Minner played a similar role by convening various task force committees to address energy issues that contribute to climate change mitigation, but perhaps more importantly, the Governor catalyzed the state's participation in RGGI.

Delaware Senator Harris McDowell also played a notable role in advancing the state's clean energy policies. The Senator served on the DCCC, DETF, SEU Task Force, and the Delaware Energy Efficiency Advisory Council, and he contributed to the adoption of Delaware's EERS and RPS (CEEP 2005; O'Mara, Cherry and Hodas 2010). As the Chair of the state's SEU Task Force, the Senator participated in the design process of the SEU and multiple clean energy policies and, following formal implementation of the SEU by the state legislature in 2007, became a founding member of the program. The Senator also played a key role in advancing the state's first RPS, which was initially introduced and assigned to the Energy & Transit Committee in 2003 following the recommendation of the Delaware Energy Task Force. However, the bill did not leave the Committee before the end of the legislative Session (CEEP 2005). In 2004, the Senator introduced a revised RPS that required 10 percent of Delaware's electricity to come from renewable sources by 2019. Senator McDowell worked with a coalition of legislators, environmental and community organizations, state utilities, and the CEEP to draft the legislation which reflected best practices found in other state RPS laws. The legislation also responded to specific concerns raised by Delaware stakeholders, and it was eventually signed into law with broad support in 2005 (CEEP 2005).

The analysis also identified a number of focusing events that contributed to placing the issue of climate change and energy policy on the political agenda and affected the policy design process. The signing of the Kyoto Protocol by President Bill Clinton (D) in 1997 signaled to the states that the climate change issue had

gained prominence on the U.S. political agenda, and, subsequently, contributed to Wyoming's carbon sequestration policy agenda. In Delaware, the DETF formed during a period in which energy shortages were occurring in places around the country, and the SEU Task Force convened in the wake of increasing energy prices. Each of these events initiated an interest in designing new policies to secure a reliable, low cost energy supply for the citizens of Delaware (DETF 2003a; SEUTF 2007). Within this context, the issue of climate change was relevant to collaborators involved in the policy process. However, the topic was not the focus of planning discussions, where policy that contributed to emissions reductions provided a co-benefit of reducing energy demand and increasing the number of renewable energy purveyors within the state.

### **Conclusion**

The IAD theoretical perspective posits that the formation of collaborative management institutions is conditional upon the environmental, socioeconomic, and institutional characteristics of a particular region. The results of the case study analysis revealed that Delaware and Oregon have each participated in a number of collaborative management institutions to facilitate the development and implementation of policies related to emissions reduction. Wyoming has also participated in collaborative policy processes, although these efforts have focused exclusively on advising the development of carbon sequestration policies, rather than policies to reduce dependence and consumption of fossil fuels. Collaborative policy processes related to climate change mitigation were not identified in Mississippi.

Delaware and Wyoming each have relatively high levels of human and social capital, which is posited to support cooperation among stakeholders. Oregon, however, exhibited high levels of human capital, but below average levels of social capital (i.e., low health care, low income, high unemployment). This finding does not support the hypothesized relationship between the state community conditions and the formation of collaborative management processes. However, the environmental, socioeconomic, and ideological conditions observed in Delaware and Oregon are distinctive from those observed in Wyoming. Delaware and Oregon have each experienced observable and relatively detrimental impacts associated with climate change. The two states also have a relatively high level of concern related to the effects of climate change, and a better understanding of the scientific basis for the issue. While there is some differentiation with respect to state-level community variables between these two states, the socioeconomic and ideological trends are more likely to support the formation of collaborative policy institutions to address the climate change issue through emissions reductions.

In Wyoming, the environmental conditions suggest that collective action to mitigate climate change would be less likely. Despite the fact that temperature change has occurred across the state, public opinion regarding the severity and the scientific consensus of the climate change issue is relatively low. Additionally, the state's "anti-Kyoto Protocol" law, adopted in 1999, sets institutional constraints on the type of mitigation policies that can be pursued by policymakers. When taken together, the environmental and institutional context, and the state's substantial economic



dependence on fossil fuel production and increasingly conservative political climate, suggests that collaborative policy efforts related to climate change mitigation are more likely to focus on rules that would not hinder the production and consumption of fossil fuels within the state.

The relationship between the contextual variables in each state and the formation of collaborative management institutions generally supports the conjectures from the IAD theoretical perspective. However, the findings in Oregon, where collaborative management processes have formed despite the relatively low levels of social capital, suggest that high levels of social capital are not necessary for the formation of collaborative management institutions. This result may be related to the fact that each of the collaborative management institutions in Oregon was formed via executive and legislative action, rather than collective action. Therefore, it may be that such processes would not have transpired in the absence of state-level efforts to reduce the transaction costs of collective action by supporting the establishment of institutions for collaboration policy processes.

The ACF, SCF, and ADR theoretical perspectives claim that, when addressing “wicked” problems, formal and inclusive collaborative policy processes that incorporate consensus-based decision making into policy decisions are more likely to produce policy outputs than a traditional adversarial policy approach (see Chapter 2). The analysis of state-level collaborative management institutions in Delaware and Oregon identified a number of consensus-based regional partnerships and collaborative engagement processes associated with both the formulation and

implementation of climate change mitigation policies. Each of the collaborative engagement processes were representative of the state's major advocacy groups, including representatives from the scientific community, although there was some variation with respect to the level of public engagement applied in each process. While the formation of Oregon's collaborative engagement processes occurred primarily within the context of climate change mitigation, Delaware's engagement processes were focused on energy efficiency and renewable energy development. Each engagement process was generally charged with analyzing a particular policy issue and recommending policy solutions for formal adoption. Ultimately, each of these policy efforts supported the adoption of formal rules at the collective choice level in both states. The next chapter discusses the theoretical implications of the findings and proposes opportunities for future research related to collaborative climate change governance.

## References

- Akerlof, K., Maibach, E. W., Fitzgerald, D., Ceden, A. Y., & Neuman, A. (2013). Do people "personally experience" global warming, and if so how, and does it matter? *Global Environmental Change-Human and Policy Dimensions*, 23(1), 81-91. doi: 10.1016/j.gloenvcha.2012.07.006
- Aklin, M., & Urpelainen, J. (2013). Debating clean energy: Frames, counter frames, and audiences. *Global Environmental Change-Human and Policy Dimensions*, 23(5), 1225-1232. doi: 10.1016/j.gloenvcha.2013.03.007
- Allen, G.M. & Gould, E.M. (1986). Complexity, wickedness, and public forests. *Journal of Forestry*, 84(4):20-23.
- American Council for an Energy-Efficient Economy (ACEEE) (2016). *State and Local Policy Database*. Retrieved from: <http://database.aceee.org/>
- Amirikian, R.A. (February 8, 2008). RE: RGGI Regulation Development Work Group/Stakeholder Meetings. Received by Kalisz, C.
- Andranovich, G. (1995). Achieving consensus in public decision making: Applying interest based problem-solving to the challenges of intergovernmental collaboration. *Journal of Applied Behavioral Research*, 31:429-45.
- Ansell, C., & Gash, A. (2008). Collaborative Governance in Theory and Practice. *Journal of Public Administration Research and Theory*, 18:543-571.
- Barron, J. (2012 February 11). Wyoming lawmakers want state regulation of gases. *Billings Gazette*. Retrieved from: <http://billingsgazette.com/news/state-and-regional/wyoming/wyoming-lawmakers-want-state-regulation-of->

gases/article\_43b2f569-4f3d-5d07-ab1e-73e7b32a3231.html

- Bauer, A., & Steurer, R. (2014). Multi-level governance of climate change adaptation through regional partnerships in Canada and England. *Geoforum*, 51, 121-129. doi: 10.1016/j.geoforum.2013.10.006
- Beach, D., & Pedersen, R. B. (2012, August). Case selection techniques in Process-tracing and the implications of taking the study of causal mechanisms seriously. In *presentation at The American Political Science Association Annual Meeting*, New Orleans, Louisiana.
- Beach, D., & Pedersen, R.B. (2013). *Process-Tracing Methods: Foundations and Guidelines*. Ann Arbor, Michigan: University of Michigan Press.
- Bennett, A. (2008a). "Process-Tracing: A Bayesian Perspective." In *The Oxford Handbook of Political Methodology*, eds. J.M. Box-Steffensmeier, H.E. Brady and D. Collier, 702- 721. New York, New York: Oxford University Press.
- Bennett, A. (2008b). "The mother of all 'isms': Organizing political science around causal mechanisms." In *Revitalizing causality: realism about causality in philosophy and social science*, ed. R. Groff, 205-219. London: Routledge.
- Bernauer, T. (2013). Climate Change Politics. *Annual Review of Political Science*, Vol 16, 16, 421-448. doi: 10.1146/annurev-polisci-062011-154926
- Betsill, M.M., & Rabe, B.G. (2009). "Climate Change and Multilevel Governance: The Evolving State and Local Roles." In *Toward sustainable Communities: Transition and Transformations in Environmental Policy*, eds. D. Mazmanian and M.E. Kraft, 201-226. Boston, Massachusetts: MIT Press.

- Bingham, G. (1986). *Resolving Environmental Disputes: A Decade of Experience*. Washington, D.C.: Conservation Foundation.
- Bishop, K. (2013 July 1). RE: State Certification of Commercial Building Energy Codes. Received by Risser, R.J.
- Borger, J. (2001 March 29). Bush kills global warming treaty. *The Guardian*. Retrieved from:  
<https://www.theguardian.com/environment/2001/mar/29/globalwarming.usnews>
- Bradford, N. (1998). Prospects for associative governance: Lessons from Ontario, Canada. *Politics & Society*, 26:539–73.
- Bryant, P. (2014). *Opportunity Mississippi: Detailing the Roadmap to Success*. State of Mississippi. Retrieved from:  
[http://www.governorbryant.ms.gov/Documents/Governor-Phil-Bryant\\_Opportunity-Mississippi1.pdf](http://www.governorbryant.ms.gov/Documents/Governor-Phil-Bryant_Opportunity-Mississippi1.pdf)
- Burger, J., Gochfeld, M., Powers, C.W., Waishwell, L., Warren, C., & Goldstein, B.D. (2001). Science, policy, stakeholders, and fish consumption advisories: Developing a fish fact sheet for Savannah River. *Environmental Management*, 27: 501–14.
- Busenberg, G. (1999). Collaborative and adversarial analysis in environmental policy. *Policy Sciences*, 32:1–11.
- Cabinet Committee on Climate and Resiliency (CCCR) (2014). *Climate Framework for Delaware*. Dover, DE: State of Delaware.

