DISSERTATION

POLICY INNOVATION AND CHANGE: THE DIFFUSION AND MODIFICATION OF THE RENEWABLE PORTFOLIO STANDARD, 1994 – 2014

Submitted by

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ABSTRACT

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To date, the U.S. federal government has not enacted a national renewable energy policy. Inertia at this level of government creates a policy space that allows American states to take the lead. State policy drives clean energy development. By the fall of 2014, every state in the nation had adopted at least one policy supportive of increased market penetration of renewable energy, and 38 states had adopted either a mandatory renewable portfolio standard (RPS) or a voluntary renewable energy goal. Between January 1, 1995 and the end of 2014, over 207 legislative changes amended existing RPSs and voluntary goals. Of these, most made small modifications or increased renewable energy requirements. Far fewer made significant changes to weaken state policy.

This dissertation contributes to our understanding of energy policy innovation and change, where the adoption of an innovation is defined as a policy that is new to the state adopting it. It does so using a mixed methods approach that answers two major research questions: Why do states adopt different types of renewable portfolio standards (RPSs), while others fail to adopt any type of RPS? And, after states adopt an RPS, why do they amend the policy in the manner that they do over time? Using case studies and event history analysis based on a unified model of policy innovation suggested by existing literature, this study finds that both the size and direction of the effects of explanatory variables as well as the individual variables themselves vary across decision types, time, and space. More specifically, while the results

confirm that household incomes, citizen and government ideology, and educational attainment are important internal state characteristics for explaining decisions to adopt and amend RPSs, the effect of these variables varies across different types of decisions. In addition, renewable energy interests and resources, fossil fuel resources and related interest groups, policy entrepreneurs, collaboration, and coalition building are important for explaining policy adoption and change. While this study found little to suggest that renewable energy potential is an important predictor of the decision to adopt an RPS, it did find that other state and federal policies are significant factors influencing the decision to adopt a certain type of RPS or amend an RPS in a certain manner. While the results of the case studies suggest that policy diffusion also plays an important role in explaining policy innovation and change, the results of the quantitative models must be interpreted with some caution.

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CHAPTER ONE: INTRODUCTION

This dissertation is an effort to contribute to our understanding of policy innovation and change. It does so through a mixed methods approach that explores answers to two major research questions: Why do states adopt different types of renewable portfolio standards (RPSs), while others fail to adopt any type of RPS? And, after states adopt an RPS, why do they amend the policy in the manner that they do over time? In addition to these research questions, several minor research questions were also developed. Generally, these involved questions of whether the explanatory variables associated with different types of policy decisions would vary by decision type and over time.

The results of the qualitative case studies and the quantitative analysis suggest that both the size and direction of the effects of the explanatory variables as well as the individual variables themselves vary across decision types, time, and space. More specifically, the results suggest that household incomes, citizen and government ideology, and educational attainment are important internal state characteristics for explaining decisions to adopt and amend RPSs. In addition, renewable energy interests and resources, fossil fuel resources and related interest groups, policy entrepreneurs, collaboration, and coalition building are important for explaining policy adoption and change. While this study found little to suggest that renewable energy potential is an important predictor of the decision to adopt an RPS, it did find that other state and federal policies are significant factors influencing the decision to adopt a certain type of RPS or amend an RPS in a certain manner. While the results of the case studies suggest that policy diffusion also plays an important role in explaining policy innovation and change, the results of the quantitative models must be interpreted with some caution.

The policy innovation literature defines a policy innovation as “a program or policy which is new to the states adopting it, no matter how old the program may be or how many other states have adopted it” (Walker 1969, p. 881). In its essence, this literature is a study of policy change: Understanding policymaking and policy change requires that we are able to explain both incremental changes to existing policies as well as non-incremental adoptions of policy innovations (Berry and Berry 2014; Shipan and Volden 2012).

There are two primary explanations for the adoption of a policy innovation: internal determinants and policy diffusion (Berry and Berry 1990, 2007). While internal determinants models assume that the internal characteristics of states are the most important factors for explaining the adoption of an innovation, policy diffusion models hold that the policy choices of other states or units of government have an important effect of the probability of adopting a new policy. With most scholars acknowledging the unlikelihood that innovation could be explained entirely by either model, the field embraced the publication of Berry and Berry’s (1990) unified model, upon which this study’s model of policy innovation and change is built.

Scholarship studying the diffusion of the RPS has a history of at least a decade, and the RPS has been one of the most frequently studied policy innovations in the literature. However, while there are several existing studies of the determinants of the adoption of an RPS and while a few studies have examined subsequent amendments to states’ policies, there are areas for improvement. This study contributes to our understanding of energy policy innovation in a handful of ways.

First, while most studies of the diffusion of the RPS measure adoption in dichotomous terms, others employ some measure of the design variations that exist across RPSs. These differences in design are important to account for because they provide some idea of how later adopters modified the policy. This study employed both a dichotomous measure of RPS adoption and a modified version of the RPS stringency score developed by Carley and Miller (2012). This dissertation's results suggest that accounting for differences in policy design allows a fuller understanding of the variables associated with different types of decisions.

Second, many states have modified their RPSs over time. Of the studies of the diffusion of the RPS reviewed in the literature review presented in Chapter Two, only three include later amendments, and all miss several amendments. This study captures a larger number of amendments and examines adoptions and amendments over a longer period (1994 to 2014) than has been done previously. Including a larger number of amendments, as well as differentiating by type of amendment, allowed an exploration of the relative importance and effect of different explanatory variables over time and across decision types.

Third, a potentially significant influence on policy innovation and change has been infrequently explored. Namely, the influence of past policy choices has widely been left out of consideration. This study expands on the findings of the studies that have incorporated consideration of a state's policy history by including several variables that capture the effects of other policies. The findings presented here confirm Berry and Berry's (2007, 2014) argument that it is important to incorporate and evaluate the influence of past policy decisions in any study of policy innovation.

Fourth, while many studies of the effectiveness of renewable energy policies incorporate the effects of such federal-level policies as the production tax credit (PTC), studies of the diffusion of the RPS rarely, if ever, incorporate an evaluation of the effects of federal policies. These studies also ignore the influence of federally owned public lands. The results of the quantitative analysis and the qualitative case studies demonstrate that while energy policy inertia at the federal level creates a space for action by the states, federal policies will influence states' policy choices.

Fifth, while most studies examining the diffusion of the RPS find little to no effect associated with regional diffusion, these studies tend to employ the neighboring states model. However, this model may not be the best method for testing for the effects of diffusion. This study used fixed-regions models and case studies. The quantitative results suggest some effect related to regional diffusion. However, as discussed in Chapter Six, these results must be interpreted with caution. The qualitative case studies provide a better analysis of diffusion and suggest that there is an effect, although whether states are learning from, competing with, or imitating other states varies by state and over time.

Lastly, this study sheds light on why key energy policies are adopted and modified over time, perhaps providing lessons learned for future studies of the adoption and modification of other types of energy policies. The use of case studies and event history analysis (EHA) in tandem with a unified model for explaining policy innovation and change can shed light on why our energy policy has evolved and is evolving in the particular manner that we observe today. In addition, as target dates for several RPSs across the U.S. have been met and as others approach, and as states continue to extend and expand existing RPS requirements, this study provides a foundation for understanding the states that will be more likely to do so.

The remainder of this chapter is organized as follows: I begin with a brief history of U.S. renewable energy policy as developed through federal and state action. The discussion then turns to the history of the RPS between 1983 and 2017. The chapter concludes with an outline of the remaining six chapters.

U.S. Renewable Energy Policy and the Role of States

The study of policy innovation is also a study of federalism, where states can serve as "policy laboratories, adopting novel policies to address their needs, abandoning unsuccessful attempts, and learning from the successes of similar states" (Volden 2006, p. 294). Federalism, which refers generally to the relationship between and the division of powers among national and sub-national units of government in a single system (Anton 1989; Landau 1973; Walker 2000), has played an important role in the development of modern U.S. renewable energy policy.[1] This section briefly outlines the history of this policy as developed through federal and state action.

Responsibility for regulating electricity has traditionally been shared by federal, state, and local governments. While local decision makers dominated early energy policy, this changed following the 1973 Organization of Petroleum Exporting Countries' (OPEC) oil embargo and the subsequent enactment of several federal laws that shifted power away from local governments (Davies 2010; Regens 1980). The result today is that authority resides primarily with the federal and state governments.[2]

U.S. energy policy has also evolved in a silo-ed, or source-specific, fashion with separate laws addressing different energy resources (Davies 2010). The most often heard critique of U.S. energy policy is the lack of comprehensiveness resulting in a patch-work of federal, state, and local approaches to regulating energy (Heiman and Solomon 2004; Lowry 2008; Osofsky and Wiseman 2013; Ostrander and Lowry 2009). While in its earlier stages, U.S. energy policy was

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[1] In general, renewable energy is defined as a source of energy that is either replenished within a relatively short-time, typically within the average human's life span, or that is not depleted with use – as fossil fuels are. An example of the former is biomass energy using wood chips or switchgrass, while an example of the latter is solar energy.

[2] Historically, states have been responsible for public utility regulation and siting electric generation facilities (Davies 2010; Rabe 2006; Regens 1980).

characterized by sharp distinctions between federal and state jurisdictions, changes in energy technologies and markets have meant that those lines have become increasingly blurred (Davies 2010).

In the U.S., support for increased renewable energy capacity emerges from concerns about climate change and the other environmental impacts associated with the use of fossil fuels, the need for increased energy security, and desires to capitalize on the economic benefits associated with the industry. Policy makers across the nation have used these issue frames to promote the adoption of policies supportive of renewable energy; and research has demonstrated that government support is key to increased market penetration of renewable resources (Rabe 2011; Schmalensee 2011; Sovacool 2008; see also: Carley and Browne 2012; Matisoff 2008; Yi 2010; Yi and Feiock 2014). While federal policies have typically focused on financial incentives, including tax incentives and grant programs to support the renewable energy industry, states have adopted a wider diversity of policies (Carley and Browne 2012; Doran 2005; Martinot, Wiser, and Hamrin 2005; Vachon and Menz 2006; Yi and Feiock 2012).

In the 1990's, many commentators "scoffed at the very possibility of 'bottom-up' American climate policy" (Rabe 2008, p. 107; see also: Doran 2005). Since that time, several factors have come together to ensure that state policy continues to play an important role in American climate and energy policy. First, changes in policy and the electric market itself have influenced a shift towards increased state oversight. Second, states have been early actors in developing policies that meet economic development goals while also reducing greenhouse gas emissions. Third, state policy makers are increasingly aware of state-specific threats from climate change. Lastly, some policy makers and policy entrepreneurs have sought to play a leadership role in an era where states drive policy (Rabe 2008 and 2011; see also: Carley 2009;

Doran 2005; Heiman and Solomon 2004; Osofsky and Wiseman 2013; Peterson and Rose 2006; Yi and Feiock 2012).

Modern renewable energy policy traces to the Public Utilities Regulatory Act of 1978 (PURPA), which, following legal challenges, was implemented in 1981. The Act created an early form of a feed-in tariff, which required that utilities purchase power from both small renewable energy producers and cogeneration units – generating units that "sequentially" produce electricity and another form of thermal energy like heat or steam (Heiman and Solomon 2004; Martinot, Wiser, and Hamrin 2005; the Federal Energy Regulatory Commission, hereafter FERC, 2017). The Act was a response to the oil embargo and has been characterized as part of a larger policy to move the U.S. towards greater energy self-sufficiency (Dincer, Payne, and Simkins 2014; Heiman and Solomon 2004; see also: Ostrander and Lowry 2009). By providing the certainty necessary to secure project financing, PURPA ensured that the renewable energy market would develop. Growth of the market, particularly the wind market, was also supported by federal and state tax credits and other financial incentives (Heiman and Solomon 2004; Martinot, Wiser, and Hamrin 2005).

Following a period of expansion, changes in policy and in the market created "a period of stagnation." As demand for power decreased in key markets, delayed nuclear facilities came into operation, natural gas prices declined, federal and state tax incentives were repealed, and federal funding for renewable energy research and development continued to decline, the development of new renewable energy projects stalled (Heiman and Solomon 2004; Martinot, Wiser, and Hamrin 2005, p. 4; see also: Ostrander and Lowry 2009). In addition to these changes, the advent of competitive wholesale and retail markets meant that the electric power market was also experiencing far-reaching institutional shifts at the state and federal levels. While many of these changes ultimately benefitted renewable energy, investments were delayed by the uncertainties created by market restructuring (Martinot, Wiser, and Hamrin 2005).

Subsequent to the period of stagnation and market restructuring, the renewable energy market entered a period of "resurgence" that was spurred by innovative state policies, some of which were enacted in tandem with market restructuring laws (Heiman and Solomon 2004; Martinot, Wiser, and Hamrin 2005, p. 5; Park 2015). The federal production tax credit (PTC) – a per-kilowatt-hour (kWh) credit for eligible renewable resources including wind and solar – played an important role (Martinot, Wiser, and Hamrin 2005; Congressional Research Service, hereafter CRS, 2017). Technological advancements and achievements in economies of scale also reduced the costs of renewable energy (Martinot, Wiser, and Hamrin 2005). During this era of market resurgence and policy innovation, feed-in tariffs ceased to be the preferred policy tool for promoting renewable energy. Rather, states turned to policies that would promote competition and reduce costs. These policies included RPSs, public benefit funds to support renewable energy, net metering, loan and grant programs, and tax incentives (Martinot, Wiser, and Hamrin 2005; Yi and Feiock 2012).

To date, the U.S. federal government has not enacted a national renewable energy policy. Inertia at this level of government creates a policy space for states to take the lead in developing renewable energy and energy efficiency-related programs and policies (Carley 2009; Carley and Browne 2012; Matisoff 2008; Rabe 2008; Yi 2010; Yi and Feiock 2012). State policy drives clean energy development (Matisoff 2008, p. 529). By the fall of 2014, every state in the nation had adopted at least one policy supportive of increased market penetration of renewable energy: 29 states had mandatory RPSs, and nine states had set voluntary renewable energy goals. Net metering policies had been adopted in 43 states and 41 states offered loan programs to support renewable energy deployment (DSIRE 2013, 2014a and b). Because of this leadership, understanding policy adoption by the states remains, and is likely to remain, important for understanding the direction of clean energy policy in the U.S. (see: Peterson and Rose 2006; Rabe 2008 and 2011).

The History of the Renewable Portfolio Standard

RPSs have proven to be one of the most popular tools for supporting renewable energy development in the U.S. (Carley and Browne 2012; Clean Energy States Alliance and Sustainable Energy Advantage, hereafter CESA and SEA, 2011; Doran 2005; Hoffer et al. 2016c; Martinot, Wiser, and Hamrin 2005; Yi 2010). Studies by the Lawrence Berkeley National Laboratory (LBNL) have shown that the renewable generation associated with RPSs has increased from around 40,000 gigawatt hours (GWh) in 2005 to 187,000 GWh in 2014. Total renewable generation is expected to increase 240 percent between 2014 and 2035. New renewable generation linked to RPSs has had several environmental and economic benefits including reductions in carbon dioxide, sulfur dioxide, and nitrogen oxides emissions. Between 2013 and 2014, new renewable capacity additions supported almost 200,000 jobs nationwide and contributed over $20 billion to the U.S. gross domestic product (Wiser et al. 2016; see: Hoffer et al. 2016c).

Generalizing and simplifying, RPSs typically mandate that at least a subset of a state's utilities or retail electric providers supply an increasing percentage of renewable energy to their customers within a set timeframe.[3] Typically, these policies require that utilities subject to the requirements demonstrate compliance by owning renewable energy credits (RECs), which represent one megawatt-hour (MWh) of electricity generated from a renewable resource. Most

[3] In some states, mandates set specific capacity targets; other states have voluntary renewable energy goals.

RPSs allow utilities to choose whether to invest in and build their own projects, which generate RECs, or purchase RECs from other projects (Carley 2009; Carley and Browne 2012; Dincer, Payne, and Simkins 2014). Some RPSs incorporate credit multipliers – for instance, one REC from a solar facility is counted as 1.5 RECs – and/or carve-outs – a mandate that a specific percentage of the RPS target be met using a specific technology, like solar (Carley and Browne 2012). The RPS has proven especially fruitful for wind developers, though these policies are becoming increasingly important for solar developers (Martinot, Wiser, and Hamrin 2005; see also: Doran 2005; Yi 2010; Yi and Feiock 2014).

Because RPSs have been designed to meet internal, “often idiosyncratic” policy goals and to capitalize on in-state resources and electric market characteristics, the attributes of these policies vary widely (Carley 2009; Carley and Browne 2012; Doran 2005; Heeter and Bird 2012; see also: Vachon and Menz 2006).[4] Design differences make these policies more or less effective for promoting the development of renewable energy resources (Carley 2009; Carley and Browne 2012; Martinot, Wiser, and Hamrin 2005; Yin and Powers 2010). Generalizing, states have adopted one of three policies: an RPS, a clean energy standard (CES), or a voluntary goal.

While RPSs typically require the development of renewable energy to meet a specific target by a certain date, CESs expand the definition of eligible resources to include energy efficiency, and in some instances, non-renewable resources. Voluntary goals are typically not enforceable, though states can provide incentives for meeting goals. Voluntary goals might specify that only renewable resources count towards the goal or, on the other end of the

[4] For a good summary of RPS design characteristics and differences across states, see Carley and Browne (2012).

spectrum, include existing coal-fired resources as eligible technologies, as was the case in West Virginia.[5] This study refers to the entire group of policies generically as 'RPSs.'

The first state to adopt an RPS, Iowa's Alternative Energy Production Law set a 105-megawatt (MW) target for the state's two investor-owned utilities (IOUs) in 1983. Eleven years later, Minnesota adopted the nation's second requirement – a 950 MW by 2002 wind and biomass target for Xcel Energy. This seems to have been a catalyst: Arizona's Corporation Commission adopted a one percent by 2003 goal for solar in 1996; in 1997, Massachusetts, Maine, and Nevada adopted what are considered traditional RPSs, and the course was set. Between 1997 and 2014, an additional 32 states would adopt an RPS, a CES, or a voluntary goal (see figure 1.1).

Between January 1, 1995 and the end of 2014, 206 bills and one ballot measure were enacted to amend existing RPSs in 32 of the 35 states included in the study.[6] Through use of an index (discussed in Chapter Three) that grouped multiple bills enacted in a state in the same month, this study examined 165 amendment events. Of the changes made to RPSs during this time period, many (64) were categorized as positive developments for the renewable energy market, and only 16 of the 31 negative amendments made substantial changes to policy. The bulk (70) of the remaining amendments to RPSs made small, but positive changes. The

[5] While West Virginia's policy was mandatory, the inclusion of coal and other non-renewable resources leads many to describe the policy as a voluntary renewable energy standard (see Chapter Five).

[6] This study excludes Iowa. Given the early date of adoption, the state is treated as an outlier. Data limitations for years before 1990 also precluded including Iowa. This study also excludes Arizona and New York. Both states' RPSs were adopted and amended in regulatory proceedings, which have a different political process and are likely influenced by variables not considered here. The three states that did not amend their RPS, Indiana, Oklahoma, and South Carolina, were late adopters, adopting in 2011, 2010, and 2014 respectively.

discussion that follows provides a brief overview of some of the major amendments made to RPSs since 1995.

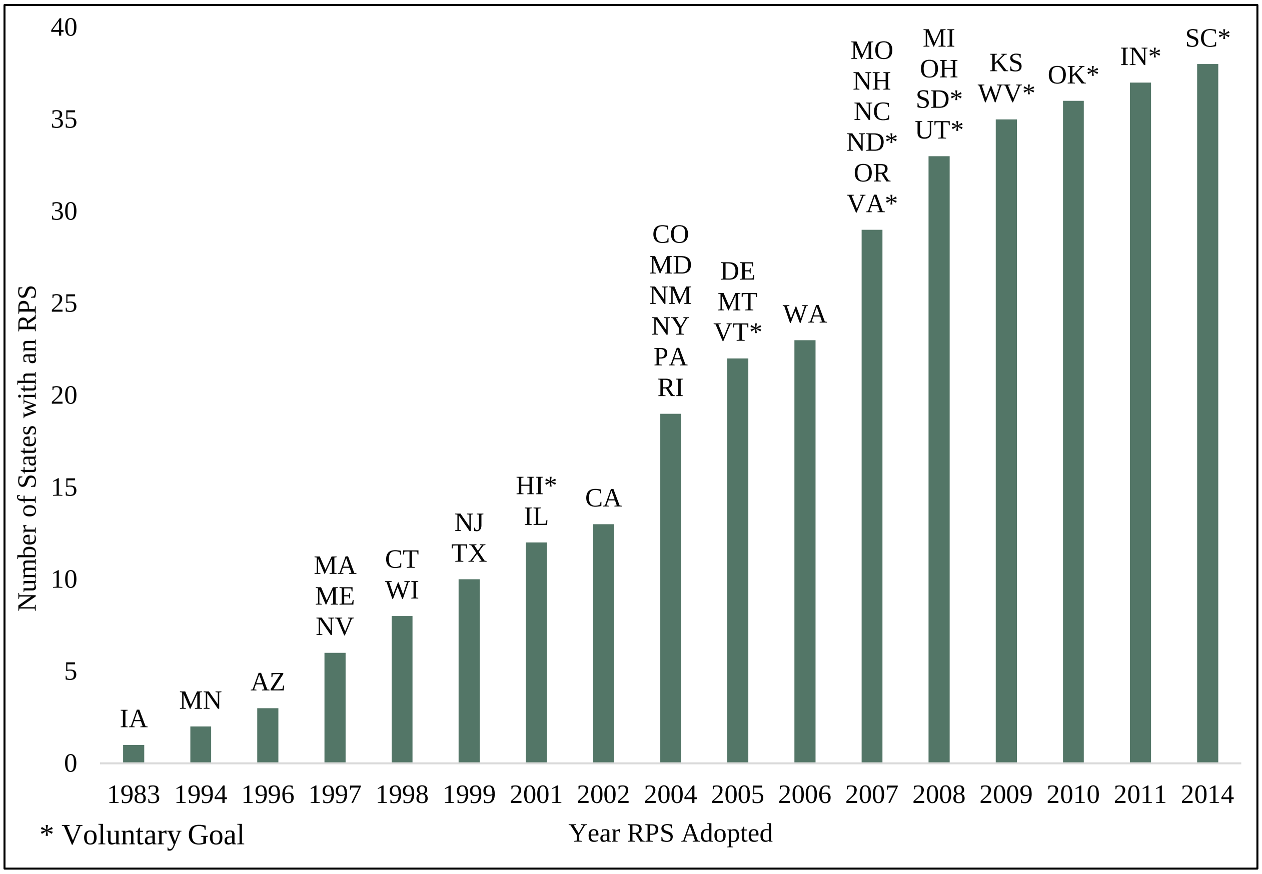

Figure 1.1. Initial RPS Adoption Dates

The first state to increase its RPS, Wisconsin's policy makers adopted a 2.2 percent by 2011 target in 1999, one year after adopting an initial 50 MW capacity target. In 2001, Minnesota set a new voluntary goal of 10 percent by 2015 for the state's utilities and Nevada's existing RPS was increased to 15 percent by 2013. In 2003, policy makers in Minnesota and Connecticut expanded the coverage of their RPSs. In Minnesota, the voluntary goal adopted in 2001 was made a requirement for Xcel Energy, while Connecticut's amendment, though it reduced the final renewable target, extended the RPS's requirements to default service providers in the state. In 2004, Hawaii's voluntary goal was modified to create a mandatory 20 percent by

2020 target. In 2005, Nevada's policy makers increased the state's RPS to 20 percent by 2015, and Texas' law makers increased the capacity target to 10,000 MW by 2025 and added a 500 MW non-wind goal.

In 2006, RPSs were increased in three states. California's legislature codified an accelerated target of 20 percent by 2010; Maine's policy makers created a 10 percent by 2017 goal for new renewable capacity (built after 2005); and Wisconsin's RPS was increased to 10 percent by 2015. An even busier year for RPS changes, policy makers in nine states increased requirements in 2007. Minnesota's legislature set a new 25 percent by 2025 requirement for all utilities except Xcel Energy, which was given a 30 percent by 2020 target. Maine's policy makers made the new renewable energy goal created in 2006 mandatory. In Connecticut, Class I requirements were increased from seven percent by 2010 to 20 percent by 2020. Illinois' voluntary goal, adopted in 2001, was increased to create a 25 percent by 2025 requirement. In Colorado and New Mexico, RPSs were expanded to cover additional utility types and the requirement for IOUs was increased to 20 percent by 2020. Montana's policy makers also extended the state's requirement to additional utility types. In Maryland a two percent solar carve-out was added and Delaware's legislature also added a solar carve-out and increased the final RPS target to 20 percent by 2019.

While a new 3,000 MW wind energy goal was added to Maine's RPS in 2008, the legislature in Massachusetts removed the sunset language from the RPS statute to require that utilities add one percent renewable energy to their portfolio each year in perpetuity, and Maryland's RPS was increased to 20 percent by 2022. In Vermont, policy makers increased the state's existing goal to 25 percent by 2025, and voters in Missouri approved Proposition C to change the state's voluntary goal, adopted the year before, to a 15 percent by 2021 requirement.

In 2009, Nevada's policy makers increased the state's RPS once again, this time adopting a 25 percent by 2025 target. Hawaii's target was increased a second time, when legislation creating a 40 percent by 2030 RPS was enacted. The same year, Virginia's existing goal was increased to a voluntary target of 15 percent by 2025. In 2010, Maine's law makers continued to enact changes, this time increasing the state's existing wind energy goal to 8,000 MW by 2030. In Colorado, the state's RPS was increased to 30 percent by 2020, Maryland's solar target dates were accelerated, and Delaware's legislature increased the RPS to 25 percent by 2025. In Ohio and Utah, coal mine methane was added as an eligible resource.

In a special session in 2011, California's policy makers adopted an increased RPS of 33 percent by 2020 and extended RPS requirements to publicly-owned utilities. While 2012 was a relatively quiet year in terms of major changes to RPSs, at the end of the year the American Legislative Exchange Council (ALEC) released model legislation to repeal RPSs. This created a stir, with several news stories published on attempts to rollback or repeal existing RPSs. However, by the end of 2013, while a handful of states had increased requirements, none had reduced them (see: The Center for the New Energy Economy, hereafter CNEE, 2013). Also a relatively quiet year for RPSs, in 2014, Ohio's policy makers froze the state's interim target at 2.5 percent for 2014 – 2016.

States have continued to amend their RPSs and significant developments since 2014 warrant some discussion. In 2015, while West Virginia's policy was repealed (see Chapter Five), Vermont's voluntary goal was replaced with a 75 percent by 2032 requirement. Also in 2015, California's Senate Bill 350 set a 50 percent by 2030 requirement and Hawaii adopted a 100 percent renewable energy target for 2045 (Hoffer et al. 2016a). In 2016, New York's Public Service Commission issued an order setting a 50 percent by 2030 CES that includes nuclear resources. Oregon's requirements for large IOUs were increased to 50 percent by 2040 (see Chapter Four), Rhode Island's legislators increased the state's requirement to 38.5 percent by 2035, and the District of Columbia passed a 50 percent by 2032 increase to its target.[7] In Ohio, though legislators voted to continue the freeze on the state's interim targets, Governor John Kasich vetoed the bill (Hoffer et al. 2016b). In 2017, Maryland's policy makers increased its RPS to 25 percent by 2020 and the Massachusetts legislature created new requirements for the procurement of offshore wind and solar (Barbose 2017).

As target dates for several RPSs across the U.S. have been met and as others approach, and as states continue to extend and expand existing RPS requirements, the study of the RPS is likely to continue to be an important endeavor, especially as we seek to understand why some states adopt increases to existing policies while others do not. This study provides a path forward for understanding why key energy policies are adopted and modified overtime. Specifically, the use of case studies and event history analysis (EHA) in tandem with a unified model for explaining policy innovation and change sheds light on why our energy policy has evolved and is evolving in the particular manner that we observe today.

Organization of the Dissertation

The remainder of this dissertation proceeds as follows: Chapter Two provides a review of the existing literature on state policy innovation. The chapter first discusses the three major explanations for policy innovation: internal determinants, external determinants, and unified models. Following this review of the literature in general, the discussion turns to studies examining environmental and energy policy innovation. The chapter then provides a review of

[7] The District of Columbia is not included in this paper as the political process there is different from that of the states.

existing research on the diffusion of the RPS. I conclude by outlining the study's contributions to the literature.

Chapter Three outlines the research methods used in this dissertation. It begins by introducing the study as a mixed methods approach which is suggested by the current state of the policy innovation literature. I then provide the study's research questions and a description of the model of policy innovation and change employed by my study. Readers are also provided a brief overview of event history analysis. The discussion then turns to a description of the study's unit of analysis and time-frame. Following this, I describe the study's dependent and independent variables. Throughout, data collection is also discussed. Grouped by major variable type, the study's hypotheses are provided. This is followed by a discussion of case study selection and methods. The chapter concludes with a brief summary and an introduction to the case studies and quantitative analysis.

Chapter Four provides the qualitative case study of the original enactment of and subsequent amendments to the Oregon Renewable Energy Act (OREA). The chapter first provides socio-economic and policy background for the state. Following this, the discussion turns to the initial adoption of OREA and potential explanations for this policy innovation. The chapter then analyzes the several changes made to this policy in the years following its original enactment. This discussion is followed by an examination of the major increase to the state's RPS adopted in 2016. A summary of the major conclusions of the case study rounds out this chapter.

The qualitative case study of West Virginia's Alternative and Renewable Energy Portfolio Act (AREPA) is found in Chapter Five. The chapter proceeds in the same manner as the previous chapter, where the study begins with the socio-economic and policy background for

West Virginia. Following this, I discuss the initial adoption of AREPA and potential explanations for this policy innovation. The discussion then turns to look at the minor changes made to this policy in the years following its original enactment. The chapter also examines AREPA's repeal in 2015. The chapter concludes with a summary of major findings.

Chapter Six details the quantitative analysis of the initial adoption of and subsequent amendments to RPSs between June 1, 1994 and December 31, 2014. The chapter begins with a discussion of model construction. Next, the model of RPS adoptions, using a dichotomous measure, is presented and results are described. The three sections following this present the results of the models of RPS adoption by type; exploring, in turn, the adoption of voluntary goals, weak RPSs, and strong RPSs. The discussion then turns to models of decisions to amend an RPS, presenting the models of decisions to negatively amend an RPS, adopt minor positive amendments to an RPS, and enact a positive change to an RPS, also in turn. The chapter concludes with a summary of results and directions for future research.

Chapter Seven concludes the dissertation. First, I provide an overarching summary of the results of the two case studies and the event history models presented in Chapter Six. The discussion then moves to this study's contributions to the literature on environmental and energy policy innovation. The next section outlines directions for future research. I conclude with a brief summary of the chapter.

CHAPTER TWO: LITERATURE REVIEW – THE ADOPTION OF U.S. STATE POLICY INNOVATIONS

Often attributed with spurring political scientists' interest in the subject, Walker (1969, p. 881), not only used existing research to provide a definition of policy innovation – the adoption of "a program or policy which is new to the states adopting it, no matter how old the program may be or how many other states have adopted it" – but also to outline the two approaches to studying innovation that would come to dominate the field for the next twenty years: internal determinants and diffusion (Berry and Berry 1990, 2007). While internal determinants models hold that the internal characteristics of states are the most important factors explaining the adoption of an innovation, models of policy diffusion posit that the policy choices of other states or units of government are most important for explaining the adoption of a given innovation. While most scholars acknowledged the unlikelihood that policy innovation could be explained entirely by either type of model, early studies typically employed single explanation methodologies that emphasized one process over another. This tendency changed in the 1990s, following the publication of Berry and Berry's (1990) unified model.

In its essence, the policy innovation and diffusion literature is a study of policy change: Understanding policymaking and policy change requires that we are able to explain both incremental changes to existing policies and non-incremental adoptions of policy innovations (Berry and Berry 2014; Shipan and Volden 2012). Because the variation between U.S. states provides an ideal setting for studying different political, social, and economic influences on policy change, policy innovation by U.S. states has likely been most often studied, and since the publication of Walker's (1969) article, more than 200 articles studying policy innovation by states have been published (Boehmke and Pacheco 2016; Berry and Berry 1990, 2007; Daley and Garand 2005; Gilardi 2016; Karch 2007b; Shipan and Volden 2012).

The sections that follow discuss three explanations for policy innovation: internal determinants, diffusion, and unified models. Following this review of the literature in general, I discuss the studies examining environmental and energy policy innovation. The discussion then turns to studies of the diffusion[8] of the Renewable Portfolio Standard (RPS) across the U.S. states. I also discuss recent criticisms of and future directions for the literature in broad terms and in terms of studies of RPS adoptions. I conclude with an outline of the contributions that this study makes.

Internal Determinants

The basic assumption underlying internal determinants models is that policy innovation occurs as a function of a state's political, economic, and social characteristics (Berry and Berry 1990, 2007, 2014; Matisoff 2008; Walker 1969; Wiener and Koontz 2012). In their pure form, these models tend to preclude the influence of other states, resting on the notion that once a state is aware of potential solutions to a problem that it faces, internal characteristics are most important for determining if and when a state will adopt a given policy or program (Berry and Berry 2007). State attributes affecting policy adoption have been found to vary by issue type, requiring that research incorporates those characteristics likely to be important to the specific issue area under study (Berry and Berry 2007, 2014; Wiener and Koontz 2012; see also: Shipan and Volden 2012).

[8] While "diffusion" refers, simply, to the spread of a policy across states or other units of government, the term is also used as short-hand for explanations that posit that inter-governmental interactions drive the adoption of policy innovations.

Because the adoption of an innovation is likely to be associated with the need to fund a new state activity, state fiscal health is typically an important variable influencing the probability of innovation.[9] Similarly, others have hypothesized that state economic capacity to fund or adapt to new public policies and programs will be related to the probability of innovation. State economic capacity has been measured in a number of ways including per capita income, gross domestic product, and level of urbanization. It may also be the case that a state's population's size, distribution (rural versus urban), and socioeconomic attributes relate to the level of public demand for an innovation (Bacot and Dawes 1997; Berry and Berry 2007; Gray 1973; Karch et al. 2013; Matisoff 2008; Walker 1969; Wiener and Koontz 2012). The political characteristics of a state's population and institutions have also been identified as having significant effects on the probability of adopting a policy innovation.

Scholars have also examined the role played policy entrepreneurs, interest groups, and advocacy coalitions – "coordinated groups of governmental officials, activists, journalists, researchers, and policy analysts" – finding that such actors have an important influence on policy adoption (Bacot and Dawes 1997; Berry and Berry 2007, p. 237; Boushey 2010; Karch, 2007a; Lyon and Yin 2010; Matisoff 2008; Potoski and Woods 2002; Shipan and Volden 2012; Wiener and Koontz 2012; Yi and Feiock 2012). In other studies, researchers have examined the importance of policy windows, or political opportunities, when a number of factors converge to create the conditions supportive of innovation (Berry and Berry 1992, 2007; Boushey 2010; Kingdon 2011).

[9] But, researchers should use caution in crafting hypotheses here. Berry and Berry (2007, footnote 21) remind us that some programs and policies are designed to address problems associated with poor fiscal health. This suggests the importance of understanding and taking account of policy goals when crafting hypotheses.

A major criticism of internal determinants models is that a state's internal characteristics are unlikely to be the only drivers of policy innovation. Simply, there may be external influences on a state's decision to innovate, and the development of a fuller explanation requires that we seek to understand these influences. Models of policy diffusion provide an avenue for exploring these other explanations.

Policy Diffusion

Policy diffusion models also aim to explain why innovations are or are not adopted by units of government, in the present case, U.S. states. Underlying these models is the idea that the probability of policy innovation in one state will be influenced by the choices made by policy makers in other states. These explanations posit that states exist in a social system where communication and emulation between members create patterns of innovation (Berry and Berry 2007, 2014; Gilardi 2016; Graham, Shipan, and Volden 2013; Karch 2007b; Matisoff, 2008; Mooney 2001; Shipan and Volden 2012; Wiener and Koontz, 2012). While it is often assumed that diffusion effects will be positive, this is not necessarily the case – policy decisions by other states might also have a negative impact, influencing a state to forgo adoption (Daley and Garand 2005; Mooney 2001).

Diffusion has been hypothesized to result through at least one of the following mechanisms: learning, competition, coercion, or imitation.[10] The relative importance of these mechanisms has been found to vary across issue areas, stage of the policy process, and point in

[10] One is hard pressed to find precise agreement here. For instance, while Berry and Berry (2007) outline three mechanisms: learning, competition, and coercive or normative pressures to conform, Berry and Berry (2014) list five: learning, imitation, normative pressure, competition, and coercion. Karch (2007b) and Gilardi (2016) find agreement on learning, imitation, and competition. And, Graham, Shipan, and Volden (2013) argue for simplifying the 104 "metaphors and modifiers" they find to learning, competition, coercion, and socialization. In some cases, the distinguishing features of these mechanisms are difficult to disentangle. There seems to be the widest agreement on learning, competition, coercion, and imitation.

time of the diffusion process (Berry and Berry 2007, 2014; Boehmke and Witmer 2004; Carley, Nicholson-Crotty, and Miller 2017; Graham, Shipan, and Volden 2013; Karch 2007a, 2007b; Shipan and Volden 2008; Shipan and Volden 2012; Whitaker et al. 2012). I discuss each mechanism below.

While some theories assume perfectly rational decision-making, other approaches to diffusion through learning suggest that state policy makers use a 'satisficing' approach to problem solving. In this understanding, obtaining information involves certain costs that create constraints on the ability of decision makers to gather and analyze information. In order to overcome these constraints, officials will look to neighboring states, states with similar internal characteristics, and/or states that serve as leaders for policy ideas (Berry and Berry 1990, 2007, 2014; Boehmke and Witmer 2004; Butler et al. 2017; Desmarais, Harden, and Boehmke 2015; Graham, Shipan, and Volden 2013; Gray, 1973; Karch 2007b; Matisoff 2008; Mooney 2001; Nicholson-Crotty and Carley 2016; Shipan and Volden 2012; Van der Heiden and Strebel 2012; Walker 1969; Wiener and Koontz 2012). Not all states or policy makers are created equal, and so the constraints officials face in different jurisdictions vary. Important resources such as length of legislative session, staff size, and access to information and financial resources can contribute to a greater capacity for information gathering and learning (Berry and Berry 2014).

Besides simplifying the information gathering, alternative crafting, and adoption processes, the use of information from and the emulation of other states' policies may also help to overcome the inertia likely to confront those who would introduce a policy innovation. The ability to point to a similar, and successful, policy in another state might make it easier to overcome the uncertainty and fear of unanticipated consequences that can arise when a new policy is proposed (see: Berry and Berry 1990; Butler et al. 2017; Gilardi 2016; Karch 2007b; Maggetti and Gilardi 2016; Nicholson-Crotty and Carley 2016; Walker 1969).

Because goals vary across decision makers, our understanding of learning is not limited to the notion that officials are searching for a solution that will effectively solve a given problem. Other goals might take higher priority at different times and in different circumstances. For instance, policy makers might also be looking to other states for lessons about how to successfully contain program costs, enact unpopular reforms with as little political backlash as possible, or ensure winning reelection or higher office (Berry and Berry 2007, 2014; Carley, Nicholson-Crotty, and Miller 2017; Gilardi 2016; Karch 2007b; Maggetti and Gilardi 2016; Shipan and Volden 2008, 2012).

Diffusion between states through learning processes might also occur through policy networks, where existing networks facilitate the flow of information and ideas and support the development of shared norms and best practices (Berry and Berry 2007; Boehmke and Witmer 2004; Karch 2007b; Matisoff 2008; Shipan and Volden 2012; Walker 1969; Wiener and Koontz 2012). Walker (1969, p. 895) argues that regional and national organizations ensure the flow of information and ideas by two means: First, by hosting conferences and through organizational publications, these associations "facilitate the exchange of ideas and knowledge" (see also: Matisoff 2008). Second, because these organizations serve as "occupational contact networks", they facilitate the movement of personnel who bring ideas with them when they enter new positions.

An important early step in the exploration of diffusion through learning, Gray's (1973) national interaction model explains learning by way of national communications networks of state officials where policy makers from previously adopting states are free to interact with decision makers from non-adopting states. Because interaction with officials from adopting states contributes to learning, the probability of innovation is positively associated with the number of interactions a non-adopting state's officials have with officials from previously adopting states. As the number of states adopting a program increases, so too does the potential for interaction between policy makers. There are, however, limitations associated with this approach. Most predominantly, the model assumes that all potential adopters are equally likely to innovate. However, given important internal differences between states, and given that state officials are unlikely to interact randomly, this approach may ignore important considerations, including geographic proximity and non-random interaction through networks (Berry and Berry 2007, 2014; see also: Karch 2007b). Recent revisions to this model attempt to address this criticism (Berry and Berry 2014).

Policy diffusion can also occur as a result of competition between states. Here, the primary form of competition involves economic competition, where states seek to attract and retain businesses, residents, jobs, and revenues (Baybeck, Berry, and Siegel 2011; Berry and Berry 2007; Boehmke and Witmer 2004; Karch 2007b; Maggetti and Gilardi 2016; Shipan and Volden 2012; Wiener and Koontz 2012). There are two primary types of competition: location-choice competition and spillover-induced competition (Berry and Berry 2014). Location-choice competition emerges when goods or resources are available in more than one jurisdiction. Policy adoptions made in these cases result from a motivation to influence where individual people or firms choose to locate. "With this type of diffusion, jurisdiction *A* adopts a policy…to encourage individuals (1) to acquire within *A* a good that is beneficial for *A* to provide, or (2) to go elsewhere to obtain a good that is costly for *A* to provide." Spillover-induced competition emerges as a result of the positive or negative externalities associated with a government's decision to adopt a policy or program. In these cases, a decision made by jurisdiction *B* has either a positive or negative effect on jurisdiction *A*, with that effect influencing jurisdiction *A*'s decision to adopt or forgo adopting the same policy (Berry and Berry 2014, p. 312 - 313).

Competition can also be strategic, where defensive policies – those that seek to avoid a loss of revenue or an increase in costs – and offensive policies – policies aimed at increasing revenues and decreasing costs – are adopted in anticipation of other states' policy choices and those states' reactions to the adopting state's policy decision (Baybeck, Berry, and Siegel 2011; Gilardi 2016; Shipan and Volden 2012; see also: Berry and Berry 2014). There has been some concern raised that competition between states can lead to a 'race to the bottom' where states undercut social programs to avoid becoming welfare magnets, or where environmental protections are undercut in order to retain or attract businesses. However, research has also found a 'race to the top' where public programs are adopted and expanded in order to enhance local quality of life, create new economic opportunities, or protect the environment (Berry and Berry 2007; Gilardi 2016; Karch 2007b; Rabe 2006; Shipan and Volden 2012).

Coercive pressures to adopt an innovation can also drive diffusion, where the use of force, threats, incentives, or other pressure is used to influence decision-making. In the U.S., the use of restrictions on grants-in-aid and other federal mandates serve as examples as coercive pressures on states (Berry and Berry 2007, 2014; Shipan and Volden 2012). State preemption is another form of coercion, where states can pass preemptive policies that block certain actions by local units of government (Shipan and Volden 2008). Less frequently studied, coercive pressure can also be exerted horizontally when larger and economically powerful states put pressure on trading partners (Jordan and Huitema 2014).

Imitation occurs when one state adopts a policy innovation in an attempt to look like another state. Imitation of another state's policy is not the result of observing policy effectiveness or political consequences. In some cases, imitation results from changing perceptions. The adoption of an innovation by states perceived as leaders or by a large number of states might make the program or policy appear to be a "legitimate state responsibility, something which all states ought to have." Such a circumstance might also create public demand for a policy innovation. States might also imitate others with which they share certain characteristics (Berry and Berry 1990, 2014; Gilardi 2016; Karch 2007b; Maggetti and Gilardi 2016; Shipan and Volden 2008; Van der Heiden and Strebel 2012; Walker 1969, p. 890). Cases of imitation can result in the adoption of policies not as suitable for the imitating state as they are for earlier adopters (Berry and Berry 2007; Shipan and Volden 2012).

