A Cross-State Analysis of Renewable Portfolio Standard Development

A thesis submitted by

Mariel Marchand

in partial fulfillment of the requirements for the degree of

Master of Arts in Urban and Environmental Policy and Planning

TUFTS UNIVERSITY

May 2017

Advisor: Francine Jacobs

Reader: Ann Rappaport

Abstract

As of December 2016, thirty-seven states have a renewable portfolio standard (RPS). RPS require that utilities provide a certain percentage of electricity generated using renewable sources by a certain date. This thesis builds on diffusion of innovation literature to understand how factors within a state, such as its political climate and the strength of interest groups, appear to influence the adoption process and structure of the RPS in five states – Connecticut, New Jersey, Michigan, Colorado, and Washington. Each of these states has a strong RPS as measured by its renewable energy goal over its current renewable energy production, the time frame in which this goal must be met, and the percentage of the electric load that is included in the regulation. This thesis uses both within-case and cross-case analysis to understand which combinations of internal state factors potentially lead to the adoption of a strong RPS. It finds that there are a number of combinations of factors that appear to contribute to strong RPS, depending on the internal circumstances of each state. However, more important is that without the opportunity to tailor the policy to meet the needs of the state, it is likely that states with unfavorable internal factors may not choose to adopt a RPS at all, let alone a strong RPS. While the innovation factors identified through the RPS diffusion research often contribute to states adopting a strong RPS, this thesis finds that the influence of these factors depends on a combination of the internal state factors with the RPS adoption process in shaping the structure of the RPS.

Acknowledgments

I would like to express my sincere gratitude to Fran Jacobs and Ann Rappaport for their guidance and encouragement throughout this process. Their insights and attention to detail have been invaluable. Thank you as well to my classmates, friends, and family for their support and patience.

Table of Contents

List of Tables

List of Figures

A Cross-State Analysis of Renewable Portfolio Standard Development

Chapter 1: Introduction

The dependence on fossil fuels for the generation of energy in the United States presents a number of challenges. Because the United States depends on receiving a portion of its oil from foreign sources, it is vulnerable to conflicts with these nations that could result in unpredictable supply shortages and prices shocks. Additionally, global warming and climate change are becoming increasingly salient issues, and one of the major causes of global warming is the release of greenhouse gases into the atmosphere through the burning of fossil fuels. A way to manage both the supply problem and the global warming problem is to reduce the amount of energy that is supplied by fossil fuels by shifting the supply to renewable sources. This can be achieved through both federal and state policies that encourage renewable use while discouraging fossil fuel use in energy production.

Although the federal government has attempted to develop renewable energy policies, most of the success in this area has come through state intervention in the form of grants, loans, feed-in tariffs, and renewable energy standards. Renewable Portfolio Standards (RPS) have become the most widely used policies, requiring utilities to provide a certain percentage of electricity to consumers from renewable sources by a specific year. As of December 2016, thirty-seven states have some form of a RPS. While the general premise of RPS is similar among them, there are many variations as well. Some RPS are voluntary, viewed as suggestions for power producers, while others are mandatory and enforced as such. There is also significant discrepancy in terms of the percentage goal above current renewable production and the time frame in which the goal must be met. The definition of a renewable energy source varies between states as well, as do the methods in which states encourage, mandate, and track compliance (DSIRE 2017c).

Research on the reasons for diffusion of RPS among states has found a number of internal state factors, such as its political climate and the presence of strong interest groups, that make a state more likely to adopt a RPS, but there has been little research on why states adopt different kinds of RPS. In addressing this question, Carley and Miller (2012) conducted a quantitative analysis of national data, looking at the types of internal factors that influence whether a state adopts a strong, weak, or voluntary RPS. More specifically, they used regression analysis to identify associations between the independent variables (internal state factors such as ideology, economic factors, and socioeconomic factors) and the dependent variable (the stringency of the state's RPS). This study provides a deeper analysis than did previous work on diffusion of RPS (Matisoff 2008), as they seek to explain how internal state factors influence the relative stringency of RPS as opposed to only looking at what types of internal factors lead to the adoption of RPS. While Carley and Miller's (2012) findings are interesting, regression analysis only allows for broad interpretations and inferences regarding the relationship between internal state factors and RPS stringency. Their analysis does not consider how the combination of these different factors within a state may influence the policy adoption process or the structure of the RPS beyond its stringency.