- Cahn, M.A., Kamieniecki, S., McCain-Tharnstrom, D., & Fiack, D. (2016). "The Bureaucracy and Politics of Energy and Environmental Policy in the Western States," In *Environmental Politics and Policy in the West*. 3rd Edition. eds. Zachary Smith and John Freemuth, 27-54. Boulder, CO:University Press of Colorado.
- Carbon Allocation Task Force (CATF) (2005). *Carbon Allocation Task Force Charter*. State of Oregon.
- Carpenter, S.L., & Kennedy, W.J.D. (1988). *Managing Public Disputes: A Practical Guide to Handling Conflict and Reaching Agreements*. San Francisco, California: Jossey-Bass.
- Center for Climate and Energy Solutions (C2ES) (2014). *U.S. Climate Policy Maps*. Retrieved from: <http://www.c2es.org/us-states-regions/policy-maps>
- Center for Climate and Energy Solutions (C2ES) (2015). *Q&A Regional Greenhouse Gas Initiative*. Retrieved from: <https://www.c2es.org/us-states-regions/regional-climate-initiatives/rggi/faq>
- Center for Energy and Environmental Policy (CEEP) (2000). *Delaware Climate Change Action Plan*. Newark, Delaware: University of Delaware.
- Center for Energy and Environmental Policy (CEEP) (2005). *The Potential Economic Impacts of a Renewable Portfolio Standard in Delaware*. Newark, Delaware: University of Delaware.
- Checkel, J.T. (2008). Tracing Causal Mechanisms. *International Studies Review*, 8(2): 362-370.

- Cheng, A. S., & Mattor, K. M. (2006). Why Won't They Come? Stakeholder Perspectives on Collaborative National Forest Planning by Participation Level. *Environmental Management* 38, 545–561.
- Chrislip, D., & Larson, C.E. (1994). *Collaborative leadership: How citizens and civic leaders can make a difference*. San Francisco, California: Jossey-Bass.
- Clean Coal Task Force (CCTF) (2008). *Report of the Clean Coal Task Force To Joint Minerals, Business, and Economic Development Interim Committee*. Laramie, Wyoming: University of Wyoming. Retrieved from: [https://www.uwyo.edu/ser/\\_files/docs/cleancoal/annualreports/cctf-2008-recommendation.pdf](https://www.uwyo.edu/ser/_files/docs/cleancoal/annualreports/cctf-2008-recommendation.pdf)
- Cole, D.H. (2011). From global to polycentric climate governance. *Climate Law*, 2(3): 395-413. doi: 10.3233/CL-2011-042
- Coleman, L. (1988). Social Capital in the Creation of Human Capital. *American Journal of Sociology*. 94:S95-S120.
- Collier, D. (2011). Understanding process tracing. *PS: Political Science & Politics*, 44(4): 823-830.
- Daniels, S.E. & Walker, G.B. (2001). *Working Through Environmental Conflict: The Collaborative Learning Approach*. Westport Connecticut: Praeger.
- Database of State Incentives for Renewables & Efficiency (DSIRE). (2016). *Programs*. Retrieved from: <http://programs.dsireusa.org/system/program>
- Davison, J.M. & Norbeck, J.M. (2012). *An Interactive History of the Clean Air Act: Scientific and Policy Perspectives*. Waltham, Massachusetts: Elsevier.

- Delaware Department of Natural Resources and Control (DNREC) (n.d.). *Delaware Department of Natural Resources and Control*. State of Delaware. Retrieved from: <http://www.dnrec.delaware.gov/Pages/Divisions.aspx>
- Delaware Energy Efficiency Advisory Council (DEEAC) (2015). *Delaware Energy Efficiency Advisory Council: 2015 Annual Report*. Dover, DE: State of Delaware.
- Delaware Energy Task Force (DETF) (2003a). *Bright Ideas for Delaware's Energy Future*. Dover, DE: State of Delaware.
- Dunlap, R. E., & McCright, A. M. (2008). A widening gap - Republican and Democratic views on climate change. *Environment*, 50(5), 26-35. doi: 10.3200/envt.50.5.26-35
- Dunlap, R.E. & McCright, A.M. (2011). "Organized Climate Change Denial". In *The Oxford Handbook of Climate Change and Society*, eds. J.S. Dryzek, R.B. Norgaard and D. Schlosberg, 144-1600. Oxford, United Kingdom: Oxford University Press.
- Eggertsson, T. (1990). *Economic Behavior and Institutions*. Cambridge, Massachusetts: Cambridge University Press.
- Elgin, D. J. (2015). Cooperative interactions among friends and foes operating within collaborative governance arrangements. *Public Administration*, 93: 769–787. doi:10.1111/padm.12167
- Elgin, D. J. and Weible, C. M. (2013). A Stakeholder Analysis of Colorado Climate and Energy Issues Using Policy Analytical Capacity and the Advocacy



Coalition Framework. *Review of Policy Research*, 30: 114–133.

doi:10.1111/ropr.12005

Energy Efficiency Resource Standards Workgroup (EERSW) (2011). *State of Delaware Energy Efficiency Resource Standards Workgroup Report*. Dover, DE: State of Delaware.

Energy Production and Conservation Act (EPCA) of 1975, P.L. 94-1063, 42 U.S.C. 6201 (1975).

Executive Order No. 18. (2010). State of Delaware.

Falleti, T.G., & Lynch, J.F. (2009). Context and Causal Mechanisms in Political Analysis. *Comparative Political Studies*, 42:1143-1166.

Fershee, J.P. (2007). Levels of Green: State and Regional Efforts, in Wyoming and Beyond, to Reduce Greenhouse Gas Emissions, in Wyoming and Beyond, to Reduce Greenhouse Gas Emissions. *Wyoming Law Review*. 7(2): 269-2007.

Fiack, D. & Kamieniecki S. (2017). Stakeholder engagement in climate change policymaking in American cities. *Journal of Environmental Studies and Sciences*. 7(1): 127-140. doi: 10.1007/s13412-014-0205-9

Fialka, J.J. (2010). Wyo.'s crash program to develop 'green' coal. E&E News.

Retrieved from:

[http://www.eenews.net/special\\_reports/coal\\_country/stories/88760](http://www.eenews.net/special_reports/coal_country/stories/88760)

Fisher, D. R. (2013). Understanding the relationship between subnational and national climate change politics in the United States: toward a theory of boomerang federalism. *Environment and Planning C-Government and Policy*, 31(5), 769-

784. doi: 10.1068/c11186

- Fung, A., & Wright, E.O. (2001). Deepening democracy: Innovations in empowered participatory governance. *Politics & Society*, 29:5–41.
- Geoghegan, T., & Renard, Y. (2002). Beyond community involvement: Lessons from the insular Caribbean. *Parks*, 12(2): 16–26.
- George A.L., & Bennett, A. (2005). *Case studies and theory development in the social sciences*. Cambridge, Massachusetts: MIT Press.
- Gerring, J. (2007). *Case Study Research. Principles and Practices*. Cambridge, Massachusetts: Cambridge University Press.
- Glasbergen, P., & Driessen, P.J. (2005). Interactive planning of infrastructure: The changing role of Dutch project management. *Environment and Planning C: Government and Policy*, 23: 263–77.
- Governor's Advisory Group on Global Warming (GAGGW) (2004). *Oregon Strategy for Greenhouse Gas Reductions*. State of Oregon.
- Governor's Climate Change Integration Group (GCCIG) (2006). *Governor's Climate Change Integration Group Charter*. State of Oregon.
- Gray, B. (1989). *Collaborating: Finding common ground for multi-party problems*. San Francisco, CA: Jossey-Bass.
- Governor's Climate Change Integration Group (GCCIG) (2008). *The Governor's Climate Change Integration Group Final Report to the Governor: A Framework for Addressing Rapid Climate Change*. State of Oregon.

- Governor's Energy Advisory Council (GEAC) (2009). *Delaware Energy Plan 2009-2014*. Dover, DE: State of Delaware.
- Governor's Vehicle Emissions Workgroup (GVEW) (2005). *Governor's Vehicle Emissions Workgroup Report*. State of Oregon.
- Grainey, M.W. (2004, January 29). RE: Establishment of Governor's Advisory Group on Global Warming. Received by Interested Parties.
- Guber, D.L., & Bosso, C.I. (2012). "Issue Framing, Agenda Setting, and Environmental Discourse". In *The Oxford Handbook of US Environmental Policy*, ed. M.E. Kraft and S. Kamieniecki, 437-460. New York, New York: Oxford University Press.
- Gunther, M. (2013 September 3). With Rooftop Solar on Rise, U.S. Utilities Are Striking Back. *Yale Environment 360*. Retrieved from: [http://e360.yale.edu/feature/with\\_rooftop\\_solar\\_on\\_rise\\_us\\_utilities\\_are\\_striking\\_back/2687/](http://e360.yale.edu/feature/with_rooftop_solar_on_rise_us_utilities_are_striking_back/2687/)
- Gunton, T. I., & Day, J. C. (2003). The Theory and Practice of Collaborative Planning in Resource and Environmental Management. *Environments*, 31(2): 5-19.
- Haas, P. M. (1992). Introduction: epistemic communities and international policy coordination. *International Organization*, 46(1), 1-35.
- Halper, E. (2014 August 9). Rules prevent solar panels in many states with abundant sunlight. *Los Angeles Times*. Retrieved from: <http://www.latimes.com/nation/la-na-no-solar-20140810-story.html>
- Hayano, D. (2009). Guarding the Viability of Coal & Coal-fired Power Plants: GA Road

Map for Wyoming's Cradle to Grave Regulation of Geologic CO<sub>2</sub> Sequestration.  
*Wyoming Law Review*. 9(1): 139-164

Heikkila, T., & Gerlak, A. K. (2005). The formation of large-scale collaborative resource management institutions: Clarifying the roles of stakeholders, science, and institutions. *Policy Studies Journal*, 33(4), 583-612. doi: 10.1111/j.1541-0072.2005.00134.x

Hogan, K. (2013, May 31). RE: State Certification of Residential and Commercial Building Energy Codes. Received by Risser, R.J.

Imperial, M. (2005). Using Collaboration as a Governance Strategy: Lessons from Six Watershed Management Programs. *Administration and Society*, 37: 281–320.

Intergovernmental Panel on Climate Change (IPCC) (2013). *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. eds. T.F. Stocker, D. Qin, G.K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley. New York, New York: Cambridge University Press.

International Carbon Action Partnership (ICAP) (2014). About ICAP. . Berlin, Germany: International Carbon Action Partnership.