The classic approach to studying policy diffusion emphasizes regional diffusion, where the actions of nearby states are presumed to be more influential than those of geographically removed states (Berry and Berry 1990, 2007; Karch 2007b; Shipan and Volden 2012; Wiener and Koontz 2012). Most models in this class assume that as the number of nearby states that have adopted a given policy increases, so will the probability of innovation in a non-adopting state (Berry and Berry 1990, 2007; Karch 2007b). However, a regional effect can also be negative. For instance, when a policy is perceived as having a detrimental impact on a state, or on the political success of a state's leaders, policy makers in neighboring states will be unlikely to emulate that policy choice (Mooney 2001). In other cases, positive spillovers create an incentive to free-ride, where a policy adoption in one state reduces a neighboring state's need to adopt the same policy (Berry and Berry 2014).

There are good reasons to imagine that states are more likely to learn from, compete with, and be otherwise influenced by their neighbors than by more far-flung states. Because neighboring states are likely to share similar social, economic, and political conditions, it may be easier for political leaders to relate their circumstances to those found in adopting neighbors. This may also create a greater degree of certainty regarding policy outcomes as leaders in a state considering an innovation may be more willing to assume that a given policy choice will result in similar outcomes in their state if a state with shared circumstances has previously confronted and succeeded in addressing the problem in question (Berry and Berry 2007; Karch 2007b; Mooney 2001; Nicholson-Crotty and Carley 2016). In terms of the communication of information, neighboring states are more likely to share overlapping media markets, and geographic proximity might facilitate the development of policy networks (Karch 2007b; Mooney 2001). When considering interstate competition, regional models seem especially pertinent. Limitations on the mobility of both individuals and firms makes it more likely that neighboring states will compete to attract and retain skilled workforces and businesses (Berry and Berry 2007).

A criticism of the regional diffusion approach is that the world has changed. Drawing upon Gray's (1973) assertion that officials are free to and will interact with officials from around the nation, critics argue that the regional approach is overly limiting given the advancements in communication and transportation that make our world increasingly small. In addition, "closeness", in terms of shared characteristics or interests, might also emerge between geographically removed states through trade and cultural interactions, shared partisan or ideological positions, or shared policy implementation environments. Critics also argue for the importance of considering national influences where national media, professional networks and meetings, and policy decisions might also be important influences on the diffusion of an innovation (Gray 1973; Karch 2007b; Nicholson-Crotty and Carley 2016; see also: Butler et al. 2017). Today, it is much easier for policy makers to look beyond neighbors and region to find the most effective and relevant policy experiments (Karch 2007b; Nicholson-Crotty and Carley 2016; Shipan and Volden 2012).

Another important criticism of regional approaches is that finding a geographically clustered pattern of diffusion is too often conflated with finding evidence of learning, imitation, competition, or coercion. It is important for students of diffusion to recognize that a geographic pattern may be a result of similar states confronting similar problems, and rather than finding the influence of other states' policy choices, patterns of policy innovation can be better explained by a state's internal characteristics and by problem and policy attributes (Shipan and Volden 2012; see also: Gilardi 2016). Related to this, scholars finding that proximity has a significant effect on diffusion also tend to fail to distinguish among the potential mechanisms of diffusion that are producing a geographic pattern of policy adoption (Baybeck, Berry, and Siegel 2011; Boehmke and Witmer 2004; Gilardi 2016; Karch 2007b; Karch et al. 2013; Maggetti and Gilardi 2016; Shipan and Volden 2008).

Vertical diffusion models have also been employed in studies of policy innovation. In these models, national action can influence action at sub-national levels, or diffusion can follow a bottom-up path. The process of diffusion may arise through such mechanisms as learning or imitation, where the national government takes on a role as leader or follower, or the process may result from different forms of coercion where the use of mandates, penalties, or incentives spurs innovation across the states (Berry and Berry 2007).

Models that are flexible in approaching the diffusion question in terms of regional or national influence include isomorphism models and leader-laggard models. Isomorphism models hold that states are most likely to emulate those states that are most similar to them. Here, the argument is that it is important to examine the potential for cue taking among similar states, even when they are geographically removed (Berry and Berry 2007; Karch 2007b). Which states serve as models for others is likely to vary by issue area (Karch 2007b).

Leader-laggard models start with the assumption that for some issue areas, certain states are leaders, or can draw upon the expertise of their state officials, and other states will emulate those leaders. While most approaches in this vein examine regional leadership, this approach can be modified to examine leader states that are likely to influence innovation across the 50 U.S. states. In general, these approaches tend to emphasize imitation, though learning and competition have also been hypothesized to play a role. However, there are known problems with these models, including the failure, often, though not always found, to identify, *a priori*, the states or types of states expected to be leaders and the expected order of innovation following adoption by a leader or set of leaders (Berry and Berry 2007; Shipan and Volden 2008).

Unified Models

Early research identified two primary explanations for the adoption of policy innovations: internal determinants and diffusion (Berry and Berry 1990, 2007, 2014; Wiener and Koontz 2012). Arguing that research since 1975 had failed to provide any “major advances in our conceptualization of state innovation or our empirical approach to its investigation” Berry and Berry (1990, p. 395 – 396) suggested that a model that unified the two approaches would assist the field in overcoming conceptual weaknesses. Primarily, such a model would guard against spurious findings of external influences when in fact internal determinants were the driving forces behind policy innovation (Berry and Berry 1990).

Berry and Berry (1990, p. 397) begin with the question: “For any state, what determines the probability that the adoption event will occur during the time period?” and provide a unified model of innovation that allows the simultaneous evaluation of the effects of external influences, internal state characteristics, and previous policy decisions on the decision to adopt a new policy. By introducing both the use of event history analysis (EHA) and a unified model for explaining the adoption of policy innovations, Berry and Berry’s (1990) pioneering work provided a path forward for the simultaneous testing of both types of explanations.

Berry and Berry’s (1990) unified model relies on Mohr’s (1969) analysis of organizational innovation which developed the theory that the propensity to innovate is a function of “the motivation to innovate, the strength of obstacles against innovation, and the availability of resources for overcoming such obstacles” (Berry and Berry 1990, p. 396). More specifically, Mohr (1969) claimed that the probability of innovation would be inversely related to the strength of the obstacles to innovation, and directly related to the motivation to innovate and the availability of resources for overcoming obstacles to innovation. Because the motivation to innovate interacts with the strength of obstacles and resource availability, in some cases we might find that high levels of motivation amount to naught in the face of large obstacles and scant resources. In other instances, low levels of motivation, even with all of the necessary resources and small obstacles to change, are likely to lead to a failure to adopt an innovation (Berry and Berry 1990, 2007).

Outlining their model, Berry and Berry (1990) argued that elements from the internal determinants and diffusion models could be re-conceptualized in terms of the motivation to innovate, obstacles to innovation, and resources for overcoming obstacles. Providing quick examples related to internal determinants models, problem severity could influence the motivation to innovate, poor fiscal health would be a likely obstacle to innovation, and public demand could be a resource for overcoming obstacles. In terms of diffusion, because the consequences of adopting a new policy or program can be difficult to predict, motivated officials might set out to gather information about policy effects from the experience of a similar adopting state where that experience provides a resource (information) for overcoming an obstacle (uncertainty) (Berry and Berry 1990; Matisoff 2008).

This "suggests that the strength of regional influences on a state's probability of innovation should vary depending on the internal environment in a state. [And if this is the case], both pure internal determinants and regional diffusion models would not only be incomplete explanations of state innovation, but the failure to incorporate either of these sources of influence (internal or regional) in a theory of state innovation may actually prevent the discovery of empirical support for the other" (Berry and Berry 1990, p. 400).

In later refinements of their unified model, Berry and Berry (2007, 2014) incorporate the effects of past policy choices by adding an 'other polices' variable which draws from earlier work by Mahajan and Peterson (1985). In a study of the broad literature on the diffusion of innovations, Mahajan and Peterson (1985) outline policy relationships where policies can be understood as independent of, complementary to, contingent on, or substitutes for one another. Berry and Berry (2007, 2014) modify this earlier conceptualization for studies of policy innovation as follows: An independent relationship between policies means that the probability that a state will adopt policy B is not necessarily affected by whether the state already has policy A. In these cases, policy A may not need to be included in a model explaining the adoption of policy B. For complementary policies, the previous adoption of policy A increases the probability that a state will adopt policy B. But, a positive relationship between two policies can exist without the policies being complementary, where the adoption of both policies is influenced by a common set of causal forces, requiring that relationships between policies are well understood. Contingent policies have a tighter relationship where the probability that a state will adopt policy B is zero until the state adopts policy A. Substitute policies may be either exact or partial substitutes for one another. When policies are exact substitutes, the adoption of policy A precludes the adoption of policy B. In the more likely case that policies are partial substitutes for one another, the existence of policy A does not preclude the adoption of policy B, but the existence of the former may reduce the probability of the adoption of the latter (Berry and Berry 2007, 2014; see also: Boehmke 2009).

While Berry and Berry's work spurred a lot of research using EHA and the unified model, the other policies aspect of their model has been widely, though not entirely, ignored in the literature (Berry and Berry 2007, 2014). By incorporating a variable to account for other policies, recent studies have begun addressing the effects related to previous policy adoptions (Berry and Berry 2014). The flexibility offered by the unified model has allowed researchers to modify and refine the model in other ways over time (Berry and Berry 2014). What follows discusses some of these recent modifications.

As originally conceived, the Berry and Berry (1990) model assumed that the probability that a state would adopt an innovation remained constant overtime. However, political realities suggest that this is not likely to be the case. For instance, policy proponents may be voted out of office, public attention may shift to a new problem, and coalitions supporting the adoption of a policy innovation may disband as time wears on without success. Of course, the reverse may also be true, where the probability of adoption increases as political circumstances change. Newer applications of the unified model, using EHA, incorporate the element of time to allow the probability of innovation to vary as political circumstances change (Berry and Berry 2014).

Typically, analyses using the Berry and Berry (1990) model employ an EHA with an observed dependent variable that measures whether or not a state adopts a policy innovation in a given year. If the state does, it is removed from the risk set, meaning that policy adoptions are measured in terms of a single event (Berry and Berry 2014). However, policy adoptions may be repeatable events, and policies can be modified after an initial adoption (see: Berry and Berry 1992; Boehmke and Witmer 2004; Carley, Nicholson-Crotty, and Miller 2017; Karch and Cravens 2014). This instance can be addressed by modifying the original model to employ a dependent variable that measures the probability of adoption in any year, allowing states to be included in the risk set across the study time-frame (Berry and Berry 2014).

Recent research has also begun to explore the effects of policy characteristics on diffusion (Berry and Berry 2014; Jordan and Huitema 2014). Some studies employ general characteristics like relative advantages, complexity, triability (how easy it is for a state to try a policy without a long-term commitment to that policy), and observability of policy effects to explain the rate and scope of diffusion (Berry and Berry 2014; Jordan and Huitema 2014; Maggetti and Gilardi 2016). Other studies have examined policies in terms of policy components. In these, policies are conceptualized in terms of their parts, where there may be several pieces to a single policy. States are likely to vary in terms of the number of policy components adopted. Additionally, the adoption of policy components can occur over time, with states choosing to adopt all components in a single year or across a period of time. In these instances, researchers may choose to modify the unified model's binary dependent variable, or researchers may choose to substitute EHA with an event count model (Berry and Berry 2014;

Boehmke 2009). These studies aim to address the criticism that research has placed too much emphasis on the characteristics of adopters and not enough emphasis on the characteristics of the policy that is being diffused (Jordan and Huitema 2014; Karch 2007b).

In the last decade or so, students of policy innovation have begun to pay increasing attention to specifying and testing for the mechanisms (learning, competition, coercion, and imitation) underlying a policy's diffusion (Baybeck, Berry, and Siegel 2011; Berry and Berry 2014; Maggetti and Gilardi 2016). Addressing this oversight in the literature may be one of the more important endeavors students of policy innovation are undertaking (Berry and Berry 2014; Gilardi 2016). Recent studies have focused on testing learning and economic competition-based explanations for policy diffusion (Baybeck, Berry, and Siegel 2011; Berry and Baybeck 2005; Boehmke and Witmer 2004; Shipan and Volden 2008).

Other refinements have addressed the tendency to measure diffusion as the number of contiguous states that have previously adopted the policy. As discussed above, the use of regional diffusion as a proxy for learning, competition, and other mechanisms faces significant shortfalls. These have been addressed by the use of different proxies for external determinants that incorporate such things as regional influence, networking opportunities, ideology, vertical diffusion, and national interactions (Berry and Berry 2014; Gilardi 2016; Maggetti and Gilardi 2016).

State Environmental and Energy Policy Innovation

Several studies have examined the diffusion of environmental and energy policies. In the sections that follow, I provide an overview of this literature, closing with the studies exploring the diffusion of the RPS. Research examining the adoption of state environmental and energy policies has covered the adoption of groundwater policies (Blomquist 1991), air quality requirements (Potoski and Woods 2002; Ringquist 1993), hazardous waste laws (Daley and Garand 2005), net metering (Stoutenborough and Beverlin 2008), and other state clean energy policies (Regens 1980; Young and Sarzynski 2009).

It seems that studies of environmental and energy policy adoptions by states have tended to ignore, or make only passing reference to, the broader literature on the adoption of policy innovations by states. While this is not always the case, many studies in this class draw on earlier theories that debated the relative influence of different internal characteristics of states. Studies also tend to ignore horizontal influences, while a handful incorporate the influence of federal policy activity.

The political characteristics of a state's population and institutions have been identified as having a significant impact on the adoption of environmentally beneficial policies. Here, liberalism and 'Democratic presence' in a state are positively associated with the adoption of environmental policies, though this became more pronounced in the last three decades (see: Bacot and Dawes 1997; Hess, Mai, and Brown 2016; Karch et al. 2013; Lyon and Yin 2010; Matisoff 2008; Wiener and Koontz 2012; Young and Sarzynski 2009).

The capacity of political institutions is also an important factor affecting policy innovation across a diversity of issue areas. Legislative professionalism and bureaucratic capacity – as measured by compensation, staff resources, and length of legislative session (for legislative professionalism) – have often been employed as measures of political capacity. Though this is not always the case (see: Stoutenborough and Beverlin 2008), political capacity has often been found to be positively associated with the adoption of environmental policies (Potoski and Woods 2002; Ringquist 1993; see: Bacot and Dawes 1997; Berry and Berry 2007; Karch et al. 2013; Shipan and Volden 2012; Squire 2007; Walker 1969).

Because the adoption of an innovation is likely to be associated with the need to fund a new state activity, state fiscal health is typically an important variable influencing the probability of innovation. State economic capacity has been measured in a number of ways, including per capita income, gross domestic product, and level of urbanization. In studies seeking to explain the adoption of environmental, energy, and climate-related policies, level of economic development and personal wealth have often been found to be positively associated with support for pro-environment policies (Daley and Garand 2005; Regens 1980; see: Bacot and Dawes 1997; Berry and Berry 2007; Gray 1973; Karch et al. 2013; Matisoff, 2008; Walker 1969; Wiener and Koontz, 2012).

There are several other variables that have been identified as important influences on the adoption of either environmental or renewable energy policies. These include a state's historic commitment to environmental protection and environmental policy innovation, interest group activity (Potoski and Woods 2002; Ringquist 1993), state dependency on non-renewable electric generation (Ringquist 1993), problem severity (Blomquist 1991; Daley and Garand 2005; Potoski and Woods 2002; Ringquist 1993), and available open space or agricultural land (Lyon and Yin 2010; Matisoff 2008; Wiener and Koontz 2012). In the studies that incorporated regional diffusion, previous adoptions within a state's EPA region had a positive effect on policy adoption by that state (Daley and Garand 2005; Stoutenborough and Beverlin 2008).

The Adoption of State Renewable Portfolio Standards

Scholars have been studying the adoption of an RPS for at least a decade. Published work has studied the diffusion of the RPS alongside other renewable energy-related policies or in isolation. Typically, adoption is measured using a dichotomous variable. Studies have tended to keep the explanations provided by the internal determinants and diffusion models separate; few studies have employed an EHA of a unified model. This set of work suggests that citizen ideology, party control of government institutions, socioeconomic characteristics, and interest group activity are particularly important for explaining the adoption of an RPS. Few studies have found evidence of diffusion.

The RPS has been lumped in with other clean energy policies in order to explain the adoption of clean energy policies generally. Studies in this group included a range of policies like the RPS, net metering, public benefit funds to support clean energy, generation disclosure requirements, financial incentives for renewable energy and energy efficiency, solar easements, and building efficiency requirements. Employing either a dichotomous measure or a count of the decision to adopt any clean energy-related policy, in general, the findings from these studies suggest that interest group activity, socioeconomic factors, and citizen ideology are important for explaining the decision to adopt a clean energy policy (Matisoff 2008; Matisoff and Edwards 2014; Vachon and Menz 2006; Wiener and Koontz 2012). The studies exploring both internal determinants and policy diffusion suggest that neighboring states models of diffusion may not allow a proper test of the external influences on the decision to adopt a clean energy policy (Matisoff 2008; Matisoff and Edwards 2014; Wiener and Koontz 2012).

The decision to adopt an RPS has more frequently been studied in isolation. In general, these studies tend to measure the decision to adopt an RPS using a dichotomous measure. While a handful of studies distinguish between mandatory requirements, voluntary goals, and clean energy standards[11] (Chandler 2009; Vasseur 2014), others incorporate RPS design variations to differentiate the type of policy adopted (Berry, Laird, and Stefes 2015; Carley and Miller 2012;

[11] Clean energy standards count non-renewable fuels, cogeneration, and energy efficiency as eligible resources for meeting a state's target.

Carley, Nicholson-Crotty, and Miller 2017; Lyon and Yin 2010; Nicholson-Crotty and Carley 2016).

Findings from these studies echo the findings of studies of clean energy policy adoption generally. Overall, this research suggests that socioeconomic characteristics, ideology, interest group activity, and energy resources influence the decision to adopt an RPS (Berry, Laird, and Stefes 2015; Carley and Miller 2012; Chandler 2009; Dincer, Payne, and Simkins 2014; Fowler and Breen 2013; Huang et al. 2007; Lyon and Yin 2010; Nicholson-Crotty and Carley 2016; Upton and Snyder 2015; Vasseur 2014; Yi and Feiock 2012; see also: Matisoff 2008; Smithwood 2011). Most studies that incorporated an examination of the influence of other states' policy decisions found little to no effect using the neighboring states model (Carley and Miller 2012; Yi and Feiock 2012; see also: Matisoff 2008), however, studies using a different measure suggest that decisions in other states might influence a decision to adopt an RPS (Carley, Nicholson-Crotty, and Miller 2017; Chandler 2009; Dincer, Payne, and Simkins 2014; Nicholson-Crotty and Carley 2016; Vasseur 2014). Nicholson-Crotty and Carley's (2016) directed dyad analysis finds support for diffusion among geographic neighbors and states with shared implementation environments (see also: Carley, Nicholson-Crotty, and Miller 2017).

Summary and Contributions

The studies undertaken to date have made it clear that particular internal state characteristics – citizen ideology (Berry, Laird, and Stefes 2015; Carley and Miller 2012; Chandler 2009; Fowler and Breen 2013; Matisoff 2008; Matisoff and Edwards 2014; Weiner and Koontz 2012; Yi and Feiock 2012), party control of government institutions (Berry, Laird, and Stefes 2015; Carley and Miller 2012; Dincer, Payne, and Simkins 2014; Lyon and Yin 2010; Upton and Snyder 2015; Vasseur 2014), state wealth and citizen income levels (Berry, Laird, and

Stefes 2015; Carley and Miller 2012; Chandler 2009; Huang et al. 2007; Upton and Snyder 2015; Vachon and Menz 2006; Vasseur 2014), educational attainment (Chandler 2009; Dincer, Payne, and Simkins 2014; Huang et al. 2007; Vachon and Menz 2006), and renewable energy or environmental interest groups (Lyon and Yin 2010; Matisoff and Edwards 2014; Vachon and Menz 2006; Vasseur 2014) – are especially important for explaining the adoption of an RPS. Interestingly, in the studies that incorporated the effects of a state's renewable energy potential, typically measured through solar and/or wind potential, findings have been mixed. While some have found positive associations, others have found negative effects (see: Carley, Nicholson-Crotty, and Miller 2017). Most studies have not found a statistically significant effect related to fossil fuel industry presence.

Studies of the diffusion of the RPS typically measure adoption in dichotomous terms (Fowler and Breen 2013; Huang et al. 2007; Matisoff 2008; Matisoff and Edwards 2014; Vachon and Menz 2006). However, others employ some measure of the design variations that exist across RPSs (Berry, Laird, and Stefes 2015; Carley and Miller 2012; Carley, Nicholson-Crotty, and Miller 2017; Chandler 2009; Lyon and Yin 2010; Vasseur 2014; Yi and Feiock 2012). These differences in design are important to account for because they provide some idea of how later adopters modified the policy. In addition, many states modified their RPSs over time. Studying both initial adoptions and subsequent modifications allows an assessment of whether certain variables become more or less important over time, or over the course of the policy process (Boehmke and Witmer 2004; Karch 2007a and b; Whitaker et al. 2012).

A potentially significant influence on the decision to adopt an RPS has been infrequently explored. While some studies have endeavored to explain the adoption of multiple clean energy policies, the influence of past policy choices, or other policies, has largely been left out of consideration. The exceptions are Carley, Nicholson-Crotty, and Miller (2017), Yi and Feiock (2012), and Young and Sarzynski (2009). Yi and Feiock (2012) find a positive relationship between past decisions to adopt supportive policies and later decisions to adopt an RPS. This study expands on this finding by incorporating variables to capture the effects of past policy choices.

Vertical influences have also been widely ignored. While many studies of the effectiveness of renewable energy polices for promoting growth in renewable energy generation within states incorporate the effects of such federal-level policies as the production tax credit (PTC) and the renewable energy production incentive, studies of the diffusion of the RPS rarely, if ever, incorporate an evaluation of the effects of these incentives. Studies of the diffusion of the RPS also ignore the influence of in-state federally-owned public lands and activities on those lands. This study incorporates an evaluation of the effects of the PTC for wind and in-state public land area on the decision to adopt an RPS.

While most studies examining the diffusion of the RPS find little to no effect associated with regional diffusion, these studies tend to employ the neighboring states model. However, as discussed above, this model may not be the best method for testing for the effects of diffusion. Of the studies of the diffusion of the RPS surveyed here, only those incorporating a non-neighboring states model found an effect (Chandler 2009; Matisoff and Edwards 2014; Vasseur 2014; Wiener and Koontz 2012). As these studies suggest, tests employing a different model might allow for a better understanding of the role that interstate interactions play in the decision to adopt an RPS. This study employs a fixed-regions approach that examined diffusion within U.S. Environmental Protection Agency Regions and within regional energy efficiency organization (REEO) groupings, as modified by adding non-participating states according to U.S. Census regions.

While no such hypotheses were developed here to explicitly test such an assertion, subsequent revisions to policies might reflect the role of policy experience over time (Carley, Nicholson-Crotty, and Miller 2017; Karch 2007b). Of the studies of the adoption of an RPS reviewed here, only Berry, Laird, and Stefes (2015), Carley and Miller (2012), and Carley, Nicholson-Crotty, and Miller (2017) include later amendments. These studies incorporate a measure reflecting changes in RPS stringency resulting from later amendments. Carley and Miller (2012) found that the adoption of strong RPSs is influenced more by ideological liberalism in government than by the degree of liberalism among the state's citizens.[12] Carley, Nicholson-Crotty, and Miller (2017) found that amendments to increase the stringency of an RPS are influenced more by internal state characteristics than by the decisions of policy makers in other states and that time is an important determinant of amendment, suggesting that policy experience plays an important role in decisions to amend an existing policy. Berry, Laird, and Stefes' (2015) study suggests that Democratic control of the legislature, a more liberal and wealthy state population, higher electricity prices, population growth, and a higher wind energy potential are positively associated with the likelihood that a state will amend its RPS.

All three studies miss several amendments to RPSs because these amendments are not included in the Database of State Incentives for Renewables and Efficiency (DSIRE). These studies also cover a shorter period than that used here. Berry, Laird, and Stefes' (2015) analysis covers adoptions and amendments between 1994 and 2009, Carley, Nicholson-Crotty, and Miller

[12] Carley and Miller (2012) do not specifically examine the variables that influence a state to amend an RPS. Rather, the authors construct models that evaluate stringency scores both at time of original adoption and at the end of 2008, which reflect amendments to existing policies.

(2017) examine adoptions and amendments between 1996 and 2009, and Carley and Miller's (2012) study covers the period between 1997 and 2008. Adding consideration of variations in design, as well as subsequent changes to an RPS is expected to shed light on the relative importance of the variables that influence policy adoption and changes to existing policies over time. In addition to incorporating a longer study period (1994 to 2014), this study also increases the typical number of observations made by studies of this type by moving the unit of analysis to state-month rather than the traditional state-year. Additional research design details are discussed in Chapter Three.

CHAPTER THREE: RESEARCH METHODS

This study aims to contribute to our understanding of policy innovation and change through the lens of the adoption and subsequent amendment of RPSs by 35 states between 1994 and 2014.[13] While the diffusion of the RPS is one of the most frequently studied policy innovations in the literature, significant gaps in our knowledge remain. These are discussed in the literature review in Chapter Two.

To address the identified shortcomings in both the broad policy innovation literature as well as in the literature on the diffusion of RPS policies specifically, this study employs a mixed methods approach that utilizes event history analysis (EHA) and qualitative case studies of two U.S. states, Oregon and West Virginia. Mixed methods approaches allow researchers to capitalize on the benefits offered by both quantitative and qualitative methods while also providing opportunities to overcome the shortcomings inherent to either. Specifically, a mixed methods approach allows the examination of broad trends through quantitative analysis, while qualitative case studies allow in-depth exploration of the more difficult to quantify factors that influence a state's decision to adopt a policy innovation and amend that policy over time. A mixed methods approach is also suggested by the current state of the policy diffusion literature, where an increasing number of studies examine policy diffusion through qualitative methods.

[13] Iowa, Arizona, and New York are excluded from this study. Iowa adopted its renewable energy requirement in 1983, which makes it quite an outlier. In addition, missing data for several dependent variables made the inclusion of Iowa impossible. The next requirement was adopted 11 years later when Minnesota initially adopted a renewable energy target for Xcel Energy. Minnesota's original adoption is excluded from the adoption models. Traditionally, adoptions used as the catalyst for subsequent adoptions are excluded from EHAs (Carley, Nicholson-Crotty, and Miller 2017). Later amendments to Minnesota's RPS are included in the amendments models. Arizona and New York are excluded because these states' RPSs were adopted and amended through regulatory procedures which are likely to be influenced by variables different from those used here.

Research has already demonstrated that policies do in fact diffuse, or are adopted by more than one state, and that policy innovation is influenced by the choices made in other states. The literature has become more and more focused on answering why this is so, or through which mechanisms – learning, competition, coercion, and/or imitation – diffusion takes place (Starke 2013).

This chapter discusses this dissertation's research methods. It begins by outlining the study's major research questions and provides a description of the model of policy innovation and change used in the study. Readers are also provided a brief overview of EHA. The discussion then turns to a description of the study's unit of analysis and time-frame. Following this, I describe the study's dependent and independent variables. Data collection is discussed throughout these sections. Grouped by major variable type, the study's hypotheses are then provided. This is followed by a discussion of case study selection and methods. The chapter concludes with a brief summary and an introduction to the three chapters that follow.

Research Questions

Mixed methods approaches require shared research questions (Yin 2009). The primary research questions for this study are: Why do U.S. states adopt RPSs and why do states amend RPSs after initial adoption? These suggest additional questions, including the following:

1. Which internal state characteristics influence the initial adoption of an RPS? Which internal state characteristics influence subsequent changes to that RPS? Does the relative importance of these internal characteristics vary over time – by initial adoption and subsequent changes to an RPS? Does the relative importance of these internal characteristics vary by the type of change being made?

2. What role do a state’s existing renewable energy policies play in influencing the initial decision to adopt an RPS? Do other policies play a role in influencing decisions to modify an RPS? Does the relative importance of the prior existence of other policies vary over time? Does the relative importance of these other policies vary by the type of change being made?
3. What role does interest group activity play in influencing the initial decision to adopt an RPS? Does this activity influence decisions to modify an RPS? Does the relative importance of this vary over time? Does the relative importance of interest group strength vary by type of change?
4. What role does the existence of federally-owned public lands play in influencing the initial decision to adopt an RPS? Does this influence the decision to modify an RPS? Does this influence vary over time and/or by type of change?
5. What role does the federal Production Tax Credit (PTC) play in influencing the initial decision to adopt an RPS? Does this effect vary in years where the PTC was allowed to lapse or when the PTC was reinstated? Does this influence decisions to modify an RPS and does this effect vary by the type of change being made?
6. What role do other states play in influencing the decision to adopt or amend an RPS? Does this role change over time or by type of amendment being adopted?
7. What role do imitation, learning, competition, and coercion play in the initial adoption of and subsequent changes to a state’s RPS?

These research questions suggest the prudence of a mixed methods approach. While the first six questions can be or have already been successfully incorporated into EHAs of the adoption and subsequent amendment of RPSs, quantitative modeling of the mechanisms of diffusion – imitation, learning, competition, and coercion – has proven more elusive (for a recent discussion, see Maggetti and Gilardi 2016). Case studies allowed an in-depth exploration of whether any of these mechanisms of diffusion appeared to be operating and which mechanisms were operating at different points during the process of policy innovation and change. In addition, incorporating the use of qualitative case studies allowed a more in-depth examination of the influence of internal state characteristics, interest groups, and policy entrepreneurs on policy innovation and change.

The Unified Model and Event History Analysis

This study employs a modified version of the Berry and Berry (1990) unified model. The authors suggest that unified models take the general form:

$$ADOPT_{i,t} = f\,(MOTIVATION_{i,t}, RESOURCES/OBSTACLES_{i,t}, OTHER\ POLICIES_{i,t}, EXTERNAL_{i,t})$$

Where the unit of analysis is the state at risk of adopting a given policy in a particular year. The dependent variable ($ADOPT_{i,t}$) is the probability that a given state (i) will adopt a policy in a given year (t). In terms of independent variables, $MOTIVATION_{i,t}$, and $RESOURCES/OBSTACLES_{i,t}$ reflects variables associated with internal determinants models. $MOTIVATION_{i,t}$ includes those variables associated with the motivations for state officials to adopt a new policy or program. $RESOURCES/OBSTACLES_{i,t}$ denotes obstacles to innovation and the resources available for overcoming those obstacles. For instance, public demand for a policy would be considered a resource supporting policy innovation by a state, while poor fiscal health would likely be an obstacle to the adoption of a new policy. $OTHER\ POLICIES_{i,t}$ represents, through use of dummy variables, the presence or absence of previously adopted policies that might affect the probability of the adoption of a policy innovation by a given state in a certain year. $EXTERNAL_{i,t}$ reflects those variables associated with the influence of other states' policy choices, or diffusion effects, on a state (i) in a given year (t) (Berry and Berry 2007, 2014).

Many studies using Berry and Berry's (1990) unified model employ EHA, a method with origins in the medical field and also known as survival analysis. Given the origins of this method, "where often, quite literally, survival was the dependent variable", the terminology associated with what most in the public policy field call EHA, is "grim": 'hazard rate', 'survival rate', 'failure rate', and 'risk set' (Allison 2014; Box-Steffensmeier and Jones 2004; Jones and Branton 2005; Young and Sarzynski 2009, p. 6-7). In studies of policy diffusion among U.S. states, failure is the adoption of a policy, the risk set includes all states that might adopt an innovation, the survival rate reflects the period of time until a policy is adopted, and the hazard rate measures the probability (or the risk) that a particular state will adopt an innovation during some time period (see: Allison 2014; Box-Steffensmeier and Jones 2004; Cleves, Gould, and Marchenko 2016; Jones and Branton 2005; Young and Sarzynski 2009). The hazard rate is the "fundamental dependent variable" in EHA and is simply the rate at which subjects experience an event (Allison 2014, p. 8; University of California, Los Angeles, hereafter, UCLA 2017).

"[B]ecause they relate change in future outcomes to conditions in the past…" and allow us to explore causal relationships through time-varying covariates, event history models are easily linked to research questions in the social sciences (Allison 2014; Blossfeld, Golsch, and Rohwer 2009, p. 21; Box-Steffensmeier and Jones 2004; Gash 2010). Most uses of EHA aim to understand the covariates associated with the timing of an event (Allison 2014; Blossfeld, Golsch, and Rohwer 2009; Box-Steffensmeier and Jones 2004; Gash 2010; Steele 2005).

Time plays an important role in causal explanations, and the role of time is very important in event history models. In all causal explanations, effect must follow cause, with a temporal interval, perhaps very small, perhaps longer, between cause and effect. When we assume there is a lag between cause and effect, a single measurement at the time of the outcome does not allow us to describe a causal process. In addition, research might miss certain outcomes when measurements are made before the end of the temporal interval required for the cause to have an effect. There might also be different shapes to how the effect develops over time, or "the causal relationship itself may change over time" (Blossfeld, Golsch, and Rohwer 2009, p. 28). Research design might lead to misleading conclusions depending on when a measurement of the effect is made: for instance, when it is increasing or peaking versus when it is decreasing or ebbing. By allowing research to examine why an event occurred when it did through the use of time-varying covariates, these models allow us to account for time and for different shapes of effects over time.

Event history data consist of a set of observations that begin at a natural starting point, with the starting point determined by the researcher (Box-Steffensmeier and Jones 1997, 2004). In policy diffusion studies, starting points are typically determined using the first adoption of a policy innovation by any state. In some studies, the first adoption is viewed as the catalyst for subsequent adoptions by other states, and this state is excluded from the risk set (Buckley and Westerland 2004; Carley, Nicholson-Crotty, and Miller 2017). Data are then collected for a certain set of time and by unit of analysis (Buckley and Westerland 2004; see also: Allison 2014).

During the time period under study, units of analysis are at risk for experiencing an event, or a change from one state to another, which is measured as a dependent variable. In some cases, units are dropped from the risk set after they experience an event. In other cases, units remain under observation because they remain at risk of experiencing the same or a different type of event. In most cases, not all units will be observed experiencing an event, either because they never experience an event or because the study ends before they experience the event (Allison 2014; Blossfeld, Golsch, and Rohwer 2009; Box-Steffensmeier and Jones 1997, 2004; Cleves, Gould, and Marchenko 2016; Gash 2010).

Units that do not experience an event during the study's time-frame, or right-censored observations, are easily dealt with by event history models, and are one reason to use these types of models. Because the end of the study time-frame is typically determined by the researcher and independent of the process under study, right-censoring is "unproblematic" and eliminating these cases would introduce selection bias and the potential for over- or underestimating the effects of covariates on survival times (Allison 2014; Blossfeld, Golsch, and Rohwer 2009, p. 41; Box-Steffensmeier and Jones 2004; Steele 2005; Steele and Washbrook 2013). The models presented in Chapter Six include right-censored observations, for example, the 12 states that have yet to adopt an RPS.[14] In the RPS amendment models, right-censoring is present for all 35 states that adopted an RPS.

This study uses models that focus on a single event (the adoption of an RPS) and models that incorporate repeated events (amendments to RPSs). The study also models competing, or different types of, events (the adoption of a particular type of an RPS and types of amendments to RPSs). When processes involve multiple events, analyses that can incorporate repeated events are preferable to those that focus on single events. And, in these cases, models that differentiate between types of events are preferable to those that simply count events, treating all events as

[14] At the time of this writing, Alabama, Alaska, Arkansas, Florida, Georgia, Idaho, Kentucky, Louisiana, Mississippi, Nebraska, Tennessee, and Wyoming had not adopted an RPS.

essentially equal. This is the case because detail and information are lost in single event studies (Box-Steffensmeier and Jones 2004; Jones and Branton 2005; Young and Sarzynski 2009).

As suggested by Jones and Branton (2005), the quantitative analysis uses the Cox proportional hazards regression model (see also: Box-Steffensmeier and Jones 2004; Young and Sarzynski 2009). The model is noted for its flexibility, especially in terms of its ability to incorporate repeating and competing events, and the effects of time-varying covariates (see: Box-Steffensmeier and Jones 2004; Cleves, Gould, and Marchenko 2016; Jones and Branton 2005). The model developed by Cox (1972) is one of the "most influential" EHA methods in use today (Allison 2014, p. 3). Additionally, the Cox model is recommended for studies of policy innovation and can analyze data formatted in discrete time intervals, as was done for this study.

Unit of Analysis and Study Time-Frame

The unit of analysis for the EHA is the state-month. While Berry, Laird, and Stefes (2015), Carley and Miller (2012), and Carley, Nicholson-Crotty, and Miller (2017) use state-year as the unit of analysis to examine subsequent amendments to RPSs (as do most studies that use EHA to evaluate policy innovation by U.S. states), using state-month allowed additional observations of amendments to these policies.[15] The move to state-month increased this study's maximum number of observations from 988 with yearly data to 12,408 monthly observations from January 1, 2013 to December 31, 2014. The unit of analysis for the qualitative case studies is the state.

Box-Steffensmeier and Jones (2004) advise that defining the appropriate start time for the observation period is a theoretical and not a statistical issue and that time-of-entry decisions are

[15] Moving from annual observations to monthly observations allowed this study to capture 165 amendment events, while annual data captured 141 events. Both data sets represent 207 changes adopted by 32 states between May 1, 1995 and December 31, 2014.

important because time-of-entry sets a natural baseline for comparing the units under study. The researcher typically determines the beginning and end dates of the study, as influenced by such things as resource constraints and data availability. Taking theoretical considerations, data availability, and resources into account, the EHA of RPS adoptions presented here begins on June 1, 1994, which is the month following Minnesota's adoption of renewable energy requirements for Xcel Energy. While this requirement did not take the same form as a typical RPS in that it set a megawatt (MW) target rather than specifying a percentage of retail sales to be provided by renewable resources, this policy was the first such policy to be enacted after Iowa adopted its renewable MW target in 1983. Given that Arizona (not included in this study) enacted a similar policy two years after Minnesota, and that Maine, Massachusetts, and Nevada adopted their RPSs in 1997, Minnesota's adoption seems a logical catalyst for subsequent adoptions of RPSs.

In the models of amendments to RPSs, states enter the risk set – they become at risk of adopting an amendment – at the beginning of the month following the initial adoption of an RPS. Minnesota, as the first state to adopt an RPS, becomes at risk for amending an RPS on June 1, 1994. South Carolina, the last state to adopt a policy (a voluntary goal) does not enter the amendment risk set until July 1, 2014. All states in these models remain under observation until December 31, 2014. The study's time-frame allows an examination of state activity during the most recent era of renewable energy policy and market development. The end date allows inclusion of South Carolina, the last state, to date, to adopt a renewable energy goal. While states continued to amend RPSs after 2014, data for many independent variables of interest is not yet available.

The qualitative case studies presented in Chapters Four and Five trace the history of the adoption and subsequent amendment of an RPS by Oregon and West Virginia. To that end, the case studies trace the history of these RPSs from initial consideration through adoption and subsequent amendments. Both case studies discuss the major changes made to these policies after 2014.

Dependent Variables

The Berry and Berry (1990) model described above offers a great deal of flexibility, allowing for the types of modifications discussed in the literature review. The model used here expands on the Berry and Berry model by shifting the unit of analysis to state at risk of adopting or amending an RPS in a particular month and adding the effects of federal-level influences. Employing variables suggested to be important by the literature on energy policy innovation, this study uses a model with the following construction:

$$\text{ADOPT}_{i,t} = f\,(\text{INTERNAL}_{i,t},\ \text{OTHER\_POLICIES}_{i,t},\ \text{EXTERNAL\_STATES}_{i,t},\ \text{EXTERNAL\_FEDERAL}_{i,t})$$

ADOPT, following Berry and Berry (1990), is the dependent variable, and is a measure of the probability that a given state (i) will adopt a policy or a type of policy, or that a state will amend a policy in a certain direction in a given month (t). This study involved the construction of four dependent variables, outlined in table 3.1, below.

Adoption dates were initially determined by cross-referencing adoption dates provided by the Database of State Incentives for Renewables and Efficiency (DSIRE), Carley and Miller (2012), and Barbose (2016). Using these to find the original enacting legislation for each state, I then constructed the legislative histories of all RPS statutes for the 35 states included in this study. Legislative histories were used to confirm original adoption dates, determine amendment dates, and, after creating bill summaries, to construct the bill scores used in the amendment index.

Table 3.1. Dependent Variables

Variable	Description	Level of Measurement
adopt	Measures the initial adoption of an RPS (including MW targets), a clean energy standard (CES), or a voluntary renewable energy goal.	Nominal: 0 = state did not adopt a policy 1 = state adopted a policy
adopt_type	Measures the initial adoption of an RPS, by type of policy adopted.	Ordinal: 0 = state did not adopt a policy 1 = state adopted a voluntary goal 2 = state adopted a weak RPS 3 = state adopted a strong RPS
amend_index	The index score of all amendments adopted in that month.	Ordinal (-.75 – 1.75): Negative numbers reflect an amendment or group of amendments that made negative changes and positive numbers reflect an amendment or group of amendments that made positive changes.[16]
amend_type3	Measures the type of change made by the amendments adopted in that month. Determined by grouping index scores.	Ordinal: 0 = state did not amend a policy 1 = negative change 2 = minor positive change 3 = positive change

This research modeled the initial adoption of an RPS four times. In the first model, a dichotomous dependent variable representing the initial adoption was used. This allows comparability to the bulk of the literature on policy innovation by U.S. states and allows comparability with several studies of the diffusion of the RPS. The second, third, and fourth models employed a variable based on Carley and Miller’s (2012) measure of RPS stringency.

[16] Details on the scoring system used to create this index are available in Appendix A.

This measure creates a stringency ratio for each state's RPS as initially adopted and compares the state's score to the median score of all other states that had previously adopted an RPS. This is used to categorize states into one of two groups: weak RPS and strong RPS. The authors created a third category to capture states that adopted a voluntary goal. While Carley and Miller (2012) are not the only authors to incorporate a measure of RPS design variation, their measure appears to be the most straightforward for capturing between-state differences. Carley and Miller (2012) calculate their stringency ratio as follows:

$$\text{Stringency} = \left(\frac{\text{Final Mandate} - \text{Starting Mandate}}{\text{Final Year} - \text{Starting Year}}\right) \times \text{RPS}_{\text{Coverage}}$$

In this equation, final mandate is the final target set by the initial RPS and the starting mandate is the first interim target that utilities are expected to meet, if one is set. Final year is the year utilities are to meet the final target, starting year is the year the RPS was adopted, and RPS coverage is a measure of the percent of the electric load covered by an RPS. Thus, RPS coverage accounts for the utilities to which the RPS does and does not apply.

The second, third, and fourth models of RPS adoption presented here employ a modified version of this stringency ratio. First, starting year is the year that utilities are expected to meet the first interim target.[17] Second, RPS coverage is measured at the same time as starting year. This ensures that starting mandate, starting year, and RPS coverage are measured at the same point in time, as set by the RPS as originally adopted.[18] Third, after calculating scores for all 35

[17] Using legislative language, I was able to find interim targets for all non-voluntary policies.

[18] Carley and Miller (2012) rely on coverage data from DSIRE, which was updated over time as RPS amendments were adopted. Data available from DSIRE did not represent RPS coverage prior to 2009. This study uses coverage data provided by Galen Barbose at the Lawrence Berkeley National Laboratory (LBNL). This data tracks and projects (after 2015) the percent of a state's retail sales subject to RPS obligations each year for the period 1998 – 2035, allowing this study to employ a measure of RPS coverage that reflects coverage at the time of first compliance year for all states that adopted an RPS. First

states in this study, I calculated the median of those scores to create a cut point between weak and strong policies. In addition to these modifications, the adoption dates and targets used here differ, in some instances, from those used by Carley and Miller (2012). These changes created discrepancies between the policy scores used here and the initial scores presented by Carley and Miller (2012). A detailed explanation is provided in Appendix B. Figure 3.1, below, depicts stringency level, by state, as initially adopted.