This thesis extends Carley and Miller's (2012) analysis, seeking to understand more specifically which combinations of internal factors result in strong RPS. It is focused on the following research questions:

1. To what extent do individual state "stories" help to explain why states develop strong RPS?

2. To what extent do background information, energy and environmental data, and innovation factors contribute to the development of a strong RPS?

3. What commonalities and differences exist across the states among these factors?

4. How do these factors contribute to the structural development and different characteristics of the RPS?

This thesis uses a qualitative, cross-case study design to compare the internal state factors that contribute to the adoption of a strong RPS in five states. These include Connecticut, New Jersey, Michigan, Colorado, and Washington. Across these states, four innovation factors are examined to determine their influence on the stringency of the RPS. These factors include the state's *political climate, the strength of relevant interest groups, the problem severity or need for the policy*, and *the policy's compatibility with the state's current practices.*

This thesis finds that there are a number of combinations of factors that appear to contribute to strong RPS, depending on the internal circumstances of each state. However, more important is that without the opportunity to tailor the policy to meet the needs of the state, it is likely that states with unfavorable internal factors may not choose to adopt a RPS at all, let alone a strong RPS. While the innovation factors identified through the RPS diffusion research often contribute to states adopting a strong RPS, this thesis finds that the influence of these factors depends on a combination of the internal state factors with the RPS adoption process in shaping the structure of the RPS. While diffusion research typically uses regressions to determine if factors either make it more or less likely for a state to adopt a strong RPS, this paper has found that under different internal circumstances, it is possible for a factor to have varying degrees of influence. Understanding how a factor's influence changes based on its interaction with other factors is integral to understanding how a strong RPS can be achieved across as many states as possible.

This thesis proceeds as follows: Chapter 2 includes a literature review of RPS regulation, diffusion of innovations, and the different methods for ranking RPS. The methodology is described in Chapter 3 and includes the rationale for choosing a case study analysis and the methods used to choose the states and internal state factors (innovation, background, and energy and environmental factors). It also includes the methods used to conduct the analysis. Chapter 4 describes the within-case findings, while Chapter 5 describes the cross-case findings. Implications and limitations are discussed in Chapter 6, and conclusions are made in Chapter 7.

Chapter 2: Literature Review

This literature review begins by establishing a solid understanding of renewable energy policy, focusing specifically on RPS. Because this thesis focuses on the diffusion of RPS, literature on the diffusion of innovations is explored. This review begins by looking more broadly at general diffusion of innovations research before becoming more focused on prior research looking specifically at the diffusion of environmental policies and renewable energy. Finally, since this thesis examines states with strong RPS, it is necessary to understand how states' RPS are ranked as either strong or weak. As such, different methods for ranking RPS are explored as well.

2.1 Renewable Portfolio Standards Regulation

The first policy responsible for renewable energy growth in the U.S. was the 1978 Public Utility Regulatory Policies Act (Public Law 95-617, 92 Statute 3117). PURPA, as it was called, required that utilities purchase power from "qualifying facilities" at prices that reflected their long-term avoided costs of not having to build the new generation facilities to produce the power themselves. Qualifying facilities were either facilities using co-generation technologies (combined heat and power) or renewable resources. They would sign long-term contracts with utilities and the avoided costs were administratively determined using models to estimate future fossil fuel prices (Lesser and Su 2008). As such, these rates were set aggressively high, as models predicted that fossil fuel rates would continue to increase dramatically (Beck and Martinot 2004). By the 1990s, the price of oil had declined and natural gas supplies had increased. Electricity rates were less than those that were contracted for as a result of PURPA leaving utilities responsible to honor the long-term contracts they had signed with renewable energy producers even though the current price of fossil fuel generated energy was less than that of the renewable energy contracts (Union of Concerned Scientists 2015). This caused the electric power market to view PURPA negatively, seeing it as a policy that subsidized renewable energy. By subsidizing producers of renewable electricity, the policy also resulted in an economic welfare loss for society because utilities were required to pay higher than market prices for electricity and passed these higher prices onto consumers (Lesser and Su 2008).

As PURPA's influence faded in the 1990s, the electric power market lost interest in federal-level energy incentives and turned largely to state renewable energy policies instead (Park 2015). State governments can use a number of policies and incentives to promote RE growth. One such method is providing direct financial support for renewables through "capital grants, preferential purchase prices, tax advantages, or low interest loans" (Berry et al. 2001, 264). Feed-in tariffs are another form of direct financial support that can be used to incentivize renewable generation. Governments can also provide indirect support through "funding of demonstrations projects, audits and evaluations, resource assessments, R&D support, and training" (Berry et al. 2001, 264). A third option is for governments to promote market shares using "voluntary agreements with producers, green tariffs allowing consumers to pay extra for renewables, and the renewable portfolio standard" (Berry et al. 2001, 265).