Javeline, D. (2014). The Most Important Topic Political Scientists Are Not Studying: Adapting to Climate Change. *Perspectives on Politics*, 12(2), 420-434. doi: 10.1017/s1537592714000784

- Kaften, C. (2016). Mississippi Considers Limiting PSC Oversight of Electric Coops. *Energy Manager Today*. Retrieved from:  
<http://www.energymanagertoday.com/mississippi-measures-would-limit-psc-authority-over-electric-coops-0122244/>
- Kamieniecki, S. (2006). *Corporate America and Environmental Policy: How Often Does Business Get Its Way?* Palo Alto, California: Stanford University Press.
- Kaufmann, R.K., Mann, M.L., Gopal, S., Liederman, J. A., Howe, P.D., Pretis, F., Tang, X., & Gilmore, M. (2016) Spatial heterogeneity of climate change as an experiential basis for skepticism. *Proceedings of the National Academy of Sciences*. 114(1): 67-71
- Keep Oregon Cool (n.d.). *Milestones: What steps has Oregon already taken to address global warming?* Retrieved from:  
<http://www.keeporegoncool.org/content/progress>
- Kempton, W., Boster, J. S., and Hartley, J. A.: 1995, *Environmental Values in American Culture*. MIT Press, Cambridge.
- Kiser, L., & Ostrom, E. (1982). "The Three Worlds of Action." In *Strategies of Political Inquiry*, ed. E. Ostrom. Beverly Hills, California: Sage.
- Knack, S., & Keefer, P. (1997). Does social capital have an economic payoff? A cross-country investigation. *The Quarterly journal of economics*, 1251-1288.
- Kotrba, R. (2015). *Wyo. Imposes 24-cent-per-gallon tax on alternative fuels*. Biodiesel Magazine. Retrieved from:

<http://www.biodieselmagazine.com/articles/324200/wyo-imposes-24-cent-per-gallon-tax-on-alternative-fuels>

- Kraft, M.E., & Johnson, B.N. (1999). "Clean water and the promise of collaborative decisionmaking: The case of the Fox-Wolf Basin in Wisconsin." In *Toward Sustainable Communities: Transition and Transformations in Environmental Policy*, eds. D. Mazmanian and M.E. Kraft, 113–152. Boston, Massachusetts: MIT Press.
- Kraft, M.E., & Kamieniecki, S. (2007). "Analyzing the Role of Business in Environmental Policy." In *Business and Environmental Policy: Corporate Interests in the American Political System*, ed. M. E. Kraft and S. Kamieniecki, 3–31. Cambridge, Massachusetts: MIT Press.
- Krause, R. M. (2012). An Assessment of the Impact that Participation in Local Climate Networks Has on Cities' Implementation of Climate, Energy, and Transportation Policies. *Review of Policy Research*, 29(5), 585-604. doi: 10.1111/j.1541-1338.2012.00582.x
- Kumlin, S., & Rothstein, B. (2005). Making and breaking social capital the impact of welfare-state institutions. *Comparative Political Studies*, 38(4), 339-365.
- Lasker, R.D., & Weiss, E.S. (2003). Broadening participation in community problem-solving: A multidisciplinary model to support collaborative practice and research. *Journal of Urban Health: Bulletin of the New York Academy of Medicine*, 80:14–60.
- Layzer, J. A. (2008). *Natural Experiments: Ecosystem-Based Management and the*

- Environment*. Cambridge, Massachusetts: MIT Press.
- Layzer, J.A. (2014). *Open for Business: Conservatives' Opposition to Environmental Regulation*. Cambridge, Massachusetts: MIT Press.
- Leach, W. D., Pelkey, N. W., & Sabatier, P. S. (2002). Stakeholder Partnerships as Collaborative Policymaking: Evaluation Criteria Applied to Watershed Management in California and Washington. *Journal of Policy Analysis and Management* 21 (4), 645–670.
- Lehner, J. (2016). *Oregon High-Tech (and Intel)*. Oregon Office of Economic Analysis. Retrieved from:  
<https://oregoneconomicanalysis.com/2016/04/21/oregon-high-tech-and-intel/>
- Leiserowitz, A. (2006). Climate change risk perception and policy preferences: The role of affect, imagery, and values. *Climatic change*, 77(1-2), 45-72.
- Libecap, G.D. (1989). *Contracting for Property Rights*. Cambridge, Massachusetts: Cambridge University Press.
- Liflin, K.T. (1994). *Ozone Discourse: Science and Politics in Global Environmental Cooperation*. New York, New York: Columbia University Press.
- Lubell, M. (2000). Cognitive Conflict and Consensus Building in the National Estuary Program. *American Behavioral Scientist*, 44(4):628-647.
- Lubell, M. 2003. "Collaborative Institutions, Belief-Systems, and Perceived Policy Effectiveness." *Political Research Quarterly* 56 (3):309-23.

- Lubell, M., Mete, M., Schneider, M., & Scholz, J. (2002). Watershed Partnerships and the Emergence of Collective Action Institutions. *American Journal of Political Science*, 46(1):148-163.
- Lutzenhiser, L. (2001). The contours of US climate non-policy. *Society & Natural Resources*, 14(6), 511-523. doi: 10.1080/08941920121404
- Lynn, L.E., Heinrich, C.J., & Hill, C.J. (2001). *Improving Governance: A New Logic for Empirical Research*. Washington, D.C.: Georgetown University Press.
- Magill B. (2016). *Lawsuit Aims to Overturn Obama's Clean Power Plan*. Scientific American. Retrieved from:  
<https://www.scientificamerican.com/article/lawsuit-aims-to-overturn-obamas-clean-power-plan/>
- Mahoney, J. (2012). The logic of process tracing tests in the social sciences. *Sociological Methods & Research*, 41(4): 570-597.
- Margerum, R.D. (2002). Evaluating Collaborative Planning: Implications from an Empirical Analysis of Growth Management. *Journal of the American Planning Association*, 68(2): 179–193.
- Martin, J., Tett, L., & Kay, H. (1999). Developing collaborative partnerships: Limits and possibilities for schools, parents and community education. *International Studies in Sociology of Education*, 9:59–75.
- Mazmanian, D. A., & Kraft, M.E. (2009). “The Three Epochs of the Environmental Movement.” In *Toward Sustainable Communities: Transition and Transformation in Environmental Policy*, 2nd ed., eds. D. A. Mazmanian and



- M. E. Kraft, 3–42. Cambridge, Massachusetts: MIT Press.
- McCright, A. M., & Dunlap, R. E. (2000). Challenging global warming as a social problem: An analysis of the conservative movement's counter-claims. *Social Problems*, 47(4), 499-522. doi: 10.1525/sp.2000.47.4.03x0305s
- McCright, A.M. and R.E. Dunlap. (2003). ‘Defeating Kyoto: The Conservative Movement’s Impact on US Climate Change Policy’, *Social Problems*, 50, 3, 348–73.
- McCright, A. M., & Dunlap, R. E. (2011a). Cool dudes: The denial of climate change among conservative white males in the United States. *Global Environmental Change-Human and Policy Dimensions*, 21(4), 1163-1172. doi: 10.1016/j.gloenvcha.2011.06.003
- McCright, A.M. and R.E. Dunlap. (2011b). The Politicization of Climate Change and Polarization in the American Public’s Views of Global Warming, 2001–2010, *Sociological Quarterly*, 52, 2, 155–94.
- McCright, A. M., Dunlap, R. E., & Xiao, C. Y. (2014). Increasing Influence of Party Identification on Perceived Scientific Agreement and Support for Government Action on Climate Change in the United States, 2006-12. *Weather Climate and Society*, 6(2), 194-201. doi: 10.1175/wcas-d-13-00058.1
- Mississippi Public Service Commission (MPSC) (2011). Order Establishing Docket to Investigate the Development and Implementation of Net Metering Programs and Standards. Docket 2011-AD-002

- Mississippi Public Service Commission (MPSC) (2015a). Order Seeking Comments on Proposed Rule. Docket 2011-AD-002
- Mississippi Public Service Commission (MPSC) (2015b). Order Adopting Net Metering Rule. Docket 2011-AD-002
- Mississippi Public Service Commission (MPSC) (2016). Petition for Rehearing of Electric Power Associations of Mississippi, Inc. Docket 2011-AD-002
- Murdock, B., Wiessner, C., & Sexton, K. (2005). Stakeholder participation in voluntary environmental agreements: Analysis of 10 Project XL case studies. *Science, Technology & Human Values*, 30:223–50.
- National Association of Clean Air Agencies (NACAA) (2013). Background and History of EPA Regulation of Greenhouse (GHG) *Emissions Under the Clean Air Act & National Association of Clean air Agencies' Comment on EPA GHG Regulatory and Policy Proposals*. Washington, D.C.: National Association of Clean Air Agencies
- Navarro, M. (2011 May 26). Christie Pulls New Yersey From 120-State Climate Initiative. *The New York Times*. Retrieved from: <http://www.nytimes.com/2011/05/27/nyregion/christie-pulls-nj-from-greenhouse-gas-coalition.html>
- North America 2050 (NA2050) (2011). *North America 2050: A Partnership for Progress*. Retrieved from: <https://www.c2es.org/docUploads/na2050-fact-sheet.pdf>
- Niles, M. T., & Lubell, M. (2012). Integrative Frontiers in Environmental Policy

Theory and Research. *Policy Studies Journal*, 40, 41-64. doi:10.1111/j.1541-0072.2012.00445.x

Nisbet, M. C. (2009). Communicating Climate Change Why Frames Matter for Public Engagement. *Environment*, 51(2), 12-23.

North, D. (1990). *Institutions, Institutional Change, and Economic Performance*. Cambridge, Massachusetts: Cambridge University Press.

O'Leary, R., Bingham, L., eds. (2003). *The Promise and Performance of Environmental Conflict Resolution*. Washington, D.C.: Resources for the Future.

Olson, M. (1965). *The Logic of Collective Action: Public Goods and the Theory of Groups*. Cambridge, Massachusetts: Harvard University Press.

O'Mara, C., Cherry, P., & Hodas, D. (2010). Clean Energy Policy in Delaware: A Small Wonder. *Natural Resources & Environment*. 25(2): 3-7.

Oregon Energy Facility Siting Task Force (OEFSTF) (1996). *Report of the Energy Facility Siting Task Force*. Portland Oregon; Pacific Energy Systems, Inc.

Oregon Department of Energy (ODE) (2005). *Oregon's Renewable Energy Action Plan*. Salem, Oregon: Oregon Department of Energy.

Oregon Department of Environmental Quality (ODEQ) (2010). *Oregon Greenhouse Gas Reporting Advisory Committee Report*. Portland, Oregon: Oregon Department of Environmental Quality.

- Oregon Department of Environmental Quality (ODEQ) (2011). *Oregon Low Carbon Fuel Standards: Advisory Committee Process and Program Design*. Portland, Oregon: Oregon Department of Environmental Quality.
- Oregon Global Warming Commission (OGWC) (2009). *Oregon Global Warming Commission: Report to the Legislature*. State of Oregon.
- Oregon Global Warming Commission (OGWC) (2013). *Oregon Global Warming Commission: Report to the Legislature*. State of Oregon.
- Oregon Public Utility Commission (OPUC) (2016). *Greenhouse Gas Reduction Goal Rate Impact Report*. Salem, Oregon: Oregon Public Utility Commission.
- Oregon Task Force on Global Warming (OTFGW) (1990). *Oregon Task Force on Global Warming Report to the Governor and Legislature*. Salem, Oregon: Department of Energy.
- Organization for Economic Co-operation and Development (OECD). (2008). *Handbook on Constructing Composite Indicators: Methodology and User Guide*. OECD. Retrieved from: <http://www.oecd.org/std/42495745.pdf>
- Ostrom, E. (1990). *Governing the Commons: The Evolution of Institutions for Collective Action* Cambridge, Massachusetts: Cambridge University Press.
- Ostrom, E. (2007). "Institutional Rational Choice: An Assessment of the Institutional Analysis and Development Framework." In *Theories of the Policy Process*, 2nd ed., ed. P.A. Sabatier. 35-72. Boulder, CO: Westview Press.