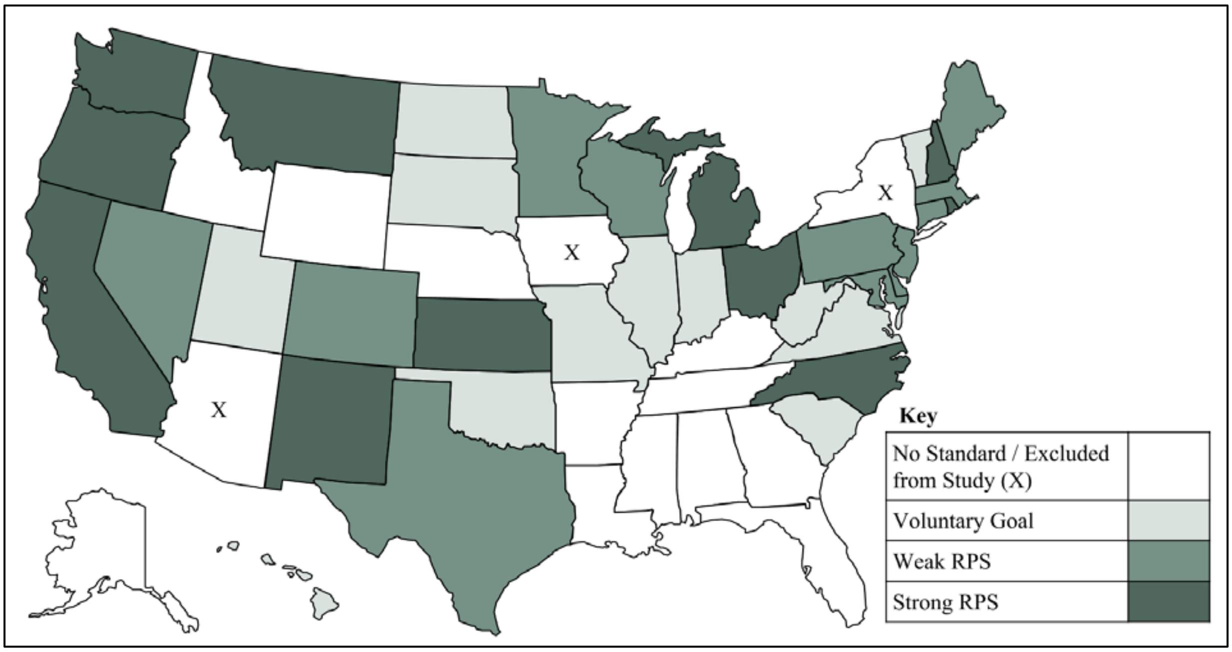

Figure 3.1. RPS Stringency, as Initially Adopted

In order to examine the variables associated with a decision to modify an RPS, I created a numerical coding system used to categorize the types of amendments made by legislation enacted after the initial adoption of an RPS. The coding system was based on the notion that important goals for an RPS include promoting in-state development of and demand for renewable energy. As such, the coding system gave preference to amendments that seemed more likely to accomplish these goals. The details of this system are provided in Appendix A.

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compliance date was determined through legislative language and from data found in Barbose's (2016) RPS status report.

When a single bill made multiple changes, I used the score for the most impactful type of change made to the RPS, as determined by the scoring system. For instance, in 2003, Connecticut decreased the RPS' final target, but expanded the requirements to cover additional utility sales. Because this change meant that the percent of the state's electric load covered by the RPS increased, this was measured as a positive change and not as reduction of a target. I did not include bills that made technical changes to clarify definitions and statutory references. Bills amending RPS reporting requirements for state agencies and utilities were also excluded.

In instances where multiple bills were enacted in a state in the same month, I used the scoring system to create an index that measured the sum score of all bills enacted that month. For example, in September 2006, lawmakers in California enacted three bills to amend the RPS. One of these bills (Senate Bill 107), codified an accelerated target of 20 percent by 2010, another (Assembly Bill 2189) amended eligibility provisions for small hydroelectric facilities, and the third (Assembly Bill 1969) required that electrical corporations purchase renewable energy from facilities owned and operated by public wastewater agencies.[19] The first bill was scored 1, and the other two bills were scored .25, creating a total score of 1.5 for the amendments adopted in September 2006.

In the monthly scoring data used here, the maximum number of events of a single type was 70, all scored .25. The next largest class of amendment events contained 23 observations of changes scored .5. The minimum number of events was a single amendment score of 1.75. Due to small numbers of certain types of events, individual monthly scores were used to combine amendments into classes, creating the dependent variable (amend_type3) used in the three models of RPS amendments. This categorization was selected following Allison's (2014, p.61)

[19] When the state's utilities commission implemented this bill, they expanded eligibility to additional facility types, creating what is known as the "AB 1969 Program" (California SB 32 2009).

caution that researchers avoid defining event types "too narrowly… [leading] to small numbers of events in one or more event types" (see also: Jones and Branton 2005). Because only 31 negative amendment events were observed across the study time-frame, all negative changes were grouped into one event type. A summary of this variable is presented in table 3.2, below.

Table 3.2. RPS Amendment Categories

Variable Name	Amendment Type	Monthly Scores	Number of Events (Total: 165)
amend_type3	Negative Change	-.75 – -.25	31
	Minor Positive Change	.25	70
	Positive Change	.5 – 1.75	64

Independent Variables

As introduced above, the general model used in this study is:

$$\text{ADOPT}_{i,t} = f\,(\text{INTERNAL}_{i,t}, \text{OTHER\_POLICIES}_{i,t}, \text{EXTERNAL\_STATES}_{i,t}, \text{EXTERNAL\_FEDERAL}_{i,t})$$

Independent variables are listed on the right side of the equation and are discussed in detail here.

INTERNAL represents the internal state characteristics found by previous research to be important to explaining the probability that a state would adopt an RPS or similar policy. These variables are existing renewable energy capacity (a proxy for renewable energy interest group strength), wind potential, retail electricity prices, citizen ideology, government ideology, Democratic and Republican candidate vote shares in presidential elections, median household income, and citizen education levels. While other studies have included a measure of per capita gross state product (GSP) to measure a state's financial resources, the Bureau of Economic Analysis changed its classification system in 1997. While Carley, Nicholson-Crotty, and Miller (2017, p. 445) found that this change did not "introduce any deviations in overall GSP per capita measurements", I found that for the majority of states, there was a significant jump in the numbers from 1996 to 1997. As Carley, Nicholson-Crotty, and Miller's (2017) study time-frame begins in 1997, it may be that they did not use data prior to the change in the classification system.

Existing renewable energy capacity, following Lyon and Yin (2010), is used as a proxy for renewable energy interest group strength. Data for this variable was obtained from the U.S. Energy Information Administration's (2017) annual data to determine total non-hydroelectric renewable energy in-state MW capacity. An additional variable constructed for this study used total in-state nameplate MW capacity and total non-hydroelectric renewable energy in-state MW capacity to create a percentage of non-hydroelectric renewable energy in-state capacity. Both were measured annually, by state. I used the state-level data, and not generator-level data from the Energy Information Administration (EIA) because in 2001, the classification scheme and coverage of generator-types for this data changed. Shrimali et al. (2012) found that this change created "irreconcilable discrepancies" that may have led to erroneous findings in previous studies of RPS effectiveness.

Capacity (measured in MW) rather than generation (measured in megawatt hours (MWh)) is used because capacity reflects the amount of energy a generating unit or set of units could produce while generation measures the amount of energy that was produced in that year. Because generation is impacted by such factors as weather (cloudy days, particularly still summers) and low natural gas prices, among other things, capacity seemed a better proxy for interest group strength because it measures the resources available to the state in a manner more independent of external influences. In addition, capacity measures resources that a particular set of interests (the renewable energy industry) wants used more frequently, an objective likely leading that industry to support both the adoption of a strong RPS and later positive amendments to that RPS.

In the studies of the diffusion of the RPS that incorporated renewable energy potential, typically measured through some combination of solar and wind potential, the findings have been mixed. Some studies found positive correlations, while others have found negative relationships. Historically, RPSs have supported the wind industry. Because states might adopt or positively amend an RPS to support the wind industry or to take advantage of their wind resources, this study incorporated two measures of wind potential, both using the National Renewable Energy Laboratory (NREL) and AWS Truepower (2011) estimates. Wind potential is determined based on available windy land area, with a turbine capacity factor of 30 percent at 80 meters high (National Renewable Energy Laboratory, hereafter NREL, and AWS Truepower 2011).

Retail electricity prices are measured as average annual residential rate in cents per kilowatt-hour (kWh) as obtained from the EIA (2015a). Residential rates were used for two reasons. First, because residential rates are likely to be the most visible rates to voters, high residential rates might be related to increased opposition to an RPS if opponents argue that the policy would or does increase electricity rates. Second, in 2003 the EIA amended the method used to calculate commercial and industrial rates. This suggested against using annual data on total average retail electricity prices by state.

Most studies of energy and environmental policy innovation have found a positive relationship between liberal citizen and government ideology and the adoption of a new policy. Four variables measure state ideology and political party preferences. Citizen ideology is measured annually using Berry, Ringquist, Fording, and Hanson’s (1998) revised 1960-2013 citizen ideology series. Data for all states in 2014 is missing from the data set, requiring that models run with this variable used lagged data. Government ideology is measured annually using

Berry, Fording, Ringquist, Hanson, and Klarner's (2010) updated NOMINATE measure, which includes data through 2014. Democratic and Republican candidate vote shares in presidential elections were measured as a percentage in November of election years and carried forward to the next election. The study's data begins with numbers from 1992. All data was collected from Peters and Woolley (2017).

Studies of the diffusion of energy and environmental policies have also found a positive relationship between citizen income and education levels. Citizen income was measured annually using U.S. Census Bureau (2017a) data on median household income by state, normalized to 2016 dollars. Within this data, there are two columns for 2013. I was unable to find an explanation for why this was the case and so used the column with the smaller standard errors. Citizen education levels were measured as the percent of the state's population 25 years and older that had completed at least a bachelor's degree. This data was also collected from the U.S. Census Bureau (2017b). Internal independent variables are summarized in table 3.3, below.

Table 3.3. Independent Variables: $INTERNAL_{i,t}$

Variable	Variable Name	Description	Level of Measurement
Renewable Energy Interest Group Strength (Existing Renewable Energy Capacity)	nameplate_re	Total nameplate capacity (MW) of all non-hydroelectric renewable resources contributing to that state's electric generating sector in that year.	Interval: 0 – 16,123.1
	percent_re	Percent of total in-state capacity (MW) of all non-hydroelectric renewable resources contributing to that state's electric generating sector in that state that year.	Interval: 0 – 100 (Actual: 0 – 34.49)

Table 3.3. Independent Variables: INTERNAL$_{i,t}$ continued			
Variable	Variable Name	Description	Level of Measurement
Wind Potential	wind_capacity	Potential installed nameplate capacity (MW).	Interval: 0 – 1,901,530
	wind_gwh	Potential annual generation in Gigawatt-hours (GWh).	Interval: 0 – 6,527,850
Retail Electricity Prices	price	Average price paid for electricity by the residential sector in that state that year in cents/kWh.	Interval: 4.6 – 37.34
Citizen Ideology	citizen	Citizen ideology measure using Berry et al's (1998) revised 1960-2013 citizen ideology series.	Interval: 0 – 100[20] (Actual: 8.45 – 95.97)
Government Ideology	government	Updated NOMINATE measure of state government ideology.	Interval: 0 – 100[20] (Actual: 0 – 92.45)
Democratic Vote Share	d_share	Percent of the vote received by the Democratic candidate in the presidential election.	Interval: 0 – 100 (Actual: 24.7 – 71.8)
Republican Vote Share	r_share	Percent of the vote received by the Republican candidate in the presidential election.	Interval: 0 – 100 (Actual: 26.6 – 72.8)
Median Household Income	income	Median household income normalized to 2016 dollars.	Interval: 36,011 – 81,018
Citizen Education	education	Percent of state population, aged 25 years and older that completed at least a bachelor's degree.	Interval: 0 – 100 (Actual: 11.4 – 41.2)

[20] 0 = most conservative, 100 = most liberal.

The OTHER_POLICIES variables allow the model to account for the influence of past decisions on later policy adoptions. As discussed in the literature review presented in Chapter Two, policies may be independent of, complementary to, contingent on, or substitutes for one another, and it is important to evaluate the effect of these past decisions on policy innovation. This research focused on complementary policy decisions, or policies where prior adoption is expected to increase the likelihood that a state will adopt an RPS. In the models of RPS amendments, the type of RPS the state initially adopted was also considered a past policy decision.

Complementary policies – interconnection standards, net metering, mandatory utility green power options, renewable energy performance-based incentives, and system benefit funds that support renewable energy – were measured in two ways. For each policy, the number of months since original adoption was recorded, counting forward beginning with the month after the policy was adopted. A policy count was also constructed capturing the number of policies, of the five, that a state had adopted to date. Date of adoption was determined using DSIRE. If DSIRE provided a date that seemed inaccurate, or if a date of original enactment was not provided, a state's annotated code or statute was used to locate the original legislation's enactment date. These policies are summarized in table 3.4, below.

Table 3.4. Independent Variables: OTHER_POLICIES$_{i,t}$

Variable Name	Description	Level of Measurement
interconnection	Number of months since the state originally adopted interconnection standards.	Interval: 0 – 396
nem	Number of months since the state originally adopted net metering.	Interval: 0 – 402
mgpo	Number of months since the state originally adopted a mandatory utility green power option.	Interval: 0 – 193

Table 3.4. Independent Variables: $OTHER\_POLICIES_{i,t}$ continueed		
pbi	Number of months since the state originally adopted a performance-based incentive.	Interval: 0 – 247
benefit_fund	Number of months since the state originally established a public benefits fund or systems benefit charge.	Interval: 0 – 247
policy_count	Number of renewable energy policies the state has adopted.	Interval: 0 – 5
adopt_type_constant	Type of RPS initially adopted by the state (held constant across all months).	Ordinal: 1 = state adopted a voluntary goal 2 = state adopted a weak RPS 3 = state adopted a strong RPS

EXTERNAL_STATES, following Berry and Berry (1990) and a number of other studies, is a measure of policy diffusion used as a proxy for the effects of the policy choices of other U.S. states on the probability of policy innovation. Because studies of the diffusion of the RPS have found little to no effect using the neighboring states model, this study used a fixed regions approach to measure the percent of states in a state's region that have previously adopted an RPS. The fixed regions approach allows this study to include Alaska and Hawaii. In studies employing the neighboring states model, these two states must be dropped. To evaluate regional diffusion effects, two fixed regions were created. The first, using modified U.S. Environmental Protection Agency (EPA) regions as suggested by Vasseur (2014), is depicted in figure 3.2, below.

EPA regions were selected because Vasseur (2014, p. 1647) makes a convincing argument that these regions create natural points of contact and competition and create opportunities for inter-state collaboration, making EPA regions likely to be "preferable to other measures of affiliation." Existing EPA regions had to be modified slightly for this study. Only two states belong to EPA Region Two: New York and New Jersey. Because New York was excluded from this study, New Jersey would have been left without a region, forcing its exclusion. To avoid this, New Jersey was grouped into EPA Region One. This was done because New Jersey, like the other states in Region One, is in the Northeast Census Region. In addition, New Jersey is a member of the Northeast Energy Efficiency Partnership (NEEP), to which the other states in EPA Region One also belong.

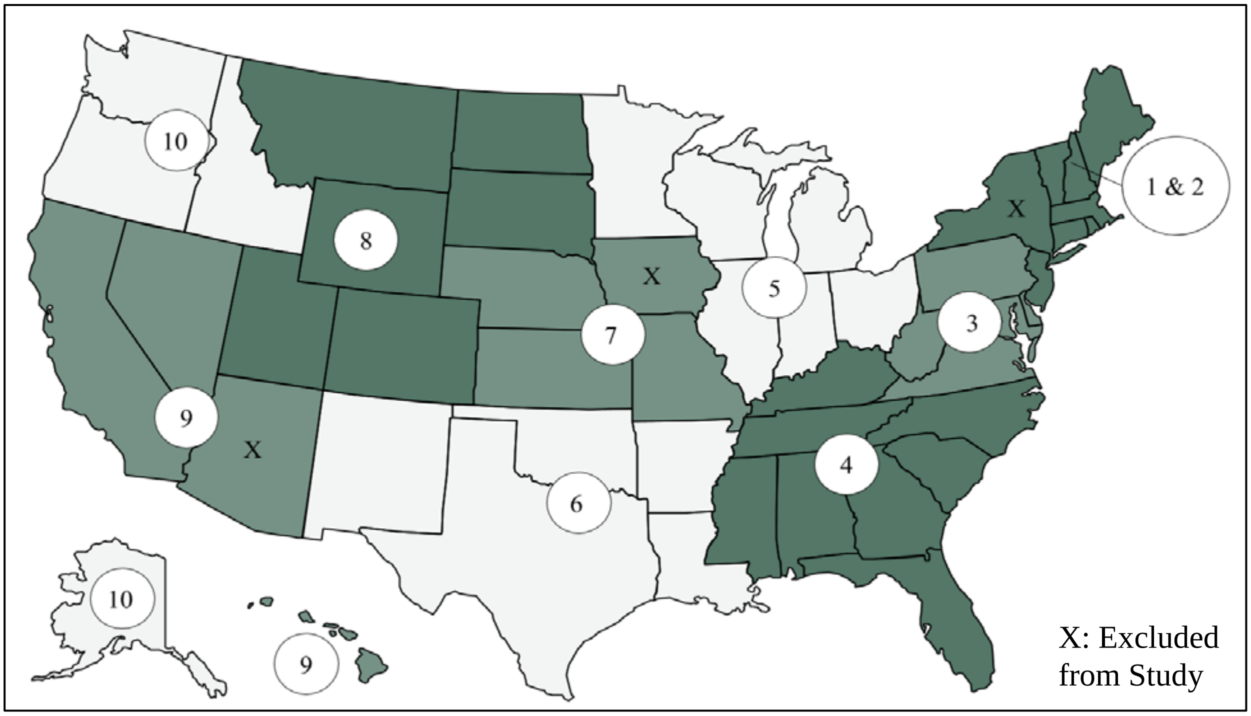

Figure 3.2. Modified EPA Regions
(U.S. Environmental Protection Agency, hereafter EPA, 2017)

Using the six regional energy efficiency organizations (REEOs)[21] as a guide, this study involved the creation of a second set of fixed regions (see figure 3.3). When states were not

[21] The six REEOs are: The Midwest Energy Efficiency Alliance (MEEA), the Northwest Energy Efficiency Alliance (NEEA), the Northeast Energy Efficiency Partnership (NEEP), the Southeast Energy Efficiency Alliance (SEEA), the South-Central Partnership for Energy Efficiency as a Resource (SPEER), and the Southwest Energy Efficiency Project (SWEEP) (Building Codes Assistance Project, hereafter BCAP, 2018).

members of a REEO, they were grouped with an organization using U.S. Census Regions as a guide. REEO regions were modified in the following ways: Texas and Oklahoma are the only two members of the South-Central Partnership for Energy Efficiency as a Resource. Because of this, they were grouped into the Southeast Energy Efficiency Alliance (SEEA) as both states belong to the U.S. Census' southern region, which is dominated by members of SEEA. West Virginia, California, Hawaii, and Alaska are not members of a REEO. These states were grouped according to census regions. West Virginia was grouped with members of SEEA, and California, Alaska, and Hawaii were grouped with other pacific region states that are members of the Northwest Energy Efficiency Alliance (NEEA). Kentucky is a member of two REEOs: SEEA and the Midwest Energy Efficiency Alliance (MEEA). Because it is in the southern U.S. Census region, Kentucky was also grouped with members of SEEA.

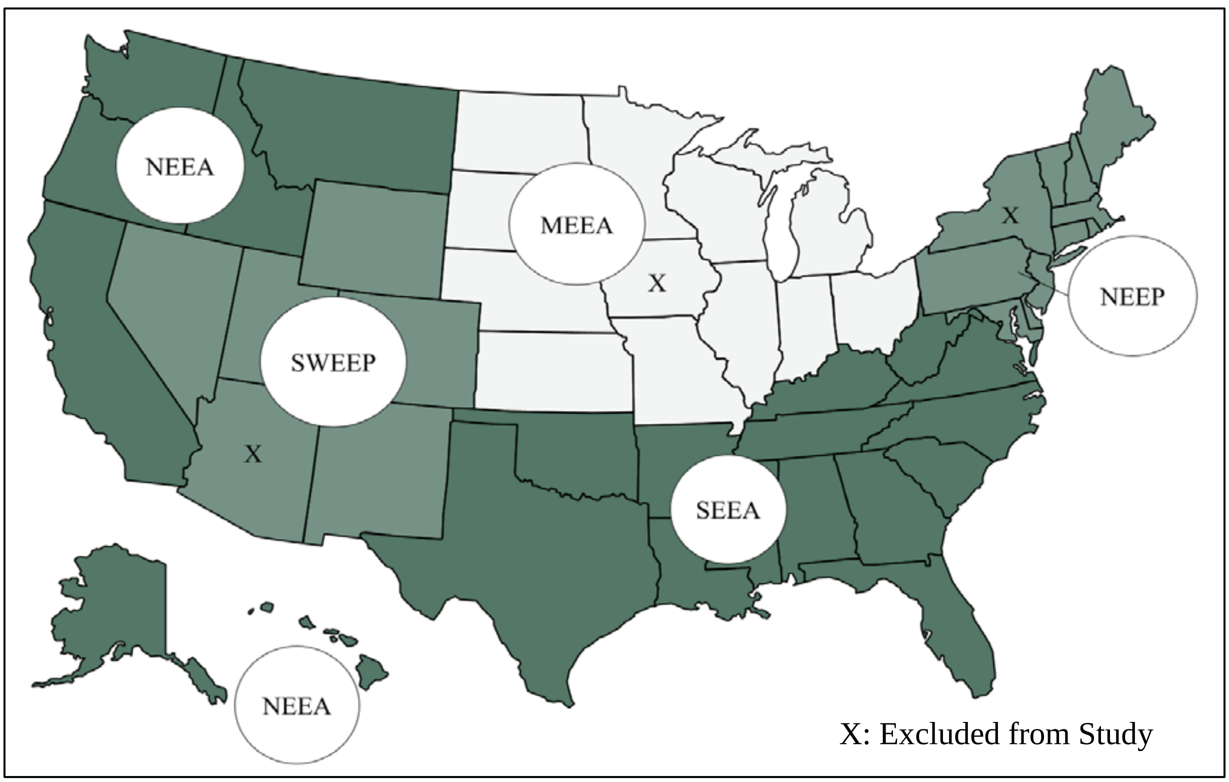

Figure 3.3. Modified REEO Regions
(BCAP 2018)

EXTERNAL_FEDERAL incorporates the effects of federal policy decisions and other activities on state policy innovation. This set of variables examines the influence of the production tax credit (PTC) and in-state federally-owned public lands in influencing both the initial adoption of an RPS and subsequent changes to a state's RPS (these variables are summarized in table 3.5, below). While the PTC has been an important driver of wind energy development, repeated expirations and extensions have created periods of uncertainty that have led to a boom-bust cycle in wind development (Union of Concerned Scientists n.d.). This cycle is also likely to impact the probability that a state will adopt or positively amend an RPS. Original enactment date, PTC lapse dates,[22] and dates that Congress acted to extend the PTC for wind were collected from a Congressional Research Service (CRS) report that was most recently updated in the summer of 2017 (see: CRS 2017).

Table 3.5. Independent Variables: EXTERNAL_FEDERAL$_{i,t}$

Variable	Variable Name	Description	Level of Measurement
Production Tax Credit	ptc_lapse	Number of months the PTC had been effect. Lapses are measured as 0, count restarts at 1 in the month Congress acted to extend the PTC.	Interval: 0 – 80
Federal Land Acreage	avg_fed_area	Year over year average of in-state public lands acreage.	Interval: 4,595.5 – 233,287,301.5
	avg_fed_area_log	Transformed avg_fed_area using the natural log in order to adjust for positive skew and a high kurtosis value.	Interval: 8.43 – 19.27
	avg_fed_percent	Year over year average of the percent of state land area that is federally-owned.	Interval: 0 – 100 (Actual: .23 – 83.67)

[22] PTC lapses are defined as periods, following expiration, where the tax credit was unavailable for wind energy systems. All extensions of the PTC were made retroactive, in essence fixing the lapse. However, during the period of the lapse, it is likely that a lot of uncertainty surrounded the credit. This argued for the importance of capturing these dates.

There are reasons to expect that as the amount of in-state public lands increases, so too will potential renewable capacity, making it probable that states with a higher proportion of public lands will adopt an RPS more supportive of renewable energy development. While this study only incorporates data on land acreage managed by the Bureau of Land Management (BLM), the U.S. Forest Service (USFS), the Fish and Wildlife Service (FWS), the National Park Service (NPS), and the Department of Defense (DOD), four of these five agencies (BLM, USFS, FWS, and NPS) manage 95 percent of the federal lands in the U.S. (see: U.S. Government Accountability Office, hereafter GAO, 2011). The variable was constructed using historical data on federal acreage by state in the years 1990, 2000, 2010, and 2013 (see: Vincent, Hanson, and Bjelopera 2014). Given the large gaps in the data, this study used average acreage and average percent of state land area and held this constant across all years.

Hypotheses

This study is designed around the assumption that most RPSs are intended to support in-state development of and demand for renewable energy (see: Yin and Powers 2010). Hypotheses were developed with these goals in mind. The models of policy innovation and change used by this study incorporate four independent equation variables. This involved data collection for a total of 25 independent variables[23] for which 57 hypotheses were identified. The following breaks hypotheses out by equation variable.

$INTERNAL_{i,t}$ Hypotheses

As discussed above, this set of variables represents the internal state characteristics found by previous research to be important to explaining the probability that a state will adopt an RPS or similar policy. These variables are existing renewable energy capacity (a proxy for renewable

[23] This number does not include variables constructed to measure time. This count also does not include state and regional identification numbers or variables that were not used.

energy interest group strength), wind potential, retail electricity prices, citizen ideology, state government ideology, Democratic and Republican candidate vote shares in presidential elections, median household income, and citizen education levels. Hypotheses related to these variables are summarized in table 3.6, below.

Table 3.6. $INTERNAL_{i,t}$ Hypotheses

H1: States with higher levels of renewable energy interest group strength, as measured through installed renewable energy capacity, will be more likely to adopt an RPS.

H2: States with higher levels of renewable energy interest group strength, as measured through installed renewable energy capacity, will be more likely to adopt a strong RPS.

H3: States with higher levels of renewable energy interest group strength, as measured through installed renewable energy capacity, will be more likely to adopt a positive change to an RPS.

H4: States with higher wind potential will be more likely to adopt an RPS.

H5: States with higher wind potential will be more likely to adopt a strong RPS.

H6: States with higher wind potential will be more likely to adopt a positive change to an RPS.

H7: States with lower average residential electricity rates will be more likely to adopt an RPS.

H8: States with lower average residential electricity rates will be more likely to adopt a strong RPS.

H9: States with lower average residential electricity rates will be more likely to adopt a positive change to an RPS.

H10: States with more liberal citizens will be more likely to adopt an RPS.

H11: States with more liberal citizens will be more likely to adopt a strong RPS.

H12: States with more liberal citizens will be more likely to adopt a positive change to an RPS.

H13: States with more liberal governments will be more likely to adopt an RPS.

H14: States with more liberal governments will be more likely to adopt a strong RPS.

H15: States with more liberal governments will be more likely to adopt a positive change to an RPS.

H16: States where a higher percentage of the vote went to the Democratic nominee in the most recent presidential election will be more likely to adopt an RPS.

H17: States where a higher percentage of the vote went to the Democratic nominee in the most recent presidential election will be more likely to adopt a strong RPS.

H18: States where a higher percentage of the vote went to the Democratic nominee in the most recent presidential election will be more likely to adopt a positive change to an RPS.

H19: States with higher median household incomes will be more likely to adopt an RPS.

H20: States with higher median household incomes will be more likely to adopt a strong RPS.

H21: States with higher median household incomes will be more likely to adopt a positive change to an RPS.

H22: States with higher levels of citizen educational attainment will be more likely to adopt an RPS.

H23: States with higher levels of citizen educational attainment will be more likely to adopt a strong RPS.

H24: States with higher levels of citizen educational attainment will be more likely to adopt a positive change to an RPS.

$OTHER\_POLICIES_{i,t}$ Hypotheses

Past policy choices influence future decisions. This study incorporates the influence of complementary policy decisions. Hypotheses related to the variables included in this group are outlined in table 3.7, below.

Table 3.7. $OTHER\_POLICIES_{i,t}$ Hypotheses

H25: States that have had more experience with interconnection standards, measured as number of months since original adoption, will be more likely to adopt an RPS.

H26: States that have had more experience with interconnection standards, measured as number of months since original adoption, will be more likely to adopt a strong RPS.

H27: States that have had more experience with interconnection standards, measured as number of months since original adoption, will be more likely to adopt a positive change to an RPS.

H28: States that have had more experience with net metering, measured as number of months since original adoption, will be more likely to adopt an RPS.

H29: States that have had more experience with net metering, measured as number of months since original adoption, will be more likely to adopt a strong RPS.

H30: States that have had more experience with net metering, measured as number of months since original adoption, will be more likely to adopt a positive change to an RPS.

H31: States that have had more experience with a mandatory utility green power option, measured as number of months since original adoption, will be more likely to adopt an RPS.

H32: States that have had more experience with a mandatory utility green power option, measured as number of months since original adoption, will be more likely to adopt a strong RPS.

H33: States that have had more experience with a mandatory utility green power option, measured as number of months since original adoption, will be more likely to adopt a positive change to an RPS.

H34: States that have had more experience with performance-based incentives for renewable energy, measured as number of months since original adoption, will be more likely to adopt an RPS.

H35: States that have had more experience with performance-based incentives for renewable energy, measured as number of months since original adoption, will be more likely to adopt a strong RPS.

H36: States that have had more experience with performance-based incentives for renewable energy, measured as number of months since original adoption, will be more likely to adopt a positive change to an RPS.

H37: States that have had more experience using system benefit funds to support renewable energy, measured as number of months since original adoption, will be more likely to adopt an RPS.

H38: States that have had more experience using system benefit funds to support renewable energy, measured as number of months since original adoption, will be more likely to adopt a strong RPS.

H39: States that have had more experience using system benefit funds to support renewable energy, measured as number of months since original adoption, will be more likely to adopt a positive change to an RPS.

H40: States that have previously adopted at least one complementary policy will be more likely to adopt an RPS.

H41: States that have previously adopted at least one complementary policy will be more likely to adopt a strong RPS.

H42: States that have previously adopted at least one complementary policy will be more likely to adopt a positive change to an RPS.

H43: States that initially adopted a strong RPS are more likely to continue to strengthen their RPSs by adopting positive changes to an RPS.

H44: Because these are more likely to be symbolic policies, states that initially adopted a weak RPS are more likely to adopt minor positive changes or negative changes to an RPS.

H45: States that initially adopted a voluntary goal are less likely to adopt positive changes to an RPS.

EXTERNAL_STATES$_{i,t}$ Hypotheses

In order to incorporate the effect that other states' policy choices have on the decision to adopt or amend an RPS, this study utilizes a fixed regions approach using modified EPA and REEO regions. Hypotheses related to this equation variable are summarized in table 3.8, below.

Table 3.8. EXTERNAL_STATES$_{i,t}$ Hypotheses

H46: States with a higher percentage of neighbors, as measured by EPA region, that have previously adopted an RPS will be more likely to adopt an RPS.

H47: States with a higher percentage of neighbors, as measured by EPA region, that have previously adopted an RPS will be more likely to adopt a strong RPS.

H48: States with a higher percentage of neighbors, as measured by EPA region, will be more likely to adopt a positive change to an RPS.

H49: States with a higher percentage of neighbors, as measured by REEO region, that have previously adopted an RPS will be more likely to adopt an RPS.

H50: States with a higher percentage of neighbors, as measured by REEO region, that have previously adopted an RPS will be more likely to adopt a strong RPS.

H51: States with a higher percentage of neighbors, as measured by REEO region, that have previously adopted an RPS will be more likely to adopt a positive change to an RPS.

$EXTERNAL\_FEDERAL_{i,t}$ Hypotheses

Studies of RPS effectiveness often incorporate the effect of federal policies like the PTC. This has not been the case in studies of the diffusion of the RPS. States with public lands, namely Western states, may be at an advantage relative to Eastern states, when it comes to renewable energy development. This is especially the case when energy projects on public lands can contribute to in-state renewable energy goals. For these reasons, the effects of federal activities should not be ignored in any study of the diffusion of RPSs. This study's incorporation of these effects is summarized by the hypotheses provided in table 3.9, below.

Table 3.9. $EXTERNAL\_FEDERAL_{i,t}$ Hypotheses

H52: States will be more likely to adopt an RPS when the PTC has been in effect for a longer period of time.

H53: States will be more likely to adopt a strong RPS when the PTC has been in effect for a longer period of time.

H54: States will be more likely to adopt a positive change to an RPS when the PTC has been in effect for a longer period of time.

H55: States with a higher proportion of federally-owned lands will be more likely to adopt an RPS.

H56: States with a higher proportion of federally-owned lands will be more likely to adopt a strong RPS.

H57: States with a higher proportion of federally-owned lands will be more likely to adopt a positive change to an RPS.

Case Study Selection and Methods

Case studies are used to investigate complex phenomena within their context. This is accomplished by allowing access to a holistic understanding of the characteristics of events, especially when the boundaries between events and context are not obvious (Yin 2009). Given the literature's difficulty in teasing out whether the mechanisms of diffusion – imitation, learning, competition, or coercion – are in fact operating within a system in which a policy is diffusing, qualitative case studies are a perfect fit for exploring the external determinants of policy innovation. This is especially true when it is difficult to draw boundaries around a policymaking context in which states may be interacting with one another or may simply be reacting to similar internal circumstances.

Case studies were selected using three variables. The first created a ranking of states using Boehmke and Skinner's (2012) update of Walker's (1969) state innovativeness scores, which covers data from the time period 1960 – 2009. In examining a state's propensity for adopting new policies relative to other states, innovativeness is understood as a general characteristic of a state. Boehmke and Skinner (2012) examine the adoption of over 180 different policies to create a new measure of state innovativeness. Policies included in their study cover a range of issue areas including crime, budgeting, labor laws, education, and health care. Policies related to energy and the environment are also captured by the scores.

The second variable for selecting case studies was Wingfield and Marcus' (2007) Green State Rankings, which ranked states from best to worst in terms of their environmental impacts as measured by the activities of citizens and policy makers. The measure employed six categories – carbon footprint, air quality, water quality, hazardous waste management, policy initiatives, and energy consumption. Each category was scored using multiple criteria including such things as average vehicle miles traveled per year, Clean Water Act permit violations, air pollution rankings from the American Lung Association, hazardous waste management per capita, number of Leadership in Energy and Environmental Design certified buildings, and the American Council for an Energy-Efficient Economy's state rankings.

The case studies presented here examine two states: Oregon, which was ranked in the top five states in both measures; and West Virginia, which was ranked in the bottom ten in both measures. The third variable used to select case studies examined outcomes. When Oregon initially adopted its RPS, it was considered to be one of the strongest policies in the nation. On the other hand, many would argue against calling West Virginia's policy an 'RPS', as the state adopted a policy that was the only portfolio standard in the nation that could be met "with 100 percent coal." The two states also differ in terms of internal socio-economic and policy characteristics, as discussed in greater detail in the case studies presented in Chapters Four and Five.

Multiple data sources were used to triangulate the evidence used in both case studies (see: Yin 2009). Data sources included primary sources like legislative and administrative research reports and other documents; transcriptions, minutes, and audio recordings of administrative hearings and official speeches; executive branch announcements; election campaign-related materials; and legislation. Secondary sources included news stories, interest group publications, and academic articles and other works.

Prior to collecting or analyzing any data for the case studies, a case study protocol was developed (see Appendix C). This protocol, following Yin (2009), was developed in order to guide data collection and analysis by providing a theoretical framework and outline of preliminary expectations about evidence to support findings related to the mechanisms of diffusion. For instance, the protocol suggested that policy makers clearly evaluating, or otherwise seeking information about the policies adopted by other states, would provide evidence of learning. The protocol did not address internal state characteristics like citizen education levels, as hypotheses for these were specified for the quantitative analysis.

Yin (2009) and Collier (2011) suggest that research begin with a timeline of events. In the initial stages of case study development, legislative histories were constructed for both Oregon's and West Virginia's portfolio standard. Research then expanded to primary and secondary data sources to construct a history of events surrounding the initial adoption and subsequent amendment of each state's policy. This involved the use of process tracing, where a careful description of each stage in the trajectory of policy change was constructed by using an outcome (the adoption of an RPS, for instance) to inform the starting place for tracing backward (and forward, in the case of amendments) in time in order to discover causes (see: Bennett 2010; Collier 2011; Starke 2013).

Summary and Introduction to the Case Studies and Quantitative Analysis

The study presented in the three chapters that follow employs a mixed-methods approach to explain policy innovation and change through the lens of the adoption and amendment of an RPS by 35 states between June 1, 1994 and December 31, 2014. The qualitative case studies and the quantitative analysis share research questions, data, and hypotheses, as suggested by Yin (2009). The case studies presented in Chapters Four and Five were designed to examine whether any of the mechanisms of diffusion appeared to be operating and whether different mechanisms were operating at different points during the process of policy innovation and change. The case studies also allowed an in-depth examination of the influence of internal state characteristics, interest groups, and policy entrepreneurs on policy innovation and change. The findings from both suggest that the particular mechanism of diffusion operating varies by state and over time.

The quantitative analysis presented in Chapter Six presents the results of seven Cox proportional hazards models. Four models evaluate the determinants of the adoption of an RPS while three models examine the variables associated with adopting a negative, minor positive, or positive change to an RPS. The results suggest that the variables associated with adoption vary by type of RPS and that the variables associated with amendments vary by type of change and are different from those associated with adoption.

CHAPTER FOUR: THE OREGON RENEWABLE ENERGY ACT

In ranking states using Boehmke and Skinner's (2012) update of Walker's (1969) state innovativeness scores, Oregon ranked fourth. In 2007, the state was ranked second in Wingfield and Marcus' Green State Rankings. As such, Oregon represents a state that scores high on two measures used to select case studies. In addition, in 2015, Clean Edge ranked Oregon third in its U.S. Clean Energy Leadership Index. The index rates states on several categories including clean energy incentives, mandates, regulations, human capital, and carbon management (Clean Edge 2015). Oregon also has abundant in-state renewable energy resources and has traditionally relied upon hydroelectric power to supply the majority of the state's electric needs. At the time that the Oregon Renewable Energy Act (OREA) was adopted, Oregon was the 26th state in the nation to adopt an RPS, and, at the time of adoption, the state's RPS was one of the strongest in the U.S.

The case study that follows demonstrates the importance of learning from other states' policy experiences in the adoption of a policy innovation. While other mechanisms of diffusion make an appearance in the case, learning dominates the explanations for why OREA took the form that it did when it was enacted. On the other hand, economic development concerns and competition appear to dominate the explanations for why OREA was amended in the ways that it was. This case also demonstrates the importance of internal state characteristics, policy entrepreneurship, and interest group activity for explaining policy innovation and change.

This chapter proceeds as follows. First, I provide socio-economic and policy background for Oregon. Following this, I discuss the initial adoption of OREA and potential explanations for this policy innovation. The discussion then turns to look at the several changes made to this policy in the years following its original enactment and explanations for these changes. This discussion is followed by an examination of the major increase to the state's RPS adopted in 2016. The chapter concludes with a summary of the major conclusions of the case study.

State Background

In 2015, Oregon had an estimated population of more than 4 million, or 1.25 percent of the U.S. population. The state is experiencing positive population growth, growing by 5.2 percent between 2010 and 2015. In general, Oregon's population compares to U.S. averages in terms of educational attainment and per capita income; but the state tends to be whiter and a little older: 16.4 percent of the population is over the age of 65, 87.6 percent of residents identify themselves as White, 30.1 percent of the population has a college degree, and median per capita income (in 2014 dollars) was $50,521 between 2010 and 2014 (U.S. Census 2015a).

Oregon's energy mix is heavily dependent upon federal hydropower projects within the Columbia River Basin. The U.S. Congress created the Bonneville Power Administration (BPA) in 1937 and charged it with delivering and selling the power generated at the Bonneville Dam in Oregon. Between the 1940s and 1960s, BPA was authorized to sell power from other federal dams in the river system (Bonneville Power Administration, hereafter BPA, n.d.). At present, BPA markets power from 31 federal dams and other nonfederal projects, including a single nuclear plant, to customers in Idaho, Oregon, Washington, and parts of California, Montana, Nevada, Utah, and Wyoming. About 28 percent of the electricity used in the Northwest comes from the BPA (BPA 2015).

The BPA is expected to take actions consistent with plans developed by the Pacific Northwest Electric Power and Conservation Planning Council (NPCC). As enacted in 1980, the Pacific Northwest Electric Power Planning and Conservation Act established the NPCC to develop regional energy conservation and electric power plans that would ensure a reliable and more environmentally conscious supply of electricity by developing five year plans through a collaborative process involving the four Northwestern states (Idaho, Montana, Oregon, and Washington), tribes, utility customers, other members of the public, and state and federal agencies (Pacific Northwest Electric Power and Conservation Planning Council, hereafter NPCC, 2013).

Three investor-owned utilities (IOUs), 19 cooperative electric utilities, six people's utility districts (PUDs), and 12 municipal utilities serve Oregon's electric market (Oregon Department of Energy, hereafter ODOE, n.d.b). Publicly-owned utilities – cooperatives, PUDs, and municipally-owned utilities (MOUs) – within the BPA service territory largely rely on BPA power which they purchase and distribute to electric customers in their territories. BPA refers to these entities as "preference customers" as these utility types are granted, by statute, preference and priority in the purchase of federal power (BPA 2009; Columbia Research Corporation 2014; Oregon People's Utility District Association, hereafter OPUDA, 2015).

Nationally, the Beaver State ranks second, after Washington, for conventional hydroelectric power generation. In 2013, conventional hydroelectric plants and other renewable resources accounted for approximately 70 percent of the state's net electric generation,[24] wind energy resources account for the bulk of non-hydroelectric renewable energy generation. Between 2007 and the end of 2013, Oregon's non-hydroelectric renewable energy capacity had "almost quadrupled" and in 2010, the state ranked third in the nation, behind Washington and California, for net renewable capacity and generation (U.S. Energy Information Administration, hereafter EIA 2012; EIA 2014a, b, and c).

[24] Hydroelectricity's share of net electric generation varies by year, depending on hydrologic conditions (see: ODOE 2005b).

The state's only coal-fired unit, owned by Portland General Electric, is scheduled to stop burning coal in 2020 (EIA 2014b and c). While the Mist Gas Field, in northwestern Oregon, is the only producing natural gas field in the Pacific Northwest, the state imports 100 percent of its crude oil and natural gas, the latter of which is used mostly in the state's electric sector (EIA 2014b; ODOE 2015).

Oregon, like its other West Coast neighbors, was an early adopter of "comparatively ambitious" policies to address climate change (Byrne et al. 2007). In 1975, the state's legislature declared its support for the development and use of sustainable forms of energy (Oregon Revised Statutes, hereafter, ORS, 2015 Section 469.010; ODOE 2005a). In 1979, the legislature created a small-scale energy loan program. The loans were financed through bond sales, a strategy authorized by the electorate in a 1980 amendment to the state's constitution (ODOE 2015). The state's small business energy tax credit, established in 1979 and allowed to sunset in July 2014, was called the "longest-running tax incentive in the country." The tax credit was used to promote the adoption of energy efficient and renewable energy technologies (ODOE 2015, p. 9). In 1997, the legislature enacted House Bill 3283, which created a first-of-its-kind carbon dioxide standard for new natural gas-fired electric generating units. The legislation also directed the Oregon Energy Facility Siting Council to adopt carbon dioxide standards for other new fossil-fuel generating units and established the Oregon Climate Trust as the official organization for managing carbon offsets (ODOE 2010; Ramseur 2007).