While these are all viable options, RPS have become the most widely called upon policy in the United States (Berry et al. 2001, 265). When compared to other state policies aimed at increasing the use of renewable energy, RPS are the most prevalent (Carley and Miller 2012; Martinot et al. 2005). RPS are state mandated programs that require a percentage or share of a state's electricity generation to come from renewable sources. Utilities must either purchase renewable energy from power producers or generate the renewable power on their own in order to meet the percentage goal by the determined year (Carley 2009). Iowa was the first state to adopt a RPS in 1983; most states began adopting RPS in the early 1990s. While the idea of a federal RPS has been considered, one of the main arguments against it is that it would "create 'winner' and 'loser' states based on the availability or lack of renewable resources in a particular region of the country" (Reisinger 2010, 883). As such, renewable portfolio standards have remained a policy adopted and tailored to meet the needs of individual states.

As of December 2016, thirty-seven states have some form of a RPS. While the general premise of RPS is similar, there are many variations among states. Included in this variation is discrepancy relating to the percentage goal of the RPS above the current renewable energy production and the time frame in which the goal must be met. The definition of a renewable energy source varies between states as well, as do the methods in which states encourage, mandate, and track compliance. Additionally, some RPS are voluntary, viewed as suggestions for power producers, while others are mandatory and enforced as such (DSIRE 2017c). These sources of variation contribute to the differences in strength among RPS.

2.2 Diffusion of Innovations

An extensive body of literature addresses the diffusion of innovations. One of the most influential works is that of Rogers (2003) who defines diffusion as "the process in which an innovation is communicated through certain channels over time among the members of a social system" (Rogers 2003, 5). When these new ideas are communicated, they can either be rejected or adopted. "The characteristics of innovations, as perceived by individuals, help to explain their different rates of adoption" (15). Rogers identifies five such factors: relative advantage, compatibility, complexity, trialability, and observability. Of these, it appears that compatibility, complexity, and observability best explain why states choose to adopt RPS. Innovations that are compatible with the existing values and needs of potential adopters are more likely to be accepted (Rogers 2003). Because RPS are used as a mechanism through which to meet the goals of burning smaller amounts of fossil fuels and reducing greenhouse gas emissions and air pollution, it is clear that the RPS is compatible with the values and needs of states.

In terms of complexity, “the degree to which an innovation is perceived as difficult to understand and use” (Rogers 2003,16), RPS are rather simple – they state a goal that utilities must meet and require those who do not to pay alternative compliance payments. RPS also rank highly in their observability. When a state adopts a RPS, the makeup of its energy portfolio changes. These results are visible to other states through a simple look at U.S. Energy Information Association data, or through compliance reports that states release each year. Rogers (2003) also highlights the importance of re-invention to diffusion. Policies that can be implemented in a variety of different ways, or re-invented, to best meet the needs of adopters are more likely to diffuse. This is one of the most important aspects of RPS – each one is different. Because the policy can be customized, it is more likely to be adopted.

While Rogers’ work looks broadly at characteristics of innovations that lead to their diffusion, Berry and Berry (2007) divide the adoption of new policies into two different models: diffusion models and internal determinants models. Diffusion models posit that states emulate one another as they learn from each other, compete with each other, and seek to conform to nationally or regionally accepted standards. As such, policies can be communicated through various channels. For example, policy leaders are those who quickly adopt new, innovative policies while policy laggards are those who wait, seeking to understand how the policy impacts early adopters in order to understand how it will impact them. Policies can also diffuse nationally or regionally among states.

Alternatively, the internal determinants model posits that "the factors causing a state to adopt a new program or policy are political, economic, and social characteristics of the state" (Berry and Berry 2007, 231). While diffusion must still contribute to a state adopting a policy, this model assumes that once a state learns of a new policy from another state, it is these internal factors that determine if and when the policy is adopted "rather than pressure created by other states' adoptions or explicit evaluations of the impacts of the policy in earlier-adopting states" (232).