- Ostrom, E. (2010). Polycentric systems for coping with collective action and global environmental change. *Global Environmental Change-Human and Policy Dimensions*, 20(4): 550–57.
- Ostrom, E. (2012). Nested externalities and polycentric institutions: must we wait for global solutions to climate change before taking actions at other scales? *Economic Theory*, 49(2): 353-369.
- Ostrom, E., Gardner, R., Walker, J. (1994). *Rules, Games, and Common-Pool Resources*. Ann Arbor, Michigan: University of Michigan Press.
- Palin, S. Campbell, G., Schwarzenegger, A., Kulongoski, T.R., Gregoire, C.O. (2008). *Pacific Coast Collaborative*. Memorandum of Understanding.
- Plummer, R., & Fitzgibbon, J. (2004). Co-management of natural resources: A proposed framework. *Environmental Management*, 33:876–85.
- Posner, P.L. (2010a). *Greenhouse Governance: Addressing Climate Change in America*. ed. B.G. Rabe, 73-100. Washington, D.C.: Brookings Institution Press.
- Posner, P.L. (2010b). “The Politics of Vertical Diffusion: The States and Climate Change.” In *Greenhouse Governance: Addressing Climate Change in America*, ed. B.G. Rabe, 73-100. Washington, D.C.: Brookings Institution Press.
- Power, J., McKenna, J., MacLeod, M.J., Cooper, A.J.G., & Convie, G. (2000). Developing integrated participatory management strategies for Atlantic dune systems in County Donegal, Northwest Ireland. *Ambio*, 29:143–9.

- Putnam, R.D., Leonardi, R., and Nanetti, R. (1993). *Making Democracy Work: Civic Traditions in Modern Italy*. Princeton, New Jersey: Princeton University Press.
- PV Magazine (2015 December 4). Mississippi to implement net metering with limitations. *PV Magazine*. Retrieved from: [https://www.pv-magazine.com/2015/12/04/mississippi-to-implement-net-metering-with-limitations\\_100022303/](https://www.pv-magazine.com/2015/12/04/mississippi-to-implement-net-metering-with-limitations_100022303/)
- Pyper, J. (2015 December 7). Mississippi Regulators Strive for Compromise With New Net Metering Rule. *Green Tech Media*. Retrieved from: <https://www.greentechmedia.com/articles/read/Mississippi-Regulators-Strive-for-Compromise-With-New-Net-Metering-Rule>
- Rabe, B.G. (2004). *Statehouse and Greenhouse: The Emerging Politics of American Climate Change Policy*. Washington, D.C.: Brookings Institution Press.
- Rabe, B. G. (2007). Beyond Kyoto: Climate change policy in multilevel governance systems. *Governance-an International Journal of Policy Administration and Institutions*, 20(3), 423-444. doi: 10.1111/j.1468-0491.2007.00365.x
- Rabe, B. G. (2008). States on Steroids: The Intergovernmental Odyssey of American Climate Policy. *Review of Policy Research*, 25(2), 105-128. doi: 10.1111/j.1541-1338.2007.00314.x
- Rabe, B.G. (2010). "Introduction: The challenges of U.S. Climate Governance." In *Greenhouse Governance: Addressing Climate Change in America*, ed. B.G. Rabe, 3-23. Washington, D.C.: Brookings Institution Press.

- Rabe, B.G. (2011). Contested Federalism and American Climate Policy. *Publius-the Journal of Federalism*, 41(3), 494-521. doi: 10.1093/publius/pjr017
- Rell, M.J., Markell, J., Baldacci, J., O'Malley, M., Patrick, D., Lynch, J.H., Corzine, J.S., Paterson, D.A., Rendell, E.G., Carcieri, D.L., & Douglas, J.H. (2009). *Northeast and Mid-Atlantic Low Carbon Fuel Standard*. Memorandum of Understanding.
- Rell, J., Minner, R.A., Baldacci, J.A., Lynch, J., Codey, R., Pataki, G.E., Douglas, J. (2005). *Regional Greenhouse Gas Initiative*. Memorandum of Understanding
- Reilly, T. (1998). Communities in conflict: Resolving differences through collaborative efforts in environmental planning and human service delivery. *Journal of Sociology and Welfare*, 25:115-42.
- Reilly, T. (2001). Collaboration in action: An uncertain process. *Administration in Social Work*, 25(1): 53-73.
- Rogers, T., Howard-Pitney, B., Feighery, E.C., Altman, D.G., Endres, J.M., & Roeseler, A.G. (1993). Characteristics and participant perceptions of tobacco control coalitions in California. *Health Education Research, Theory & Practice*, 8:345-57.
- Sabatier, P.A., Focht, W., Lubell, M., Trachtenburg, Z., Vedlitz, A., & Matlock, M. eds. (2005a). *Swimming Upstream: Collaborative Approaches to Watershed Management*. Cambridge, Massachusetts: MIT Press.
- Sabatier, P.A., & Jenkins-Smith, H. (1988). Special Issue: Policy Change and Policy-Oriented Learning. *Policy Sciences*, 21:123-278.

- Sabatier, P.A., & Jenkins-Smith, H.C., eds. (1993). *Policy Change and Learning: An Advocacy Coalition Approach*. Boulder, Colorado: Westview Press.
- Sabatier, P.A., & Jenkins-Smith, H.C. (2007). "The Advocacy Coalition Framework: An Assessment." In *Theories of the Policy Process*. 2nd ed., ed P.A. Sabatier, 117-168. Boulder, Colorado: Westview Press.
- Sabatier, P.A., Leach, W.D., Lubell, M., & Pelkey, N.W. (2005b). "Theoretical Frameworks Explaining Partnership Success." In *Swimming Upstream: Collaborative Approaches to Watershed Management*. ed. P.A. Sabatier, W. Focht, M. Lubell, Z. Trachtenberg, A. Vedlitz and M. Matlock, 73-200, Cambridge, Massachusetts: MIT Press.
- Sabatier, P.A., & Zalfonte, M. (2001). "Public Knowledge: Advocacy Organizations." In *International Encyclopedia of the Social and Behavioral Sciences*, eds. N.J. Smelser and P.B. Baltes. Amsterdam: Elsevier.
- Saillan, C.D. (2007). United State Supreme Court Rules EPA Must Take Action on Greenhouse Gas Emissions: *Massachusetts v. EPA*. 47: 794-814.
- Shabecoff, P. (1988 June 24). Global Warming Has Begun, Expert Tells Senate. *New York Times*. Retrieved from <http://www.nytimes.com/1988/06/24/us/global-warming-has-begun-expert-tells-senate.html>
- Short, C., & Winter, M. (1999). The problem of common land: Towards stakeholder governance. *Journal of Environmental Planning and Management*, 42:613–30.



- Simon, H.A. (1955). A Behavioral Model of Rational Choice. *Quarterly Journal of Economics*, 69(1):99-118.
- Smith, C. (2009). Institutional Determinants of Collaboration: An Empirical Study of County Open-Space Protection. *Journal of Public Administration Research and Theory* 19 (1), 1–21.
- Sol Systems. (2010 July 14). Delaware Senate Passes Amendment to Strengthen RPS. *SolSystems*. Retrieved from:  
<http://www.solsystems.com/blog/2010/07/14/delaware-senate-passes-amendment-to-strengthen-rps/>
- Sommer, L., & Samuel, M. (2016 January 1) Like Night and Day: How Two States' Utilities Approach Solar. *NPR*. Retrieved from:  
<http://www.npr.org/2016/01/01/460960961/like-night-and-day-how-two-states-utilities-approach-solar>
- Stanton, E.A., Daniel, J., Vitolo, T., Knight, P., White, D., & Keith, G. (2014). *Net Metering in Mississippi: Costs, Benefits, and Policy Considerations*. Cambridge, Massachusetts: Synapse Energy Economics, Inc.
- State of Oregon. (2005). *Governor Announces New Step to Curb Global Warming in Oregon* [Press Release]. Retrieved from:  
[http://archivedwebsites.sos.state.or.us/Governor\\_Kulongoski\\_2011/governor.oregon.gov/Gov/p2005/press\\_082905.shtml](http://archivedwebsites.sos.state.or.us/Governor_Kulongoski_2011/governor.oregon.gov/Gov/p2005/press_082905.shtml)
- Stauffer, T. (2016 February 16). Mississippi Solar Alerts Fans of Solar Power (and Energy Oversight) to Legislative “Power Grab.” *Jackson Free Press*.

- Retrieved from: <http://www.jacksonfreepress.com/weblogs/politics-blog/2016/feb/16/mississippi-solar-alerts-fans-energy-oversight-leg/>
- Stern, P.C., Fineberg, H.V., & NRC Committee on Risk Characterization (1996). *Understanding Risk: Informing Decisions in a Democratic Society*. Washington, D.C.: National Academy Press.
- Stoker, G. (1998). Governance as theory: Five propositions. *International Social Science Journal*, 50:17–28.
- Susskind, L., & Cruikshank, J. (1987). *Breaking the Impasse: Consensual Approaches to Resolving Public Disputes*. New York, New York: Basic Books.
- Susskind, L., McKernan, S., & Thomas-Larmer, J. eds. (1999). *The Consensus Building Handbook: A Comprehensive Guide to Reaching Agreement*. Thousand Oaks, California: Sage.
- Sustainable Energy Utility Task Force (SEUTF) (2007). *The Sustainable Energy Utility: A Delaware First*. Dover, DE: State of Delaware.
- Tett, L., Crowther, J., & O'Hara, P. (2003). Collaborative partnerships in community education. *Journal of Education Policy*, 18:37–51.
- The Associated Press (AP) (2015 December 4). Mississippi Tries to Balance Utility Worries in Solar Rules. *Jackson Free Press*. Retrieved from: <http://www.jacksonfreepress.com/news/2015/dec/04/mississippi-tries-balance-utility-worries-solar-ru/>

The Associated Press (AP) (2016 March 29). Mississippi bill sets limited regulatory power over utility cooperatives. *Electric Light & Power*. Retrieved from: <http://www.elp.com/articles/2016/03/mississippi-bill-sets-limited-regulatory-power-over-utility-cooperatives.html>

The Climate Registry (TCR) (2015). Membership Benefits & Options. *The Climate Registry*. Retrieved from: <https://www.theclimateregistry.org/programs-services/voluntary-reporting/membership-benefits/>

The Future of Coal Under Carbon Cap and Trade. Hearings before the Select Committee on Energy and Global Warming, House, 110<sup>th</sup> Cong. (2007) (Testimony of Governor Dave Freudenthal). Retrieved from: <http://www.markey.senate.gov/GlobalWarming/tools/assets/files/0015.pdf>

Trabish, H.K. (2016 February 16). Mississippi lawmakers push legislation to end PSC oversight of electric cooperatives. *Utility Dive*. Retrieved from: <http://www.utilitydive.com/news/mississippi-lawmakers-push-legislation-to-end-psc-oversight-of-electric-coo/414081/>

Trabish, H.K. (2015 December 21). Mississippi co-op offers threatens to sue regulators unless they lower net metering rate. *Utility Dive*. Retrieved from: <http://www.utilitydive.com/news/mississippi-lawmakers-push-legislation-to-end-psc-oversight-of-electric-coo/414081/>

Ury, W. (1993). *Getting Past No: Negotiating Your way from Confrontation to Cooperation*. Rev. ed. New York, New York: Bantam Books.