Enacted in 1999, legislation to restructure the electric market for large IOUs also created a public purpose charge designed in part to support the adoption of energy efficiency and renewable energy technologies in the state. The public purpose charge was originally collected from customers of Portland General Electric (PGE) and Pacific Power, a subsidiary of

PacifiCorp. The legislation received broad support from the Oregon Public Utility Commission (OPUC), industry associations, environmental groups, renewable energy advocacy organizations, utilities, and the Citizens' Utility Board (CUB) (Energy Trust of Oregon 2003a and b; Oregon Public Utility Commission, hereafter OPUC, n.d; Renewable Northwest Project, hereafter RNP, 1999). The first strategic plan of the Energy Trust of Oregon, the administrator of the portion of the fund designed to support energy efficiency and renewable energy projects, set a goal to obtain 10 percent of Oregon's electricity from renewable resources by 2012 (Energy Trust of Oregon 2003a and b; ODOE 2005a; OPUC n.d). A similar goal was maintained in subsequent strategic plans and promoted in the 2005 – 2007 State Energy Plan (see: ODOE 2005b).

Oregon's economy and politics have evolved in the last 100 years. At the turn of the 20th Century, the state's economy was rural in nature, based in agriculture and natural resources. By the turn of the 21st Century, that emphasis had shifted to an urban economy based on knowledge-based and service-sector industries. This shift, along with demographic changes, urbanization, globalization, and advances in technology impacted rural and urban Oregonians differently, creating a political divide between different regions of the state (Clucas, Henkels, and Steel 2011).

The economic changes in Oregon had a number of important effects. First, political power shifted out of the rural areas and into urban centers. Second, increasing diversity in urban areas created regional differences in political demands. However, with increasing migration of Latino peoples into rural areas, there are some who think that this gap will be less important in the future. Third, a lack of economic opportunities in rural areas drove younger citizens to seek opportunity elsewhere. While Oregon's average age increased to 39 in 2007, many rural areas had populations whose average age exceeded this state average. In 2010, rural areas of the state had not experienced the same economic growth that urban areas had, and some rural regions continued to experience the effects of the economic downturn that had taken place earlier in the decade. Recent statistics show that more than 65 percent of the state's population lives in urban areas, and the service-sector accounts for approximately 82 percent of Oregon's jobs, while the natural resource extraction industries account for less than one percent of non-farm labor. These changes led to shift in the state's politics (Clucas, Henkels, and Steel 2011).

Because of the changes described above, Oregon's politics shifted from a politics of consensus and cooperation to one of conflict during the mid-1990s. Changes in the state led to a partisan realignment beginning in the early 1980s. While rural voters became increasingly supportive of the Republican Party, urban voters became more supportive of the Democratic Party. With this party realignment, voters in Oregon, like those in the rest of the nation, also became more ideologically coherent in that the rural-urban divide was reflected in the conservative-liberal divide (Clucas, Henkels, and Steel 2011; see also: Moore Information 2009; Yardley 2008). The state's legislature soon followed. In 1990, the Republican Party gained control of the House for the first time since 1971 (Clucas, Henkels, and Steel 2011).[25]

However, Oregon's Democratic Party had been "gaining ground" since 1988 and took back control of the governor's office and the legislature in the mid-2000s. This was a result of an increasing number of voters changing their registration or registering as Democrats and it was also the result of shifting demographics in rural areas. Urban voters, who tended to be wealthier and better educated, moved to rural areas in the state, and brought their political interests with them (Yardley 2008). In 2008, "all regions experienced gains in Democratic Party registration",

[25] The Democratic Party had control of the Senate.

and in 2009, Gallup found that Oregon was the fourth most liberal state in the nation (Clucas, Henkels, and Steel 2011; Saad 2009).

Early Efforts and Initial Adoption

While a recommendation that Oregon consider an RPS was made as early as 2001 (see: Climate Solutions 2001), the history of OREA can be most clearly traced to 2003, when Governors Gary Locke (D-WA), Ted Kulongoski (D-OR), and Gray Davis (D-CA) launched the West Coast Governors' Global Warming Initiative (WCGGWI).[26] Among the final list of recommendations from the 2004 WCGGWI Executive Committee report was to "Set goals and implement strategies and incentives to increase retail energy sales from renewable resources by one percent or more annually in each state trough 2015" (Jolly et al. 2004, p. 2).[27] A month later, in December 2004, Oregon's Governor's Advisory Group on Global Warming, which was established in order to develop a state strategy to compliment the larger regional effort, released a plan for reducing greenhouse gas emissions in the state. This strategy also called for the adoption of a policy that would increase the percent of retail energy sales sourced from renewable resources by one percent or more annually, a standard that would put the state on path to a 20 percent by 2020 renewable energy target. The recommendation referenced the WCGGWI report (Jolly et al. 2004; Governor's Advisory Group on Global Warming 2004; Pedersen 2007).

In 2005, the Oregon Department of Energy (ODOE), on direction from Governor Kulongoski, drafted and released a Renewable Energy Action Plan (REAP). The Plan outlined several action items that the state should take in order to promote increased development of

[26] The WCGGWI was a predecessor to the Western Climate Initiative (WCI), which was created in 2007 through an agreement between the Governors of Arizona, California, New Mexico, Oregon, and Washington (Van't Hof 2007).

[27] Massachusetts' legislature set a 1 percent per year target in 1997.

renewable energy resources. Among these action items was an RPS feasibility study and the creation of a Renewable Energy Working Group (REWG) to guide implementation of the REAP. The Plan also urged the governor's office to coordinate WCGGWI goals with those outlined in the REAP (see: ODOE 2005a).

As established in 2006 by Governor Kulongoski, the REWG's members represented state, local, and tribal governments; public and private utilities, consumer interest groups, the renewable energy industry, and education and businesses interests (see: Oregon Renewable Energy Working Group, hereafter REWG, 2006a). The group held meetings to discuss Oregon's renewable energy policy and implementation of the REAP from February 2006 to April 2009 (REWG 2009). A preliminary task for the REWG was to study and develop a plan for achieving a target of 25 percent renewable energy by 2025. The mechanisms for achieving that target were open, though the group focused on evaluating a feed-in tariff and an RPS. The REWG was expected not only to design the policy but also to work on a strategy for developing bipartisan and stakeholder support for the initiative (REWG 2006a). The deliberations, working papers, draft legislation, and other products emerging from the REWG informed the Governor's RPS legislation (ODOE n.d.c).

Legislation to enact OREA was introduced in the 2007 Regular Session. While a total of five bills to establish an RPS were introduced, Senate Bill 838, introduced by Senator Brad Avakian (D) at the request of Governor Kulongoski, was enacted on June 6th. The bill's coalition included its main proponent, Governor Kulongoski, and eighteen legislative sponsors, including the state's current Governor Kate Brown (D),[28] and Republican Senators Bruce Starr and Jason Atkinson. The bill passed the Senate on a vote of 20 to 10. In the House, the bill passed by a vote

[28] As of March 2018. The state's next gubernatorial election will be held in November 2018.

of 41 to 18. In addition to bipartisan support, the bill also received support from a diverse coalition of local government officials, business and labor interests, environmentalists, consumer advocates, tribes, utilities, and the Public Utilities Commission (Jaquiss 2013; Renewable Energy World 2007; RNP 2007; Sickinger 2014b).

With the enactment of Senate Bill 838, Oregon established what at the time was one of "the most ambitious" renewable energy requirements in the nation (Stoel Rives Energy Group 2007). As enacted, OREA required that the state's three largest utilities meet a 25 percent renewable energy target by 2025. For the state's smaller utilities, the Act created targets of five or 10 percent renewable energy by 2025, with the target determined by utility size. The Act also created a small-scale community renewable energy projects goal of eight percent by 2025. Eligible resources were limited to biomass, geothermal, hydropower, ocean thermal, solar, tidal, wave, wind, and hydrogen produced from renewable resources. OREA set limits on the types of biomass and hydroelectric facilities that were eligible and required that all facilities used for compliance be constructed within the Western Electricity Coordinating Council (WECC) region after January 1995. Compliance was based on the purchase and ownership of renewable energy credits (RECs), or utilities could opt to make alternative compliance payments (ACPs) (Database of State Incentives for Renewables and Efficiency, hereafter DSIRE, 2014c; ODOE n.d.a).

Explaining OREA's Adoption: Internal Characteristics and Policy Diffusion

Previous studies of the diffusion of environmental, energy, and RPS policies have made it clear that certain internal characteristics of states are important for explaining policy innovation – the adoption of a policy new to that jurisdiction, but not necessarily invented by that jurisdiction. Namely, these studies have demonstrated that liberal citizen ideology, democratic control of institutions, state wealth and citizen income levels, and educational attainment are positively associated with the probability of adopting an RPS. Scholars have also found that policy entrepreneurs, interest groups, and advocacy coalitions have an important influence on policy diffusion and adoption. This case is especially illustrative of the important role played by policy entrepreneurs and interest groups.

In 2007, the Democratic Party enjoyed unified control of the state's government. Republicans were in the minority in both chambers of the state's legislature for the first time in 16 years, after Democrats won back control of the House (Silverman 2007a and b). Oregon's state wealth, citizen income levels, and educational attainment are also factors that would suggest, as past studies have found, that the state was a likely candidate for adopting an RPS.

While studies of the adoption of RPSs have found a positive relationship between renewable energy or environmental interest group activity in a state and the adoption of this particular policy innovation, the studies that incorporated the effects of a state's renewable energy potential, typically measured by accounting for solar and/or wind potential, have found both positive and negative effects on adoption rates (Carley and Miller 2012; Chandler 2009; Lyon and Yin 2010; Matisoff 2008; Matisoff and Edwards 2014; Vachon and Menz 2006; Vasseur 2014; Yi and Feiock 2012). Recently, scholars studying policy innovation have begun to address the criticism that research has not placed enough emphasis on the characteristics of the policy being adopted (Jordan and Huitema 2014; Karch 2007b). Karch (2007b) explains that in order to understand policy innovation, we must also consider how a state did or did not modify the policy. The participation of interest groups and trade associations in REWG meetings appears to have played an important role in informing the content of OREA.

Renewable energy and environmental interest groups were active in the state prior to 2007. In elections from 2003 to 2006, Oregon ranked third in the nation for total proenvironmental group contributions to candidates and political parties (Moore 2007). Oregon has tremendous renewable resource potential from almost every source of renewable energy. The state's climate supports substantial amounts of hydroelectric generation, contributes to a booming wind industry, and enables the burgeoning solar and biomass industries. Given these resources, Oregon's utilities were early leaders in using renewable energy. In 2003, the state's utilities were already relying on non-hydroelectric renewable resources, using wind, geothermal, and biomass to meet approximately four percent of demand. In 2005, the state had five wind projects with a total of 259 megawatts (MW) of capacity (ODOE 2005b). Two of the state's IOUs also had successful green power programs – programs that allow utility customers to opt to pay to support utility investment in renewable energy technologies. In 2005, PGE and PacifiCorp led the nation in renewable energy sales through their green power options: PGE ranked second, and PacifiCorp ranked fourth (ODOE 2005a and 2005b).

Given interest group activity, available renewable resources, and utility support and participation in the working group, Oregon was very likely to adopt an RPS. Additionally, members of the REWG included those representing renewable energy, environmental, and other utility interests. With this participation, it is unsurprising that these interests also supported the bill's enactment.

It is clear that environmental groups influenced the language defining eligible resources. For instance, concern arose in a handful of meetings that any use of woody biomass resources also needed to promote the health of old growth forests. In a discussion on the health of these forests, REWG members discussed the importance of thinning and clearing underbrush to avoid large fires. Members argued that if woody biomass was taken during forest health activities, those resources should be utilized to generate biomass energy that would be counted towards the

RPS (REWG 2006e and 2006f). In the final version of the bill enacting OREA, eligible biomass includes electricity generated from: "Forest or rangeland woody debris from harvesting or thinning conducted to improve forest or rangeland ecological health and to reduce uncharacteristic stand replacing wildfire risk" (Oregon SB 838C 2007, section 4.2c).

Another example, members of the group were concerned about how to define eligible hydroelectric resources (see: REWG 2006e and 2006f). There seemed to be a good deal of concern about protecting fish. Other members of the group brought up the importance of aligning existing federal and state definitions of hydropower with the definition that would be included in the RPS. Demonstrating the influence of interest groups on the form that the policy took, the bill enacting OREA uses existing law to protect certain waterways from development:

> "Electricity generated by a hydroelectric facility may be used to comply with a renewable portfolio standard only if: (a) The facility is located outside any protected area designated by the Pacific Northwest Electric Power and Conservation Planning Council as of July 23, 1999, or any area protected under the federal Wild and Scenic Rivers Act, Public Law 90-542, or the Oregon Scenic Waterways Act, ORS 390.805 to 390.925…" (Oregon SB 838C 2007, section 4.4a).

As discussed below, other concerns raised in REWG meetings by biomass and small-scale hydroelectric interests would reemerge in later amendments to OREA, again demonstrating interest group influence on policy content.

Alternative energy industry members and advocacy groups also participated in the REWG meetings. For those groups that participated in REWG's Community Caucus, it is clear that they influenced policy content: The RPS included an eight percent small-scale community renewable energy projects goal (see: REWG: Community Caucus 2006).

While a handful of utilities participated directly in REWG meetings, industry associations represented other utilities. In general, it seems that utility positions on the RPS were influenced by the Fifth Northwest Electric Power and Conservation Plan (adopted by BPA in 2005); the

Pacific Northwest Utilities Conference Committee (PNUCC) meetings; and position statements issued by utilities and utility associations. It seems fairly clear from meeting documents, transcripts, and audio files that the utilities were not originally supportive of a mandate, preferring that if the state did adopt an RPS, that it be in the form of a non-binding goal (see: Lobdell, O'Conner, and Banister 2006; MidAmerican Energy Holdings Company 2006; REWG 2006d). The main argument behind this stance related to the diversity of utilities in Oregon. This diversity appears to have influenced REWG negotiations and OREA's final policy content.

A representative from the PNUCC – a voluntary association of public and private utilities buying power from the BPA in Idaho, Oregon, Montana, and Washington – argued that the diversity among utilities in Oregon, in terms of ownership structure, number of customers, and size of service territory, made a universal mandate inappropriate (Lobdell, O'Conner, and Banister 2006; Pacific Northwest Utilities Conference Committee, hereafter PNUCC, n.d.a and n.d.b; REWG 2006d). The Oregon Municipal Electric Utilities Association (OMEU) – representing the interests of the state's municipally-owned utilities – agreed with this position, holding, in a resolution provided by the organization to the REWG, that the state should adopt renewable energy goals rather than "one-size fits-all mandated standards" and that if the state were to adopt a mandate, it must treat consumer-owned utilities (COUs) differently from IOUs (Oregon Municipal Electric Utilities Association, hereafter OMEU, n.d, 2006). This general sentiment was also reflected in PNUCC's assertion that any renewable standard needed to respect the existing governance and regulatory structure, with a mandate marking a significant departure by treating COUs as regulated entities (Lobdell, O'Conner, and Banister 2006; REWG 2006d).

In addition to the argument against a mandate, BPA's utility customers argued that they already met their demand with a resource mix that was "almost entirely clean, renewable hydropower" (OMEU 2006; REWG 2006e). These utilities were especially concerned that an RPS not interfere with their right to access federal preference power – power produced by BPA facilities and statutorily assured to Oregon's COUs (see: REWG 2006e and f). At the August 11, 2006 meeting of the REWG, the COUs presented draft language for including COUs in the state's RPS. This language included a clause stating, "nothing in this act shall cause a utility to reduce the amount of load served by BPA from the federal base system including but not limited to Tier One" (O'Conner, Godard, and Wanderscheid 2006, p. 3).

Competitive tensions between utility-types emerged in REWG meetings where large COUs and the IOUs argued that allowing some utilities an exemption from complying with the RPS would create an unfair advantage. Summing up the concerns, large utilities argued that low electric rates were driving in-state economic development and that companies located in a service territory where electric costs increased due to a mandate would choose to move into the territory of a utility without a compliance obligation (REWG 2006e and f). The important role played by these arguments becomes clear in evaluating OREA as enacted. First, the statute treats utilities differently by setting different targets based on utility size. Second, as enacted, Senate Bill 838 included a clause to protect BPA customers:

> "A consumer-owned utility is not required to comply with a renewable portfolio standard to the extent that compliance would require the utility to reduce the utility′s purchases of the lowest priced electricity from the Bonneville Power Administration pursuant to section 5 of the Pacific Northwest Electric Power Planning and Conservation Act of 1980, P.L. 96-501, as in effect on the effective date of this 2007 Act. The exemption provided by this subsection applies only to firm commitments for BPA electricity that the Bonneville Power Administration has assured will be available to a utility to meet agreed portions of the utility′s load requirements for a defined period of time" (Oregon SB 838C 2007, section 8.3).

Third, the law acknowledges competitive concerns by applying renewable targets, based on utility size, to all electric providers in the state.

Studies of the adoption of RPSs have consistently found that the presence of fossil fuel industry interests has no effect on adoption rates (Carley and Miller 2012). Because Oregon imports 100% of the fossil fuels used for transportation and electricity production in the state – it's single coal-fired unit imports coal from Wyoming – this case study sheds little light on whether this effect might be found in other qualitative studies of the diffusion of RPSs or other clean energy policies. For this case, fossil fuel interests were not as much of a consideration as was existing hydropower for explaining the adoption of OREA in the specific form that it was adopted.

Oregon has a long history of collaboration among a diverse set of interests to address energy-related policy. In the drafting and passage of Senate Bill 1149, Oregon's 1999 restructuring legislation, several groups worked to develop a policy that many interests could agree upon. The coalition included residential, commercial, and industrial consumer interest groups, environmental groups, renewable energy advocacy organizations, COUs, IOUs, the League of Oregon Cities, representatives of labor unions, officials from the Governor's Office, and state legislators (RNP 1999). As passed, the bill was supported by a diverse set of interests reflecting this coalition (Energy Trust of Oregon 2003a and b; OPUC n.d; RNP 1999). This history of collaboration likely played a role in the success of the REWG in developing an RPS that multiple interests could agree upon.

In addition to the role played by interest groups and industry associations, students of policy innovation have also found that policy entrepreneurs have an important influence on policy diffusion and adoption (Bacot and Dawes 1997; Berry and Berry 2007; Boushey 2010;

Karch, 2007a; Lyon and Yin 2010; Matisoff 2008; Potoski and Woods 2002; Shipan and Volden 2012 Wiener and Koontz 2012; Yi and Feiock 2012). The leadership exhibited by Governor Kulongoski seems especially important for explaining the adoption of OREA. Governor Kulongoski stated that the RPS was a “centerpiece” of his energy agenda and that the policy would make Oregon a leader in the development of renewable energy (Hill 2007; ODOE n.d.c). He made this agenda clear in initiating the REAP process, establishing the REWG, and recognizing and promoting the economic and environmental benefits associated with developing renewable energy in the state (Hill 2007; ODOE 2005a and n.d.c; Tucker 2007).

As discussed above, Oregon was also an early adopter of ambitious policies to address climate change and promote sustainable forms of energy. This leadership likely contributed to a growth in alternative energy industry businesses, which in turn led to a growth in related advocacy organizations. It is also likely that these policies, allowing utilities and other industries to take advantage of the state’s resources, created market certainty for and familiarity with renewable energy technologies, which may have contributed to support for an RPS. While it is difficult to disentangle the effects of Oregon’s traditional leadership on climate change and renewable energy, the state’s renewable energy potential, interest groups, and policy entrepreneurship when seeking to explain RPS adoption, it seems that all of these factors contributed to an environment more supportive of renewable energy than found in many other states, at least in 2007.

Models of policy diffusion aim to explain how and why innovations spread across units of government. Underlying these models is the idea that policy innovation in one state will be influenced by the choices made by policy makers in other states. Diffusion has been hypothesized to result through at least one of the following mechanisms: learning, competition, coercion, or imitation. To explain adoption, studies tend to employ the neighboring states model, which examines diffusion as a function of the number of neighboring states that have already adopted the policy in question, positing that as that number increases, so too will the likelihood of innovation.

Looking at the Oregon case in this manner, the model is almost certain to have predicted the state's adoption of OREA: In 2007, three of the state's four immediate neighbors had already adopted an RPS. When viewed through the lens of a modified map of regional energy efficiency organizations (REEOs),[29] the number of Oregon's neighbors that had previously adopted an RPS grows to four (see figure 4.1).

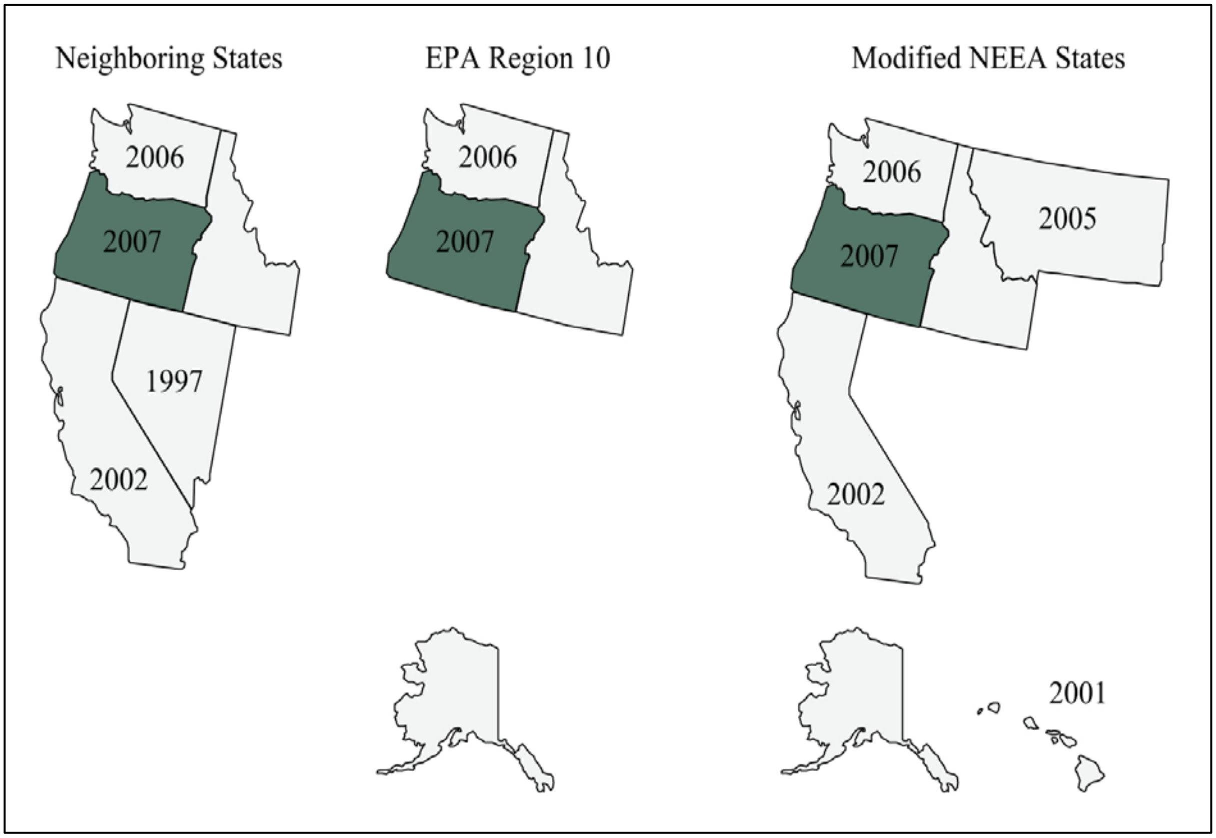

Figure 4.1. Oregon's Neighbors and RPS Adoption Dates

[29] Oregon is a member of the Northwest Energy Efficiency Alliance (NEEA), a REEO region that I modified to include Alaska, California, and Hawaii.

In addition to simply adopting an RPS prior to Oregon, some of the state's neighbors had recently made significant modifications to their policies. In 2004, Hawaii increased their renewable goal by creating a mandatory 20 percent by 2020 target. The following year, Nevada increased their RPS to 20 percent by 2015, and in 2006, California's legislature codified an accelerated target of 20 percent by 2010. However, the neighboring states proxy does not allow us to disentangle the mechanisms of diffusion that influenced the adoption of OREA. Looking more closely at the REWG meetings suggests that learning was the primary mechanism at work when Oregon's RPS was crafted and ultimately adopted.

Some approaches to diffusion through learning suggest that state policy makers use a 'satisficing' approach to problem solving because obtaining information involves certain costs that create constraints on the ability of decision makers to gather and analyze information. In order to overcome these constraints, officials will look to neighboring states and/or states with similar internal characteristics for policy ideas and lessons learned and employ these examples in the decision making process (Berry and Berry 1990, 2007, 2014; Boehmke and Witmer 2004; Graham, Shipan, and Volden 2013; Gray, 1973; Karch 2007b; Matisoff 2008; Mooney 2001; Shipan and Volden 2012; Walker 1969; Wiener and Koontz 2012). Diffusion between states through learning processes might also occur through policy networks, where existing networks facilitate the flow of information and ideas (Berry and Berry 2007; Boehmke and Witmer 2004; Karch 2007b; Matisoff 2008; Shipan and Volden 2012; Walker 1969; Wiener and Koontz 2012).

Policy makers in Oregon were especially fortunate. As a member of the WCGGWI, the state was already part of a network of like-minded states. And, the REWG had been created for the express purpose of crafting an RPS through a collaborative process designed to coordinate Oregon's goals with those of Washington and California. Because the REWG was to employ a months-long collaborative and consensus-based process for investigating and developing new renewable energy policy, the group seems to have been designed to promote policy learning prior to the adoption of a policy innovation. Examples drawn from other states were provided in almost every meeting held by the REWG when drafting the state's RPS.

At the inaugural meeting of the REWG, Bill Drumheller, a liaison from the ODOE, noted that his department had been investigating national and international experience with production-based incentives (like a feed-in tariff) and RPSs and that he would be attending an RPS-focused conference in Chicago and hoped to bring ideas back from that gathering. Michael Grainey, an ODOE representative in the REWG, also noted that in developing policy recommendations for Oregon, "We are looking at what is working and not working in other states and countries right now" (REWG 2006a, p. 3). Later meetings of the group provide additional evidence that the REWG was interested in the experiences of other states. For instance, during the April 20, 2006 meeting, participants brought up the RPS ballot initiative in Washington to support their position that COUs be allowed to continue to rely on BPA resources while also offering non-hydroelectric renewable energy to their customers (REWG 2006b).

The working group also invited Ryan Wiser, of Lawrence Berkeley National Laboratory, to present on experiences with RPSs in other states (see: REWG 2006c). Wiser noted that no two states had identical RPS designs and suggested that these different designs were a result of different goals, markets, and political influences (Wiser 2006a). In his presentations, Wiser gave overviews of the advantages and disadvantages of an RPS, common RPS design "pitfalls", elements of a strong RPS, and discussed lessons learned and RPS design elements that needed to be carefully considered. Throughout his presentations, he provided examples from other states (see: Wiser 2006a and 2006b).

The RPS Discussion Group, a sub-group of the REWG, included representatives from consumer advocate organizations, utilities, the energy industry, and environmental groups. As made clear by a letter submitted to Mike McArthur, Chair of the REWG, the group held several meetings to discuss RPS design details including renewable energy certificate (REC) purchasing and banking, mechanisms to promote increased renewable energy capacity, eligible resources and other definitions to include in the policy, whether all utilities should be required to comply or whether certain utilities would be excluded, and whether Oregon should allow utilities flexibility in complying with the standard. It becomes clear, when looking at the topics focused on by the group, that they used the information provided in Wiser's presentations and looked for lessons learned and policy options in other states' RPSs (Oregon RPS Discussion Group 2006).

Policy diffusion can also occur as a result of competition between states. States are particularly competitive in terms of economic development, where competition emerges over attracting and retaining key industries, residents, and the jobs and revenue associated with these. Evidence of competition between states emerges in this case. A factor influencing Oregon's decision to adopt an RPS may have been increasing demand for renewable energy in California, a good portion of which was being met both by generating units located in Oregon and by Oregonian companies building assets elsewhere in the West and selling their energy to California's utilities (see: Electric Power Daily 2005; Shikes 2005). It was no secret that California's demand was driven, at least in part, by the state's policies: "California 'is an important market for PPM [Energy, a Portland-based company,] partly because of the state's aggressive renewables portfolio standard,' said a PPM spokeswoman in an interview" (Platts 2005).[30]

[30] California's demand continues to drive the renewable energy market on the West Coast (see: Russell 2011).

Participants in the REWG meetings often noted California's demand for renewable energy and pointed out the RPS ballot initiative in Washington. Frequently, renewable energy demand by the two states came up when the debate turned to whether Oregon's RPS should include an in-state requirement. Meeting participants, especially utilities, argued that a requirement that all resources used to comply with the RPS be located in Oregon might hinder utilities' ability to procure necessary resources. Put simply, utilities wanted to ensure that they would be allowed to procure cost-effective renewable resources anywhere in the WECC and not just in Oregon. Utilities took this position because during resource procurement, they would be competing with other utilities in states without strict in-state requirements (REWG 2006d, e, and f). A related argument was that without an RPS in Oregon, high quality sites for wind would be developed by companies from California and Washington, with Oregonian consumers losing out on the benefits, like price stability, associated with wind (see: REWG 2006d).

Federal policy also became a point of concern in these discussions, where some worried that an in-state requirement would run counter to the Interstate Commerce Clause (see: REWG 2006d). BPA's utility customers also argued that because new renewable projects built by the Administration would be located in the WECC, allowing resources built anywhere in this region was important if publicly-owned utilities would need to purchase renewable energy from BPA in order to comply with a mandate (REWG 2006e). Other members of the group argued that flexibility was important for utility planning purposes. Specifically, utilities argued that an expiration of the federal production tax credit for wind would increase costs, creating uncertainty for the wind industry and for procurement of wind resources (REWG 2006d). In sum, the decision to forgo an in-state requirement and define geographically eligible resources as those located within the WECC region seems to have been influenced by competitive concerns and existing federal policy.

Legislative Changes 2009 – 2014

Amendments to OREA were enacted nearly every year between 2009 and 2014. The first amendment to the standard, House Bill 3039, was enacted during the 2009 Regular Session. The bill made a number of changes, which included creating a solar feed-in tariff pilot program, a "solar photovoltaic generating standard" requiring that the three largest utilities develop 20 MW of alternating current solar from systems at least 500 kilowatts (kW) in size by 2020, and implementing a two-for-one credit multiplier for these systems, if they were put into operation before January 2016 (DSIRE 2014c; ODOE 2013b; Oregon Legislative Assembly 2009a; OPUC 2014). With the enactment of this bill, Oregon became the first state in the nation to require that utilities procure solar energy from large-scale facilities (Law 2009).

The bill's passage divided the renewable energy and environmental communities. While some solar advocates, including Desari Strader, the executive director of the Oregon Solar Energy Industries Association (OSEIA), argued that the bill would be a boon for the solar industry, solar-panel installers, the CUB, the Ecumenical Ministries of Oregon, the Oregon League of Conservation Voters, other environmental groups, and some members of OSEIA voiced concern. Most notably, opponents argued that a two-for-one credit multiplier for utility investments in large-scale solar weakened the state's RPS because it "effectively [reduced] the percentage of renewable energy required under the standard" (Finney 2009; Law 2009; Sickinger 2009; Van Fleet and Manvel 2009). The bill was so controversial that members of OSEIA's board voted to remove a member who called the bill an "affront to the solar industry." Another board member quit after the group voted to support the legislation (Law 2009). On the other hand, renewable energy advocates supported the pilot feed-in tariff program (see: RNP 2010).

A bill to add pre-1995 municipal solid waste (MSW) and biomass facilities as eligible resources under the RPS was also introduced in the 2009 Regular Session. Although House Bill 2940 placed several limitations on when and how much MSW and biomass energy could be used for compliance (Oregon Legislative Assembly 2009b), because the state's RPS excluded pre-1995 renewable energy facilities of any type, and because MSW was not eligible under the original standard, several environmental and renewable energy advocacy groups, and Governor Kulongoski, characterized the proposal as an effort to weaken the state's RPS as originally enacted in 2007 (see: Finney 2009; Kulongoski 2009; Manvel 2009; Oregon Secretary of State 2009; Poisner 2009; RNP 2009; Russell 2009; Sickinger 2009). While both chambers of the state's legislature passed the legislation, Governor Kulongoski vetoed the bill. The Governor's veto letter expressed his "hope to work with legislators and stakeholders to develop consensus on how to expand [RPS MW requirements], while also addressing, in a more comprehensive way, concerns from individual renewable resource sectors that seek to become eligible for the RPS" (Kulongoski 2009).

In the 2010 Special Legislative Session, five amendments to OREA were enacted. Following up on the pledge made in his 2009 veto letter, Kulongoski spent time between the end of the 2009 Regular Session and the start of the 2010 Special Session with a group of stakeholders determined to develop a compromise that would allow electricity from pre-1995 biomass facilities to count towards the RPS.

The bill, as originally proposed to the House Interim Committee on Sustainability and Economic Development, was the result of a collaborative effort between several interests, including the Oregon Forest Industries Council, the Renewable Northwest Project, the CUB, the Governor's Office, and at least two major utilities – PacifiCorp and PGE. Introduced to the Interim Committee as Legislative Concept 123, House Bill 3674 included many of the same provisions as House Bill 2940. However, the bill addressed concerns that extending eligibility to these resources would mean that fewer renewable energy facilities would be built in Oregon. It did so by adding the condition that RECs from these biomass and MSW facilities could not be used for compliance until 2026. Participants in the collaborative effort supported the bill as introduced (Oregon State Legislature 2010). However, the League of Women Voters of Oregon opposed the inclusion of MSW (Sickinger 2009).

House Bill 3674 was enacted during the 2010 Special Session and added MSW incineration facilities as eligible resources under OREA. The bill placed several limitations on MSW facilities: Projects burning chemically treated wood were not eligible, facilities had to be located within the WECC region or be designated environmentally preferable by BPA, and the bill set an annual cap of 11 MW of MSW that could be used for compliance. The bill also amended eligibility provisions related to resource vintage to allow energy from pre-1995 biomass and MSW facilities to be used for compliance beginning in 2026, if those facilities were registered with the Western Renewable Energy Generation Information System (WREGIS) by January 1, 2011 (DSIRE 2014c; ODOE 2013b; Oregon Legislative Assembly 2010b).

House Bill 3649 extended eligibility to other pre-1995 renewable resources. OREA originally allowed certain utility-owned low-impact hydroelectric facilities built after 1995 to qualify under the RPS. House Bill 3649 expanded eligibility to non-utility-owned certified low-impact hydroelectric facilities built prior to 1995. The bill authorized the use of up to 40 MW from these facilities to meet compliance obligations in a single year (Budnick 2010; ODOE 2013b; Oregon Legislative Assembly 2010a; Van't Hof 2010).

As originally conceived, House Bill 3633 was crafted to support the development of marine energy projects – including on- and off-shore wind, tidal, ocean thermal, and wave energy resources – by allotting four percent of the existing eight percent shared renewables goal to marine energy (Oregon State Legislature 2010). As eventually enacted, however, the legislation made more modest changes by amending language in the section of OREA that created the small-scale community renewable energy projects goal to emphasize the importance of community renewable energy projects relying on marine energy sources and tasking the Department of Land Conservation and Development with developing a study that would address barriers to and the effects of developing marine energy resources off of Oregon's coast (Oregon HB 3633B 2010; ODOE 2013b; Oregon State Legislature 2010).

Two bills amended provisions of the solar photovoltaic generating standard created by House Bill 3039 in 2009. House Bill 3690 made technical and clarifying changes to the standard. Among the changes impacting the RPS, the bill defined size limits (500 kW) for qualifying facilities, authorized the Public Utilities Commission to adjust the program's target, and capped the program at 25 MW of alternating current facilities. If this target was not met, the program would sunset March 31, 2015 (Oregon Legislative Assembly 2010c; Van't Hof 2010). With the enactment of House Bill 3691, utilities were allowed to recover the above-market costs, or "the difference between what the electric power produced by a project is worth, at standard rates, and what it actually costs to produce the power", associated with complying with the RPS and/or the solar photovoltaic generating standard (Oregon HB 3691A 2010; ODOE 2013b; Oregon Legislative Assembly 2010d; Oregon Secretary of State 2010).

Two additional changes were made to OREA in 2011. House Bill 2622 amended the Act to allow any facility that converts from coal to a renewable energy source after January 1, 2012, to qualify as a new facility, and an eligible facility under the RPS (Association of Oregon Counties, hereafter AOC, 2011; DSIRE 2014c; ODOE 2013b; Oregon Legislative Assembly 2011a). OREA required the ODOE to create a system for RECs to be used by utilities to demonstrate compliance with the RPS. When the Department created the rules to implement this requirement, ownership of RECs related to facilities built prior to 2005 was not addressed. House Bill 3571, also enacted in 2011, addressed this oversight by amending OREA to clarify REC ownership provisions (ODOE 2013a; Oregon Legislative Assembly 2011b).

In the 2013 Regular Session, House Bill 2893 was enacted. The legislation made a handful of changes to the solar photovoltaic generating standard created by House Bill 3039 in 2009. First, the bill increased the program cap from 25 MW to 27.5 MW. Second, the program's sunset date was extended by one year to March 2016 (Oregon Legislative Assembly 2013). Although the bill was amended to remove increases to the prices paid under the feed-in tariff, the Sierra Club and the Renewable Northwest Project supported raising the program's cap (see: RNP 2013; Sierra Club 2013).

Between the enactment of OREA in 2007 and 2013, new data centers were built and Amazon continued to expand its data centers in Umatilla Electric Cooperative's (UEC) service territory. The additional load threatened to move UEC into the large utility category by 2016, which would require that it meet OREA's 25 percent by 2025 renewable energy mandate (Jaquiss 2013; Mapes 2013; Renewable Energy Advisory Council 2013; Sickinger 2014b). The utility was concerned that it would have to raise its electric rates in order to comply with the higher requirements. In order to avoid this, UEC sought an exemption from the RPS (Mapes

2013; Renewable Energy Advisory Council 2013). The utility also supported a bill that would have weakened the state’s Standard by allowing power from large hydroelectric facilities to be used for RPS compliance (Jaquiss 2013; Mapes 2013; Renewable Energy Advisory Council 2013; Sickinger 2014b). UEC later filed a ballot measure to extend eligibility to legacy hydroelectric facilities.

Several groups, including the other large utilities, opposed the ballot initiative (Mapes 2013; Northwest Energy Coalition 2014; RNP 2014; Sierra Club 2014; Stanfield 2013). Large utilities argued that UEC’s move was an attempt to gain unfair advantage: “‘It's unclear a fix is even needed,’ said Scott Bolton, vice president of government affairs for PacifiCorp… ‘You don't want to give them something special that makes them the data center capital of the world while other areas are begging for economic development’” (Mapes 2013). The CUB and Governor Kitzhaber, also opponents of the ballot initiative, hoped to negotiate with UEC to address the issue, and later in the year, Governor Kitzhaber and state Representative Greg Smith (R) co-chaired a working group to determine whether a legislative compromise could be developed (Mapes 2013; Northwest Energy Coalition 2014; Renewable Energy Advisory Council 2013; RNP 2014; Sickinger 2014a). Specifically, the group sought to find a way to avoid saddling smaller utilities with the costs associated with procuring new renewable resources while also ensuring that large utilities would not be put at a disadvantage in terms of the costs of complying with the RPS (Sickinger 2014a).

In the 2014 Regular Session, a compromise bill was enacted. House Bill 4126, or the “Data Center Bill”, changed provisions related to the use of unbundled RECs to meet the provisions of OREA (Oregon HB 4126 2014; Oregon Legislative Assembly 2014; Sickinger

2014a).[31] The end result of the bill was that smaller utilities would be allowed to use unbundled RECs – where the energy produced is sold as separate commodity from the environmental attributes associated with renewable energy – to comply with the RPS. Because unbundled RECs are and were less costly than bundled RECs, the measure was intended to reduce the costs of compliance for smaller utilities like UEC. Because large utilities were opposed to this option, arguing that this gave small utilities an unfair advantage, the bill also contained language directing OPUC to study a special green tariff for industrial customers of large utilities, a tariff that small energy providers had long opposed (RNP 2014; Sickinger 2014a).

With the compromise bill "Everybody gave a little something…" (Sickinger 2014a). Environmental groups, who had opposed the ballot initiative, and cooperatively-owned utilities both supported House Bill 4126, especially because it removed the threat of the ballot initiative (Markham, 2014; Northwest Energy Coalition 2014; RNP 2014; Sierra Club 2014). Upon enactment of the legislation, the Renewable Northwest Project announced "We're not debating whether or not renewable energy is a good idea anymore; instead we're talking about how best to offer more renewable energy and increase Oregon's competiveness. Everyone involved in this process agrees that renewable energy plays a critical role in Oregon's clean energy future" (RNP 2014).

Explaining Legislative Changes: 2009 – 2014

What is striking about the set of bills enacted between 2009 and 2014 is that they can all be most clearly tied to economic concerns, renewable energy interests, and/or utility interests. In 2009, the first amendment to OREA ensured a place for solar in Oregon's RPS. Between 2009

[31] A 2010 ballot initiative, Measure 71, amended the state's constitution to require that the legislature meet annually rather than biennially (see: Ballotpedia 2010). Even year regular sessions began in 2012, however OREA was not amended that year.

and 2010, a statewide debate culminated with the extension of eligibility to existing small biomass, MSW, and low-impact hydroelectric facilities. In 2010, ocean energy was given higher priority in the RPS and amendments were made to clarify provisions for solar. In 2011, utilities converting an existing facility were ensured that that activity would be rewarded, and a clarifying amendment provided certainty to pre-2005 generating units. In 2013, while clarifications to the solar standard were enacted, the major debate that year and the next revolved around the economic interests of utilities.

The 2009 and 2013 amendments to ensure a place for solar in OREA have relatively clear ties to interstate competition. Evidence from the 2006 REWG meetings demonstrates that policy makers and interest groups in Oregon were watching California's solar market. In a discussion about the Energy Trust of Oregon, participants noted California's solar policies and a recent investment, by the state, of $300 million. Participants in Oregon argued that the state would need to become more aggressive in its support of solar if it wanted to attract solar companies (REWG 2006e). The creation of a solar carve-out, multiplier, and feed-in tariff in 2009 likely reflects economic development concerns and a desire, by policy makers, to provide support for Oregon's solar industry.

In 2010, two bills extended RPS eligibility to certain pre-1995 biomass, MSW, and certified low-impact hydroelectric facilities. These amendments have clear origins in the 2006 meetings of the REWG, providing additional evidence of the importance of interest groups in informing policy content. For instance, in the July, August, and September meetings of the REWG, arguments were made in favor of including pre-1995 small biomass and hydroelectric projects. Other participants argued in favor of including small pre-1995 MSW projects. All proponents of these proposals argued that inclusion would not drastically reduce RPS requirements and would be economically important for the few small projects – termed "outliers" by some REWG participants – in existence in 2006. Oregon's COUs were especially in favor of including these resources, as these utilities had already developed biomass and other small renewable energy projects by the time the REWG began to meet. These utilities argued that early action to incorporate renewable energy into an electric portfolio should be rewarded. Lastly, members of the public commented that these resources were important for rural Oregonians and for economic development in the central and eastern areas of the state (see: REWG 2006d, e, and f).

The other three bills amending the RPS in 2010 reflect the economic concerns of utilities and renewable energy interests. While House Bill 3633 added language supportive of marine energy projects, the two bills amending provisions relating to the solar photovoltaic generating standard created by House Bill 3039 in 2009 clarified targets and utility cost recovery for the program and the RPS. In the latter case, House Bill 3691 allowed utilities to recover the above-market costs associated with complying with OREA.

In 2011, the two changes made to OREA reflect broader state policy interests and the economic interests of renewable energy developers. First, House Bill 2622, which allowed the state's single coal-fired facility to convert to a renewable energy source and qualify as a new facility under the RPS clearly provides an incentive for PGE to comply with the state's energy and environmental policy goals. The second bill to enact changes to the state's RPS in 2011 clarified REC ownership provisions to provide certainty for renewable energy project developers.

The last major change to OREA covered in the study here is clearly tied to the economic interests of utilities and to intrastate competition. The UEC compromise bill, or the Data Center

Bill, removed the threat of a ballot initiative backed by UEC and it also gave something to both sides on the issue. While UEC and other cooperatives were assured that the costs of complying with the RPS would be reasonable, by allowing the use of unbundled RECs, large utilities were also provided the possibility of a green tariff for industrial customers.

Throughout the 2009 – 2014 period of amendments, we also see a role played by policy entrepreneurs, leaders, and multi-stakeholder negotiation, a theme also present in the study of the adoption of the state's RPS. The leadership of actors like Governor Kulongoski, through the creation of a group to address concerns about the bill introduced the year before, ensured that the biomass and MSW compromise was enacted in 2010. The leadership exhibited by, at minimum, Governor Kitzhaber and Representative Greg Smith, and the development of a working group to create a compromise solution avoided a potential policy showdown and assured the passage of a bill acceptable to most interests in 2014 (see: Markham 2014).

OREA's Expansion: 2015 – 2016

In 2015, environmental groups failed to move the "Coal to Clean" bill through the state's legislature. The bill was opposed by the state's utilities and died in committee. Following this, Renew Oregon – a coalition of businesses, non-profits, community organizations, and individual citizens concerned about climate change and promoting the use of clean energy – filed a ballot measure for the 2016 election. The measure, like the failed bill, would have required that electric providers stop supplying energy from coal-fired electric generating units and replace it with other sources (Kullgren 2015; Renew Oregon 2016; Trabish 2016b). The measure would have also required that utilities meet a 50 percent renewable energy target by 2040 (Kullgren 2015).

A broad coalition supported the measure, and supporters engaged in a statewide community and educational outreach campaign. Polls showed that about seventy percent of

Oregonians supported the proposal (Randall 2015). According to Renew Oregon's Communication Director Brad Reed, "That brought the utilities to the table" (Trabish 2016b).

On March 8, 2016, Governor Kate Brown signed Senate Bill 1547 into law. The Act required Oregon's IOUs, Pacific Power and PGE, to meet a 50 percent renewable energy target by 2040, the Eugene Water and Electric Board, a COU serving approximately 5 percent of Oregon's load, must meet and maintain a target of 25 percent by 2025, and for the state's remaining 37 small and medium utilities, the RPS remains unchanged from the standard set in 2007 (Delony 2016; Sukunta 2016). The bill included a four percent cost cap and allows the OPUC to delay enforcement if grid reliability is threatened (Trabish 2016a and b).

Senate Bill 1547 created one of the most aggressive RPSs in the nation – the two IOUs supply 70 percent of the state's electric load. The bill followed significant expansions of RPSs in California (50 percent by 2030), Hawaii (100 percent by 2045), and Vermont (75 percent by 2032). Also, in 2015, New York's Governor, Andrew Cuomo, directed the state's Public Service Commission (PSC) to develop a 50 percent by 2030 Clean Energy Standard. This Standard was issued by order of the PSC in the summer of 2016 (Delony 2016).

In addition to creating a new 50 percent renewable energy target, the bill set a timetable for eliminating the use of out-of-state coal-fired electricity in Oregon by 2030 (Delony 2016; Hales 2016; Sukunta 2016; Theriault 2016). The bill lifted the moratorium on using RECs from pre-1995 biomass and MSW facilities established by House Bill 3674 in 2010 (Delony 2016; Trabish 2016b). The bill also established a community solar program under which residential and small commercial customers are allowed to receive credit on their electricity bills from off-site solar facilities located in Oregon (Delony 2016; Trabish 2016b).

The bill was supported by a diverse coalition of stakeholders, including PacifiCorp, PGE, the CUB, the Northwest Energy Coalition, the Oregon Environmental Council, the Oregon League of Conservation Voters, the Natural Resources Defense Council, the Sierra Club, and Renewable Northwest (Delony 2016; Hales 2016; Sickinger 2016a and b; Trabish 2016b). As was the case for the initial adoption of the RPS and for subsequent amendments to OREA, Senate Bill 1547 was brought about through negotiation. While past negotiations included a broad set of stakeholders, the 2016 legislation appears to have resulted from negotiations between environmental advocates, renewable energy groups, and the states two large IOUs (Sickinger 2016a and b; Theriault 2016; Trabish 2016b). The meetings began after environmental groups failed to move a clean energy bill through the state's legislature in 2015 and subsequently began gathering signatures for a similar proposal for the 2016 ballot. The utilities engaged in negotiation in order "to craft a more flexible and affordable compromise to the ballot measure", which environmental groups promised to "drop" if the compromise became law (Sickinger 2016b; see also: Theriault 2016; Trabish 2016b).

However, members of the OPUC complained that their concerns about the legislation were left largely unaddressed (Sickinger 2016b; Trabish 2016a). Opponents argued that the bill would do little to address carbon emissions from the coal-fired plants currently delivering electricity to the Oregon market and that the bill would be a boon to utilities, allowing Oregon's IOUs to invest in higher cost renewable energy, and pass those costs on to the ratepayers, while the coal plants in other states would continue to operate and supply low-cost electricity to other states' markets (Trabish 2016a and b; Walton 2016).

Conclusions

The adoption of OREA demonstrates the importance of learning from other states' experiences. What also becomes clear is that economic development concerns appear to be the most important drivers of later amendments and that these economic concerns involved both inter- and intra-state competition. Similar to what Boehmke and Witmer found in 2004, this case suggests that while policy innovation, in at least some states, is driven by learning, policy change may be driven more by competitive concerns.

In 2007, the Democratic Party enjoyed unified control of the state's government. Oregon's state wealth, citizen income levels, and educational attainment are also factors that would suggest, as past studies have found, that the state was a likely candidate for adopting an RPS. The participation of interest groups and trade associations in REWG meetings played an important role in informing the content of OREA. These factors made Oregon very likely to adopt an RPS.

Oregon has a long history of collaboration among a diverse set of interests to address energy-related policy. This history of collaboration likely played a role in the success of the REWG in developing an RPS that multiple interests could agree upon. This history would also be important in ensuring the successful enactment of later changes to the state's policy. The leadership exhibited by Governor Kulongoski also seems especially important for explaining the adoption of and changes made to OREA.

While it is difficult to disentangle the effects of Oregon's traditional leadership on climate change and renewable energy, the state's renewable energy potential, interest groups, and policy entrepreneurship when seeking to explain RPS adoption, all of these factors contributed to an environment more supportive of renewable energy than found in many other states, at least in 2007.

Some evidence of competition between states emerges in this case. A factor influencing Oregon's decision to adopt an RPS may have been increasing demand for renewable energy in California and the upcoming ballot initiative to establish an RPS in Washington. Amendments to OREA were enacted nearly every year between 2009 and 2014. What is striking about the set of bills enacted during this time is that they can all be clearly tied to economic development concerns, renewable energy interests, and/or utility interests. Throughout the 2009 – 2016 period of amendments, we also see a role played by policy entrepreneurs, leaders, and multi-stakeholder negotiation.

CHAPTER FIVE: WEST VIRGINIA'S ALTERNATIVE AND RENEWABLE ENERGY PORTFOLIO ACT

Using Boehmke and Skinner's (2012) update of Walker's (1969) state innovativeness scores to create a ranking of states, West Virginia ranked 43rd. In 2007, Wingfield and Marcus ranked the state last in their Green State Rankings. As such, West Virginia represents a state that scores low both in terms of innovativeness and environmental policies and consciousness, which were the measures originally used to select case studies. In addition, in 2015, Clean Edge ranked West Virginia 46th in its U.S. Clean Energy Leadership Index. The index rates states on several categories including clean energy incentives, mandates, regulations, human capital, and carbon management (Clean Edge 2015). West Virginia relies upon coal to supply the majority of the state's energy needs, representing a divergent case from Oregon, a state that relies heavily on hydropower. With the enactment of the state's Alternative and Renewable Energy Portfolio Act (AREPA) in 2009, West Virginia's lawmakers enacted a relatively weak RPS, in effect creating a renewable goal for the state. When looking at the adoption of RPSs, renewable goals, and clean or alternative energy standards (standards that include non-renewable resources and/or energy efficiency), West Virginia was the 35th state to adopt such a policy.

The case study that follows demonstrates diffusion through imitation. While economic competition also emerges, it seems most likely that the adoption of AREPA was a case of imitation heavily influenced by in-state characteristics. AREPA was largely a symbolic act and reflected the dominance of coal in the state's economy.

This chapter proceeds as follows. First, I provide socio-economic and policy background for West Virginia. Following this, the discussion turns to the initial adoption of AREPA and potential explanations for this policy innovation. Minor changes made to the policy following its adoption and AREPA's repeal in 2015 are then discussed. The chapter concludes with a summary of the major findings of the case study.

State Background

In 2015, West Virginia had an estimated population of just over 1.8 million (or .57 percent of the nation's total). That number is down from years past, as the state is experiencing negative population growth. West Virginia's residents tend to be older, Whiter, less educated, and poorer than national averages: 18.2 percent of the population is 65 years and older, 93.6 percent of residents identify themselves as White, 18.7 percent of the state's citizens have college degrees, and median per capita income (in 2014 dollars) was $41,576 between 2010 and 2014 (U.S. Census 2015b).

The Mountain State's economy has been highly dependent on coal for more than 250 years. Ranked second in the nation for coal production in 2015,[32] and accounting for 12 percent of total U.S. coal production in 2012, the state relies heavily on coal-fired electric generation: In 2013, 95 percent of the state's net electric generation in was powered by coal. The bulk of the remainder is made up by hydropower and some wind. West Virginia is also an important exporter of electricity. In 2010, 56 percent of the state's net electric generation was sold to consumers in other states (U.S. Energy Information Administration, hereafter EIA, 2014d and 2015b).

A point of pride in the state, coal not only played an important role in the economic and cultural development of West Virginia, the state's coal reserves also fueled the nation's industrialization, and accounted for at least half of total U.S. electric generation until around

[32] Wyoming was ranked first, while West Virginia's neighbors were third (Kentucky), fourth (Illinois), fifth (Pennsylvania), eighth (Indiana), twelfth (Ohio), fourteenth (Virginia), and nineteenth (Maryland) (EIA 2015b).

2005. By 2014, coal's share of the national electric market had declined to 39 percent, with losses mostly attributable to the electric sector's switch to natural gas (Bowen, Christiadi, and Deskins 2015; Paalborg 2011; EIA, 2015c; Valentine and Kroh 2014; Van Nostrand 2013).

The coal industry has been crucial for the state's economic health – the state collected approximately $407 million in coal severance taxes in 2014. But, the sector has faced production and employment declines that have been particularly pronounced in the last decade (Bowen, Christiadi, and Deskins 2015). While total coal production declined by 20 percent between 1997 and 2008, the losses over the next five years were larger: In 2013, coal production stood at 113 million tons, down from 235 million tons in 2008 (Bowen, Christiadi, and Deskins 2015; Valentine and Kroh 2014). West Virginia is also experiencing increased competition from coal producing states in the Midwest. Between 2011 and 2013, while production in the state was declining, production in Indiana increased by four percent, and in Illinois by more than 38 percent (Bowen, Christiadi, and Deskins 2015). The industry's job losses began in 1983, decreasing from a little over 41 thousand jobs in that year to around 20 thousand by the first quarter of 2014 (Bowen, Christiadi, and Deskins 2015; Plumer 2013).

There are several possible, and likely interrelated, explanations for this decline. First, increasing automation of coal mining, especially through mountaintop removal mining, accounts for some job losses (Plumer 2013; Valentine and Kroh 2014). Second, while some blamed job losses on new regulatory hurdles created by the Obama administration, others note the small increase in job numbers following the implementation of stricter permitting requirements for mountaintop removal mining (Paalborg 2011; Plumer 2013; Ward 2011). Third, the regulation of power plant sulfur emissions spurred increased production of low-sulfur Western coal and contributed to decreased demand for higher sulfur Eastern coal (Plumer 2013; Valentine and

Kroh 2014). Fourth, many of the easy to access coal seams in West Virginia have been depleted (Lovan 2011; Paalborg 2011; Plumer 2013; Strobo 2012; Valentine and Kroh 2014). Fifth, plunging natural gas prices and stricter emissions regulations have increased the costs associated with coal in the electricity sector, influencing a shift towards natural gas-fired generation (Plumer 2013; Strobo 2012; Valentine and Kroh 2014; Van Nostrand 2013).

Job losses, production decline, and the attendant impacts on state and county coffers led to calls to diversify the state's economy. In addition, the environmental and health impacts associated with coal production and use spurred a growing movement that supported increased investment in renewable and alternative energy resources. Many who supported diversification argued that the state should capitalize on its natural gas, biomass, geothermal, wind, and solar resources (Paalborg 2011; Plumer 2013; Valentine and Kroh 2014; Van Nostrand 2013).

West Virginia is also an important producer of natural gas, ranking ninth in natural gas production in 2013 (EIA 2013, 2014d). While West Virginia has several hydroelectric facilities, these account for about two percent of the state's net generation. Several large wind projects have already been developed in the state. However, wind accounts for less than two percent of the state's net generation. This is because most of the existing projects were not developed in response to West Virginia's energy policies, rather they were built in order for utilities to meet more rigorous RPS requirements in neighboring states (EIA 2013; Van Nostrand 2013). The solar industry has never had much success in the state. And, repeals of supportive policies contributed to job losses in this sector (Valentine and Kroh 2014).

At the same time that West Virginia's energy economy experienced change, so too did the state's political culture. Traditionally, West Virginians tend to be economically liberal and socially conservative, and until about the 2000 presidential election, the state was solid blue:

While coal dominated the economy, unions dominated the state's politics. There is also a strong sense of loyalty to the party of Franklin Roosevelt and John Kennedy. While registered Democrats continue to outnumber Republicans 51 to 28 percent, surveys related party identification and ideology provide some evidence that the state's politics are shifting towards increased support for Republican and Conservative candidates (West Virginia Secretary of State 2012; see: Bias, Brisbin, and Leyden 2006). Another indicator of the shift in the state's politics comes from recent presidential elections. George W. Bush carried the state in 2000 and 2004 (Kaplun 2008). And, in a state that has traditionally supported Democratic candidates, President Obama beat prison inmate Keith Judd by only 16 percentage points in the 2012 Democratic primary. Obama's unpopularity in the state is related to a successful message that the U.S. Environmental Protection Agency's new regulations and the Affordable Care Act harmed the state's economy, and that the "War on Coal" took West Virginian jobs, a message that the state's Democrats left "largely unchallenged" (Woodruff 2014).

Early Efforts and Initial Adoption

Governor Joe Manchin III (D) introduced AREPA, which would create a 25 percent by 2025 alternative and renewable energy standard, in his February 2009 State of the State Address (Anderson 2009; Hohmann 2009a and b; Kabler 2009). Introducing the policy, Manchin stated that it would "put West Virginia at the forefront of new energy development." The speech then turned to the need to continue to support the use of coal and the development of clean coal technologies (Manchin 2009).

The first legislative attempt to enact AREPA, Senate Bill 297, was introduced during the Regular Session on February 19, 2009 by Senate President Earl Ray Tomblin (D) and Senate Minority Leader Don Caruth (R) on request of the Governor. The bill's companion, House Bill

2682 – which never moved past the first committee – was introduced that same day by Speaker Rick Thompson (D) and Delegate Tim Armstead (R), also on request of the Governor. The legislative findings point to several reasons for the legislation. Most prominently, the findings cite the economic development potential associated with alternative and renewable energy. Less prominently, the findings cite the need to reduce electric sector emissions and to ensure that the sector would continue to meet state and reasonably foreseeable federal regulations while continuing to provide reasonably priced electricity.

The Senate Bill was the subject of some controversy when an amendment added nuclear energy to the list of eligible technologies. This amendment was removed in the version that passed the House (see: Garvin 2009). While the Senate passed the bill 32-2 and the House passed the bill 72-28 in April, a technical problem with the legislation prevented its enactment (West Virginia House of Delegates 2009a; West Virginia Legislature 2009).

A similar proposal to AREPA, House Bill 2891, was also introduced during the 2009 Regular Session by Delegates Barbara Fleischauer (D), Robert Beach (D), Margaret Staggers (D), Barbara Hatfield (D), Clif Moore (D), Joseph Talbott (D), Bonnie Brown (D), Danny Wells (D), and Bob Tabb (D). The Democratic proposal differed from AREPA in that it would have required the state's Public Service Commission to establish an RPS requiring that utilities meet a 15 percent by 2021 renewable energy target. The legislation explicitly excluded fossil fuels and nuclear resources from the definition of eligible resources. The bill languished in the first committee it was assigned to.

The First Special Session of 2009 was called to convene at the end of May. Among the 13 items on the Governor's agenda for the session, AREPA was reintroduced on May 31 (see: Porterfield 2009). As before, two versions of the legislation were introduced in the House (House

Bill 103) and Senate (Senate Bill 1013). Speaker Rick Thompson (D) and Delegate Tim Armstead (R) sponsored the House Bill while in the Senate, Senate President Earl Ray Tomblin (D) and Senate Minority Leader Don Caruth (R) sponsored the bill. The two versions, as introduced, were very similar, if not identical, to Senate Bill 297 and House Bill 2682, introduced in the Regular Session just months before.

While the Senate version of the legislation died in committee, Governor Manchin approved AREPA (House Bill 103) on June 17, 2009. The House Bill passed its originating chamber on a vote of 69 – 30 and passed the Senate with a vote of 28 – 4 (West Virginia House of Delegates 2009b; West Virginia Senate 2009). AREPA required that utilities with more than 30,000 customers supply 25 percent of retail electric sales from alternative or renewable resources by 2025. The Act also set interim targets for large utilities at 10 percent from 2015 to 2019, and 15 percent from 2020 to 2024. Smaller utilities were subject to smaller goals. The Act was later amended in the 2009 Fourth Special Session (House Bill 408) to relax definitions and terms of compliance under the portfolio standard. As enacted, this legislation amended the definition of "Advanced Coal Technology", set a 10 percent cap on the percentage of the requirement that could be met using natural gas, and amended provisions relating to renewable energy credits and greenhouse gas emissions offsets tracking and data disclosure to allow third party participation and to prevent public disclosure of sensitive pricing information.

As enacted, and later amended, AREPA employed an "unusually permissive" definition of alternative energy resources (Paalborg 2011, p. 138; see also: Heeter and Bird 2012; Public Service Commission of West Virginia, hereafter WVPSC, 2012; Sadasivam 2015; Van Nostrand 2013). In fact, it is hard to find a technology, other than nuclear, that is excluded from the list of qualifying resources. Qualifying 'alternative energy' resources included: "coal technology, coal bed methane, natural gas, fuel produced by a coal gasification or liquefaction facility, synthetic gas, integrated gasification combined cycle technologies, waste coal, tire-derived fuel, pumped storage hydroelectric projects, and recycled energy…" and any project that reduced or offset greenhouse gas emissions, which could include grid modernization projects and energy efficiency (U.S. Department of Energy, hereafter DOE n.d; West Virginia HB 103 2009; see also: Heeter and Bird 2012; Van Nostrand 2013). AREPA's definition of qualifying facilities was so permissive that "A number of existing plants considered to be conventional generating plants [qualified] to meet the portfolio standard" (WVPSC 2012, p. 19). Because AREPA did not provide a minimum requirement for renewable energy, the renewable energy provisions of West Virginia's standard were more similar to a non-binding goal than a renewable mandate (Cardosi and Timony 2015; Morris 2011; Paalborg 2011; DOE n.d).

Compliance was based on the purchase of alternative energy credits (AECs). AECs could be purchased for facilities located in West Virginia or within the PJM (Pennsylvania, Jersey, Maryland) regional transmission organization's (RTO) territory. The legislation directs the West Virginia Public Service Commission (WVPSC) to develop AEC rules, and provides for credit multipliers, in theory providing incentives for renewable resources. Under the statute, utilities would receive one credit for each megawatt hour (MWh) of electricity generated or purchased from an alternative energy facility, two credits for each MWh of electricity generated or purchased from a renewable energy facility, and three credits for each MWh of electricity generated or purchased from a renewable energy facility located on a reclaimed surface mine located in West Virginia. The statute also contained provisions relating to customer-generators and net energy metering (NEM), and credits for energy efficiency programs (DOE n.d).

In 2011, the state's two major utilities, American Electric Power and Allegheny Power, which, at the time, supplied 99 percent of the state's retail electric power, released their AREPA compliance plans. The plans "[indicated] that no new renewable generation capacity would be required through 2025" (Heeter and Bird 2012, p. 8).

Explaining AREPA's Adoption: Internal Characteristics and Policy Diffusion

Previous studies of the diffusion of environmental, energy, and RPS policies have made it clear that certain internal characteristics of states are important for explaining policy innovation. Namely, scholars have found that liberal citizen ideology, democratic control of institutions, higher state wealth and citizen income levels, and higher citizen education levels are especially important for explaining the adoption of an RPS. Scholars have also found that policy entrepreneurs, interest groups, and advocacy coalitions have an important influence on policy diffusion and adoption. This case is especially illustrative of the importance of in-state economic interests and other interest groups.

In 2009, it seems likely that many who study the diffusion of clean energy policies might have had a difficult time predicting the adoption of AREPA. In favor of adoption, the Democratic Party held unified control of the state's political institutions (National Conference of State Legislatures, hereafter NCSL, 2009). The state's citizens, at the time, tended to be economically liberal, socially conservative supporters of the Democratic Party. But a shift towards conservatism and support of the Republican Party had already begun. On the other hand, lower than average educational attainment and per capita income might have suggested against adoption. These competing factors might also help to explain why AREPA took the largely symbolic form that it did.

Studies of the diffusion of RPSs have consistently found that the presence of fossil fuel industry interests has no effect on the probability of adoption (Carley and Miller 2012). However, West Virginia's history with coal likely played an important role in shaping AREPA's content. The state's economy is heavily dependent on the coal industry and has been so for more than two centuries. This dependence is reflected in AREPA.

The state's political leadership has long promoted the industry and continues to do so. In the 2008 State of the State Address, Governor Manchin promoted the "critical" role that clean coal, or the "greening of the coal industry" should play in addressing concerns about energy security and climate change (Manchin 2008). Also in 2008, the West Virginia Division of Energy, created just one year before, released its first State Energy Plan. In suggesting a path forward for West Virginia, the Division's plan declares, "New technologies applied to our conventional energy resources will be an even more significant factor in our energy future than nontraditional resources. Specifically, advanced coal technologies represent the most viable option for our nation to transition away from imported oil" (West Virginia Division of Energy 2008, p. 2).

Given economic dependence and the focus on advanced coal technologies during the time that AREPA was introduced and later enacted, it is unsurprising that West Virginia's government enacted a policy with requirements that could be met without utilities needing to build any new non-coal-fired generating units (see: WVPSC 2012). In terms of protecting an important and politically powerful state industry, West Virginia's portfolio standard may have made political sense (see: Paalborg 2011).

There is also evidence of coalition building. The bill's passage is suggestive of the need to understand in-state politics when attempting to explain the adoption of a policy innovation.

While the state's government was under the unified control of the Democrats at the time that AREPA was passed, Governor Manchin's policy had bipartisan support in the legislature. This may have been key to the bill's success as earlier legislation to create an RPS, which was sponsored by a larger, but solely Democratic coalition, did not make it out of committee. AREPA also had the support of the AFL-CIO, business and industry interests, university leaders, and the West Virginia Coal Association (see: Hohmann 2009a; Overton 2015; Rivard 2009).

Models of policy diffusion aim to explain the spread of policy innovations across units of government. Underlying these models is the idea that the adoption of a policy in one state will be influenced by the choices made by policy makers in other states. Diffusion has been hypothesized to result through at least one of the following mechanisms: learning, competition, coercion, or imitation. To explain adoption, many studies have employed the neighboring states model, which models diffusion as a function of the number of neighboring states that have already adopted the policy in question. The assumption in this model is that as the number of neighboring states adopting the policy innovation increases, so too will the likelihood of adoption by the state in question.

Looking at West Virginia in this manner, the model is likely to have predicted the state's adoption of AREPA: In 2009, four of the state's five immediate neighbors had already adopted an RPS or CES. On the other hand, when using the modified map of Regional Energy Efficiency Organizations (REEOs),[33] a neighboring states model might be less likely to predict AREPA's adoption (see figure 5.1).

[33] West Virginia is not a member of a REEO. Using U.S. Census regions as a guide, I modified the Southeast Energy Efficiency Alliance's region to include Oklahoma, Texas, and West Virginia.

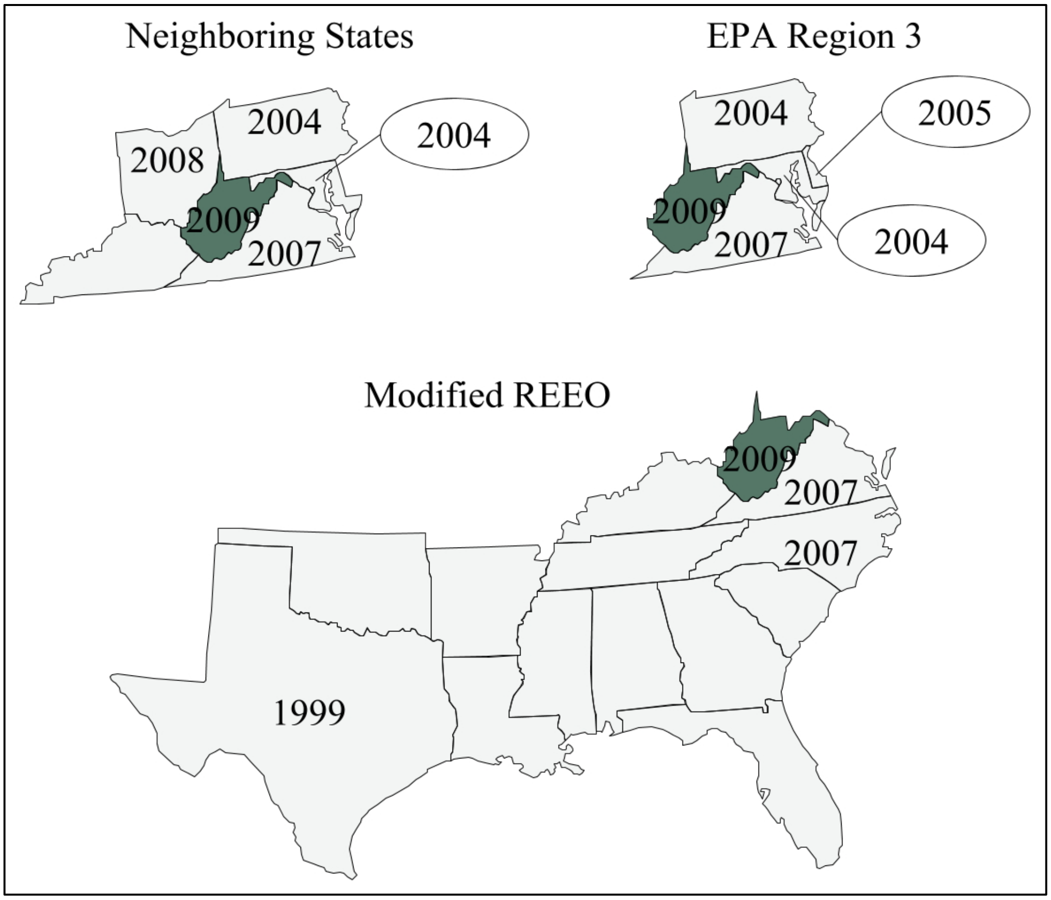

Figure 5.1. West Virginia's Neighbors and RPS Adoption Dates

Even more telling is a look at West Virginia's regional neighbors. When examining the 2012 map of RPSs that included alternative resources – energy efficiency, renewable thermal resources, combined heat and power, and non-renewable resources (coal, natural gas, and nuclear) – a pattern emerges. Of the five states that included non-renewable resources in their clean energy standards (CESs), one is West Virginia and three are close neighbors of the state (see figure 5.2).

The simplest explanation for the adoption of AREPA is that the adoption of this largely symbolic policy was a case of imitation. Besides boasting that West Virginia had the only portfolio standard in the nation that could be met "with 100 percent coal", the Director of the West Virginia Division of Energy, Jeff Herholdt, also stated that "the last thing he [wanted] it to

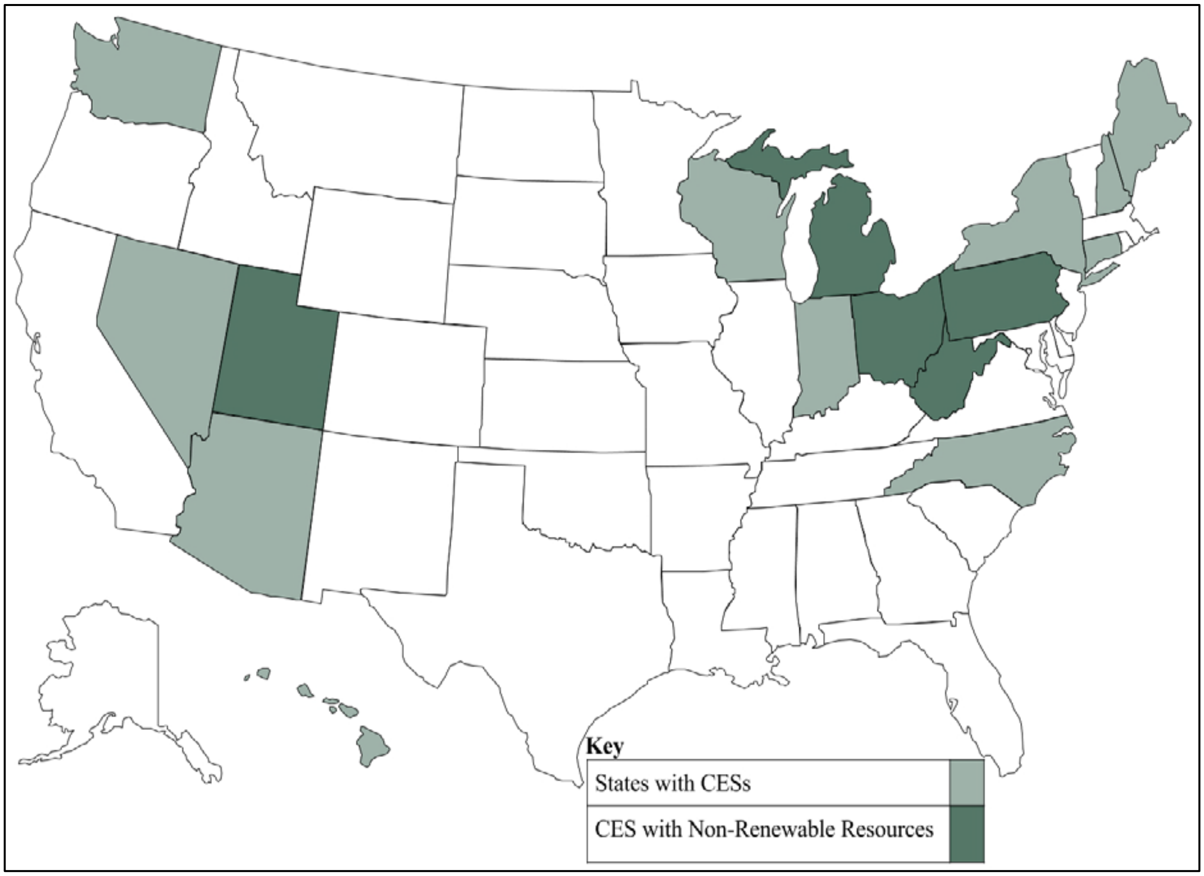

Figure 5.2. CESs and CESs Allowing Non-Renewable Resources

do [was to] reduce coal generation in the state. He said the aim of the five-year plan [was not] to incentivize renewables, but that it was good publicity for the state to have at least some sort of renewable portfolio standard" (Valentine and Kroh 2014; Ward 2013). Further evidence for imitation comes from the statute's results. West Virginia's Alternative and Renewable Energy Portfolio Standard (AREPS) has been associated with the failure of solar and other renewable energy resources to take hold in the state: "Not one renewable energy project has been built to satisfy those requirements…It was an entirely hollow bill" (Valentine and Kroh 2014).

AREPA's design is highly suggestive of a symbolic policy. Carley (2012) argues that for states with energy markets that have the ability to sell renewable energy and/or the renewable energy certificates (RECs) associated with that generation out of state for compliance with mandatory targets, the incentive to free-ride on other states' policies increases. Furthermore, states with the incentive to free-ride are likely to either avoid adopting an RPS altogether or may adopt a voluntary goal as a symbol of their support for renewable energy. Carley (2012) also argues that for states that are dependent upon carbon-intensive generation, as is the case for West Virginia, free-ridership allows them to profit off of the policies of other states while avoiding addressing the carbon footprint of their own generation mix.

The PJM Interconnection's area of oversight spans 14 states. The RTO coordinates wholesale electricity sales for utilities in Delaware, Illinois, Indiana, Kentucky, Maryland, Michigan, New Jersey, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, and West Virginia. The RTO also serves utilities in the District of Columbia (PJM 2017). Of the 14 states with utilities in the RTO, ten adopted a portfolio standard before West Virginia. At the time AREPA was adopted, the existing RPSs in Delaware, New Jersey, Michigan, Ohio, Pennsylvania, and Virginia allowed RECs or alternative energy credits associated with facilities in West Virginia to be used to demonstrate compliance.

However, this simple explanation might not be the only explanation. And, the adoption of a symbolic policy is not necessarily the result of diffusion through imitation. Other states in the U.S. have adopted CESs that allow certain non-renewable resources to be used to meet portfolio requirements. The inclusion of energy efficiency, non-renewable, and local non-renewable or renewable resources might serve to meet two objectives for policy makers. First, including these resources can be a method for promoting economic goals. Second, and related to the first, the inclusion of these resources can be a way to ensure public support for the policy (Heeter and Bird 2012).

In West Virginia's case, it seems likely that the state's policy makers included the resources that they did in order to promote certain economic goals related to coal, and by so doing, generated broader support for AREPA. With coal jobs and revenues declining, political leaders in the state likely wanted to provide assurances to the industry that it would have a place in the future of the state's energy policy. AREPA may have been seen as a mechanism for ensuring that coal would continue to fuel electric generating plants in West Virginia. The policy's particular form may also have been driven by activities in other states. An important aspect of AREPA suggests this to be the case.

When AREPA was enacted, West Virginia became one of five states to include coal-based technologies in a CES (see figure 5.2, above).[34] Four of these five states are significant coal producers. Of the coal-producing states that included a coal-based technology in their CES on enactment, West Virginia ranks second, Pennsylvania ranks fifth, Ohio ranks twelfth, and Utah ranks thirteenth (EIA 2015b). While Michigan, the fifth state to include coal in its CES, does not produce coal, it does rely heavily on the resource for electric generation and economic activity at its ports (EIA 2016).

Minor Legislative Changes: 2010 – 2014

While several bills were introduced to amend AREPA during the period between 2010 and 2014, only two were enacted. The first, Senate Bill 350, enacted in 2010, amended the definition of recycled energy. Rather than the original definition where

> "useful thermal, mechanical or electrical energy produced from: (i) Exhaust heat from any commercial or industrial process; (ii) waste gas, waste fuel or other forms of energy that would otherwise be flared, incinerated, disposed of or vented; and (iii) electricity or equivalent mechanical energy extracted from a pressure drop in any gas, excluding any pressure drop to a condenser that subsequently vents the resulting heat"

[34] Heeter and Bird (2012) missed Utah's standard, enacted in 2008, which included advanced coal technologies. Indiana's goal, which also includes non-renewable technologies, was enacted in 2011, after AREPA. Because of this, it is not included in the discussion here.

was an alternative energy resource, Senate Bill 350 amended the statute to define such resources as renewable (West Virginia SB 350 2010). The second amendment to AREPA was enacted in 2011. In the original Standard, “Alternative energy resources” included natural gas. Senate Bill 465 amended the definition of “alternative energy resources” to read “natural gas, including any component of raw natural gas” (West Virginia SB 465 2011).

It is likely that the Act was not significantly amended during this period because AREPA was not threatening the coal industry’s viability. The total number of coal jobs had increased, and the state’s Public Service Commission had found that the Act would have negligible effects on both coal mining operations and the utilities whose plants relied on that mined coal (WVPSC 2012; Sadasivam 2015). However, political changes in the state provided some warning of the Act’s impending repeal.

AREPA became a major campaign issue in the 2012 Election. Defined as a “cap and trade” measure by emerging Republican candidates, Democratic and Republican incumbents alike faced criticism for their support of the legislation. The Tea Party launched a “Say It Ain’t So Joe” campaign against Senator Joe Manchin accusing him of supporting an Obama-style cap and trade program. At the same time, the Act was also framed as a measure crafted in order to appease special interests. Republican candidates argued that coal lobbyists and unions wanted the legislation, and so would continue to support state Democrats and Republicans who ushered the bill into law, while coal miners and West Virginia’s ratepayers would support the GOP and their effort to repeal AREPA (Kuykendall 2012).

AREPA’s Repeal: 2014 – 2015

Under AREPA, utilities were required to own AECs equal to at least 10 percent of total retail sales beginning January 1, 2015 (Paalborg 2011; see also: WVPSC, 2012; Van Nostrand

2013). However, AREPA was repealed when House Bill 2001 was enacted. The repeal passed the House by a vote of 95 – 4, the dissenting votes all from Democrats. The Senate passed the bill unanimously, and the former Senate President who had carried AREPA, Governor Earl Ray Tomblin (D), signed the bill on February 3, 2015 (Cardosi 2015; Sadasivam 2015; West Virginia House of Delegates 2015; West Virginia Legislature 2015; West Virginia Senate 2015).

Those arguing in favor of the repeal included many voices that had been in favor of AREPA's enactment just six years before. The major argument was that times had changed and that economic conditions and increasing federal regulations impacting the coal industry necessitated the repeal. For instance, Senate Majority Whip and Chair of the West Virginia Senate's Energy, Industry, and Mining Committee stated that if the state wanted to "promote coal and energy" the repeal was necessary (Cardosi and Timony 2015).

Conclusions

It is easier to begin to explain AREPA's repeal than its enactment. The growth in support for the Republican Party among West Virginia's citizens hit a tipping point in the 2014 mid-term election when the Republican Party took control of both chambers of the state's legislature for the first time since 1931, taking control of the House for the first time in 94 years (Hunt 2014; Sadasivam 2015; Willis 2014). Republicans and other Conservative voices seem to have successfully labeled AREPA a cap and trade measure, linking the bill to an unpopular policy option. Democrats in the state became increasingly concerned to distance themselves from President Obama. Rhetoric about an Obama Administration-led "War on Coal" combined with job and profit losses in what is arguably West Virginia's most important industry also likely played a role in AREPA's increasing unpopularity and support for the repeal.

AREPA was largely a symbolic act. The importance of coal in the state's economy had an important impact on the policy's design. In 2009, in terms of internal state characteristics, it seems likely that many would have had a difficult time predicting the adoption of AREPA. While the Democratic Party held unified control of the state's political institutions, a shift towards conservatism and support of the Republican Party had already begun. Lower than average educational attainment and per capita income suggested against the probability of adoption. These competing factors might also help to explain why AREPA took the largely symbolic form that it did.

The case is especially illustrative of the importance of in-state interest groups. While studies of the diffusion of RPSs have not found that the presence of fossil fuel industry interests effects adoption rates, West Virginia's history with coal likely played an important role in AREPA's design. There is also evidence of coalition building. Governor Manchin's policy had bipartisan support in the legislature. This may have been key to the bill's success. The policy also had the support of coal and labor union interests, two sides that might be traditionally opposed to one another.

The simplest explanation for the adoption of AREPA is that the adoption of this largely symbolic policy was a case of imitation. However, it might also be the case that the state's policy makers designed AREPA in the manner that they did in order to promote certain economic goals related to coal, and by doing so, generated broader support for AREPA. The policy was left largely untouched because it was not threatening the coal industry's viability. However, when this policy was poised to become a potential nuisance, and when political currents had shifted dramatically, it was repealed. All of this suggests that AREPA is a case of imitation.

CHAPTER SIX: QUANTITATIVE ANALYSIS OF RPS ADOPTIONS AND AMENDMENTS 1994 - 2014

This chapter provides a quantitative analysis of state RPS policymaking over time. I begin by discussing how the models were constructed. Next, the model of RPS adoptions, using a dichotomous measure, is presented and results are described. The three sections following this present the results of the models of RPS adoption by type; exploring, in turn, the adoption of voluntary goals, weak RPSs, and strong RPSs. The discussion then turns to models of decisions to amend an RPS, presenting the models of decisions to negatively amend an RPS, adopt minor positive amendments to an RPS, and enact a positive change to an RPS, also in turn. The chapter concludes with a summary of results and directions for future research.

Studies of the diffusion of the RPS have found that particular internal state characteristics –citizen ideology, party control of government institutions, state wealth and citizen income levels, educational attainment, and active renewable energy or environmental interest groups – are especially important for explaining the adoption of an RPS. In terms of the effects of a state's renewable energy potential, typically measured through solar and/or wind potential, findings have been mixed. Findings have also been mixed when studies incorporate a proxy for policy diffusion. Few studies have incorporated RPS design differences, later amendments, the influence of past policy decisions, and the effects of federal policies. The analysis presented below contributes to our understanding of policy diffusion and change. It does so through use of Cox proportional hazards regressions of a unified model of policy innovation that takes the following form:

$$\text{ADOPT}_{i,t} = f\,(\text{INTERNAL}_{i,t},\ \text{OTHER\_POLICIES}_{i,t},\ \text{EXTERNAL\_STATES}_{i,t},\ \text{EXTERNAL\_FEDERAL}_{i,t})$$

$ADOPT_{i,t}$, following Berry and Berry (1990), is the dependent variable, and is a measure of the probability that a given state (i) will adopt an RPS or certain type of RPS, or that a state will amend its policy in a certain direction in a given month (t). Figure 6.1, below, outlines RPS adoptions and amendments by year.

Many studies using Berry and Berry's (1990) unified model employ an event history model of one type or another. As suggested by Jones and Branton (2005), this study uses a Cox proportional hazards model for every model of RPS adoption and change (see also: Box-Steffensmeier and Jones 2004; Young and Sarzynski 2009). The model is noted for its flexibility, especially in terms of its ability to incorporate both repeating events and time-varying covariates (see: Box-Steffensmeier and Jones 2004; Cleves, Gould, and Marchenko 2016; Jones and Branton 2005). The model developed by Cox (1972) is one of the "most influential" methods for event history analysis (EHA) in use today (Allison 2014, p. 3). Additionally, the Cox model is recommended for studies of policy innovation and can analyze data formatted in discrete time intervals, making it a good fit for this dissertation.

The models presented below suggest that renewable energy interests, citizen income levels, citizen and government ideology, and educational attainment are important for explaining decisions to adopt and amend RPSs. As has typically been the case, this study found little to suggest that renewable energy potential is an important predictor of the decision to adopt an RPS. While the results of the models presented below suggest that regional diffusion is occurring, these results must be interpreted with caution, as discussed in greater detail below. The results here suggest that effects related to other policies and federal policy are important factors for explaining the decision to adopt or amend an RPS. The research questions for this dissertation involved whether the explanatory variables associated with decisions to adopt or modify an RPS would vary by decision type. The results of the models presented here suggest that this is, in fact, the case and that the size and direction of the effect of shared variables also varies by decision type.