U.S. Energy Information Administration (EIA) (2013). Most new residential solar PV

- projects in California program are not owned by homeowners. *Today in Energy*. Retrieved: <http://www.eia.gov/todayinenergy/detail.cfm?id=12991>
- U.S. Environmental Protection Agency (USEPA) (2001). *Partnerships and Progress: EPA State and Local Climate Change Program: 2001 Progress Report*. Washington, D.C: U.S. Environmental Protection Agency.
- U.S. Environmental Protection Agency (USEPA) (2016a). Inventory of U.S. Greenhouse Gas Emissions and Sinks: 199-2014. U.S. U.S. Environmental Protection Agency: Washington, D.C.
- U.S. Environmental Protection Agency (USEPA) (2016b). What Climate Change Means for Delaware. Retrieved from: <https://www.epa.gov/climate-impacts/climate-change-impacts-state>
- U.S. Environmental Protection Agency (USEPA) (2016c). What Climate Change Means for Mississippi. Retrieved from: <https://www.epa.gov/climate-impacts/climate-change-impacts-state>
- U.S. Environmental Protection Agency (USEPA) (2016d). What Climate Change Means for Oregon. Retrieved from: <https://www.epa.gov/climate-impacts/climate-change-impacts-state>
- U.S. Environmental Protection Agency (USEPA) (2016e). What Climate Change Means for Wyoming. Retrieved from: <https://www.epa.gov/climate-impacts/climate-change-impacts-state>
- U.S. Global Change Research Program (USGCRP) (2014). *Global Climate Change Impacts in the United States*. New York, New York: Cambridge University

Press.

Van Evera, S. (1997). *Guide to Methods for Students of Political Science*. Ithaca, New York: Cornell University Press.

Veenstra, G. (2000). Social capital, SES and health: an individual-level analysis. *Social science & medicine*, 50(5), 619-629.

Warner, J. F. (2006). More Sustainable Participation? Multi-Stakeholder Platforms for Integrated Catchment Management. *Water Resources Development*, 22(1): 15–35.

Walton, R. (2016 February 1). Mississippi PSC denied net metering rehearing request. *Utility Dive*. Retrieved from:  
<http://www.utilitydive.com/news/mississippi-psc-denied-net-metering-rehearing-request/413053/>

Weatherly, J. (2015a December 3). Update: Five years in the making: PSC adopts net-metering rule. *Mississippi Business Journal*. Retrieved from:  
<http://msbusiness.com/2015/12/after-5-years-the-psc-adopts-net-metering-rule/>

Weatherly, J. (2015b December 17). Power association to appeal net-metering rule. *Mississippi Business Journal*. Retrieved from:  
<http://msbusiness.com/2015/12/power-association-to-appeal-net-metering-rule/>

- Weatherly, J. (2016 January 28). UPDATE: PSC rejects reconsidering net-metering rule. *Mississippi Business Journal*. Retrieved from:  
<http://msbusiness.com/2016/01/psc-asked-to-reconsider-net-metering-rule/>
- Weber, E. P., Lovrich, N. P., & Gaffney, M. (2005). Collaboration, Enforcement, and Endangered Species: A Framework for Assessing Collaborative Problem-Solving Capacity. *Society and Natural Resources*, 18, 677–698.
- Weech-Maldonado, R., & Merrill, S. (2000). Building partnerships with the community: Lessons from the Camden Health Improvement Learning Collaborative. *Journal of Healthcare Management*, 45:189–205.
- Weible, C.M. (2006). "An Advocacy Coalition Framework Approach to Stakeholder Analysis: Understanding the Political Context of California Marine Protected Area Policy." *Journal of Public Administration Research and Theory*, 17:95-117.
- West Coast Governors' Global Warming Initiative (WCGGI). (2004). *West Coast Governors' Global Warming Initiative Staff Recommendations to the Governors*. Portland, Oregon: Department of Environmental Quality.
- Western Climate Initiative (WCI) (2007). *2007 Governor's Agreement*. Retrieved from: <http://www.westernclimateinitiative.org/history>
- Western Governor's Association (WGA) (2007). Govs. *Freudenthal, Huntsman Elect to Lead WGA, Announce Long-term Plan for Addressing Energy, Climate Change*. Western Governor's Association. Retrieved from:  
<https://westgov.org/news/75-news-2007/96-govs-freudenthal-huntsman->

elected-to-lead-wga-announce-long-term-plan-for-addressing-energy-climate-change-61207

Western Regional Air Partnership (WRAP) (2009). *Facts About the WRAP*. Western Regional Air Partnership. Retrieved from:

<https://www.wrapair.org/facts/index.html>

Wilson (2007 May 9). 31 states join Climate Registry. *Los Angeles Times*. Retrieved from: [http://articles.baltimoresun.com/2007-05-09/news/0705090545\\_1\\_gas-emissions-greenhouse-gas-registry](http://articles.baltimoresun.com/2007-05-09/news/0705090545_1_gas-emissions-greenhouse-gas-registry)

Williamson, O.E. (1975). *Markets, Hierarchies, Analysis and Antitrust Implications: A Study in the Economics of Internal Organization*. New York, New York: Free Press.

Williamson, O.E. (1985). *The Economic Institutions of Capitalism*. New York, New York: The Free Press.

Wind, C.A. (2016). *Clean Fuels Program Improvements 2017 Advisory Committee Charter*.

## **Conclusions, Implications, and Future Research**

The issue of global climate change poses a complex, collective action problem for policymakers at all levels of governance, the causes and environmental consequences of which are characteristic of contemporary environmental issues of the third environmental epoch (Mazmanian and Kraft 2009; Olson 1965). Such issues are characterized by a much greater combination of scientific and technical complexity, long-term time scales, involve large numbers of diverse stakeholder groups, and produce trans-jurisdictional impacts. The primary drivers of climate change, GHG emissions, are associated with virtually every social and economic activity within contemporary society (IPCC 2013; USGCRP 2014; USEPA 2016). Thus, effective mitigation requires policy coordination across a wide spectrum of diverse, and sometimes adversarial, policy actors. The climate change issue also has significant information and analysis requirements; therefore, epistemic communities play a crucial role as communicators in the policy process by defining and framing the issue within the context of policy debates (Haas 1992; Lipton 1994).

In the U.S., where federal policy efforts have consistently failed largely due to divergent political and economic ideologies among policymakers and stakeholders, climate change policy implementation has primarily occurred at the subnational level (Dunlap and McCright 2008; Layzer 2014; Lutzenhiser 2001; McCright and Dunlap 2003, 2011a, 2011b; McCright, Dunlap and Xiao 2014; Posner 2010a; Rabe 2004, 2008). Beginning with Rabe's (2004) initial exploration of how some states have overcome the political challenges of regulating GHG emissions, policy scholars have



explored various aspects of the climate change policy process, including the role of horizontal (e.g., Bauer and Steurer 2014, Betsill and Rabe 2009) and vertical policy diffusion (e.g., Betsill and Rabe 2009; Fisher 2013; Posner 2010b) in producing policy outcomes, “issue framing” around climate change policy discussions (Aklin and Urpelainen 2013; Guber and Bosso 2012; Kamieniecki 2006; Kraft and Kamieniecki 2007; Nisbet 2009), cross-state comparisons of particular policy instruments (e.g., renewable portfolio standards), and the impact that such policies are likely to have in the context of the U.S. contribution to global GHG emissions.<sup>90</sup> The findings of this research has largely pointed to the importance of policy entrepreneurs and third party technocratic institutions in pushing policy forward, and the process of policy learning as a source of policy diffusion (e.g., Kraus 2012; Rabe 2004, 2007, 2011).

While inquiry on the policy and politics of state-level climate change policymaking has grown in recent years, the amount and scope of research has not kept pace with growth in the saliency and urgency of the climate change issue (Rabe 2010). In particular, little inquiry has been conducted on collaborative climate change governance and the role of stakeholder engagement in policy formulation and implementation (Bernauer 2013; Javeline 2014). In the context of climate change policymaking, and environmental policy more generally, a history of mistrust between environmental and industrial interests exists as a result of conflict over

---

<sup>90</sup> “Horizontal diffusion” refers to the diffusion of one state’s policy design or idea to other states. “Vertical diffusion” refers to the diffusion of policy design or ideas that occur at the federal or local level to the state level.

previous policy issues (Weech-Maldonado and Merrill 2000). In such instances, establishing trust incrementally via collaborative policymaking processes may be essential prior to undertaking important policy negotiations (Ansell and Gash 2008). Where the issue of anthropogenic climate change has been plagued by deep disagreement over desired states and preferred outcomes, collaborative management processes offer a potentially effective approach to developing cooperation among polarized interest groups and advancing mitigation and adaptation policy (Agranoff and McGuire 2004; Ansell and Gash 2008; Fiack and Kamieiecki 2017; McGuire and Agranoff 2011; Niles and Lubell 2012).

A major goal of this study was to present and evaluate a possible framework for understanding the nature of collaborative management institutions and stakeholder engagement involving climate change mitigation at the state level. While a number of studies have applied theories related to stakeholder engagement in the policy process to understand and evaluate policy and environmental outcomes (e.g. Cheng and Mattor 2006; Heikkila and Gerlak 2005; Layzer 2008; Leach, Pelkey and Sabatier 2002; Smith 2009; Weber, Lovrich and Gaffney 2005), the application of such theories to state-level climate change policymaking processes has yet to be extensively analyzed in the literature. As a “wicked” environmental problem of the 21<sup>st</sup> century, effectively addressing the climate change issue will require comprehensive emissions mitigation efforts to occur across economic sectors. Therefore, developing an effective stakeholder framework can help us to understand the multifaceted stakeholder dynamics around climate change communication and

can be a critical contribution to theory and, subsequently, to policymaking by helping decision makers become aware and knowledgeable about their constraints and opportunities concerning climate change mitigation.