Original RPS Adoptions

Year	Original RPS Adoptions	Amendments (Number of Bills Enacted if > 1)
1994	MN	
1995		MN
1996		MN
1997	MA, ME, NV	MN
1998	CT, WI	MN
1999	NJ, TX	ME, MN, WI
2000		MN
2001	HI, IL	MN (2), NV
2002	CA	
2003		CA, CT, MN (2), NV (2)
2004	CO, MD, NM, PA, RI	HI, ME
2005	DE, MT, VT	CA, CT, MN (2), NV, TX
2006	WA	CA (3), CT, HI, ME (2), VT, WI
2007	MO, NC, ND, NH, OR, VA	CA (3), CO, CT, DE, IL, MD, ME (2), MN (2), MT, NM, NV (2), PA, TX
2008	MO, OH, SD, UT	CA, DE, MA, ME, MD (2), MN (2), MO (2), NH (2), NJ, PA, RI, VT
2009	KS, WV	CA (2), DE, HI (2), IL (2), ME, MN, MT (4), NC, ND, NH, NV, OH (2), OR, RI, SD, VT, VA
2010	OK	CA (2), CO (3), DE, IL, MA, MD, ME (2), MI, MO, NJ (2), OH (2), OR (5), UT (3), VA, VT, WI, WV
2011	IN	CA, CT, DE, HI (2), IL (3), MD (2), ME (3), MN, MT (2), NC (2), NM, NV, OR (2), RI, VT, WI, WV
2012		CA (5), KS, MA, MD (4), NH, NJ, OH, VA (2), VT, WA (2), WI
2013		CA (2), CO, CT, MD (2), MN (2), MO, MT (5), NH, NV (3), OR, RI, VA (2), VT, WA (3)
2014	SC	CA (2), IL, MA, ME, NH, NM, OH, OR, RI, VA, WA (2), WI (2)

Figure 6.1. Timeline of RPS Adoptions and Amendments, by Year

Modeling Decisions to Adopt or Amend an RPS – Observations, Model-Building, Testing the Proportional Hazards Assumption, and Goodness of Fit

While the data construction for the quantitative analysis involved the collection of 12,408 total observations, many of these observations were excluded in the models presented below. In the four models of RPS adoption, 799 observations were initially excluded because the origin time for the risk period was set at June 1, 1994 (the month after Minnesota initially adopted its renewable energy requirement for Xcel Energy).[35] As Minnesota's original adoption of an RPS is used as the catalyst for the adoption of an RPS by other states, this required excluding all observations of Minnesota from these models, which removed an additional 247 monthly observations. All observations of a state are dropped after a state adopts an RPS. This removed an additional 4,032 observations, leaving a total of 7,330 observations.

In the three models of amendments to RPSs, states enter the risk set the month after they adopt any type of RPS. This meant that 3,168 observations were dropped because these represented observations of states that never adopted an RPS. An additional 4,961 observations were dropped because these observations were made before states entered the risk set. To allow for repeating events, states did not leave the risk set until their data ran out on December 31, 2014. The final models of RPS amendments use 4,279 observations each.

In order to evaluate the relative impacts of internal state characteristics, past policy decisions, actions in other states, and federal policy on the decision to adopt or amend an RPS, univariate analysis was used to determine the initial variables to include in all models.[36]

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[35] This removed 17 months for each of the 47 states for which event histories were collected.

[36] Univariate analyses for the model using a dichotomous measure of RPS adoption are provided in Appendix D. Univariate statistics for the models of RPS adoption using the modified Carley and Miller (2012) stringency score can be found in Appendix E. The univariate analyses for the models of RPS amendments are provided in Appendix F.

Categorical variables were examined using log-rank tests of equality and continuous variables were analyzed with Cox proportional hazards models. Any variable with a probability value (p-value) for the Chi-squared result greater than .3 was excluded from initial models (see: UCLA 2017).[37]

The results of the univariate analyses were used to suggest variables for further exploration. Model construction then proceeded by examining significance levels for the remaining variables when they were included in a full model of RPS adoption or amendment, as guided by the theory outlined in the literature review and research methods chapters. Initially, all variables were examined in single models testing for improvement in model fit. In each run, variables that duplicated one another, for example, government ideology and a lagged measure of government ideology were tested. All variables with a p-value over .2 in any of these models were excluded. Once a final model of significant variables was obtained, the variables excluded by the initial univariate analysis were individually added to the model to test whether they improved model fit. Once this was complete, all remaining non-significant variables (with a p-value over .15) were excluded and interaction terms were tested. All excluded interaction terms had p-values above .1.

The Cox proportional hazards model leaves the baseline hazard unestimated, allowing it to take whatever form is suggested by the data. This means that, unlike parametric EHA models, researchers do not need to specify the particular form of the baseline hazard that all subjects face. The hazard could be exponentially increasing, or it could decrease overtime, or it could increase, then decrease and increase again. What Cox models do assume is that the form that the baseline hazard takes is the same for all subjects in a study and that the covariates shift the baseline

[37] Throughout this study, ties were handled using the Efron and exact partial likelihood methods, where appropriate, and as suggested by Allison (2014), Box-Steffensmeier (n.d.), and Jones and Branton (2005).

hazard for subjects in a proportional manner. Put simply, if this assumption is met and we were to model the baseline hazard, where all subjects are given a citizen ideology score of ‘0’, compared to the hazard for a particular group of subjects with a citizen ideology score of 57.63297, we would see roughly parallel lines (see: Cleves, Gould, and Marchenko 2016).

In order to test that the proportional hazards assumption was met by all models used here, I used a link test to ensure that the variables were correctly specified. Next, a test using the Schoenfeld residuals was used to test the null hypothesis that the proportional hazards assumption had been violated. If any variables had a p-value close to 0.05 in these tests, I used plots of Schoenfeld and Martingale residuals to determine whether the variable needed to be transformed to meet the proportional hazards assumption. Once any variable that needed to be transformed was transformed, tests of the proportional hazards assumption were run again. The final test of all models used here involved evaluating goodness of fit, which was done using a comparison of Cox-Snell residuals to the model’s Nelson-Aalen cumulative hazard function. An example of the results of one of these tests is provided in figure 6.2, below.

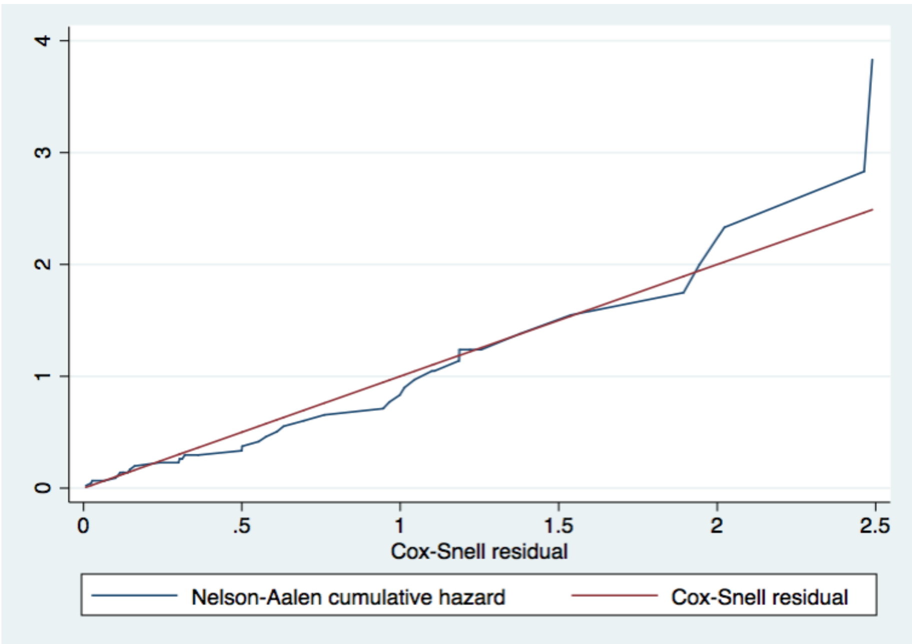

Figure 6.2. Cumulative Hazard of Cox-Snell Residuals

Modeling the Decision to Adopt Any Type of an RPS

The first model of RPS adoption examines the independent variables associated with the probability that a state will adopt any type of RPS. The final model is presented in table 6.1, below. Figure 6.2 shows the results of the goodness of fit test using Cox-Snell residuals.

Table 6.1. Cox Proportional Hazards Model of RPS Adoption (34 Events)

Variable	Coefficient	Hazard Ratio[38]	Standard Error (hr)
income	.000121	1.000121**	.0000384
citizen_lag	.0373624	1.038069*	.0173224
nem	.0152989	1.015417***	.0040671
mgpo	.099582	1.104709***	.0252394
pbi	.1011213	1.106411***	.0274532
benefit_fund	.0275774	1.027961**	.0090593
policy_count	-1.081042	.3392419**	.1193622
reeo_adopt	-.42271	.6552686***	.074755
b2.reeo_region#reeo_adopt			
1 (NEEP)	.3755228	1.455752***	.1527119
3 (MEEA)	.3016427	1.352078***	.1115718
4 (SWEEP)	.3062194	1.35828***	.1128976
5 (NEEA)	.2389536	1.26992**	.1089483

Log likelihood = -65.235416   LR $chi^2(12) = 89.91$ Prob > $chi^2 = 0.0000$

*p < 0.05   **p<0.01   ***p<0.001

The results of this model suggest that internal state characteristics and past policy decisions are important for explaining the adoption of an RPS. While median household income, as expected, has a positive and statistically significant impact on the probability that a state will adopt an RPS, the effect measured here is relatively small, with a one-unit (one dollar) increase in income associated with a .012 percent increase in the probability of adoption. With incomes measured in the tens of thousands of dollars, the effect accumulates rather quickly. Liberal

[38] A note on interpreting coefficients and hazard ratios: The direction of the coefficient tells us whether the hazard is increasing or decreasing with an increase in the variable. In order to interpret the degree to which a variable impacts a hazard ratio, a hazard ratio that is less than one is subtracted from one and one is subtracted from a hazard ratio greater than one (see: Cleves, Gould, and Marchenko 2016).

citizen ideology, lagged one-year, was found to be a statistically significant predictor of the probability of adopting an RPS. As expected, as states move towards a more liberal population, associated with a one-hundred-thousandth percent increase in Berry et al's (1998) revised 1960-2013 citizen ideology series, the probability of adoption increases by 3.8 percent.

The model also suggests some interesting observations about the impact of other policies, or past policy decisions. As expected, with each additional month that a state has had a performance-based incentive (PBI) for renewable energy and/or a policy requiring that utilities provide their customers the option of purchasing green or renewable power – a mandatory green power option (MGPO) – the probability of adopting an RPS increases by over ten percent. This finding is supported by the case study of Oregon's Renewable Energy Act (OREA), which found that a history of leadership among utilities, demonstrated through their MGPO offerings, and a history of utilities' experience with renewable resources, perhaps captured in this model by the PBI variable, translated into increased support, by utilities, of the state's RPS.

Also as expected, there is an increased probability of adoption associated with the number of months that a net metering or system benefits fund for renewable energy has been in place. The effect associated with these policies is smaller, at 1.5 percent and 2.8 percent respectively. This latter finding is also supported by the OREA case study. When originally adopted, Oregon's system benefits fund applied to the state's investor-owned utilities (IOUs) and was supported by the Oregon Public Utility Commission (OPUC), industry associations, environmental groups, renewable energy advocacy organizations, utilities, and the Citizens' Utility Board (CUB). Many of the same interests that supported the state's system benefits fund also supported the state's RPS. The existence of these four policies might signal broad support for renewable energy resources in a state which translates into increased support for an RPS.

Contrary to expectations, the adoption of a greater number of policies associated with support for the renewable energy industry does not have a positive effect. Each additional policy reduces the probability of adopting an RPS by 66.1 percent, suggesting that there may be some level of policy saturation where the adoption of an RPS starts to be viewed as less necessary or redundant. Mahajan and Peterson (1985) outline policy relationships where policies can be understood as independent of, complementary to, contingent on, or substitutes for one another. Substitute policies may be either exact or partial substitutes for one another. When policies are exact substitutes, the adoption of policy A precludes the adoption of policy B. In the more likely case that policies are partial substitutes for one another, the existence of policy A does not preclude the adoption of policy B, but the existence of the former may reduce the probability of the adoption of the latter (Berry and Berry 2007, 2014; see also: Boehmke 2009). It might be the case that the policies captured by the policy count function as partial substitutes for certain types of RPSs.

This seems to be supported by Yi and Feiock's (2012) finding that a positive relationship exists between the likelihood that a state adopts an RPS and their index of supply-side energy policies, which is a count of the number of policies that a state has in place prior to adopting an RPS. The authors find that with each additional policy – a corporate income tax incentive, a personal income tax incentive, and/or a systems benefit fund – the likelihood that a state adopts an RPS increases by 81.7 percent. However, the authors find that this effect is not constant across the types of RPSs that a state can adopt, finding that the effect is stronger for the adoption of a mandatory RPS than for a voluntary goal. It may be the case that because the model here captures all types of RPSs, the effect of the number of policies that a state has previously adopted is more reflective of the effect in states adopting voluntary and weak RPSs.

The model here suggests that some mechanism of diffusion is working, although contrary to expectations and not in the manner found in most of the previous research on the external determinants of the diffusion of the RPS. When previous research has found an effect, positive relationships have typically been reported. Here, the data suggests that the effect associated with the percent of states that have previously adopted an RPS is negative, reducing the overall likelihood of adoption by 34.5 percent. However, the extent of this effect varies by REEO region, with region reversing the effect of this over time by 45.5 percent in NEEP states and 26.9 percent in NEEA states, when compared to states in the SEEA region in the southeastern U.S. (see figure 6.3).

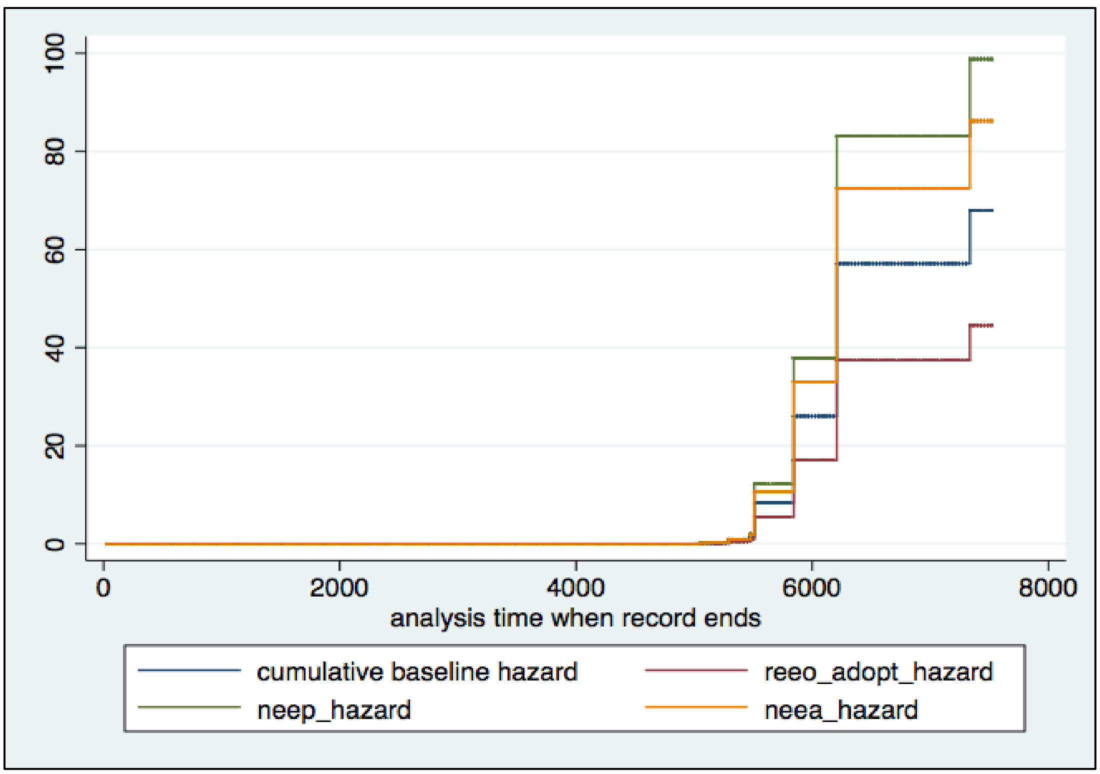

Figure 6.3. The Effects of Diffusion and Region on the Cumulative Baseline Hazard

Modeling the Decision to Adopt an RPS, by Type

To evaluate the relative impacts of internal state characteristics, past policy decisions, policy decisions in other states, and federal policy on the decision to adopt a voluntary, weak, or strong RPS, three Cox proportional hazards models were constructed. The goal of each of these models was to test whether the independent variables explaining different decisions remained the same. For each RPS type, the model presented above was tested first. This model did not prove to be the best fit for any of the three potential types of RPSs that a state could adopt. Variables that proved significant in the first model, as well as variables that were excluded by this first model, made appearances in the models discussed below, suggesting that taking account of policy design differences is important for understanding policy innovation.

The Adoption of Voluntary Goals

The variables that proved significant for explaining the decision to adopt a voluntary RPS were citizen ideology (lagged one year), government ideology, the number of months that a state had a system benefits fund for renewable energy and an interconnection policy in place, and retail electricity prices for the residential sector. Retail prices were interacted with time in order to meet the proportional hazards assumption.[39] The model's results are provided in table 6.2.

Table 6.2. Cox Proportional Hazards Model of the Adoption of a Voluntary Goal (12 Events)

Variable	Coefficient	Hazard Ratio	Standard Error (hr)
citizen_lag	.1430597	1.153799***	.0472533
government	-.0391486	.9616078**	.0146061
benefit_fund	-.0412081	.9596294*	.0202893
interconnection	.0185347	1.018707*	.0090988
price_t	-.000074	.999926*	.0000361
Log likelihood = -32.413691	LR $chi^2(5)$ = 23.12		Prob > chi^2 = 0.0003
*p < 0.05	**p=0.01		***p<0.001

[39] This created a variable that summed the average price paid for a single kilowatt-hour in a year by day. For example, Alabama's residents paid 6.69 cents per kilowatt-hour, on average, over the course of 1994. Taking an extremely unlikely example, the transformation of this variable calculated that in the month of June, a resident using one kilowatt-hour of electricity a day paid $1.94 for that month's use and paid $4.01 for electricity use in June and July.

While the effect of citizen ideology in the model of the adoption of any type of RPS had a relatively small positive effect (3.8 percent), citizen ideology has the largest impact on the probability of adopting a voluntary renewable energy goal. For each one-hundred-thousandth percent increase in a state's citizen ideology score, the probability of adoption increases by 15.4 percent. Interestingly, government ideology has the opposite effect. For each one-hundred-thousandth percent increase in a state's score, the likelihood of adopting a voluntary goal decreases by 3.8 percent. In the model of the adoption of strong RPSs, this result was reversed: A one-unit increase in the government ideology score is associated with an 8.7 percent increase in the probability that a state will adopt a strong RPS. This result is in line with Carley and Miller's (2012) finding that the adoption of strong RPSs is influenced more by ideological liberalism in government than by the degree of liberalism among the state's citizens.

While the number of months that a state has had a system benefits fund has a negative impact on the likelihood that a state adopts a voluntary goal, the number of months that an interconnection standard has been in place has a positive effect. The relative effects are rather small, with each additional month that a system benefits fund has been in place, the probability of adoption decreases by 4.04 percent and with each additional month that interconnection standards have been in effect, the likelihood of adopting a goal increases by 1.87 percent. Yi and Feiock (2012) find that the effects of past policy decisions vary by the type of RPS adopted by a state. Given the positive effect associated with the decision to adopt any type of RPS and the negative effect found in this model, it may be the case that system benefits funds function as or are seen as partial policy substitutes for voluntary RPSs and reduce the likelihood of adopting a goal, but not another type of RPS.

The results associated with the number of months that interconnection standards have been in effect are more difficult to interpret. In the model of the decision to adopt a strong RPS, interconnection also had a positive effect – each additional month that a state has had interconnection standards in place increases the probability of adoption by 2.3 percent. This suggests that interconnection standards are complementary policies to RPSs, however, the relationship between these policies might vary by state. Like RPSs, not all interconnection standards are created equally. It could be the case that states with interconnection standards that are less supportive of renewable energy are more likely to adopt an equally symbolic goal, while states with strong interconnection standards are more likely to adopt a strong RPS. Testing this would require a variable capturing design differences across interconnection standards.

Residential electricity prices have a small negative effect on the probability that a state adopts a goal. For each one-hundredth of a cent increase in price, the likelihood that a state will adopt a goal decreases by .000074 percent. Because opponents to RPSs have argued that these policies lead to higher electric rates, this finding suggests confirmation of the hypothesis that higher prices will reduce the probability of adopting an RPS.

The Adoption of Weak RPSs

The variables important for explaining the adoption of a weak RPS differed entirely from those that explain the adoption of a voluntary goal. Interestingly, the amount of federal land in a state and the percent of states that have previously adopted an RPS are negatively associated with the probability that a state will adopt a weak RPS. The model's results are provided below, in table 6.3.

The two variables that have the most impact on the probability that a state will adopt a weak RPS are the percent of renewable energy contributing to a state's electric supply in a year and federally-owned public lands. The other three variables have relatively small effects on the probability that a state will adopt a weak RPS in a given month. The effect associated with an increase in median household income is nearly identical to that found in the model of RPS adoption using a dichotomous measure.

Table 6.3. Cox Proportional Hazards Model of the Adoption of a Weak RPS (11 Events)

Variable	Coefficient	Hazard Ratio	Standard Error (hr)
percent_re	.2595644	1.296365**	.1180633
income	.0001219	1.000122**	.0000445
nem	.0129298	1.013014*	.005299
avg_fed_area_log	-.3252698	.7223325*	.1097442
epa_adopt	-.0353911	.9652279*	.014087

Log likelihood = -27.713313 LR $chi^2(5) = 23.43$ Prob > $chi^2 = 0.0003$

*p < 0.05 **p=0.01 ***p<0.001

The number of months that a state has had a net metering (NEM) policy in place has a small, but positive effect. For each additional month that NEM has been available, the probability of adopting a weak RPS increases by 1.3 percent, which is also a very similar to the first model (1.5 percent). Interestingly, the effect of an additional month with a NEM policy in place has the opposite effect on the decision to adopt a strong RPS, where the probability of adoption decreases by 1.8 percent. As was discussed above about interconnection, not all NEM policies are created equally, and it could be that design differences in these policies make them more or less complementary to different types of RPSs.

In-state federally-owned public lands have a negative effect on the likelihood of adopting a weak RPS. As the total acreage of federal public lands increases by one-hundred-thousandth of a log-acre, the probability that a state will adopt a weak RPS decreases by 27.8 percent. Because federal lands did not prove significant in any of the other models of RPS adoptions, a possible explanation for this is that most federal lands are located in the Western U.S., and these states might be more conservative, making them less likely to adopt any type of RPS. However, of the 18 states west of the Mississippi river that are included in this study, four never adopted an RPS, only three initially adopted a weak RPS, and six adopted strong RPSs. And, as discussed below, federal lands are positively associated with the adoption of positive amendments to RPSs. These findings suggest that there might be some regional variation in the direction of the relationship between public lands and support for renewable energy.

Lyon and Yin (2010) find that states with larger amounts of renewable capacity are less likely to adopt an RPS with an in-state requirement – a mandate that eligible resources are located in the state. They argue that this finding suggests that states with smaller amounts of existing capacity will seek to protect and support in-state economic interests by use of an in-state requirement. In the models of RPS adoptions, the percent of renewable energy contributing to a state's electricity mix is only important for explaining the adoption of a weak RPS, and the relationship is positive and fairly large, for each one-hundredth of a percent increase in the percent of renewable energy used in state, the likelihood that a state will adopt a weak RPS increases by 29.6 percent.

Used as a proxy for renewable energy interest group strength in a state, this finding is also suggestive that states adopt different RPS designs because they are trying to achieve different goals. It could be the case that the adoption of weak RPSs occurs because policy makers are prioritizing one type of goal – satisfying existing interest groups – over another – perhaps diversifying the types of renewable energy contributing to a state's electric sector. Differences in policy goals could lead states to adopt policies that are more or less symbolic. A state with a lot of renewable capacity prior to the adoption of an RPS might be more likely to adopt a policy that is more symbolic than that adopted by a state seeking to increase in-state use of renewable energy.

Similar to the results of the first model of RPS adoption, the percent of states that have already adopted an RPS has a negative effect on the probability of adopting a weak RPS. With each additional state that adopts an RPS in a state's region, the likelihood that a state will adopt a weak RPS decreases by 3.5 percent. This result seems to be explained when looking at the states that initially adopted weak RPSs (see figure 6.4). Of the 11 states that initially adopted a weak RPS, seven are located in the northeast in EPA Regions One and Three. It might be the case that the negative diffusion effect in this model is driven by some type of interaction among the states in this region, and we would not find the same effect for the other four states that adopted weak RPSs.

Figure 6.4. States with Weak RPSs, as Initially Adopted

Berry and Berry (2014) suggest that policies can create positive externalities that extend to neighboring states and that increase the incentive to free-ride. Carley (2012) argues that for states with energy markets that have the ability to sell renewable energy and/or the renewable energy certificates (RECs) associated with that generation out of state for compliance with mandatory targets, the incentive to free-ride on other states' policies increases and that states will be more likely to either avoid adopting an RPS altogether or will adopt a symbolic policy. The results here could suggest that rather than needing to adopt a weak RPS to support in-state renewable energy producers, policy makers in a non-adopting state are provided a substitute when a neighboring state adopts any type of RPS. This was suggested by the case study of West Virginia's Alternative and Renewable Energy Portfolio Act (AREPA), presented in Chapter Five. Prior to the adoption of what was considered to be the weakest RPS in the U.S., the existing RPSs in Delaware, New Jersey, Michigan, Ohio, Pennsylvania, and Virginia allowed RECs or alternative energy credits associated with facilities in West Virginia to be used to demonstrate compliance.

The Adoption of Strong RPSs

The variables associated with the adoption of a strong RPS share some similarities with the first three models. In this model, government ideology, interconnection, MGPO policies, NEM, and wind potential are all associated, to varying degrees, with the adoption of a strong RPS (see table 6.4). What is striking in this model is that all variables are associated with relatively small changes to the cumulative baseline hazard.

The most significant variable for explaining the adoption of a strong RPS, as expected and similar to what was found by Carley and Miller (2012), a one-hundred-thousandth percent increase in the government ideology score, suggesting a more liberal state government, is associated with an 8.7 percent increase in the probability that a state will adopt a strong RPS. As noted above, the opposite is true for voluntary goals where increasing liberalism in government is associated with a decreased probability of adoption.

Table 6.4. Cox Proportional Hazards Model of the Adoption of a Strong RPS (11 Events)			
Variable	Coefficient	Hazard Ratio	Standard Error (hr)
government	.0835613	1.087152***	.0340341
interconnection	.0228329	1.023096**	.010627
mgpo	.0252238	1.025545**	.0118394
nem	-.0182849	.9818813*	.009991
wind_gwh[40]	.000000517	1.000001	.000000328

Log likelihood = -24.90014 LR $chi^2(5)$ = 32.37 Prob > chi^2 = 0.0000

*p<0.1 **p < 0.05 ***p<0.01 ****p<0.001

Three past policy decisions impact the likelihood that a state adopts a strong RPS. In the model of decisions to adopt voluntary goals and in this model, the number of months that interconnection standards have been in place has a positive effect on the likelihood of adopting either type of RPS, although the effect here (2.3 percent) is larger than that found for voluntary goals (1.9 percent). On the other hand, when comparing the full model to this model, and to the model of decisions to adopt a weak RPS, a different finding related to NEM emerges. A negative relationship is only found in this RPS adoption model, although the effect is very small. With each additional month that a NEM policy has been in place, the probability of adopting a strong RPS decreases by 1.8 percent.

As noted above, interconnection standards and NEM policies are not created equally. It could be that the relationship between interconnection standards, NEM, and RPSs varies by state and by policy design. It might be that states with less developed interconnection standards are more likely to adopt a voluntary goal, while states with strong interconnection standards are more likely to adopt a strong RPS as part of a sustained effort to support the renewable energy

[40] While potential wind capacity, measured in GWh, has an extremely small positive impact on the likelihood that a state will adopt a strong RPS, model fit was greatly improved by including this variable, which remained statistically significant at the .05 level in all models except for this final model, where the variable's p-value is 0.115.

industry. On the other hand, given utility-led backlash against NEM, it could be the case that states with weaker NEM policies face less utility opposition to an RPS, if that RPS in some way meets their needs, perhaps through design that puts it into the weak category. In the same vein, states with stronger NEM policies are likely to see stiff opposition to any additional policy that might impact utilities' bottom-lines and so, policy makers in these states might be less likely to adopt a strong RPS. Testing this would require a different specification of interconnection standards and NEM policies than that used here.

The relationship between number of months that an MGPO has been in place and the increased probability of adopting a strong RPS is suggested by the case study presented in Chapter Four. The study of OREA made clear that a history of leadership among IOU's, through their green power programs, led to increased support for renewable energy, which translated into support for developing what emerged as one of the strongest RPSs enacted in the U.S.

While the inclusion of a variable capturing wind potential greatly improved model fit and performance, this variable tells us almost nothing about the effect of renewable energy potential on the likelihood of adopting a strong RPS. The hazard rate, which is ever so slightly larger than one suggests that the effect of this variable is positive, but nearly constant across all states, and does not have much of an effect on the cumulative baseline hazard. It might be the case that in other models, a more nuanced understanding of the effect of renewable energy potential on the decision to adopt a strong RPS could be teased out, but this would require a different variable than that used here.

Modeling RPS Amendment Decisions

In order to evaluate the relative effects of internal state characteristics, past policy decisions, activities in other states, and federal policy on the decision amend an RPS, univariate analysis was used to determine the initial variables to include in the models presented below.[41] Categorical variables were examined using log-rank tests of equality and continuous variables were analyzed through Cox proportional hazards models. Model building then proceeded using backward and forward selection (see: UCLA 2017). All remaining non-significant variables (with a p-value over .15) were excluded and interaction terms were tested. All excluded interaction terms had p-values above .1. I then proceeded through the Cox proportional hazards diagnostic tests, as described above. Because these are repeated event models, robust standard errors were obtained (see: Cleves, Gould, and Marchenko 2016; Yi and Feiock 2012).[42]

The models presented below each examine one type of RPS amendment event: a negative change, a minor positive change, or a positive change. These categories were created by grouping events according the index score each event received, as described in Chapter Three, and as summarized in table 6.5, below.

Table 6.5. RPS Amendment Categories

Variable Name	Amendment Type	Monthly Scores	Number of Events (Total: 165)
amend_type3	Negative Change	-.75 – -.25	31
	Minor Positive Change	.25	70
	Positive Change	.5 – 1.75	64

The Adoption of Negative Amendments to an RPS

Between April 1, 1996 and June 30, 2014, 17 states adopted 31 negative amendments to RPSs. The bulk of these events (26) took place between March 2009 and the end of June 2014. During this time, about four negative amendments were adopted each year by states across the nation, though 2013 was a particularly active year, when seven negative changes were adopted (see table 6.6).

[41] See Appendix F.
[42] All models presented in this chapter were clustered on state by specifying id in the stset command in Stata.

Table 6.6. History of Negative RPS Amendments

1996	1998	1999	2007	2008	2009	2010	2011	2012	2013	2014
MN	MN	ME	TX	NH	MT (2)	MI	MD	NH	CA	NM
					ND	OH	MN	OH	CT	OH
					OH	UT	WI	VA	MT (2)	OR
						WV	WV		NH	WI
									RI	
									VA	

(Number of Events if > 1)

The variables that proved important for explaining the decision to adopt a negative amendment to an RPS were the type of RPS previously adopted by a state, citizen ideology and educational attainment, number of months that a NEM policy had been in place, and the percent of neighboring states that had previously adopted an RPS. The results of this model are provided in table 6.7, below.

Contrary to expectations, states that previously adopted a voluntary goal or a weak RPS were less likely than states that had previously adopted a strong RPS to adopt negative changes. In states that initially adopted a voluntary goal, the likelihood of adopting subsequent negative amendments is reduced by 84.1 percent. For states that adopted a weak RPS, the probability is reduced by 94.3 percent. This variable did not prove significant for explaining either minor positive amendments or positive changes to RPSs. This might suggest that states that initially adopted strong RPSs were more likely to relax requirements as time passed and policy experience and other changes in the state necessitated (see: Carley, Nicholson-Crotty, and Miller 2017). And, this finding fits with the overall history of RPSs across the states, where states have tended to adjust and increase RPSs and have less frequently rolled back existing weak policies.

Table 6.7. Cox Proportional Hazards Model of the Adoption of Negative RPS Amendments (31 Events)			
Variable	Coefficient	Hazard Ratio	Robust Standard Error (hr)
adopt_type			
Voluntary RPS	-1.837706	.1591822****	.0624789
Weak RPS	-2.869472	.0567289***	.0481711
citizen_lag	.2447295	1.277276**	.1368679
r_share	-.1025895	.9024974*	.0582746
education	.4498744	1.568115**	.283634
nem	.0076916	1.007721**	.0032344
citizen_lag#education	-.0101869	.9898648***	.0033714
epa_adopt	-1.760941	.1718831	•
b4.epa_region#epa_adopt			
EPA Region 1	1.7727711	5.886791****	.0466083
EPA Region 3	1.786378	5.967801****	.0643828
EPA Region 5	1.765846	5.846514****	.0623622
EPA Region 6	1.766013	5.847492****	.1166536
EPA Region 7	.7273245	2.069536	•
EPA Region 8	1.783048	5.947955****	.070884
EPA Region 9	1.743254	5.715914****	.0622592
EPA Region 10	1.726296	5.6198****	.2076425

Log pseudolikelihood = -72.355988 Wald $chi^2(14)$ = 258855.03 Prob > chi^2 = 0.0000

*p=0.1 **p < 0.05 ***p<0.01 ****p<0.001

Contrary to expectations, states with more liberal citizens are more likely to adopt a negative change – for every one-hundred-thousandth percent increase in the citizen ideology score, the probability of adopting a negative amendment increases by 27.7 percent. In states where the number of people over 25 years old with at least a bachelor's degree increases by a tenth of a percent, the probability of adopting a negative amendment also increases, by 56.8 percent. In states with higher numbers of liberal and more educated citizens, the individual effects of ideology and education are tempered somewhat, as education and ideology increase together, the effect on the hazard rate associated with each variable on its own is reduced by 1.01 percent.

Interestingly, an increasing share of the vote that went to the Republican presidential candidate in the last presidential election is negatively associated with the probability of adopting a negative change. As that vote share increases by a tenth of one percent, the likelihood of adopting a negative amendment decreases by 9.75 percent. However, given the relatively low cumulative baseline hazard that all states that adopted an RPS would eventually adopt a negative amendment to an RPS, the effect of these variables turns out to be rather small, as shown in figure 6.5.

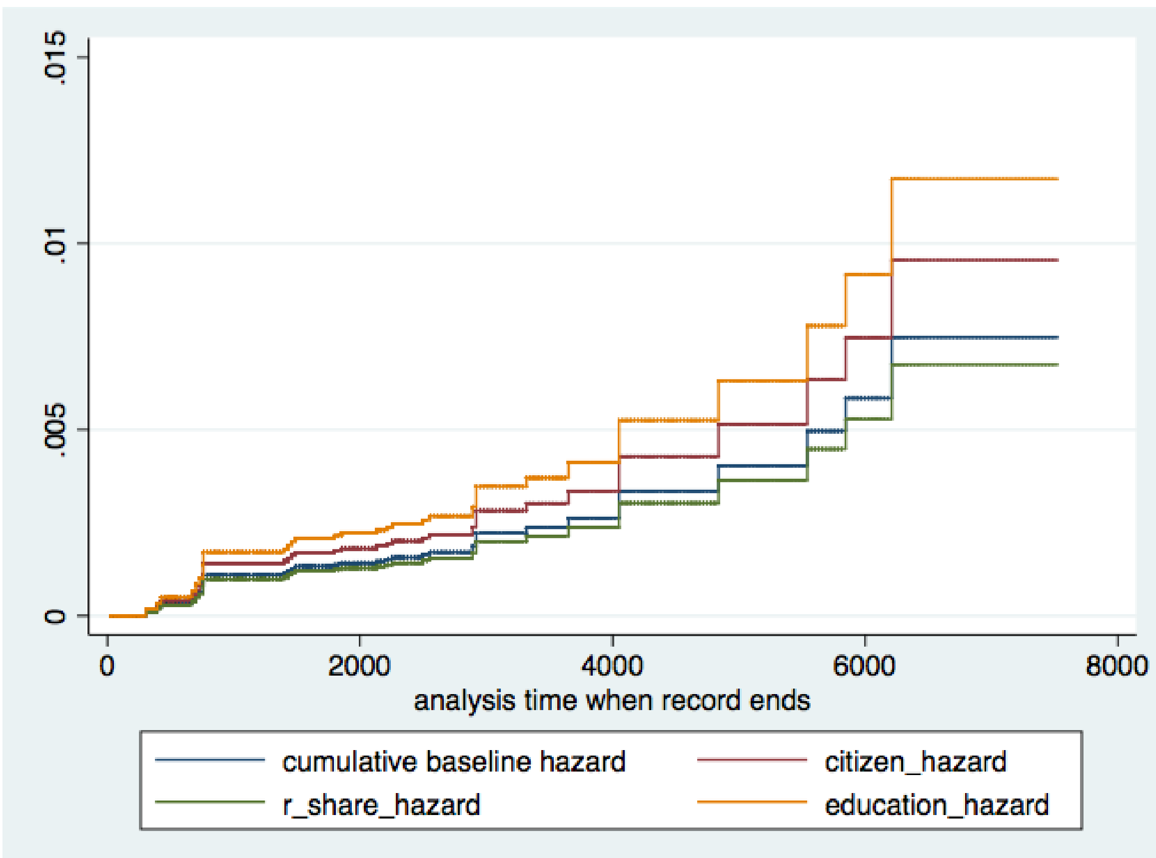

Figure 6.5. Effects of Ideology and Education on the Cumulative Baseline Hazard

These results are reflective of Berry, Laird, and Stefes' (2015) finding that a more liberal state population is positively associated with the likelihood that a state will amend its RPS. However, the results here suggest that liberal ideology is not necessarily associated with positive amendments to RPSs. Given that Berry, Laird, and Stefes' (2015) study covers amendments up to 2009, the study missed, at least, the 22 negative changes made to RPSs between 2010 and 2014 (see table 6.6, above), which could explain a difference in results.

Contrary to expectations, experience with NEM increases the probability that a state will adopt a negative RPS amendment, though the effect is small, increasing the likelihood of adopting such an amendment by .77 percent. This could be support for the argument presented above, that given utility-led backlash against NEM, it could be the case that states with weaker NEM policies face less utility opposition to an RPS, if that RPS in some way meets their needs. On the other hand, states with stronger NEM policies are more likely to see stiff opposition to any policy that might additionally impact utilities' budgets, perhaps making policy makers in these states more willing to relax RPS requirements.

Across all three models, the interaction of EPA Region and RPS adoption percentages in that region suggests that states are increasingly likely to adopt amendments to RPSs as an increasing number of states in their region adopt RPSs. The size of this impact varies by region, suggesting that there may be some variation in the degree to which states are influenced by the activities of their neighbors. However, especially given the size of the hazard ratios in this model and in the model of positive amendments, this could also be an artifact of time, as the bulk of RPS amendments came after 2006, and by the end of 2007, most of the states that would adopt an RPS had already done so (see figure 6.1, above).

An example of why we should be cautious in attributing these results solely to interstate interactions comes from state activity in EPA Region Three. For states in this region, the model tells us that the likelihood of adopting a negative amendment to an RPS increases by 496.8 percent for every additional state that adopts an RPS, as compared to EPA Region Four.[43] In

[43] EPA Region Four was selected as the baseline region as only two states in this southeast region adopted an RPS. The first was North Carolina in 2007, and the second was South Carolina in 2014. Because of

Region Three, Maryland was the first state to adopt an RPS, doing so in October 2004. One month later, Pennsylvania adopted its RPS. Both states adopted what were categorized as weak RPSs in this study, although Pennsylvania included waste coal and coal mine methane, arguably making it a weaker RPS than Maryland's. In July 2005, Delaware was the third state to adopt an RPS, also adopting a weak RPS. In April 2007, Virginia adopted its voluntary goal, and in June 2009, West Virginia was the last state in this region to adopt what was considered one of the weakest RPSs in the nation (see table 6.8).

Table 6.8. History of RPS Adoptions and Negative Amendments – EPA Region 3

Original RPS Adoptions	MD	PA	DE	VA	WV					
	May 2004	November 2004	July 2005	April 2007	June 2009	April 2010	April 2011	May 2011	March 2012	February 2013
Negative Amendments						WV	WV	MD	VA	VA

In May 2010 and April 2011, West Virginia adopted the first negative changes to an RPS in this region. These came in quick succession following the state's initial adoption, at which time, the adoption rate in this EPA Region was 100 percent. In May 2011, Maryland adopted two amendments to its RPS. The first added solar water heating as a Tier I resource, while the second added waste-to-energy, which when combined and using the index created for this study, resulted in a negative change.[44] In March 2012, Virginia added landfill gas and other thermal energy as an eligible resource and provided an additional alternative compliance pathway for complying with the state's goal. In February 2013, Virginia adopted a second set of negative

this, North Carolina is the state in the analysis most likely not to be influenced by RPS policy decisions in other states in its region. In addition, EPA Regions Four and Seven were the only regions where negative amendments were not adopted during the study's timeframe.

[44] Amendments adding thermal resources were scored +.25.

RPS amendments, this time eliminating the performance incentive provided to utilities that met the goal. The second bill amending the state's goal, while positive in addressing REC ownership, was subsumed by the negative score given to the first bill.

Because every negative change in this region came after every state had adopted an RPS, it is difficult to say with a high degree of certainty that this demonstrates that policy decisions in one state impact policy decisions in others. It could be the case that other internal, regional, or national factors were affecting states in this region between April 2010 and February 2013. It might also be that these results are more reflective of in-state policy experience than they are of interstate interactions (see: Carley, Nicholson-Crotty, and Miller 2017). Caution is further warranted when interpreting these results because the example described above applies in other regions – the bulk (25) of the negative amendments adopted by states were adopted when regional RPS adoption rates were between 80 and 100 percent.

On the other hand, it could be the case that this is evidence of diffusion. As discussed above, Berry and Berry (2014) suggest that policies adopted by one or more states can create incentives for other states to free-ride. It might be that in some regions, increasing incentives to free-ride meant that states moved to relax their standards because they could take advantage of other states' policies while also supporting certain in-state resources. For instance, the addition of thermal and waste-to-energy resources might have been a reaction to the new markets for alternative energy credits created when West Virginia and Virginia adopted their policies.

The Adoption of Minor Positive Amendments to an RPS

States began to adopt minor positive changes a little earlier than they started adopting negative amendments. Between May 1, 1995 and the end of August 2014, 25 states adopted 70 minor amendments to RPSs. While peak activity for states adopting negative amendments to

RPSs occurred between 2009 and 2014, peak activity for minor positive changes to RPS occurred between 2009 and 2011 – 29 of the 70 total amendments were adopted during this three-year time-frame (see table 6.9).

Table 6.9. History of Minor Positive RPS Amendments

1995 - 2001	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
MN (5)[45]	CA	ME	CA	CT	CA	DE	DE	IL	DE	KS	MD (2)	MA
	NV (2)		CT	HI	MN	MO	HI	MA	HI (2)	MA	MO	ME
			MN (2)	ME	NV (2)	NH	IL (2)	ME	IL	MD	VA	NH
				VT	PA	NJ	ME	MO	MT (2)	WI	VT	VA
						RI	MN	NJ	NC (2)		WA	
							NC	VA	NM			
							NH	VT	NV			
							OH	WI	RI			
							SD					

(Number of Events if > 1)

The results of the model of small, positive amendments to RPSs are provided in table 6.10, below. The variables that proved important for explaining this decision were nameplate renewable energy capacity, median household incomes lagged one year, number of months that a MGPO and PBI had been in place, citizen ideology and educational attainment, and government ideology. The percent of states that had previously adopted an RPS in a state's region once again proved statistically significant for explaining the decision to amend an RPS.

The internal characteristics and other policies variables that proved statistically significant for explaining the likelihood that a state would adopt a minor positive change to an

45 Minnesota did not adopt minor amendments to its RPS in 1996 and 1998.

RPS all have relatively small effects on the overall probability of adoption. Existing renewable energy capacity has a very small, negative impact on the likelihood of adoption. For every additional .1 MWs in renewable capacity, the probability of adopting a minor positive amendment decreases by .000077 percent. Used as a proxy for the strength of renewable energy interests in a state, this finding is in line with Lyon and Yin's (2010) argument that states with smaller amounts of existing in-state renewable energy capacity will seek to protect those interests, while states with higher levels of renewable energy penetration will be less motivated to protect those interests.

Table 6.10. Cox Proportional Hazards Model of the Adoption of Minor Positive RPS Amendments (70 Events)

Variable	Coefficient	Hazard Ratio	Robust Standard Error (hr)
nameplate_re	-.0000768	.9999232****	.0000208
income_lag	.0000403	1.00004**	.0000156
mgpo	.0165391	1.016677***	.0051
pbi	.0078331	1.007864****	.0019032
citizen_lag#government_lag	.0002533	1.000253**	.0001033
citizen_lag#education_lag	-.0007609	.9992394**	.0003265
epa_adopt	-.093657	.9105951**	.0344457
b10.epa_region#c.epa_adopt			
EPA Region 1	.0983727	1.103374***	.0383253
EPA Region 3	.0983584	1.103358***	.0377763
EPA Region 4	-2.872971	.0565307****	.0062292
EPA Region 5	.1019927	1.107375***	.0380162
EPA Region 6	.0392266	1.040006*	.025572
EPA Region 7	.1211728	1.12882****	.0378482
EPA Region 8	.0822552	1.085733***	.0341405
EPA Region 9	.1016368	1.106981***	.0388512

Log pseudolikelihood = -200.6595 Wald $chi^2(20)$ = 7475.92 Prob > chi^2 = 0.0000

*p=0.1 **p < 0.05 ***p<0.01 ****p<0.001

The internal characteristics and other policies variables that proved statistically significant for explaining the likelihood that a state would adopt a minor positive change to an RPS all have relatively small effects on the overall probability of adoption. Existing renewable energy capacity has a very small, negative impact on the likelihood of adoption. For every additional .1 MWs in renewable capacity, the probability of adopting a minor positive amendment decreases by .000077 percent. Used as a proxy for the strength of renewable energy interests in a state, this finding is in line with Lyon and Yin's (2010) argument that states with smaller amounts of existing in-state renewable energy capacity will seek to protect those interests, while states with higher levels of renewable energy penetration will be less motivated to protect those interests.

The number of months that a state has had a PBI in place is positively associated with an increased (.79 percent) probability of adopting a minor positive amendment. The effect of the length of time that an MGPO has been in place has a larger effect on the probability of adoption, increasing it by 1.67 percent for every additional month that the policy has been in place. These findings might reflect state support for particular interests and/or resources where the existence of either or both policies is a clear signal of support for renewable energy resources in the state, and minor positive amendments reflect efforts to continue to support in-state economic interests. Combined, the findings related to renewable energy capacity and other policies are suggested by the case study presented in Chapter Four, where policy makers adopted several amendments to OREA that were aimed at supporting very specific interests and resources.

Increasing liberalism and educational attainment among a state's citizens together reduce the likelihood of adoption by .00076 percent for every one-unit increase in each of these variables. On the other hand, higher median household incomes increase the probability of adoption. For every one dollar increase in income, the probability of adoption increases by .004 percent. With each one-hundred-thousandth percent increase in citizen and government ideology, the likelihood of adopting a minor positive amendment to an RPS increases by .025 percent.

While this last finding is somewhat supportive of Carley and Miller's (2012) finding that decisions to strengthen an RPS are associated more with ideological liberalism in government than by the degree of liberalism among the state's citizens, the model of positive amendments found no such relationship. Carley and Miller's (2012) study examined RPS amendments captured in DSIRE's database through 2008. This makes it likely that the study missed several of the minor amendments captured here. At minimum, their study did not capture the 25 negative changes, the 43 minor positive changes, and the 36 positive changes made to RPSs between 2009 and 2014. It might be instructive to compare the amendments captured in this study to those used in theirs to explore why this difference in results emerges.

The model suggests that while the overall impact of other states' decisions to adopt an RPS is negative (reducing the likelihood of adopting a minor positive amendment by 8.9 percent), that effect, when compared to the effect in EPA Region Ten,[46] is reversed in all EPA Regions except for Region Four, where North Carolina adopted all of its amendments prior to South Carolina's adoption of a voluntary goal.

Again, caution is warranted in interpreting these results. The positive effect might emerge, not because decisions in other states impact decisions in one state, but because other internal, regional, or national factors are influencing states in the same way. Evidence for this caution emerges because more than two-thirds (52) of all minor positive amendments adopted during the study's time-frame were adopted between May 2003 and August 2014 in EPA Regions One, Three, Five, Eight, and Nine when RPS adoption percentages in these regions ranged between 75 and 100 percent. In EPA Region Seven, the effect on the probability of

[46] Regions Ten and Six were tested as baseline regions because in both regions, only one minor positive amendment event was recorded. EPA Region Ten was selected because it is smaller and had fewer RPS adoptions than did EPA Region Six.

adopting a minor positive change that is associated with a neighbor adopting an RPS is the largest in this model. However, only Kansas and Missouri adopted RPSs in this region, and of the four amendments that the two states made, three came after both states had originally adopted their RPS. Figure 6.6 shows the effect on the baseline hazard associated with adoption percentages generally and for states in EPA Regions Eight and Five.

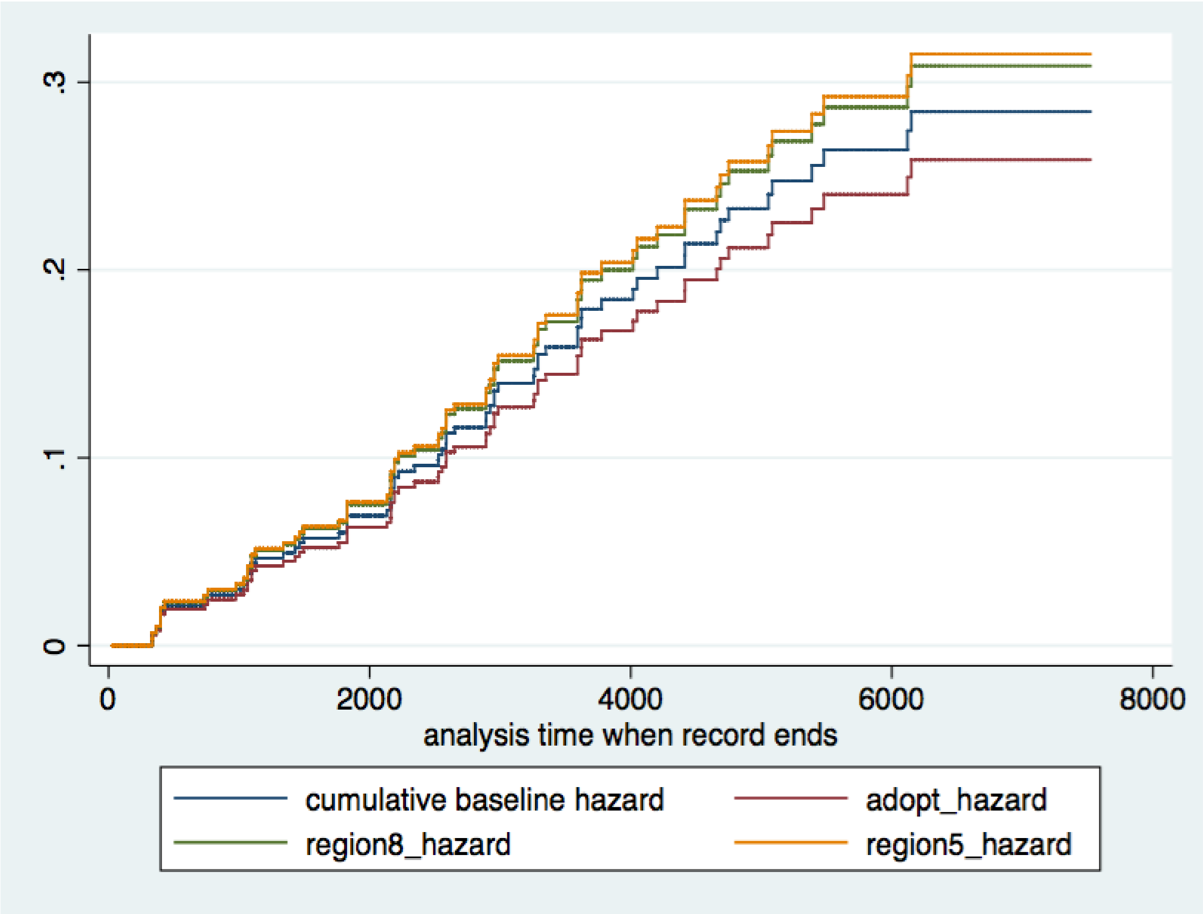

Figure 6.6. Effects of RPS Adoption Percentages on the Cumulative Baseline Hazard

The Adoption of Positive Amendments to an RPS

Positive changes to RPSs began to be adopted later in the overall history of RPSs in the U.S. The first such amendment was adopted by Wisconsin in October 1999, when policy makers increased the state's initial 50 MW capacity target, adopted in 1998, to a 2.2 percent by 2011 target. Between May 2001 and the end of September 2014, an additional 22 states adopted 63 positive amendments to their RPSs. The bulk of this activity occurred between 2007 and 2011, when 39 amendments were adopted (see table 6.11). This is roughly comparable to peak activity periods for the other types of amendments categorized in this study, where most negative changes were adopted between 2009 and 2014, and peak activity for minor positive changes to RPS occurred between 2009 and 2011.

Table 6.11. History of Positive RPS Amendments

2001	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**
MN	CT	HI	NV	CA	CA	CA	CA	CA	CA	CA	CO	CA
NV	MN		TX	ME	CO	MA	HI	CO	CT	MD	MN	IL
	(2)							(2)				
				WI	CT	MD	NV	DE	IL	NJ	NV	RI
					DE	ME	OR	MD	ME	VT	OR	WA
					IL	MN	RI	ME	OR	WA	WA	
					MD	MO	VA	NJ	VT			
					ME	PA	VT	OR				
					MN	VT						
					MT							
					NM							

(Number of Events if > 1)

The variables that proved important for explaining the adoption of a positive amendment to an RPS were percent renewable energy capacity, median household incomes, number of months that a NEM policy had been in place, citizen ideology, the share of the vote that the Democratic candidate for president received in the most recent presidential election, residential electricity rates, and federally-owned public lands. Regional influences, once again, are significant predictors of decisions to positively amend an RPS. The results of this model are provided in table 6.12, below.

Table 6.12. Cox Proportional Hazards Model of the Adoption of Positive RPS Amendments (64 Events)			
Variable	Coefficient	Hazard Ratio	Robust Standard Error (hr)
percent_re	.1451645	1.15623***	.056046
income	.0000381	1.000038**	.0000154
nem	-.0046436	.9953672**	.0017824
avg_fed_area_log	.2905368	1.337145****	.107982
citizen_lag#d_share	.0006983	1.000699****	.0001693
percent_re#price	-.0086093	.9914277***	.0031771
epa_adopt	-1.514019	.2200238	•
b4.epa_region#epa_adopt			
EPA Region 1	1.510023	4.526834****	.0257698
EPA Region 3	1.515096	4.549859****	.0236982
EPA Region 5	1.505885	4.508139****	.030194
EPA Region 6	1.459327	4.303061****	.0720095
EPA Region 7	.4789399	1.614362	•
EPA Region 8	1.499834	4.480945****	.0314109
EPA Region 9	1.509022	4.522306****	.0194768
EPA Region 10	1.496436	4.465743****	.058054
Log pseudolikelihood =-175.4035	Wald $chi^2(13)$ = 575435.48		Prob > chi^2 = 0.0000
*p<0.1	**p < 0.05	***p<0.01	****p<0.001

While the effect of in-state renewable energy capacity on the probability of adopting a minor positive change to an RPS was comparatively small, the effect in this model is much larger. For every additional one-hundredth of a percent increase in renewable energy capacity, the likelihood of adopting a positive change to an RPS increases by 15.6 percent. When interacted with residential electricity rates, the effect of renewable energy capacity is tempered, every one-hundredth of a cent increase in electricity rates has a small, negative effect on the increased probability of adoption associated with in-state renewable energy capacity (see figure 6.7). This seems to suggest that while policy makers might be motivated to adopt policies that support an in-state economic interest, this motivation will be tempered by higher electricity rates. Opponents have frequently made the case that RPSs increase rates, and the findings here suggest that policy makers might be less likely to adopt amendments that would strengthen an RPS in states where this argument would be more potent.

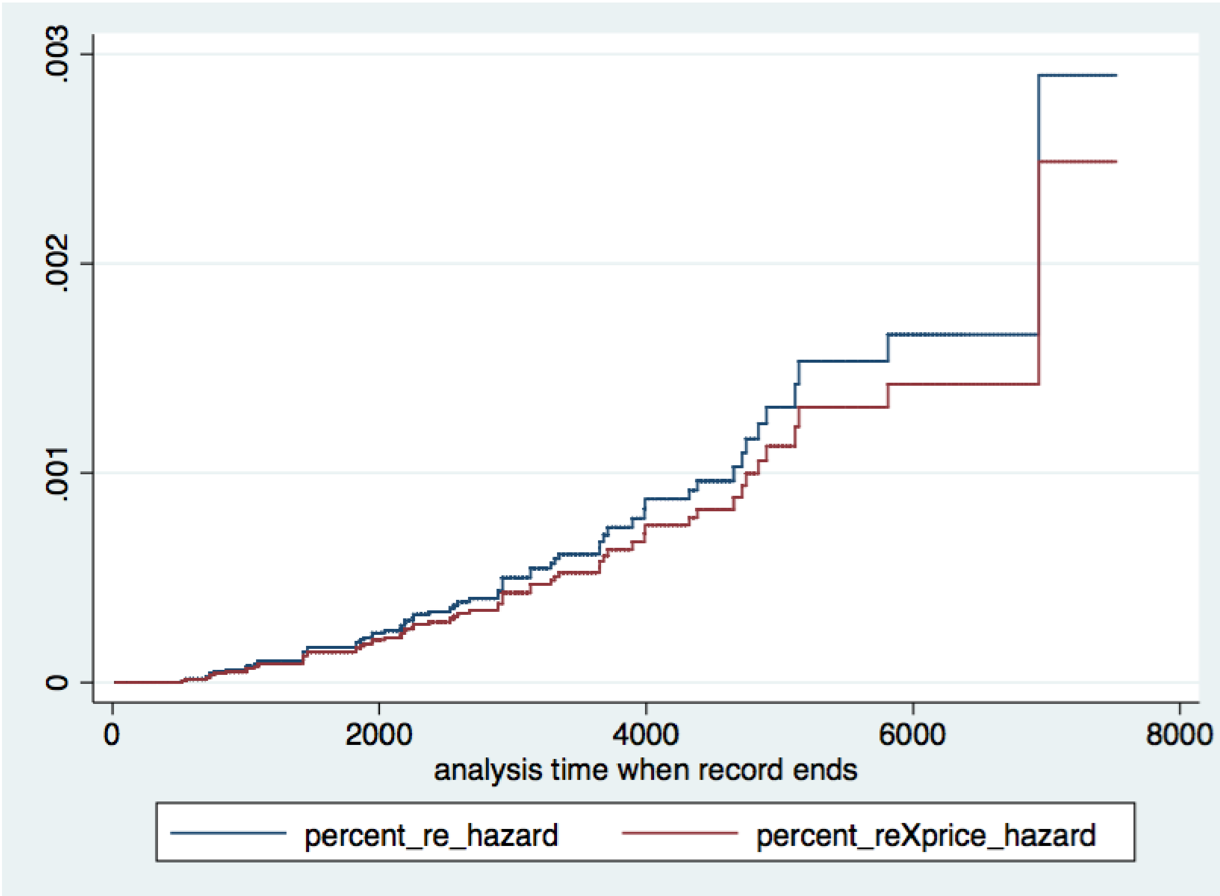

Figure 6.7. Effects of Residential Electricity Rates on the Hazard Associated with Percent Renewable Energy

While in-state federally-owned public lands had a negative effect on the likelihood that a state would adopt a weak RPS (reducing the probability of adoption by 2.8 percent), increased acreage of these lands in a state has a positive effect on the likelihood that a state will adopt a positive amendment to its RPS. With every one-hundred-thousandth of a log-acre increase in federal lands in a state, the probability of adopting a positive amendment to an RPS increases by 33.7 percent. A greater share of a state's land-area that is federally-owned suggests that a state has a comparative advantage in terms of open spaces for potential renewable energy development. In addition, while not entirely easy, siting transmission lines across federal lands might be easier than attempting to build transmission to new renewable projects across a patch-work of privately-owned lands. In the case of positive amendments, it could be that these attributes enhance a pre-existing motivation to capitalize on the benefits of renewable energy.

As expected, states with wealthier and more liberal citizens – as reflected by median household incomes, citizen ideology, and presidential vote shares – are more likely to adopt positive changes to RPSs. However, the impact of these variables is comparatively smaller than that associated with the other variables in the model. For every one-dollar increase in median household incomes, the probability of adopting a positive amendment to an RPS also increases, by .0038 percent. As noted, given that incomes are measured in the tens of thousands of dollars, this effect adds up quickly. Increasing citizen ideology, measured as a one-hundred-thousandth percent increase in a state's score, combined with an additional .1 percent of the vote to the Democratic candidate in the most recent presidential election increases the likelihood of adopting a positive amendment by .069 percent.

Similar to what was found in the model of the adoption of strong RPSs, the number of months that a state has had a NEM policy in place has a small, but negative effect on the probability of adopting a positive amendment to an RPS. While in this model, the effect is smaller – each additional month that a state has had a NEM policy in place reduces the likelihood of adoption by .0046 percent compared to 1.8 percent in the model of strong RPSs – the results, combined with a finding of a small positive effect in the models of the adoption of weak RPSs and negative RPS amendments suggest that some sort of policy interaction is occurring. Perhaps, as discussed above, the design details of other policies matter when evaluating the impacts of past policy decisions on the likelihood of subsequently adopting a policy innovation or change.

As was the case in the other two models of RPS amendments, the effect of other states' policy decisions proves significant in this model. Similar to what was found in the model of negative amendments, while the model suggests that the overall effect might be negative, the effect by region is positive and very large. At minimum, in most regions, when compared to EPA Region Four, the likelihood of adopting a positive amendment increases by 330 percent for each additional state that adopts an RPS.[47] As was the case for the other models, this could be an artifact of time or the result of other influences, as 34 of the 64 positive amendments were adopted between June 1, 2004 and September 30, 2014 in EPA Regions One, Three, Five, and Nine when RPS adoption rates in those regions were at 100 percent. On the other hand, this model, especially, could suggest that some sort of interstate interaction is occurring, and that the interaction varies by region and over time: between October 1999 and the end of March 2014, 30 positive amendments were adopted in all EPA Regions except EPA Region Four when RPS adoption percentages in these regions ranged from zero to 83 percent.

Summary and Conclusion

The models presented above share points of agreement and exhibit areas of disagreement. This section discusses these differences and similarities, focusing on the findings related the hypotheses presented in Chapter Three. Balancing a desire to provide the best fitting models with the need to avoid over-specification meant that not all hypotheses were tested in the multi-variate Cox proportional hazard models presented in this chapter.[48] As an aid to the discussion, table

[47] North Carolina did not adopt a positive amendment to its RPS during this study's time-frame. Only one positive amendment event was recorded in EPA Region Seven.

[48] Guidance varies on the proper ratio of the number of events to independent variables. Because there are so few RPS adoption events, a ratio of 10 to 1, as suggested by the bulk of the medical literature on event history analysis, was impossible to achieve. Other authors suggest a ratio of 5 to 1, while some suggest that 2-3 events per independent variable is sufficient for avoiding type I and type II errors.

6.13 (below) provides a summary, using rounded coefficients, for comparing the models. One of the goals of this dissertation was to test whether the explanatory variables associated with decisions to adopt or modify an RPS differed by decision type. The results presented here suggest that this is, in fact, the case and that the size and direction of the effect of shared variables also varies by decision type.

Table 6.13. Cox Proportional Hazards Models of RPS Adoptions and Amendments							
	All RPSs	Voluntary Goal	Weak RPS	Strong RPS	Negative Change	Minor Positive Change	Positive Change
percent_re			.25956***				.14517***
nameplate_re						-.00008****	
wind_gwh				.0000005*			
price_t		-.00007**					
income	.00012***		.00012***				.00004**
income_lag						.00004**	
citizen_lag	.03736**	.14306****			.24473**		
r_share					-.10259*		
government		-.03915***		.08356***			
education					.44987**		
interconnection		.01853**		.02283**			
nem	.01529****		.01293**	-.01828*	.00769**		-.00464**
mgpo	.09958****			.02522**		.01654***	
pbi	.10112****					.00783****	
benefit_fund	.02758***	-.04121**					
policy_count	-1.081***						
adopt_type							
Voluntary RPS					-1.8377****		
Weak RPS					-2.8695***		
avg_fed_area_log			-.32527**				.29054**
percent_re#price							-.00861****
citizen_lag#d_share							.00069****
citizen_lag#education					-.01019***		
citizen_lag#education_lag						-.00076**	
citizen_lag#government_lag						.00025**	
				$*p \leq 0.1$	$**p < 0.05$	$***p<0.01$	$****p<0.001$

Table 6.13. Cox Proportional Hazards Models of RPS Adoptions and Amendments continued							
	All RPSs	Voluntary Goal	Weak RPS	Strong RPS	Negative Change	Minor Positive Change	Positive Change
reeo_adopt	-.42271****						
reeo_region # reeo_adopt							
1 (NEEP)	.37552****						
3 (MEEA)	.30164****						
4 (SWEEP)	.30622****						
5 (NEEA)	.2389536***						
epa_adopt			-.03539**		-1.760941	-.09366**	-1.514
epa_region # epa_adopt							
EPA Region 1					1.7728****	.09837***	1.51****
EPA Region 3					1.7863****	.09836***	1.5151****
EPA Region 4					•	-2.8729****	•
EPA Region 5					1.7659****	.10199***	1.5059****
EPA Region 6					1.766****	.03923*	1.4593****
EPA Region 7					.72733	.12117****	.47894
EPA Region 8					1.7831****	.08226***	1.4998****
EPA Region 9					1.7433****	.10164***	1.509****
EPA Region 10					1.7263****	•	1.4964****
				*p≤0.1	**p < 0.05	***p<0.01	****p<0.001

As expected, the percent of renewable energy used by a state's electric sector in a given year had a positive effect on the probability that a state would adopt a positive change to an RPS. However, contrary to expectations, a similar result was not found regarding the adoption of strong RPSs. Rather, this variable was positively associated with the likelihood that a state would adopt a weak RPS. The models presented above also suggest that a greater share of renewable energy in a state's electricity supply is negatively associated with the likelihood of adopting a minor positive change to an RPS.

Lyon and Yin (2010) find that states with larger amounts of renewable capacity are less likely to adopt an RPS with an in-state requirement and argue that this finding suggests that states with smaller amounts of existing capacity will seek to protect and support in-state economic interests. The OREA case study suggests that many of the amendments that policy makers made to Oregon's requirements supported specific interests and resources in that state. Combined, the results found here and by Lyon and Yin (2010) suggest that policy makers will design and re-formulate policy that supports in-state renewable energy interests. However, the size of the renewable energy industry in a state will be associated with different policy decisions.

Specifically, it seems that RPS design differences emerge when policy makers seek to achieve different goals. In the case of the adoption of weak RPSs and positive amendments to existing RPSs, policy makers might be seeking to support an already influential industry in the state, explaining the positive relationship between renewable energy capacity and adoption. On the other hand, policy makers might also be motivated to protect smaller interests and specific resources in their state, which explains the negative relationship between the amount of renewable energy used in a state and the adoption of minor positive amendments. As the non-hydroelectric renewable energy industry expands, it might be the case that policy makers will be less motivated to adopt small, protective amendments to an RPS.

As expected, higher average residential electricity rates had a negative effect on the probability that a state would adopt a positive amendment to an RPS. Electric rates also had a negative effect on the likelihood that a state would adopt a voluntary goal. In the case of positive amendments, price had a tempering effect on the positive effect associated with the percent of renewable energy used by a state's electricity sector. It seems that while policy makers might be motivated to adopt either a symbolic policy or to strengthen an existing policy that supports an in-state economic interest, this motivation will be tempered by higher electricity rates because opponents can make a potent argument that such a change might increase what are already considered to be burdensome electricity rates.

Wind potential was expected to be positively associated with an increased probability of adopting a strong RPS. While this might be the case, the results found here suggest that in-state wind potential has a constant effect across all states and does not explain why some states adopt an RPS while others do not. Wind potential was not a significant explanatory variable for any of the models of RPS amendment decisions. Future research using Cox proportional hazards models of RPS adoptions and amendments might test the effect of other variables that capture renewable energy potential. In the meantime, this study might suggest that this constant effect explains why previous research has found both positive and negative relationships (see: Carley, Nicholson-Crotty, and Miller 2017).

Across all of the models presented above, median household incomes, citizen ideology, government ideology, and/or educational attainment proved statistically significant, to varying degrees, for explaining the probability that a state would adopt or amend an RPS. As expected, and as suggested by previous studies of the diffusion of energy policies generally and the RPS specifically, median household income was positively associated with the likelihood that a state would adopt an RPS and a positive change to an RPS. Income was also positively associated with the probability that a state would adopt a weak RPS, and income lagged one year was associated with the likelihood that a state would adopt a minor positive amendment to an RPS.

As expected, states with more liberal populations are more likely to adopt an RPS. However, while the effect of citizen ideology in the model of the adoption of any type of RPS had a relatively small positive effect, citizen ideology has a much larger positive effect on the probability of adopting a voluntary renewable energy goal. As expected and as suggested by Carley and Miller's (2012) finding that the adoption of strong RPSs is influenced more by ideological liberalism in government than by the degree of liberalism among the state's citizens, a more liberal government reduces the likelihood that a state will adopt a voluntary goal and increases the probability that a state will adopt a strong RPS.

Contrary to expectations, states with more liberal and educated citizens are more likely to adopt a negative change. However, in states with higher numbers of both liberal and more educated citizens, the individual effects of ideology and education are tempered by the interaction of these two variables. Interestingly, and contrary to expectations, an increasing share of the vote that went to the Republican presidential candidate in the last presidential election is negatively associated with the likelihood of adopting a negative change. While increasing liberalism and educational attainment among a state's citizens together reduce the probability of adopting a minor positive change, citizen ideology interacted with government ideology increases the likelihood of adoption. As expected, states with more liberal citizens – as reflected by citizen ideology and presidential vote shares – are more likely to adopt positive changes to

RPSs. The results found in the models of RPS amendments tend to support Berry, Laird, and Stefes' (2015) finding that a more liberal state population is positively associated with the likelihood that a state will amend its RPS. However, the results here suggest that liberal ideology is not necessarily associated with positive amendments to RPSs.

Other, pre-existing, state policies proved to be important explanatory factors in all of the models presented above. The number of months that interconnection standards had been in place had a positive effect on the probability that a state would adopt a voluntary goal, and as expected, on the likelihood that a state would adopt a strong RPS. This result, as discussed above, suggests that interconnection standards are complementary policies to RPSs, however, the relationship between these policies might vary by state and policy design. Perhaps states with interconnection standards that are less supportive of renewable energy are more likely to adopt a symbolic voluntary goal, while states with strong interconnection standards are more likely to adopt a strong RPS as part of a sustained effort to support the renewable energy industry.

The number of months that a state has had a NEM policy in place has divergent effects on the probability of adoption or amendment. As expected, a longer history with NEM increased the probability of adopting any type of RPS. Contrary to expectations, this history was also positively associated with the likelihood of adopting a weak RPS, but negatively associated with the likelihood that a state would adopt a strong RPS. In a similar fashion, and also contrary to initial expectations, the amount of time that a NEM policy had been in place was positively associated with the probability that a state would adopt a negative change to an RPS and negatively related to the likelihood of adopting a positive amendment. These results suggest that some sort of policy interaction is occurring. It might be the case, as discussed, that states with weaker NEM policies face less utility opposition to an RPS, while states with stronger NEM policies are likely to see stiff opposition to any additional policy decision that might impact utilities' bottom-lines. It seems that design differences in these policies also make them more or less complementary to different types of RPSs. This suggests that future research could account for the design details of other policies when evaluating the effects of past policy decisions on policy innovation and/or change.

As expected, the number of months that a state has had an MGPO in place is positively associated with the probability of adopting an RPS or a strong RPS. This is supported by OREA's case study, which found that a history of leadership among the state's IOU's, through their green power programs, led to increased support for renewable energy, which translated into support for and participation in developing what emerged as one of the strongest RPSs enacted in the U.S. Also as expected, a longer history with a PBI in place was positively associated with the probability of adopting an RPS. Somewhat unexpectedly, the amount of time that a state had an MGPO and/or PBI was not significant in explaining the decision to adopt a positive amendment, but both policies were associated with a greater likelihood of adopting a minor positive change. Again, this finding is suggested by the case study presented in Chapter Four. The existence of an MGPO and/or a PBI might signal broad support for renewable energy resources in the state, and minor positive amendments reflect efforts to continue to support this industry.

While the number of months that a state has had a systems benefit fund has a negative impact on the likelihood that a state will adopt a voluntary goal, the reverse, as expected, is true for the adoption of any type of RPS. Yi and Feiock (2012) find that the effects of past policy decisions vary by the type of RPS adopted by a state. Given the divergent findings, it could be the case that systems benefit funds function as partial policy substitutes for voluntary RPSs and reduce the likelihood of adopting a goal, but not another type of RPS. Contrary to expectations, the adoption of a greater number of policies associated with support for the renewable energy industry does not have a positive effect on the likelihood that a state will adopt an RPS. This could be because there might be some level of policy saturation where the adoption of an RPS starts to be viewed as less necessary or redundant. Alternatively, this could support Yi and Feiock's (2012) finding that while a positive relationship exists between their index of other policies and the likelihood that a state adopts an RPS, this effect is not constant across types of RPSs.

Contrary to expectations, states that previously adopted a voluntary goal or a weak RPS were less likely than states that had previously adopted a strong RPS to adopt negative changes to an RPS. This might suggest that states that initially adopted strong RPSs were more likely to relax requirements as time passed and policy experience and other changes in the state necessitated (see: Carley, Nicholson-Crotty, and Miller 2017). This finding also fits with the overall history of RPS policies across the states, where states have tended to adjust and increase RPSs and have less frequently rolled back existing weak policies.

The results presented here related to the other policies variables argue for the importance of incorporating the influence of past policy decisions in models of policy innovation and change, as suggested by Berry and Berry (2007, 2014). In the models presented here, past policy decisions appeared as important explanatory variables in every model. Additionally, the effect of past policy decisions varies across the models. Future research should continue to incorporate the design differences of the policy under study and should incorporate the differences in design of these other policies. This would allow and examination of whether, for instance, states with weak interconnection standards are, in fact, more likely to adopt a symbolic voluntary goal, while states with strong interconnection standards are more likely to adopt a strong RPS.

As expected, while the total acreage of in-state federally-owned public lands has a negative effect on the likelihood that a state will adopt a weak RPS, it has a positive effect on the likelihood that a state will adopt a positive amendment to its RPS. Because federal lands did not prove significant in any of the other models of RPS adoptions, a possible explanation for this is that most federal lands are located in the Western U.S., and these states might tend to be more conservative, making them less likely to adopt any type of RPS. A greater share of a state's land-area that is federally-owned suggests that a state has a comparative advantage in terms of open spaces for renewable energy development. In addition, siting transmission lines across federal lands might be easier than attempting to build transmission to new renewable projects across a patch-work of privately-owned lands. In the case of positive amendments, it could be that these attributes complement policy makers' motivations to support the renewable energy industry in their state. At minimum, these results suggest that there might be some regional variation in the relationship between public lands and support for renewable energy.

Vertical influences on the decision to adopt an RPS have been widely ignored. The results presented here suggest that federal policy has at least some influence on state renewable energy policy. Future research could refine and develop new measures of federal influence to better test for its effects.

In all models where the percent of states in a region that had previously adopted an RPS was significant for explaining a decision to adopt or amend an RPS, the effect was generally negative, which was contrary to expectations and not suggested by other studies that have modeled diffusion effects using neighboring states or fixed regions. However, when region was accounted for, this negative effect was reversed for all regions except for EPA Region Four in the model of minor positive amendments. The results related to regional diffusion suggest areas for caution in interpreting results and a handful of potential avenues for future research.

First, it might be the case that the size and direction of the effect related to regional diffusion is driven by interactions between states in particular regions. For instance, of the 11 states that initially adopted a weak RPS, seven are located in the northeast in EPA Regions One and Three. Perhaps the negative relationship found between RPS adoption percentages and the probability of adopting a weak RPS is explained by incentives to free-ride on the policies adopted by other states in this region, and we would not find a similar effect when looking at the other four states that adopted weak RPSs.

Second, all of the models presented here suggest that there is some regional variation in the degree to which states are influenced by the policy decisions of their neighbors. Future research could explore whether this is in fact the case, and if it is, why this is so. Research in this vein could also incorporate variables to capture the mechanisms of diffusion – learning, competition, coercion, and imitation – to test whether regional variation relates to the particular mechanism of diffusion at work in a particular region at a particular time.

Third, we should be cautious when attributing results to regional diffusion. As suggested above, the results could be an artifact of time. This is especially the case for the models of RPS amendments because the bulk (174) of amendments to RPSs occurred between February 1, 2007 and the end of 2014, and most (26) states that would adopt an RPS had done so by the end of 2007. While no such hypotheses were developed here to explicitly test such an assertion, subsequent revisions to policies might reflect the role of policy experience over time and not the effects of decisions in other states (Carley, Nicholson-Crotty, and Miller 2017; Karch 2007b). When examining the cumulative baseline hazard for the three models of RPS amendments (see figure 6.8), it is clear that the probability of adopting any type of amendment to an RPS is increasing over time when all other variables are set to zero. Research using different proxies to test for the mechanisms of diffusion should take the effect of time seriously, and account for this when developing variables to account for the effects of policy decisions in other states.

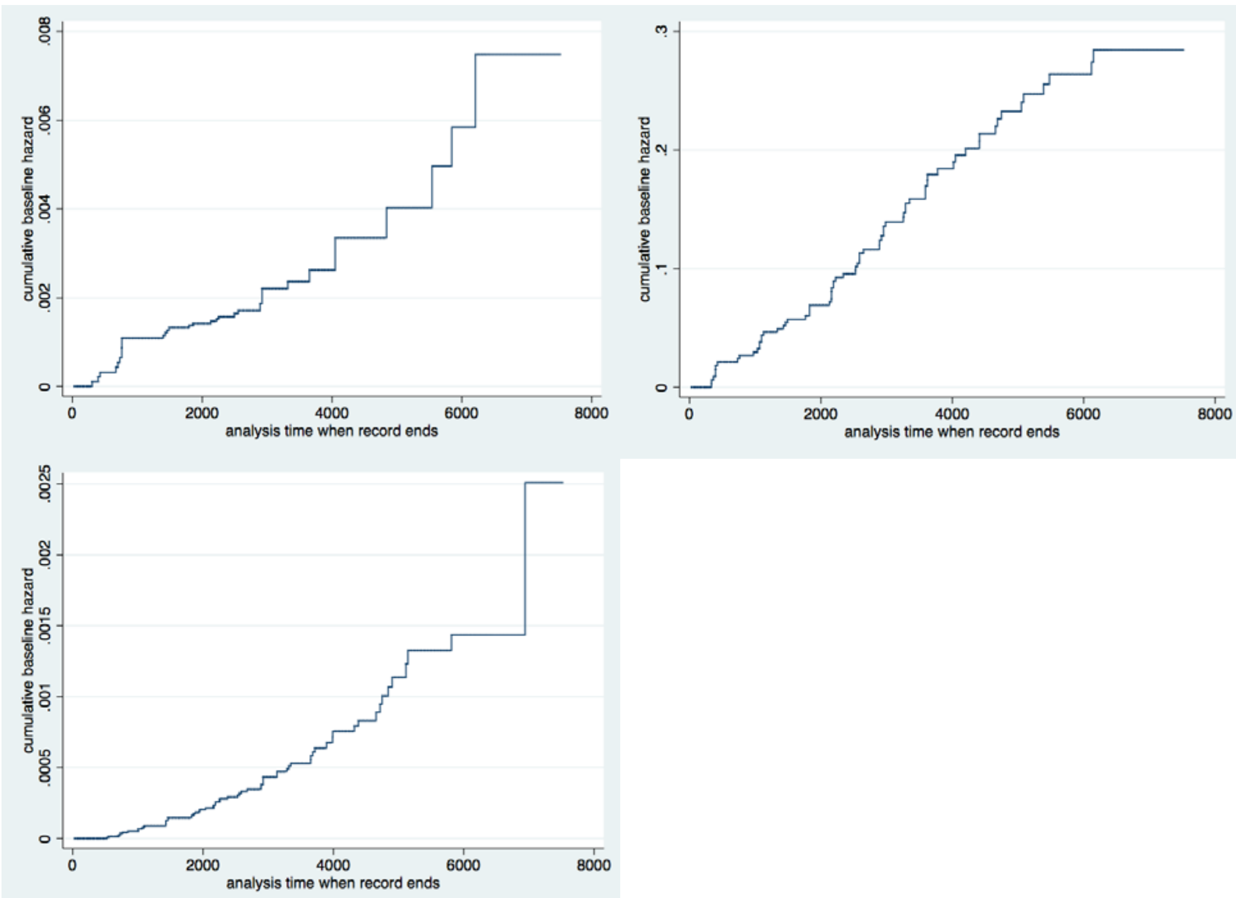

Figure 6.8. Cumulative Baseline Hazards, Clockwise: Negative Amendments, Minor Positive Amendments, Positive Amendments

Studies of the diffusion of the RPS have found that particular internal state characteristics –citizen ideology, party control of government institutions, state wealth and citizen income levels, educational attainment, and active renewable energy or environmental interest groups – are especially important for explaining the adoption of an RPS. In terms of the effects of a state's renewable energy potential, typically measured through solar and/or wind potential, findings have been mixed. Findings have also been mixed when studies incorporate a proxy to evaluate the effects of regional diffusion. Few studies have incorporated RPS design differences, later amendments, the influence of past policy decisions, and the effects of federal policies.

The models presented above echo the findings of previous research suggesting that renewable energy interests, citizen income levels, citizen and government ideology, and educational attainment are important for explaining decisions to adopt and amend RPSs. However, the results presented above also diverge from previous research in demonstrating that the effect of these variables is not always positively associated with a decision to adopt or strengthen an RPS. As has been the case in other studies, this study found little to suggest that renewable energy potential is an important predictor of the decision to adopt an RPS. While the results of the models presented above suggest the possibility of regional diffusion effects, these results must be interpreted with caution. Unlike many studies that have come before, this dissertation examined the effects of other policies and federal policy. The results presented in this chapter suggest that these are important factors for explaining the decision to adopt or amend an RPS.

CHAPTER SEVEN: CONCLUSION

This dissertation used a mixed methods approach to explore answers to two major research questions: Why do states adopt different types of RPSs, while others fail to adopt any type of RPS? And, after states adopt an RPS, why do they amend the policy in the manner that they do over time? In addition to these research questions, several minor research questions were also developed. Generally, these involved questions of whether the explanatory variables associated with different types of policy decisions would vary by decision type and over time. The results of the qualitative case studies and of the quantitative analysis suggest that both the size and direction of the effects of the explanatory variables as well as the individual variables themselves vary across decision types, time, and space.

The remainder of this chapter is organized as follows: First, I provide an overarching summary of the results of the two case studies and the event history models presented in Chapter Six. The discussion then moves to the contributions to the literature on environmental and energy policy innovation that this dissertation makes. The next section outlines directions for future research. I conclude with a brief summary of the chapter.

Summary of Results: Explaining RPS Adoptions and Amendments

Studies of the diffusion of the RPS have found that particular internal state characteristics –citizen ideology, party control of government institutions, state wealth and citizen income levels, educational attainment, and renewable energy or environmental interest groups – are especially important for explaining the adoption of an RPS. Interestingly, in the studies that incorporated the effects of a state’s renewable energy potential, typically measured through solar and/or wind potential, findings have been mixed. While some have found positive relationships, others have found negative effects (see: Carley, Nicholson-Crotty, and Miller 2017). Findings have also been mixed when studies incorporate a proxy for policy diffusion, though the disagreement tends to be over whether or not there is an effect and not the direction of the effect. Most studies have not found a statistically significant effect related to fossil fuel industry presence. Few studies have incorporated RPS design differences, later amendments, the influence of past policy decisions, and the effects of federal policies.

This dissertation suggests that household incomes, citizen and government ideology, and educational attainment are important internal state characteristics for explaining decisions to adopt and amend RPSs. In addition, renewable energy interests and resources, fossil fuel resources and related interest groups, policy entrepreneurs, collaboration, and coalition building are also found to be important for explaining policy adoption and change. As has typically been the case, this study found little in the quantitative models to suggest that renewable energy potential is an important predictor of the decision to adopt an RPS, although, as discussed below and in Chapter Four, in-state wind potential, especially, appeared to be on top of mind during meetings of Oregon's renewable energy working group (REWG). This dissertation suggests that effects related to other state policies and federal policy are important factors for explaining the decision to adopt a certain type of RPS or amend an RPS in a certain manner. While the results of the case studies suggest that policy diffusion plays an important role, the results of the quantitative models must be interpreted with caution.

Across all of the Cox proportional hazards models presented in Chapter Six, median household incomes, educational attainment, citizen ideology, and government ideology proved statistically significant, to varying degrees, for explaining the probability that a state would adopt or amend an RPS. Both case studies also suggest that these internal state characteristics played a role in explaining why Oregon adopted a strong RPS and continued to strengthen that policy while West Virginia adopted what was in essence a renewable energy goal that was eventually repealed.

Median household incomes are positively associated with the probability that a state will adopt any type of RPS, a weak RPS, a minor positive amendment to an RPS, and a positive amendment to an RPS. Oregon's higher median per capita income might have served as a resource supporting the adoption of an RPS and several subsequent positive amendments to the policy. Educational attainment, on its own, is positively associated with the adoption of a negative amendment. This finding is not necessarily supported by the case studies. Oregon's population tends to be more educated than West Virginia's, and Oregon adopted a single negative amendment to its RPS, while West Virginia adopted three.

The quantitative models suggest that states with more liberal citizens are more likely to adopt an RPS of any type, a voluntary goal, a negative change to an RPS, and a positive change. An increasing share of the vote that went to the Republican presidential candidate in the last presidential election is negatively associated with the likelihood of adopting a negative change. Additionally, states with more liberal and highly educated citizens are less likely to adopt a minor positive amendment to an RPS. Berry, Laird, and Stefes' (2015) find that a more liberal state population is positively associated with the likelihood that a state will amend its RPS. The results of the quantitative analysis presented in Chapter Six suggest that liberal ideology is not necessarily associated with positive amendments to RPSs.

The comparison to the case studies is interesting. Both states experienced shifts in political culture around the early to mid-2000s. While in Oregon, the result was increased support for the Democratic Party, the opposite effect occurred in West Virginia. Oregon adopted a strong RPS and several positive and minor positive amendments to that RPS. This tends to be in-line with the quantitative findings related to the initial adoption of any type of RPS and the adoption of subsequent positive amendments. On the other hand, as West Virginia's citizens increasingly voted for Republican presidential candidates, the state adopted two small negative amendments to its RPS, and in 2015, repealed the Alternative and Renewable Energy Portfolio Act (AREPA) outright. The quantitative models might not have allowed anyone to predict this.

Carley and Miller (2012) find that the likelihood of adopting a strong RPSs is influenced more by ideological liberalism in government than by the degree of liberalism among the state's citizens. This is supported by the quantitative analysis of the adoption of strong RPSs and the Oregon Renewable Energy Act (OREA) case study. In 2007, the year the RPS was adopted, the Democratic Party enjoyed unified control of Oregon's government.