This study contributes to scholarship related to collaborative environmental governance by establishing a foundation for understanding and evaluating the role of collaborative management policy actors and institutions in the development of subnational climate change policy. Although the climate change issue is a global commons problem that will necessitate international cooperation to be addressed effectively, emissions reductions will occur at the subnational level, through the modification of energy consumption characteristics associated with various end-use activities. In the U.S., where substantive federal policy action has been limited, a diverse array of policy mechanisms associated with climate change mitigation has been enacted at the subnational level. These efforts have occurred to varying degrees within politically and economically diverse polities across all regions of the nation. Furthermore, U.S. governance occurs within a democratic, federalist system, characterized by decentralized, complex networks of government agencies, private groups, and non-profit entities. Therefore, effective policy adoption and implementation will likely benefit from consultation with regionally significant public, private, and non-profit interests and coordination across multiple levels of governance (Betsill and Rabe 2009; Cole 2011; Ostrom 2010, 2012). As such a state-level examination of state-level climate change policymaking, with a focus on

collaborative policy processes, offers a valuable opportunity to understand how stakeholder engagement affects policy adoption and implementation dynamics.

### **Summary of Findings**

The study began by making the case for a state-level focused investigation of climate change policy by analyzing the political barriers and policy challenges that have, thus far, successfully prevented the passage of federal legislation to regulate GHG emissions (see Chapter 1). The analysis applied policymaking process theories to provide a framework for understanding the motives, strategies, and access points that fossil fuel and conservative political interests have utilized to block successfully the climate change issue and prevent policy proposals from gaining traction on the federal policy agenda. The investigation drew upon data related to interest group lobbying expenditures and campaign finance, political party platforms, and Congressional voting records, as well as research related to public perception of climate science, to illustrate the past and present political obstacles to federal climate change policy and assess the likelihood of climate change policy adoption at the federal level in the coming years.

The extent of federal-level opposition to policy intervention in support of climate change mitigation is most recently exemplified by the political agenda of President Donald J. Trump. Less than six months following his inauguration, President Trump has sought to weaken executive-level actions to address the climate change issue that were established by President Barak Obama and reduce the federal regulatory power of the U.S. EPA to regulate GHG emissions from the electric power

sector. He has decided that the United States should withdraw from the Paris Climate Agreement, joining only two other nations, Nicaragua and Syria, as non-participants in the world's most substantive international climate change agreement to date. Based on this and the analysis, the chapter concluded that, in the short to medium term, a federal policy to regulate emissions is unlikely to be achieved. Therefore, state and local-level climate change policy initiatives will serve as the primary pathway for guiding emissions reduction efforts within the U.S.

Chapter 2 introduced the topic of collaborative environmental governance, and the relevance of collaboration via stakeholder engagement to addressing the “wicked” environmental challenges of the third environmental epoch, particularly within the context of climate change mitigation. The chapter presented a theoretical framework developed by Sabatier et al. (2005) to analyze stakeholder involvement in collaborative watershed management that can potentially be useful for understanding the process of stakeholder engagement in the development of state-level climate change policy. The chapter included a discussion of the theoretical foundations that support the conceptual relationships provided in the framework, and the development of hypotheses regarding the causal mechanisms that drive the overall collaborative policymaking process. Chapter 3 introduced the methodological approaches that were employed to select and analyze the four case studies. Both Chapter 2 and Chapter 3 build upon the work of Sabatier et al. (2005) and outline a conceptual framework for understanding and evaluating the variables that may affect collaborative climate change policymaking in American states.

The study continued with an analysis of state-level trends related to climate change policy adoption, energy consumption, and CO<sub>2</sub> emissions (see Chapter 4 and Chapter 5). The state-level analyses were followed by the development of two composite indicators, the State-Level Climate Change Performance Index (SLCCPI) and State-Level Climate Change Policy Adoption and Implementation Index (SLCCPAII), designed to rank the fifty states based upon their relative experiences in climate change mitigation and policy action (Chapter 6). The results of the SLCCPI and SLCCPAII provided a large-n comparative analysis of state-level experiences with respect to climate change mitigation performance and policy implementation that can be used by academics and policy practitioners to evaluate state-level performance in a number of areas related to both the physical drivers of anthropogenic climate change and policy tools associated with climate change mitigation. The section concluded with the selection of four states for case study analysis, Delaware, Oregon, Wyoming, and Mississippi, using criteria developed from the hypothesized relationships between collaborative governance institutions and climate change mitigation and policy outcomes.

Chapter 7 applied the contingency model for collaborative governance, introduced in Chapter 2, to examine the climate change policymaking experiences in each of the four states. The case study investigation relied upon process tracing techniques and applied a mixed-methods approach to evaluate hypotheses regarding how climate change policymaking takes place across the American states, whether and how the process generates policy outcomes, and the role of stakeholder

engagement in producing policy outcomes. Delaware was selected as a “most-likely” case, or vanguard state, in which, given the successful achievement of policy adoption and mitigation, collaborative engagement processes were expected to exist. Mississippi was selected as a least-likely case, or “laggard” state, in which little or no action to address and mitigate climate change has occurred, and therefore it is unlikely that collaborative policy processes had taken place. Oregon and Wyoming were selected as deviant cases in which substantial climate change action has occurred with relatively low mitigation performance and little or no climate change action has occurred yet relatively high mitigation performance has been achieved, respectively.

The results of the case study analysis showed that the proposed conceptual framework, and the associated theoretical perspectives, for collaborative climate change policy offer an informative approach for analyzing how GHG mitigation efforts transpire in the American states. In particular, the study revealed how state-level conditions may influence the type of policy process applied in the decision-action arena (traditional versus collaborative), and the subsequent effect of the policy process on policy outcomes. The findings of the case study analyses also contribute to our understanding of how the climate change policymaking process takes place. Previous research on state-level climate change policy has found that policy learning via horizontal diffusion, policy entrepreneurs, and technocratic institutions are each important drivers of state-level climate change action. The analyses showed that all three of these variables contributed to stakeholder discussions in Delaware and

Oregon, where technocratic experts and policy approaches taken by other states facilitated collaborative learning across diverse stakeholder groups and reduced the potential barriers to cooperation between advocacy coalitions. Thus, collaborative policy processes may serve as incubators of climate change policy planning, in which technical experts and the analysis of previous state-level policy action contribute to the development of policy proposals.

The analysis also found that policy entrepreneurs have played a particularly visible role at critical points in the policy process. With respect to the formation of collaborative policy institutions, policy entrepreneurs played an important role by framing the climate change issue as an important environmental problem to be addressed, setting the policy agenda, and mobilizing resources to reduce the transaction costs associated with collective action. Policy leaders have also contributed to the survival of collaborative management institutions and the adoption of formal policy by continuing to support stakeholder discussions and carrying policy proposals through the legislative process.

### **Implications of Findings**

In light of the political upheaval associated with efforts to ignore the climate change problem at the federal level, understanding the conditions and processes that facilitate successful climate change policy adoption at the subnational level continues to be an extremely critical area of research. Given the diffuse sources of anthropogenic GHG emissions, the scientific complexity of the climate change problem, and the role that fossil fuels play in all areas of economic activity, addressing the climate change



issue through policy intervention will benefit from the engagement of diverse stakeholder groups through collaborative planning and decision-making processes at the subnational level. The study presented and applied a possible framework for understanding the role of collaborative policy processes in the development of climate change policy to an investigation of the climate change policy experiences in four states, specifically, Delaware, Oregon, Wyoming, and Mississippi, which have exhibited divergent trends with respect to climate change policy adoption. The findings of the analysis provide important implications regarding the role of stakeholder engagement and collaborative governance in climate change policymaking, and the conditions under which such efforts may be more likely to occur and succeed.

The most critical implication of the case study investigation is the prevalent role that stakeholder engagement and collaborative policy processes have played in the planning, adoption, and implementation stages of state-level climate change initiatives. Delaware and Oregon are among the nation's leading states with respect to climate change policy action (see Chapter 4 and Chapter 6) and, as the investigation revealed, each state has consistently relied upon collaborative governance processes for developing policy strategies related to climate change mitigation (see Chapter 7). In addition to the array of intrastate stakeholder advisory groups that have participated in various stages of the policy process, each state has also engaged in regional multistate partnerships designed to coordinate and expand the coverage of climate change mitigation efforts. The findings suggest that policymakers who are

interested in facilitating successful policy adoption and implementation ought to directly engage diverse and regionally significant advocacy coalitions in the policymaking process. Therefore, collaborative policy processes offer a constructive venue for successful policy development and implementation.

While stakeholder engagement was found to be a consistent component of each state's climate change policy adoption efforts, policy entrepreneurs were important contributors to the formation and survival of these unilateral and multilateral initiatives (see Chapter 7). None of the collaborative policy processes formed organically without executive- or legislative-level support (see Table 7.6 and Table 7.7). This finding suggests that, in the case of state-level collaborative climate change governance, collective action may not occur without the presence of third party actors that are willing to subsidize the transaction costs associated with establishing formal collaborative processes composed of diverse stakeholder groups. The finding suggests that policy entrepreneurs play a key role in catalyzing collaborative policy processes to support climate change policy discussions and, subsequently, produce policy outcomes.

Given the scientific complexity associated with understanding the climate change issue, epistemic communities have been an integral component of climate change policy discussions at both the national and international level (see Introduction and Chapter 1). In the U.S., despite nearly unanimous agreement among climate change scientists that human activity is affecting the global climate, the scientific consensus regarding various aspects of anthropogenic climate change has

historically been an important point of contention amongst those who support and those who oppose emissions reduction efforts. Consequently, public opinion regarding the climate change issue, including the level of scientific consensus, the severity of the problem, and the societal effects of a changing climate, are likely to be important indicators of stakeholders' willingness to engage in collective action related to mitigation efforts within a particular region.

One way to support stakeholder awareness of the scientific evidence of the climate change issue and its implications for society and the environment is to facilitate collaborative learning via the inclusion of scientific experts in collaborative policy processes (Daniels and Walker 2001). Delaware and Oregon each facilitated collaborative learning by including scientific and technical experts as participants in many of their advisory groups (see Table 7.6 and Table 7.7). In Oregon, where a majority of the state's collaborative policy processes were explicitly formed to address the climate change issue, advisory groups such as the Oregon Global Warming Commission and the Climate Change Integration Group also sought to engage the general public with climate change science via deliberate outreach efforts. Additionally, Delaware and Oregon have each experienced significant and observable environmental impacts associated with a changing climate, relative to those experienced in Wyoming and Mississippi (see Table 7.3). Each of these factors have likely affected the general public's perception of the climate change issue in these states which, relative to Wyoming, Mississippi, and the national average, is more in line with views that would generally support policy efforts related to climate change

mitigation (see Table 7.4). The findings suggest that exposure to the negative environmental effects of climate change and the inclusion of the scientific community in stakeholder engagement processes may be important in influencing public perceptions concerning the issue and collective action efforts related to climate change policy action.

In addition to public opinion regarding the climate change issue and the role epistemic communities play in supporting policy action through collaborative learning, the analysis of policy experiences in the four states also revealed how human and social capital, socioeconomic conditions, and political factors may influence the type of decision-action arena that is formed, and the type of climate-related policies that are implemented. Mississippi, for example, was found to have relatively low social and human capital and an increasingly conservative political climate. As such, when developing its net metering program, the state relied upon a traditional, negotiated rulemaking process that was ultimately more sympathetic to conservative interests and facilitated adversarial relationships between environmental and utility-sector interests.