Lyon and Yin (2010) suggest that states with smaller amounts of existing renewable energy capacity will seek to protect and support these in-state economic interests. Combined with the results of the OREA case study and the results of the quantitative analysis, this suggests that policy makers will design and re-formulate policy that supports in-state renewable energy interests. However, the size of the renewable energy industry in a state will be associated with different policy decisions. Specifically, RPS design differences emerge when policy makers seek to achieve different goals. In the case of the adoption of weak RPSs and positive amendments to existing RPSs, policy makers might be seeking to support an already influential industry in the state, explaining the positive relationship between renewable energy capacity and adoption. On the other hand, policy makers might also be motivated to protect smaller interests and specific resources in their state, which explains the negative relationship between the amount of renewable energy used in a state and the adoption of minor positive amendments. As the non-hydroelectric renewable energy industry expands, it might be the case that policy makers will be less motivated to adopt small, protective amendments to an RPS. The findings of the quantitative analysis suggest that motivations to promote an influential renewable energy industry will be tempered by higher residential electricity rates.

In-state economic concerns and interest groups played important roles in informing the policy design of both West Virginia's and Oregon's RPS. While most studies of the diffusion of the RPS have not found a significant effect related to in-state fossil fuel industries, it seems clear that the significance of coal in West Virginia's economy played an important role in shaping AREPA's content and influencing the policy's eventual repeal. There is also evidence of policy entrepreneurship and coalition building. When AREPA was initially adopted, Governor Manchin's policy had bipartisan support and support from coal and labor union interests, two sides that might be traditionally opposed to one another.

In Oregon, the state's traditional leadership on climate change and renewable energy, renewable energy potential, interest groups, and policy entrepreneurship all contributed to an environment supportive of renewable energy. Oregon also has a long history of collaboration among a diverse set of interests to address energy-related policy. This history of collaboration played a role in the success the REWG had developing an RPS upon which multiple interests could agree. This history, along with the leadership of Governors Kulongoski and Kitzhaber especially, would also be important in ensuring the enactment of later changes to the state's policy; many of which were aimed at supporting specific in-state economic interests.

Wind potential was expected to be positively associated with an increased probability of adopting a strong RPS. While this might be the case, the results of the quantitative analysis suggest that in-state wind potential has a constant effect across all states and does not explain why some states adopt an RPS while others do not. However, in-state wind potential was a concern for Oregon's REWG. Members of the group argued that without an RPS, high quality sites for wind would be developed by companies from California and Washington, and Oregonian consumers would lose out on the benefits associated with developing this resource. In West Virginia, it does not seem that wind potential played an important role in the adoption of AREPA. While several large wind projects have already been developed in the state, these were built to sell power and/or renewable energy credits to meet RPS requirements in neighboring states.

While the effect was not consistently positive, other, pre-existing, state policies proved to be important explanatory factors in all of the quantitative models presented in Chapter Six. The number of months that interconnection standards had been in place had a positive effect on the probability that a state would adopt a voluntary goal or a strong RPS. The number of months that a state has had a net metering policy in place has different effects in different models, increasing the likelihood of adopting any type of RPS, a weak RPS, and a negative change; and reducing the probability of adopting a strong RPS or a positive amendment.

A longer history of requiring that utilities offer a green power option to their customers (an MGPO), providing a performance-based incentives (PBI) to renewable energy projects, or requiring that utilities collect a small fee on all utility bills to contribute to a fund for renewable energy development (a systems benefit charge) were all positively associated with the likelihood of adopting any type of RPS. MGPOs were positively associated with an increased probability of adopting a strong RPS or a minor positive change to an RPS. PBIs were also positively associated with the likelihood of adopting a minor positive amendment. A longer history with a systems benefit charge had a negative effect on the probability that a state would adopt a voluntary goal, and the adoption of a larger number of any of these policies was associated with a reduced probability of adopting any type of RPS. Lastly, states that had initially adopted a voluntary goal or a weak RPS were less likely than states that had previously adopted a strong RPS to adopt negative changes to an RPS.

Yi and Feiock (2012) find that the effect of their index of other policies – a count of whether a state has adopted a corporate income tax incentive, a personal income tax incentive, and/or a systems benefit fund – is not constant across the types of RPSs that a state can adopt: it is stronger for the adoption of a mandatory RPS than for a voluntary goal. The OREA case study suggests that utilities' leadership with their green power options and a history of support for the state's systems benefit fund translated into increased support for renewable energy resources and OREA. Taken together, the results of this dissertation suggest that other policies can be complementary, increasing the likelihood of adopting certain types of policy innovations or changes, or they can serve as partial substitutes, reducing the probability of adopting other types of policy innovations or changes. It might be the case that the policy design of pre-existing policies is related to whether they will have a positive or negative effect on the likelihood of adoption.

While the total acreage of in-state federally owned public lands has a negative effect on the likelihood that a state will adopt a weak RPS, it has a positive effect on the likelihood that a state will adopt a positive amendment. These findings suggest that there might be some regional variation in the direction of the relationship between public lands and support for renewable energy. When considered in tandem with the results of the case studies, it seems clear that responses to federal policies will vary by region and that different federal policies will have different effects on states' policy decisions and designs.

In West Virginia, as Democrats sought to distance themselves from the policies of the Obama Administration, Republicans in the state successfully promoted a narrative that the administration was waging a war on coal and the jobs associated with the industry. This contributed to increased support for the Republican Party, which allowed them to take control of both chambers of the state's legislature in 2014, the first time they had done so since 1931. One year later, AREPA had been repealed.

The development of the OREA through the REWG required compromise. Significant aspects of the policy that emerged related to federal power resources provided by the Bonneville Power Administration (BPA). BPA's utility customers successfully argued that they should be able to continue to rely on these resources, which would be built within the Western Electricity Coordinating Council (WECC) region. The result was that Oregon's policy did not include an in-state requirement and allowed utilities to use resources built anywhere in the WECC region. In addition, OREA included a clause to protect BPA's utility customers and ensure that they could continue to purchase federal power resources.

In all of the quantitative models where the percent of states in a region that had previously adopted an RPS was significant for explaining a decision to adopt or amend an RPS, the effect was negative, which was contrary to expectations and not suggested by other studies that have modeled diffusion effects using neighboring states or fixed regions. However, when region was accounted for, this negative effect was reversed for most regions. These results suggest areas for caution in interpreting quantitative results and a handful of potential avenues for future research. These are discussed in greater detail below and in Chapter Six.

The case studies provide better evidence of diffusion. First, vertical influences, discussed above, are present in both case studies. The adoption of OREA demonstrates the importance of learning from other states' experiences. What also becomes clear is that economic development concerns appear to be the most important drivers of later amendments and that these economic concerns involved both inter- and intra-state competition. Similar to what Boehmke and Witmer (2004) found, this case suggests that while policy innovation, in at least some states, is driven by learning, policy change might be driven by competitive concerns.

On the other hand, the simplest explanation for the adoption of AREPA is that the adoption of this largely symbolic policy was a case of imitation. However, it might also be the case that the state's policy makers designed AREPA in the manner that they did in order to promote certain economic goals related to coal, and by doing so, generated broader support for the policy. AREPA was left largely unchanged because it was not threatening the coal industry's viability. However, when this policy was poised to become a potential nuisance (the first compliance year), and when political currents had shifted dramatically, it was repealed. This tends to suggest that AREPA is in fact a case of imitation, where a symbolic policy was adopted.

Theoretical and Applied Contributions

This dissertation was developed as an effort to contribute to our understanding of policy innovation and change. It has done so through a mixed methods approach that used existing and original research and that included the construction of an original dataset of RPS adoptions and amendments occurring between May 1, 1994 and December 31, 2014. Scholarship studying the diffusion of the RPS has a history of at least a decade, and the RPS has been one of the most frequently studied policy innovations in the literature. However, while there are several existing studies of the determinants of the adoption of an RPS, there are areas for improvement. This study contributes to our understanding of energy policy innovation and change in a handful of ways, which are discussed below.

While most studies of the diffusion of the RPS measure adoption in dichotomous terms, others employ some measure of the design variations that exist across RPSs. These differences in design are important to account for because they provide some idea of how later adopters modified the policy. This study employed both a dichotomous measure of RPS adoption and a modified version of the stringency score developed by Carley and Miller (2012). The results suggest that accounting for differences in policy design allow a fuller understanding of the variables associated with different types of decisions. For instance, the number of months that a net metering policy had been in place in a state had a positive effect on the probability that a state would adopt any type of RPS or a weak RPS but had a negative effect on the likelihood of adopting a strong RPS.

Many states have modified their RPSs over time. Of the studies of the diffusion of the RPS reviewed in the literature review presented in Chapter Two, only Berry, Laird, and Stefes (2015), Carley and Miller (2012), and Carley, Nicholson-Crotty, and Miller (2017) include later amendments. These studies all incorporate a measure that reflects changes in the stringency of an RPS resulting from later amendments, and all miss several amendments. This is the case for two reasons. First, all three studies rely on the RPS histories provided in the Database of State Incentives for Renewables and Efficiency (DSIRE), which tends to focus on major amendments to RPSs and which does not maintain historic information (for instance, West Virginia's policy was removed from the database when AREPA was repealed). Second, all three cover a shorter time span. Berry, Laird, and Stefes' (2015) analysis covers adoptions and amendments between 1994 and 2009, Carley, Nicholson-Crotty, and Miller (2017) examine adoptions and amendments between 1996 and 2009, and Carley and Miller's (2012) study covers the period between 1997 and 2008. As shown in figure 6.1, this means that at minimum, these studies missed the 116 amendments that occurred between 2010 and 2014. In addition to examining adoptions and amendments over a longer period (1994 to 2014), this study also increased the typical number of observations made by studies of this type because the unit of analysis is the state-month rather than the traditional state-year. This allowed the inclusion of a larger number of amendment events in the event history models.

Including a larger number of amendments, as well as differentiating by type of amendment, allowed an exploration of the relative importance and effect of different explanatory variables over time and across decision types. This demonstrated that different types of policy decisions are associated with different types of explanatory variables and when explanatory variables are shared, the size and/or direction of the effect of the explanatory variables will vary. This result is generally supported by the case studies.

A potentially significant influence on policy innovation and change has been infrequently explored. Namely, the influence of past policy choices has widely been left out of consideration. This study expanded on the findings of the studies that have incorporated consideration of a state's policy history by including several variables that captured the effects of other policies. The findings presented here confirm Berry and Berry's (2007, 2014) argument that it is important to incorporate and evaluate the influence of past policy decisions in any study of policy innovation. In addition, the findings here suggest support for Mahajan and Peterson's (1985) argument that are different relationships among policies where the prior adoption of one policy will increase the likelihood of the adoption of an innovation, while the adoption of a different policy will reduce the probability of adopting the same innovation.

Vertical influences on the diffusion of the RPS have also tended to be left out of consideration. While many studies of the effectiveness of renewable energy policies incorporate the effects of such federal-level policies as the production tax credit (PTC), studies of the diffusion of the RPS rarely, if ever, incorporate an evaluation of the effects of federal policies. Studies on the diffusion of the RPS also ignore the influence of federally owned public lands. The results of the quantitative analysis and the qualitative case studies presented in this dissertation demonstrate that while energy policy inertia at the federal level creates space for action by the states, federal policies do influence states' policy choices.

While most studies examining the diffusion of the RPS find little to no effect associated with regional diffusion, these studies tend to employ the neighboring states model. However, this model may not be the best method for testing for the effects of diffusion. This study used a fixed-regions model that examined diffusion within U.S. Environmental Protection Agency (EPA) Regions and within regional energy efficiency organization (REEO) groupings, as modified by adding non-participating states according to U.S. Census regions. The quantitative models suggest some effect related to regional diffusion. However, as discussed in Chapter Six, these results must be interpreted with caution. The qualitative case studies provide a better analysis of the mechanisms of diffusion and suggest that the mechanisms operating will vary by state and across time.

Lastly, this study sheds light on why key energy policies are adopted and modified over time, perhaps providing lessons learned for future studies of the adoption and modification of other types of energy policies. The use of case studies and event history analysis (EHA) in tandem with a unified model for explaining policy innovation and change can shed light on why our energy policy has evolved and is evolving in the particular manner that we observe today. In addition, as target dates for several RPSs across the U.S. have been met and as others approach, and as states continue to extend and expand existing RPS requirements, this study provides a foundation for understanding the states that will be more likely to do so. This dissertation also suggests a handful of avenues for future research, which are discussed in what follows.

Future Research

As noted above, states have continued to modify existing RPSs. In 2015, while West Virginia repealed its RPS (see Chapter Five), Vermont, California, and Hawaii adopted significant expansions to their policies. In 2016, New York, Oregon (see Chapter Four), Rhode Island, and the District of Columbia increased their targets. In 2017, Maryland increased its RPS and Massachusetts created new requirements for the procurement of offshore wind and solar. This brief summary only includes the more significant amendments that have been adopted. Future research could extend the study presented here to capture the amendments that have been adopted since the beginning of 2015.

The models presented in Chapter Six echo the findings of previous research suggesting that renewable energy interests, citizen income levels, citizen and government ideology, and educational attainment are important for explaining decisions to adopt and amend RPSs. However, the results also diverge from previous research in demonstrating that the effect of these variables is not always positively associated with a decision to adopt or strengthen an RPS. Future research could evaluate the effects of other variables not included in this study.

For instance, an assumption with a long and extensive research history is that the primary goal of elected officials is to win reelection. Berry and Berry (1990, 2007) suggest that the motivation of state officials to innovate should vary with their level of electoral security. Because electoral insecurity is related to the amount of time until the next election, this makes it more likely that unpopular decisions will be made as far away as possible from the next election, with popular decisions passed closer to an election (Berry and Berry 1990, 2007). Future research might examine whether electoral security influences the likelihood that a state will adopt an innovation or amend an existing policy.

There have been a number of studies of the influence of problem severity on motivation to innovate. The level of problem severity might clarify, in the minds of state officials, the relative need for a new policy or program. Severity might also be linked to the level of public and/or interest group demand for a solution to the problem (Berry and Berry 2007; see also: Bacot and Dawes, 1997; Potoski and Woods, 2002; Wiener and Koontz 2012). Future research might examine whether the effect of problem severity varies at different points in the policy process.

The quantitative analysis found that in-state wind potential has a constant effect across all states and does not explain why some states adopt an RPS while others do not. Future research might test the effect of other variables that capture renewable energy potential. Case studies should also evaluate whether renewable energy potential plays a role in informing policy decisions.

The studies undertaken to date have made it clear that particular internal characteristics of states are especially important for explaining the adoption of an RPS or other energy policy. This study evaluated the effects of several of these variables and demonstrated that the significance and effect of these variables is not consistent across decision types. This suggests that when evaluating the effects of explanatory variables, future research should continue to account for policy design. In addition, examining repeated amendment events of different types captured detail that a simple count of amendments would not have allowed (see: Box-Steffensmeier and Jones 2004; Jones and Branton 2005; Young and Sarzynski 2009). Future research should continue to move away from simple event count models and simple dichotomous measures of events to develop dependent variables that account for different types of policy decisions.

The results presented throughout this dissertation argue for the importance of incorporating the influence of past policy decisions in models of policy innovation and change, as suggested by Berry and Berry (2007, 2014). In all of the quantitative models and in the OREA case study, past policy decisions are important explanatory variables. Additionally, the effect of past policy decisions varied across the quantitative models. While future research should continue to incorporate the design differences of the policy under study, it should also incorporate the differences in the design of other policies. This would allow a more detailed understanding of policy relationships. For instance, future research could explore whether states with weak interconnection standards are, in fact, more likely to adopt a symbolic voluntary goal, while states with strong interconnection standards are more likely to adopt a strong RPS.

In addition to considering existing in-state policies, future research should continue to evaluate the effects of federal and local policies on policy making at the state-level. Vertical influences on the decision to adopt an RPS have been widely ignored. The results presented here suggest that federal policy has at least some influence on state renewable energy policy, and that there might be some regional variation in the effect. Future research should refine and develop new measures of federal influence to better test for its effects.

In the last decade or so, students of policy innovation have begun to pay increasing attention to specifying and testing for the mechanisms (learning, competition, coercion, and imitation) underlying a policy's diffusion (Baybeck, Berry, and Siegel 2011; Berry and Berry 2014; Maggetti and Gilardi 2016; Starke 2013). This might be one of the more important endeavors that students of policy innovation are undertaking (Berry and Berry 2014; Gilardi

2016). Recent studies have focused on testing learning and economic competition-based explanations for policy diffusion (Baybeck, Berry, and Siegel 2011; Berry and Baybeck 2005; Boehmke and Witmer 2004; Shipan and Volden 2008). Future research can contribute to this endeavor by developing proxies that test for specific mechanisms and by expanding the number of case studies that investigate whether, how, and when different mechanisms of diffusion are operating.

In all of the quantitative models where the percent of states in a region that had previously adopted an RPS was significant for explaining a decision to adopt or amend an RPS, the effect was generally negative. However, when region was accounted for, this negative effect was reversed for most regions. These results also suggest that there is some regional variation in the degree to which states are influenced by the policy decisions of their neighbors. Future research could explore whether this is in fact the case, and if it is, why this is so. Research in this vein could also incorporate variables to capture the mechanisms of diffusion – learning, competition, coercion, and imitation – to test whether regional variation relates to the particular mechanism of diffusion at work in a particular region at a particular time.

We should be cautious when attributing the results of quantitative modeling to regional diffusion. As suggested in Chapter Six, the results could be an artifact of time. This is especially the case for the models of RPS amendments because the bulk (174) of amendments to RPSs occurred between February 1, 2007 and the end of 2014, and most (26) states that would adopt an RPS had done so by the end of 2007. Future research using different proxies to test for diffusion or for the mechanisms of diffusion should take the effect of time seriously and account for this when developing explanations of policy innovation and change.

Concluding Remarks

This dissertation was developed as an effort to contribute to our understanding of policy innovation and change. It has done so through a mixed methods approach that explored answers to two primary research questions: Why do states adopt different types of RPSs, while others fail to adopt any type of RPS? And, after states adopt an RPS, why do they amend the policy in the manner that they do over time? The results suggest that household incomes, citizen and government ideology, and educational attainment are important internal state characteristics for explaining decisions to adopt and amend RPSs. In addition, renewable energy interests and resources, fossil fuel resources and related interest groups, policy entrepreneurs, collaboration, and coalition building are important for explaining policy adoption and change. While this study found little to suggest that renewable energy potential is an important predictor of the decision to adopt an RPS, it did find that other state policies and federal policies are significant factors influencing the decision to adopt a certain type of RPS or amend an RPS in a certain manner. While the results of the case studies suggest that policy diffusion also plays an important role in policy innovation and change, the results of the quantitative models must be interpreted with some caution. While this dissertation contributes to our understanding of energy policy innovation and change in particular, it also suggests avenues for future research applicable to all students of policy innovation.

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APPENDIX A – RPS AMENDMENTS SCORING

Score	Type of Change	Explanation and/or Example
+ 1	Replace voluntary goal with a mandatory target.	Example: In 2004, Hawaii amended its policy to create a mandatory target. The state also increased the final percentage target.
	Increase a mandatory target.	Example: In 2007, Connecticut increased their Class I requirements from 7% by 2010 to 20% by 2020.
	Create a new mandatory RPS.	Example: Minnesota's original RPS applied only to Excel Energy. An RPS for all other utilities and an increase to Excel's requirements was enacted in 2007.
+ .75	Creates a new requirement or program that is additional to the existing mandatory RPS.	Example: In 2013, Nevada required that NV Energy retire 900 MW of coal and offset that with at least 350 MW from new renewable energy facilities.
	Creates a new carve-out and increases the RPS' target to reflect this.	Example: In 2013, Minnesota created a solar carve-out of 1.5% and increased the final RPS target by 1.5%.
	Phases energy efficiency out as an eligible resource for meeting RPS requirements.	Example: In 2013, Nevada's RPS was amended to phase out energy efficiency by 2025. Theoretically, these types of changes increase the amount of renewable energy resources that will be used for compliance.
	Adds utility types that must comply with RPS targets or goals.	A lot of these types of bills also increased mandatory targets, and so were scored '+1'. A few changes, like that adopted by Montana in 2007, add utilities without increasing targets. These bills increase the amount of a state's load subject to RPS requirements.
	Increases requirement but allows energy efficiency as an eligible resource.	Adding efficiency might reduce the amount of renewable energy used for compliance.

Score	Type of Change	Explanation and/or Example
+ .5	Increases or accelerates a carve-out’s target.	Increases (2.5% to 5% solar) or accelerations (5% by 2020 to 5% by 2015) to carve-outs are technically increases to an RPS, but these increases typically make minor changes, for instance, accelerating the target date two years or increasing a target by a couple of percentage points.
	Increases a separate program’s target or cap.	Example: California’s Feed-in Tariff program was first created to support the acquisition of renewable energy from wastewater facilities. It set a low MW cap that once met, meant that utilities would not be required to purchase additional energy from these facilities. In 2008, that MW cap was increased, and additional renewable energy resources were included in the program.
	Allows a state agency to increase requirements.	Example: In 2013, California set its existing target as the floor and gave the Utilities Commission discretion to increase RPS requirements.
	Creates a new goal or expands an existing goal.	Example: Maine’s original wind energy goals were established in 2008. In 2010, the legislature increased the goal by 5000 MW. As voluntary programs, increases like this do not score as highly as increases to mandatory requirements.
	Creates a program to support an existing goal.	Example: Vermont’s adoption of a Feed-in Tariff is categorized in this manner, as the program’s intent was to ensure that utilities would meet the state’s goal.
	Creates new program additional to an existing goal.	Example: In 2011, Vermont adopted a change to require that utilities purchase a certain amount of baseload power from an existing biomass facility.

Score	Type of Change	Explanation / Example
+ .25	Adds utility types but requires use of alternative compliance payments (ACPs) to meet some portion of the requirements.	Example: In 2009, Illinois expanded their RPS to cover additional suppliers, but required that these suppliers meet 50% of the requirement with ACPs.
	Allows utility types to opt-in to the RPS.	Example: In 2011, legislation enacted in Illinois allowed municipal and cooperative utilities to opt-in to the RPS.
	Adds eligible renewable resources, energy storage, cogeneration / combined heat and power and /or energy efficiency.	These types of amendments diversify the types of energy that can be used to demonstrate compliance. While not increasing an existing target, they represent an effort to support the clean energy market.
	Creates a carve-out or requires purchases of specific types of resources without increasing an existing final RPS target.	By supporting specific types of resources, these types of amendments represent an effort to support and diversify the clean energy market.
	Clarifies an existing carve-out to set interim targets.	For instance, amending "5% by 2020" to "1% by 2012, 2.5% by 2015, and 5% by 2020", these changes can improve market certainty.
	Creates a multiplier for a specific resource.	By supporting specific types of resources, these types of amendments represent an effort to support and diversify the clean energy market.
	Sets renewable energy credit (REC) expiration dates.	Example: In 2014, Virginia's goal was amended so that RECs expired five years after they were acquired.
	Creates a REC Tracking system or other mechanisms for verifying compliance.	A positive change for enforcing RPS requirements.
	Allows utilities to recover the costs of complying with an RPS.	Allowing utilities to recover their costs may decrease utility opposition to an RPS.

Score	Type of Change	Explanation and/or Example
- .25	Adds waste-to-energy, chemically treated wood, or otherwise weakens the definition of eligible biomass.	These changes add resources that are associated with air pollution, and so treated as weakening an RPS.
	Reduces the amount of retail sales used to calculate compliance requirements.	Utilities' compliance is typically calculated as a percentage of retail sales. Changes removing sales to certain entities from the calculation reduces that percentage, and so are likely to reduce RPS requirements.
- .5	Adds large hydroelectric facilities (over 30 MW) as eligible resources.	Allowing large hydroelectric facilities to compete with resources like wind and solar weakens requirements.
	Exempts certain utilities from RPS requirements.	While these changes reduce the amount of electric load subject to the RPS, all of these bills exempted small utilities.
	Allows certain utilities to use unbundled RECs.	Example: Lawmakers in Oregon did this to appease a single utility whose sales were increasing dramatically, which would make it subject to the large utility RPS requirements. This was treated the same as the creation of a new alternative compliance pathway.
	Creates new pathway for demonstrating compliance with an RPS.	Example: In 2013, Washington allowed utilities meeting certain requirements, including those that demonstrated that their territory saw no demand growth in the last three years and those that did not purchase fossil fuel resources, to be considered in compliance with the RPS.
	Delays a carve-out or other target dates or decreases carve-out targets.	These types of changes are not as severe as delays or decreases to an overall target.
	Small decrease to an RPS target.	Example: In 2012, New Hampshire decreased Class I interim targets from an additional 1% per year to .9% per year.

Score	Type of Change	Explanation and/or Example
- .75	Adds fossil fuel resources as eligible resources.	Example: In 2012, Ohio allowed energy generated at certain fossil fuel-fired facilities to be used to demonstrate compliance.
	Delays or decreases mandatory targets.	Example: In 2014, Ohio delayed their target date by two years.
	Eliminates a performance incentive for meeting an existing goal.	Example: In 2013, Virginia eliminated the performance incentive offered to utilities for meeting the state's voluntary goal.
- 1	Repeals an RPS or a voluntary goal.	For the states included in this study, only West Virginia has repealed a target. However, they did so in 2015, outside of the time-frame of the quantitative analysis.

APPENDIX B – RPS STRINGENCY SCORE COMPARISON – CARLEY AND MILLER (2012) AND HOFFER[49]

State	Carley and Miller	Hoffer [50]	Explanation
CA	73.65	120.79	Using DSIRE's data, Carley and Miller set the starting mandate at 14% with a starting year of 2002. However, the legislation adopted in 2002 sets a mandate of a 1% increase per year beginning in 2003 and ending with a 20% by 2017 target.
CO	25.68	51.65	As is typical for most scoring discrepancies, a difference in starting year contributes to the difference in scoring.[51] In addition to this, Carley and Miller use 2020 as the final year. However, the ballot initiative adopted by voters in 2004 set 2015 as the final target date. The 2020 date was set by a 2007 amendment that increased the state's RPS.
CT	89.15	0	Carley and Miller use a 27% by 2020 target. However, this target was adopted in 2007, nine years after the RPS was initially enacted. The 1998 enactment created a target of 13% by 2009, with an initial load coverage of 0. An amendment in 2003 significantly expanded the percent of load covered by the RPS.
DE	32.24	51.75	As originally enacted in 2005, the RPS set a starting mandate of 1% in 2007. Carley and Miller use a starting mandate of 2% with the starting date of 2005. They also set the initial percent of load covered to 56.5%. According to LBNL, the initial load covered in the first compliance year was 69%.

[49] The table presented here only compares scores for states that adopted non-voluntary RPSs before 2009, which is the end of the time-frame employed in the Carley and Miller (2012) study. Additionally, this table only outlines key discrepancies in scoring. In most cases, disagreement in scoring is a result of the use of a different starting year and/or percent of load covered.

[50] When only calculating scores for the states also evaluated by Carley and Miller (2012), I found a median of 57.46. The median increases to 62 when including scores for the additional states included in this study. This latter score was used to categorize non-voluntary policies as weak or strong.

[51] As discussed in the Chapter Three, while Carley and Miller (2012) calculate starting year as the date of adoption, I calculate starting year as the first compliance date.

State	Carley and Miller	Hoffer	Explanation
MN	55.15	49.37	Minnesota originally adopted a MW requirement for Excel Energy in 1994.[52] In 2001, the state adopted a voluntary goal for all utilities in the state. Carley and Miller date the original enactment of the state's RPS to 2007, the year the state adopted a non-voluntary policy.
NM	0	62	Setting both the starting and final mandate at 10% creates a score of 0. However, the legislation creating the state's RPS sets an initial 5% by 2006 target.
NV	66.15	8.9	Carley and Miller use 0% as the starting mandate and 3% as the final mandate to be met by 2001 (the source for these numbers is unclear). Using legislative language from the 1997 Act, I use .2% by 2001 as the starting mandate with a final 1% by 2009 target.
PA	74.8	1.86	Carley and Miller use a final mandate of 18% by 2020. At least 10% of this original mandate included fossil fuels. When calculating a stringency score for Ohio, Carley and Miller exclude these types of resources from their calculation. While Pennsylvania's policy includes fossil fuels in both alternative energy tiers, I used only Tier I requirements for determining the stringency ratio. While this study employed an initial load coverage of 4%, Carley and Miller use 97.3%. This higher percentage likely reflects an Order by the Utility Commission implementing major legislation (Act 129) enacted in 2008, and/or the end of the RPS exemption period for most electric distribution companies in the state.

[52] To calculate percentages for Minnesota, I used EIA data to find total in-state nameplate capacity in 1994 and calculated what percent of that total a 275 MW requirement in 1998 and a 675 MW requirement in 2002 would be.

State	Carley and Miller	Hoffer	Explanation
TX	43.82	23.97	Carley and Miller use 1998 as the starting year for Texas. However, Texas adopted their RPS in 1999 with the first date for compliance set in 2003. We also differ in our calculations of the starting and final percentage mandates. While Carley and Miller use 0% for the starting mandate and 6.4% by 2009 for the final mandate, the intent of the initial legislation is an additional 2000 MW of renewable energy by 2009. In 1998, the state already had an estimated 827.5 MW of renewable energy.[53] I used this language to calculate the percentage increase that an additional 452.5 MW in 2003 and 2000 MW by 2009 represented. This worked out to .58% by 2003 and 2.55% by 2009.
WI	19.92	0	Wisconsin created a small requirement in 1998. In 1999, the statute was amended to resemble a more traditional RPS. Carley and Miller do not catalogue this earlier adoption, but I do.[54]

[53] This appears to match the calculations made by the legislature in setting a 2880 MW by 2009 target.

[54] I calculated Wisconsin's percentage requirement by dividing the 50 MW requirement with total nameplate capacity in 1998, which was 13,131.3 MW.

APPENDIX C – CASE STUDY PROTOCOL

Mechanism	Evidence	Notes
Learning	Policy makers are actively looking to find or are actively referencing the design and implications of other states' successful RPSs.	A successful RPS is one that was passed with little political backlash. A successful RPS has increased in-state renewable energy capacity or demand.
Imitation	Policy adopted is identical or very similar to another state's policy with which the adopting state shares certain internal characteristics. Policy may not be designed to take advantage of the adopting state's renewable resources, for example, the policy might promote solar when solar is not an abundant resource.	The internal characteristics likely to be important are shared citizen and government ideology, electric market characteristics, strength of interest groups, and economic characteristics.
Competition	Policy adopted will be similar to that of a state experiencing economic benefits from the renewable energy industry. Policy adopted will be similar to that of a perceived leader state (especially California).	Competition will be signaled by policy that creates incentives for in-state renewable energy development. Policy aims to attract solar and wind developers to the state and increases the state's ability to participate in a regional REC market.
Coercion	Policy adopted is similar to that of other members of a regional energy-related organization.	Policy will reflect an attempt to satisfy the demands of an important partner.

APPENDIX D – UNIVARIATE ANALYSES OF INDEPENDENT VARIABLES FOR THE DICHOTOMOUS RPS ADOPTION MODEL

Log-rank Test for the Equality of Survivor Functions by EPA Region		
EPA Region	Events Observed	Events Expected
1	7	1.76
3	5	2.86
4	2	9.93
5	5	3.45
6	3	4.21
7	2	3.06
8	5	4.36
9	3	.5
10	2	3.86
Total	34	34
	Chi2(8) = 43.68	Pr > chi2 = 0.0000

Log-rank Test for the Equality of Survivor Functions by REEO Region		
REEO Region	Events Observed	Events Expected
1	10	2.93
2	6	15.57
3	9	7.89
4	4	2.87
5	5	4.74
Total	34	34
	Chi2(4) = 26.44	Pr > chi2 = 0.0000

Cox Proportional Hazards Model: Univariate Statistics		
Variable	LR Chi^2 (1)	Prob > Chi^2
INTERNAL		
nameplate_re	3.33	0.0679
nameplate_re_lag	2.36	0.1244
percent_re	10.94	0.0009
percent_re_lag	7.63	0.0057
wind_capacity	0.22	0.6412
wind_gwh	0.14	0.7133
price	6.72	0.0095
price_log	8.16	0.0043
price_lag	6.80	0.0091
citizen	24.47	0.0000
citizen_lag	26.13	0.0000
government	6.75	0.0094

Cox Proportional Hazards Model: Univariate Statistics		
Variable	LR Chi^2 (1)	Prob > Chi^2
INTERNAL cont…		
government_lag	3.17	0.0751
d_share	28.12	0.0000
r_share	31.04	0.0000
income	12.72	0.0004
income_lag	9.45	0.0021
education	16.45	0.0000
education_lag	17.9	0.0000
OTHER_POLICIES		
interconnection	2.42	0.1201
nem	6.5	0.0108
mgpo	5.19	0.0227
pbi	4.91	0.0267
benefit_fund	12.00	0.0005
policy_count	5.25	0.0220
EXTERNAL_STATES		
epa_adopt[55]	7.24	0.0071
reeo_adopt[56]	5.49	0.0191
EXTERNAL_FEDERAL		
ptc_lapse	0.03	0.8675
avg_fed_area	1.13	0.2882
avg_fed_area_log	3.58	0.0585
avg_fed_percent	0.04	0.8323

[55] Percent of states in the state's EPA region that had previously adopted an RPS.

[56] Percent of states in the state's REEO region that had previously adopted an RPS.

APPENDIX E – UNIVARIATE ANALYSES OF INDEPENDENT VARIABLES FOR RPS TYPE ADOPTION MODELS

Log-rank Test for the Equality of Survivor Functions by EPA Region		
RPS Type	$Chi^2(8)$	Pr > Chi^2
Voluntary	5.75	0.6757
Weak	14.50	0.0696
Strong	4.54	0.8054

Log-rank Test for the Equality of Survivor Functions by REEO Region		
RPS Type	$Chi^2(4)$	Pr > Chi^2
Voluntary	4.25	0.3729
Weak	20.27	0.0004
Strong	8.85	0.0649

Cox Proportional Hazards Model: Univariate Statistics – Voluntary RPS		
Variable	LR Chi^2 (1)	Prob > Chi^2
INTERNAL		
nameplate_re	1.15	0.2844
nameplate_re_lag	1.22	0.2689
percent_re	0.00	0.9637
percent_re_lag	0.10	0.7483
wind_capacity	0.04	0.8464
wind_gwh	0.06	0.8128
price	1.05	0.3063
price_log	0.96	0.3266
price_lag	0.83	0.3626
citizen	0.20	0.6576
citizen_lag	0.28	0.5961
government	2.06	0.1513
government_lag	2.09	0.1483
d_share	0.72	0.3972
r_share	0.71	0.4002
income	0.01	0.9413
income_lag	0.08	0.7743
education	0.07	0.7889
education_lag	0.07	0.7963
OTHER_POLICIES		
interconnection	0.08	0.7748
nem	0.15	0.7015
mgpo	3.01	0.0828
pbi	0.03	0.8587
benefit_fund	6.10	0.0135
policy_count	2.28	0.1306

Cox Proportional Hazards Model: Univariate Statistics – Voluntary RPS		
Variable	LR Chi^2 (1)	Prob > Chi^2
EXTERNAL_STATES		
epa_adopt[57]	0.66	0.4179
reeo_adopt[58]	2.49	0.1145
EXTERNAL_FEDERAL		
ptc_lapse	0.46	•
avg_fed_area	2.29	0.1305
avg_fed_area_log	0.18	0.6721
avg_fed_percent	0.95	0.3287

Cox Proportional Hazards Model: Univariate Statistics – Weak RPS		
Variable	LR Chi^2 (1)	Prob > Chi^2
INTERNAL		
nameplate_re	0.05	0.8164
nameplate_re_lag	0.07	0.7986
percent_re	3.83	0.0504
percent_re_lag	2.75	0.0970
wind_capacity	0.00	0.9990
wind_gwh	0.01	0.9354
price	2.03	0.1547
price_log	2.87	0.0902
price_lag	2.20	0.1376
citizen	7.14	0.0076
citizen_lag	5.48	0.0192
government	0.00	0.9443
government_lag	0.17	0.6833
d_share	7.68	0.0056
r_share	8.85	0.0029
income	6.44	0.0112
income_lag	6.02	0.0141
education	5.39	0.0202
education_lag	6.69	0.0097
OTHER_POLICIES		
interconnection	0.71	0.4011
nem	4.17	0.0411
mgpo	1.00	0.3165
pbi	0.44	0.5077
benefit_fund	1.41	0.2347
policy_count	0.01	0.9041

[57] Percent of states in the state's EPA region that had previously adopted an RPS.

[58] Percent of states in the state's REEO region that had previously adopted an RPS.

Cox Proportional Hazards Model: Univariate Statistics – Weak RPS		
Variable	LR Chi^2 (1)	Prob > Chi^2
EXTERNAL_STATES		
epa_adopt[57]	0.02	0.8985
reeo_adopt[58]	4.64	0.0311
EXTERNAL_FEDERAL		
ptc_lapse	0.05	0.8223
avg_fed_area	0.31	0.5793
avg_fed_area_log	3.81	0.0509
avg_fed_percent	0.15	0.7004

Cox Proportional Hazards Model: Univariate Statistics – Strong RPS		
Variable	LR Chi^2 (1)	Prob > Chi^2
INTERNAL		
nameplate_re	1.97	0.1599
nameplate_re_lag	2.61	0.1062
percent_re	0.86	0.3543
percent_re_lag	0.37	0.5416
wind_capacity	0.01	0.9082
wind_gwh	0.01	0.9184
price	0.00	0.9759
price_log	0.06	0.8009
price_lag	0.00	0.9943
citizen	1.22	0.2689
citizen_lag	1.20	0.2732
government	11.97	0.0005
government_lag	6.81	0.0091
d_share	2.69	0.1010
r_share	3.04	0.0810
income	0.01	0.9224
income_lag	0.13	0.7154
education	0.30	0.5866
education_lag	0.32	0.5712
OTHER_POLICIES		
interconnection	4.76	0.0291
nem	0.34	0.5614
mgpo	12.60	0.0004
pbi	0.02	0.8894
benefit_fund	0.95	0.3306
policy_count	3.44	0.0637

Cox Proportional Hazards Model: Univariate Statistics – Strong RPS		
Variable	LR Chi^2 (1)	Prob > Chi^2
EXTERNAL_STATES		
epa_adopt[57]	0.12	0.7319
reeo_adopt[58]	0.77	0.3808
EXTERNAL_FEDERAL		
ptc_lapse	0.01	0.9429
avg_fed_area	0.03	0.8724
avg_fed_area_log	0.83	0.3619
avg_fed_percent	0.85	0.3562

APPENDIX F – UNIVARIATE ANALYSES OF INDEPENDENT VARIABLES FOR AMENDMENT TYPE MODELS

Log-rank Test for the Equality of Survivor Functions by EPA Region		
Amendment Type	$Chi^2(8)$	Pr > Chi^2
Negative Change	10.31	0.2441
Minor Positive Change	14.56	0.0683
Positive Change	16.70	0.0334

Log-rank Test for the Equality of Survivor Functions by REEO Region		
Amendment Type	$Chi^2(4)$	Pr > Chi^2
Negative Change	5.17	0.2698
Minor Positive Change	2.36	0.6697
Positive Change	13.69	0.0084

Log-rank Test for the Equality of Survivor Functions by RPS Type		
Amendment Type	$Chi^2(3)$	Pr > Chi^2
Negative Change	1.49	0.6857
Minor Positive Change	0.72	0.6986
Positive Change	1.70	0.4284

Cox Proportional Hazards Model: Univariate Statistics – Negative Change		
Variable	Wald Chi^2 (1)	Prob > Chi^2
INTERNAL		
nameplate_re	0.14	0.7077
nameplate_re_lag	0.00	0.9835
percent_re	0.12	0.7245
percent_re_lag	0.01	0.9138
wind_capacity	0.45	0.5019
wind_gwh	0.40	0.5264
price	0.26	0.6083
price_log	0.09	0.7583
price_lag	0.07	0.7856
citizen	6.31	0.0120
citizen_lag	4.83	0.0279
government	1.55	0.2129
government_lag	0.85	0.3568
d_share	2.60	0.1071
r_share	0.71	0.3981
income	0.59	0.4415
income_lag	1.32	0.2512
education	0.38	0.5358
education_lag	0.59	0.4407

Cox Proportional Hazards Model: Univariate Statistics – Negative Change		
Variable	Wald Chi^2 (1)	Prob > Chi^2
OTHER_POLICIES		
interconnection	6.03	0.0141
nem	3.67	0.0554
mgpo	3.36	0.0669
pbi	0.32	0.5727
benefit_fund	1.81	0.1789
policy_count	3.42	0.0643
EXTERNAL_STATES		
epa_adopt[59]	2.85	0.0916
reeo_adopt[60]	0.23	0.6335
EXTERNAL_FEDERAL		
ptc_lapse	1.21	0.2717
avg_fed_area	0.01	0.9264
avg_fed_area_log	0.85	0.3562
avg_fed_percent	0.03	0.8519

Cox Proportional Hazards Model: Univariate Statistics – Minor Positive Change		
Variable	Wald Chi^2 (1)	Prob > Chi^2
INTERNAL		
nameplate_re	2.26	0.1331
nameplate_re_lag	1.89	0.1697
percent_re	1.47	0.2260
percent_re_lag	1.44	0.2296
wind_capacity	1.58	0.2084
wind_gwh	1.61	0.2049
price	0.51	0.4752
price_log	0.19	0.6595
price_lag	0.40	0.5275
citizen	0.23	0.6350
citizen_lag	2.16	0.1413
government	2.50	0.1142
government_lag	2.05	0.1526
d_share	4.62	0.0317
r_share	4.57	0.0325
income	0.50	0.4805
income_lag	3.14	0.0765
education	0.72	0.3967
education_lag	0.41	0.5227
OTHER_POLICIES		
interconnection	0.40	0.5251
nem	0.49	0.4844

[59] Percent of states in the state's EPA region that had previously adopted an RPS.

[60] Percent of states in the state's REEO region that had previously adopted an RPS.

Cox Proportional Hazards Model: Univariate Statistics – Minor Positive Change		
Variable	Wald Chi^2 (1)	Prob > Chi^2
OTHER_POLICIES cont..		
mgpo	2.04	0.1528
pbi	7.12	0.0076
benefit_fund	0.10	0.7475
policy_count	1.55	0.2131
EXTERNAL_STATES		
epa_adopt[59]	0.54	0.4619
reeo_adopt[60]	0.03	0.8640
EXTERNAL_FEDERAL		
ptc_lapse	0.66	0.4148
avg_fed_area	0.29	0.5881
avg_fed_area_log	0.13	0.7200
avg_fed_percent	0.19	0.6628

Cox Proportional Hazards Model: Univariate Statistics – Positive Change		
Variable	Wald Chi^2 (1)	Prob > Chi^2
INTERNAL		
nameplate_re	1.26	0.2617
nameplate_re_lag	1.37	0.2418
percent_re	2.11	0.1462
percent_re_lag	1.90	0.1676
wind_capacity	8.05	0.0045
wind_gwh	8.41	0.0037
price	0.00	0.9836
price_log	0.15	0.7011
price_lag	0.00	0.9923
citizen	4.99	0.0255
citizen_lag	5.08	0.0243
government	10.44	0.0012
government_lag	8.25	0.0041
d_share	9.98	0.0016
r_share	5.38	0.0203
income	2.91	0.0879
income_lag	3.25	0.0714
education	1.56	0.2118
education_lag	2.14	0.1436
OTHER_POLICIES		
interconnection	0.97	0.3244
nem	0.09	0.7610
mgpo	0.90	0.3438

Cox Proportional Hazards Model: Univariate Statistics – Positive Change		
Variable	Wald Chi^2 (1)	Prob > Chi^2
OTHER_POLICIES cont..		
pbi	1.90	0.1680
benefit_fund	2.46	0.1169
policy_count	7.73	0.0054
EXTERNAL_STATES		
epa_adopt[59]	0.22	0.6374
reeo_adopt[60]	0.89	0.3452
EXTERNAL_FEDERAL		
ptc_lapse	1.17	0.2791
avg_fed_area	4.46	0.0346
avg_fed_area_log	1.96	0.1618
avg_fed_percent	3.79	0.0517