In contrast, while Wyoming exhibited similar political trends to those of Mississippi, the state was found to have relatively high levels of social and human capital and substantial economic reliance on extractive industries (primarily coal production). Consequently, the state has employed collaborative policy processes to support the development of policies related to climate change mitigation. However, the state has pursued carbon capture and sequestration, rather than direct emissions

regulation, as its primary approach to climate change mitigation. This policy approach would support climate change mitigation while protecting the region's coal industry, which, as the nation's top coal producer, serves as an economic staple of the region. The initial conditions and subsequent decision-action arenas that have been employed in Mississippi and Wyoming to develop climate change mitigation policies both provide support for the relationships identified in the conceptual framework regarding collaborative climate change policy processes. However, the experience in Wyoming reveals how economic and political interests can shape the policy agenda with respect to the focus and design of climate change mitigation policy efforts.

### **Recommendations for Future Research**

While the climate change policy experiences in Delaware, Oregon, Mississippi, and Wyoming reflect positively on the proposed conceptual framework for collaborative climate change policy, the small sample size of the study constrains the ability to form hard and fast broad generalizations. Therefore, further examination of the collaborative management framework via additional state-level case studies is a logical path for future research in this area. Future inquiry should also focus on the micro-level interactions that take place between stakeholders who are engaged in collaborative climate change management institutions. One may conclude that, given the regularity regarding the formation of collaborative management processes in both Delaware and Oregon, such institutions contribute to the development of civic community amongst advocacy coalitions. However, a more focused empirical examination of policy network structure within these policy subsystems would

provide valuable insight into the effectiveness of such institutions with respect to fostering cooperation among policy actors. Therefore, conducting in-depth empirical analyses of large n-studies to test the internal dynamics of state-level collaborative climate change policy in the future is recommended.

Two additional aspects of the theoretical framework that warrant further examination include the level of stakeholder inclusiveness in collaborative policy institutions and the environmental and socioeconomic effects of policies that have been developed via collaborative policy processes. The collaborative institutions established in both Delaware and Oregon have generally been composed of a diverse collection of public, private, government representatives with divergent interests regarding prospective policy proposals related to climate change mitigation. However, it is unclear how the composition of these collaborative decision making bodies was designed, and how each representative was selected to serve on their respective committees. It may be that the stakeholders included in each collaborative policy process were chosen based upon their relative political power or existing policy networks, as opposed to the actual diversity of stakeholders within the region. Choosing collaborative policy process participants based upon political motives, rather than on more objective criteria, may diminish the benefits of such processes with respect to facilitating an inclusive, democratic, decision-making process, and ultimately, may reduce the substantive legitimacy of adopted policies. Thus, to understand how such collaborative policy process may be influenced by political power and how such dynamics can translate into policy outputs through these

processes, future research should also focus on understanding whether important stakeholders have been omitted from the decision-making process, how such omissions transpires, and the overall effect with respect to legitimacy among state-level stakeholders.

As discussed in Chapter 2, a common criticism of collaborative policy processes that rely on consensus-based decision-making processes is the potential for such processes to produce “lowest common denominator” policies. This phenomenon describes a policy outcome in which, in order to reach widespread agreement on policy decisions across all stakeholders, the final design of policy outputs become ineffective at actually improving environmental conditions, relative to those developed in a traditional, top-down, decision-making process. In contrast, a common criticism of traditional policymaking processes is the potential for negative economic impacts from regulatory action to be disproportionately distributed to certain stakeholder groups. In this case, collaborative policy processes offer a potential opportunity to mitigate the distributional impacts of policy implementation by including such interests in the decision-making process. Therefore, in order to assess the relative effectiveness of collaborative policy process to more traditional policymaking approaches, future research should focus on the environmental and economic outcomes of policies that have been developed via collaborative policy process, relative to those that have not.

Although climate change policy in the U.S. has primarily occurred at the state-level, the issue of anthropogenic global climate change will require the global

community to participate in emissions mitigation efforts. Given the recent trends with regard to the development of international climate change agreements, there is a growing opportunity to investigate how national climate change policy development takes place, and the role of stakeholder engagement within the policy process. Therefore, in the long-term, research related collaborative climate change policy processes should shift the level of focus to the international arena and conduct comparative, cross-national studies of climate change policy processes. In this context, it would be valuable for academics and policy practitioners alike to understand the dynamics of multilevel climate change governance and the extent to which national-level governments coordinate and vertically integrate regional policy efforts with subnational governing bodies and institutions.



## References

- Agranoff, R., & McGuire, M. (2004). *Collaborative Public Management*. Washington, DC: Georgetown University Press.
- Aklin, M., & Urpelainen, J. (2013). Debating clean energy: Frames, counter frames, and audiences. *Global Environmental Change-Human and Policy Dimensions*, 23(5), 1225-1232. doi: 10.1016/j.gloenvcha.2013.03.007
- Ansell, C., & Gash, A. (2008). Collaborative Governance in Theory and Practice. *Journal of Public Administration Research and Theory*, 18:543-571.
- Bauer, A., & Steurer, R. (2014). Multi-level governance of climate change adaptation through regional partnerships in Canada and England. *Geoforum*, 51, 121-129. doi: 10.1016/j.geoforum.2013.10.006
- Bernauer, T. (2013). Climate Change Politics. *Annual Review of Political Science*, Vol 16, 16, 421-448. doi: 10.1146/annurev-polisci-062011-154926
- Betsill, M.M., & Rabe, B.G. (2009). "Climate Change and Multilevel Governance: The Evolving State and Local Roles." In *Toward sustainable Communities: Transition and Transformations in Environmental Policy*, eds. D. Mazmanian and M.E. Kraft, 201-226. Boston, Massachusetts: MIT Press.
- Cheng, A. S., & Mattor, K. M. (2006). Why Won't They Come? Stakeholder Perspectives on Collaborative National Forest Planning by Participation Level. *Environmental Management* 38, 545-561.
- Cole, D.H. (2011). From global to polycentric climate governance. *Climate Law*, 2(3): 395-413. doi: 10.3233/CL-2011-042

- Daniels, S.E. & Walker, G.B. (2001). *Working Through Environmental Conflict: The Collaborative Learning Approach*. Westport Connecticut: Praeger.
- Dunlap, R. E., & McCright, A. M. (2008). A widening gap - Republican and Democratic views on climate change. *Environment*, 50(5), 26-35. doi: 10.3200/envt.50.5.26-35
- Fiack, D. & Kamieniecki S. (2017). Stakeholder engagement in climate change policymaking in American cities. *Journal of Environmental Studies and Sciences*. 7(1): 127-140. doi: 10.1007/s13412-014-0205-9
- Fisher, D. R. (2013). Understanding the relationship between subnational and national climate change politics in the United States: toward a theory of boomerang federalism. *Environment and Planning C-Government and Policy*, 31(5), 769-784. doi: 10.1068/c11186
- Guber, D.L., & Bosso, C.I. (2012). "Issue Framing, Agenda Setting, and Environmental Discourse". In *The Oxford Handbook of US Environmental Policy*, ed. M.E. Kraft and S. Kamieniecki, 437-460. New York, New York: Oxford University Press.
- Haas, P. M. (1992). Introduction: epistemic communities and international policy coordination. *International Organization*, 46(1), 1-35.
- Heikkila, T., & Gerlak, A. K. (2005). The formation of large-scale collaborative resource management institutions: Clarifying the roles of stakeholders, science, and institutions. *Policy Studies Journal*, 33(4), 583-612. doi: 10.1111/j.1541-0072.2005.00134.x

- Intergovernmental Panel on Climate Change (IPCC) (2013). *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. eds. T.F. Stocker, D. Qin, G.K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley. New York, New York: Cambridge University Press.
- Javeline, D. (2014). The Most Important Topic Political Scientists Are Not Studying: Adapting to Climate Change. *Perspectives on Politics*, 12(2), 420-434. doi: 10.1017/s1537592714000784
- Kamieniecki, S. (2006). *Corporate America and Environmental Policy: How Often Does Business Get Its Way?* Palo Alto, California: Stanford University Press.
- Kraft, M.E., & Kamieniecki, S. (2007). "Analyzing the Role of Business in Environmental Policy." In *Business and Environmental Policy: Corporate Interests in the American Political System*, ed. M. E. Kraft and S. Kamieniecki, 3–31. Cambridge, Massachusetts: MIT Press.
- Krause, R. M. (2012). An Assessment of the Impact that Participation in Local Climate Networks Has on Cities' Implementation of Climate, Energy, and Transportation Policies. *Review of Policy Research*, 29(5), 585-604. doi: 10.1111/j.1541-1338.2012.00582.x
- Layzer, J. A. (2008). *Natural Experiments: Ecosystem-Based Management and the Environment*. Cambridge, Massachusetts: MIT Press.
- Layzer, J.A. (2014). *Open for Business: Conservatives' Opposition to Environmental*

*Regulation*. Cambridge, Massachusetts: MIT Press.

- Leach, W. D., Pelkey, N. W., & Sabatier, P. S. (2002). Stakeholder Partnerships as Collaborative Policymaking: Evaluation Criteria Applied to Watershed Management in California and Washington. *Journal of Policy Analysis and Management* 21 (4), 645–670.
- Lifitin, K.T. (1994). *Ozone Discourse: Science and Politics in Global Environmental Cooperation*. New York, New York: Columbia University Press.
- Lutzenhiser, L. (2001). The contours of US climate non-policy. *Society & Natural Resources*, 14(6), 511-523. doi: 10.1080/08941920121404
- Mazmanian, D. A., & Kraft, M.E. (2009). “The Three Epochs of the Environmental Movement.” In *Toward Sustainable Communities: Transition and Transformation in Environmental Policy*, 2nd ed., eds. D. A. Mazmanian and M. E. Kraft, 3–42. Cambridge, Massachusetts: MIT Press.
- McCright, A.M. and R.E. Dunlap. (2003). ‘Defeating Kyoto: The Conservative Movement’s Impact on US Climate Change Policy’, *Social Problems*, 50, 3, 348–73.
- McCright, A. M., & Dunlap, R. E. (2011a). Cool dudes: The denial of climate change among conservative white males in the United States. *Global Environmental Change-Human and Policy Dimensions*, 21(4), 1163-1172. doi: 10.1016/j.gloenvcha.2011.06.003
- McCright, A.M. and R.E. Dunlap. (2011b). The Politicization of Climate Change and Polarization in the American Public’s Views of Global Warming, 2001–2010,

*Sociological Quarterly*, 52, 2, 155–94.

McCright, A. M., Dunlap, R. E., & Xiao, C. Y. (2014). Increasing Influence of Party Identification on Perceived Scientific Agreement and Support for Government Action on Climate Change in the United States, 2006-12. *Weather Climate and Society*, 6(2), 194-201. doi: 10.1175/wcas-d-13-00058.1

McGuire, M., & Agranoff, R. (2011). The limitations of public management networks. *Public Administration*, 89(2): 265–84.

Niles, M. T., & Lubell, M. (2012). Integrative Frontiers in Environmental Policy Theory and Research. *Policy Studies Journal*, 40, 41-64. doi:10.1111/j.1541-0072.2012.00445.x

Nisbet, M. C. (2009). Communicating Climate Change Why Frames Matter for Public Engagement. *Environment*, 51(2), 12-23.

Olson, M. (1965). *The Logic of Collective Action: Public Goods and the Theory of Groups*. Cambridge, Massachusetts: Harvard University Press.

Ostrom, E. (2010). Polycentric systems for coping with collective action and global environmental change. *Global Environmental Change-Human and Policy Dimensions*, 20(4): 550–57.

Ostrom, E. (2012). Nested externalities and polycentric institutions: must we wait for global solutions to climate change before taking actions at other scales? *Economic Theory*, 49(2): 353-369.

- Posner, P.L. (2010a). *Greenhouse Governance: Addressing Climate Change in America*. ed. B.G. Rabe, 73-100. Washington, D.C.: Brookings Institution Press.
- Posner, P.L. (2010b). "The Politics of Vertical Diffusion: The States and Climate Change." In *Greenhouse Governance: Addressing Climate Change in America*, ed. B.G. Rabe, 73-100. Washington, D.C.: Brookings Institution Press.
- Rabe, B.G. (2004). *Statehouse and Greenhouse: The Emerging Politics of American Climate Change Policy*. Washington, D.C.: Brookings Institution Press.
- Rabe, B. G. (2007). Beyond Kyoto: Climate change policy in multilevel governance systems. *Governance-an International Journal of Policy Administration and Institutions*, 20(3), 423-444. doi: 10.1111/j.1468-0491.2007.00365.x
- Rabe, B. G. (2008). States on Steroids: The Intergovernmental Odyssey of American Climate Policy. *Review of Policy Research*, 25(2), 105-128. doi: 10.1111/j.1541-1338.2007.00314.x
- Sabatier, P.A., Focht, W., Lubell, M., Trachtenburg, Z., Vedlitz, A., & Matlock, M. eds. (2005). *Swimming Upstream: Collaborative Approaches to Watershed Management*. Cambridge, Massachusetts: MIT Press.
- Smith, C. (2009). Institutional Determinants of Collaboration: An Empirical Study of County Open-Space Protection. *Journal of Public Administration Research and Theory* 19 (1), 1–21.
- U.S. Global Change Research Program (USGCRP) (2014). *Global Climate Change*

*Impacts in the United States*. New York, New York: Cambridge University Press.

U.S. Environmental Protection Agency (USEPA) (2016). Inventory of U.S. Greenhouse Gas Emissions and Sinks: 199-2014. U.S. U.S. Environmental Protection Agency: Washington, D.C.

Weber, E. P., Lovrich, N. P., & Gaffney, M. (2005). Collaboration, Enforcement, and Endangered Species: A Framework for Assessing Collaborative Problem-Solving Capacity. *Society and Natural Resources*, 18, 677–698.

Weech-Maldonado, R., & Merrill, S. (2000). Building partnerships with the community: Lessons from the Camden Health Improvement Learning Collaborative. *Journal of Healthcare Management*, 45:189–205.

## Appendix 1 SLCCPI Indicator Correlation Matrix

	Emissions Per Capita	Emissions-GDP Intensity	Energy Per Capita	Energy-GDP Intensity	Emissions- Energy Intensity	Alternative Energy Per Capita	Alternative Energy Share
Emissions Per Capita	1.000	-0.027	0.693	0.130	0.258	0.360	0.141
Emissions-GDP Intensity	-0.027	1.000	-0.409	0.487	0.049	-0.377	-0.102
Energy Per Capita	0.693	-0.409	1.000	0.316	-0.251	0.768	0.501
Energy-GDP Intensity	0.130	0.487	0.316	1.000	-0.410	0.222	0.354
Emissions- Energy Intensity	0.258	0.049	-0.251	-0.410	1.000	-0.521	-0.678
Alternative Energy Per Capita	0.360	-0.377	0.768	0.222	-0.521	1.000	0.863
Alternative Energy Share	0.141	-0.102	0.501	0.354	-0.678	0.863	1.000



## Appendix 2 Results of the SLCCPI

State	Rank	CI Value	Indicator Scores				Indicator Values					
			Emissions	Emissions-GDP Intensity	Energy	Energy-GDP Intensity	Emissions	Emissions-GDP Intensity	Energy	Energy-GDP Intensity		
WY	1	379,264	66,766	95,915	36,782	46,428	83,812	49,562	-0.00023	4,956	-0.00023	2,575
TX	2	370,490	79,969	26,016	99,808	65,378	42,659	56,660	-0.00017	-6,510	-0.00017	0,790
AK	3	367,048	69,357	44,523	100,000	100,000	13,917	39,250	0.00007	-6,545	0.00007	-0,354
NV	4	337,579	100,000	14,204	15,187	100,000	100,000	38,956	-0.00003	-3,586	-0.00003	-0,374
DE	5	333,508	94,105	8,966	83,472	20,117	79,234	47,614	-0.00009	-3,538	-0.00009	0,195
ND	6	316,470	0,000	100,000	0,000	52,995	64,779	98,696	-0.00036	11,647	-0.00036	3,553
AL	7	315,302	44,202	22,572	68,602	44,470	65,735	69,721	-0.00018	-8,333	-0.00018	1,648
TN	8	291,427	61,913	16,615	70,165	22,568	66,298	53,868	-0.00014	-1,117	-0.00014	0,606
UT	9	288,855	72,923	22,741	72,828	29,201	46,145	45,018	-0.00018	-1,602	-0.00018	0,025
WV	10	287,230	54,552	58,163	62,524	21,655	35,487	54,850	-0.00041	0,273	-0.00041	0,671
NH	11	286,765	43,615	6,315	67,315	17,923	83,628	67,969	-0.00008	-0,599	-0.00008	1,533
PA	12	280,301	51,859	9,938	67,756	19,690	69,621	61,436	-0.00010	-0,679	-0.00010	1,104
LA	13	275,097	43,469	20,339	75,754	72,877	48,108	48,108	-0.00017	-2,134	-0.00017	0,228
MD	14	274,826	55,194	10,406	68,551	23,051	66,360	51,265	-0.00010	-0,824	-0.00010	0,435
NM	15	273,156	65,768	15,976	73,064	19,808	43,856	54,683	-0.00014	-1,645	-0.00014	0,660
MA	16	263,854	56,385	6,977	70,107	17,191	67,690	45,685	-0.00008	-1,107	-0.00008	0,669
NY	17	263,005	51,393	4,416	68,738	17,500	70,865	50,094	-0.00006	-0,858	-0.00006	0,358
NC	18	257,940	56,669	12,333	76,291	24,640	47,176	40,811	-0.00011	-2,232	-0.00011	-0,252
VT	19	256,956	43,235	6,350	66,578	22,455	53,859	64,480	-0.00008	-0,465	-0.00008	1,304
SD	20	252,305	35,373	12,949	25,364	0,000	83,728	94,892	0.00012	7,033	0.00012	3,303
NJ	21	251,902	50,200	2,774	71,269	15,290	57,749	54,620	-0.00005	-1,318	-0.00005	0,656
IN	22	246,886	53,957	20,777	65,620	21,525	34,645	50,362	-0.00017	-0,290	-0.00017	0,376
OK	23	244,114	39,613	16,298	65,014	34,080	34,017	55,093	-0.00014	-0,180	-0.00014	0,687
VA	24	242,793	50,523	9,690	66,923	10,553	43,566	43,566	-0.00010	-0,528	-0.00010	-0,071
MI	25	241,263	53,154	3,507	69,441	10,833	50,291	54,038	-0.00006	-0,986	-0.00006	0,618
MN	26	240,260	44,144	6,909	57,163	14,390	58,385	59,269	-0.00008	1,248	-0.00008	0,961
FL	27	237,974	51,382	6,115	71,919	16,041	52,740	39,775	-0.00007	-1,436	-0.00007	-0,320
KS	28	236,391	48,908	12,020	71,004	22,675	22,956	58,828	-0.00011	-1,270	-0.00011	0,932
GA	29	234,852	61,963	7,275	75,939	16,702	39,266	33,707	-0.00008	-2,168	-0.00008	-0,719
OH	30	234,137	50,113	6,756	71,059	19,132	39,498	47,579	-0.00008	-1,280	-0.00008	0,193
WA	31	232,864	59,156	5,867	95,822	29,894	33,389	8,736	-0.00007	-5,785	-0.00007	-2,360
RI	32	232,778	45,481	6,760	76,589	21,049	37,335	45,564	-0.00008	-2,286	-0.00008	0,061
CT	33	230,123	51,009	2,949	71,150	15,305	51,537	38,173	-0.00005	-1,297	-0.00005	-0,425
ID	34	229,836	45,540	5,165	82,854	50,480	19,670	26,128	-0.00007	-3,426	-0.00007	-1,217
CA	35	223,502	49,490	3,074	73,105	20,007	36,478	41,349	-0.00005	-1,652	-0.00005	-0,216
MT	36	222,906	45,174	25,444	68,292	40,406	16,421	27,169	-0.00020	-0,777	-0.00020	-1,148
WI	37	221,960	42,909	8,738	62,249	22,424	37,955	47,685	-0.00009	0,323	-0.00009	0,200
AR	38	218,411	38,970	11,041	64,128	45,046	17,375	41,851	-0.00011	-0,019	-0.00011	-0,183
IA	39	218,010	14,873	7,597	30,634	4,744	60,162	100,000	-0.00008	6,074	-0.00008	3,639
CO	40	211,767	44,365	1,249	61,530	6,276	48,124	50,223	-0.00004	0,454	-0.00004	0,367
HI	41	211,294	55,337	4,817	78,085	16,623	17,894	37,937	-0.00007	-2,667	-0.00007	-0,441
ME	42	207,313	49,613	12,842	85,453	38,356	17,789	3,260	-0.00012	-3,899	-0.00012	-2,720
IL	43	204,900	35,772	0,000	66,775	11,631	31,288	59,432	-0.00003	0,040	-0.00003	0,972
OR	44	202,469	45,070	11,278	88,670	57,452	0,000	0,000	-0.00011	-4,484	-0.00011	-2,934
AZ	45	201,382	49,952	2,365	73,314	17,980	29,123	28,648	-0.00005	-1,690	-0.00005	-1,051
SC	46	191,807	40,932	5,882	68,756	22,621	20,125	33,490	-0.00007	-0,861	-0.00007	-0,733
MS	47	191,171	27,884	6,253	65,293	36,048	18,015	37,678	-0.00007	-2,231	-0.00007	-0,458
KY	48	184,682	36,375	11,534	52,898	11,597	25,613	46,665	-0.00011	0,204	-0.00011	0,133
NE	49	169,451	14,128	3,025	34,384	5,697	33,844	78,374	-0.00005	5,392	-0.00005	2,217
MO	50	164,877	29,540	1,406	59,553	10,273	15,835	48,270	-0.00004	0,813	-0.00004	0,005