In his paper on the adoption of renewable portfolio standards, Matisoff (2008) seeks to determine which model, regional diffusion or internal determinants, provides a more robust explanation for why renewable portfolio standards diffuse among states. After running a series of regressions for both models, Matisoff finds that the internal determinants model produces a large amount of explanatory power while the regional diffusion model does not. Supporting this point is the extensive research on the internal state factors that influence the adoption of environmental and renewable energy policies across the country (Matisoff 2008; Sapat 2004; Carley and Miller 2012; Carley et al. 2013, Berry et al. 2015). While these scholars all develop slightly different conclusions, they focus on the many different internal state factors that drive states to adopt policies. These factors include *state political climate* (Sapat 2004; Berry et al. 2015), *strength of relevant interest groups* (Sapat 2004; Matisoff 2008), the environmental problem's severity or need (Sapat 2004; Berry and Berry 2007; Matisoff 2008), and the *policy's compatibility with the state's current practices* (Rogers 2003). These researchers identify a number of other possible relevant factors, but these are the ones that are most often associated with statistically significant results.

Carley and Miller (2012) were the first scholars to take this research a step further by seeking to understand which of these factors lead to the adoption of a strong RPS. They do this by ranking RPS using a methodology that is further explained below. They then conduct a series of regressions to determine if there is an association between the independent variables (internal factors such as ideology, economic factors, socioeconomic factors) and the dependent variable (either a strong, weak, or voluntary RPS) (Carley and Miller 2012).

2.3 Ranking Renewable Portfolio Standards

Since, in theory, a more stringent policy will yield better outcomes for residents and the environment in general, the stringency of RPS is one of their critical characteristics; voluntary or weak RPS are likely to yield no significant benefits. Only three research groups have attempted to rank states' RPS according to their stringency, each using a slightly different method and yielding similar but not identical results. In order to analyze the impacts of different strength RPS on renewable energy generation in their respective states, Yin and Powers (2010) were the first to rank states according to the strength of their RPS. To determine a strength rating for each state, they multiply the nominal percentage requirement of renewable energy by the percentage of the state's electric load that is covered by the RPS legislation. This is then multiplied by the total retail electricity sales in that year. The existing renewable energy generation is subtracted from this number to determine the required increase in renewable energy production. This number is then divided by the total retail electricity sales in that year to determine a measure of RPS strength for each given year (Yin and Powers 2010).

While Yin and Powers are not directly interested in the diffusion of RPS, but rather their effectiveness at increasing renewable generation, Carley and Miller (2012) conducted a national quantitative analysis looking at what types of internal factors influence the stringency of the RPS adopted by states as of 2009. To do this, they begin by ranking the states based on the strength of their RPS: either as strong, weak, or voluntary. Because utilities are not required to meet the standards set by voluntary RPS, these policies are even less stringent than are weak policies. This ranking approach assumes that states with more stringent mandates will achieve greater renewable energy diversification while states with weak or nonbinding standards will experience less.

To arrive at a measure of stringency, Carley and Miller (2012) first subtract the amount of renewable energy used in the state at the time when the mandate was first adopted from the amount of renewable energy required by the final year of the RPS. This results in the total change in renewable energy generation. The study then divides this change by the number of years over which the RPS is being implemented, from the starting year to the deadline for meeting the standard. The average annual level of change is then multiplied by the percentage of the state's electric load that is covered by the RPS legislation to find a measure of stringency. The authors argue that their method is more accurate than that of Yin and Powers (2010) because it results in one measure of stringency rather than a different measure of stringency for each year (Carley and Miller 2012).

Finally, in their paper on RPS, Berry et al. (2015) use a similar method to rank the states according to what they term the ambitiousness of the state's RPS as of 2009. Their method differs in that they do not include the final step of accounting for the percentage of the electric load that is impacted by the RPS legislation. Comparing the two lists of ranked states, it is clear that this final step affects the results. New York is at the top of Berry et al. (2015) list but falls in the middle of Carley and Miller's (2012). This suggests that while there are methods for ranking states' RPS, there is not yet an agreed upon measure of strength.

In his dissertation, Helwig (2014) uses the methods of Yin and Powers (2010) and Carley and Miller (2012) to re-rank the states based on the states' 2013 RPS targets in order to determine how the strength of a RPS impacts the renewable energy production of those states. Helwig (2014) does not suggest which method of ranking states he deems to be more accurate, though he does cite Carley and Miller's (2012) claim that their method is more accurate than that of Yin and Powers (2010) because it does not have the potential to be influenced by the yearly fluctuations in energy supply prices as does Yin and Powers'. Because his paper was written before that of Berry et al. (2015), their method of ranking states is not included in Helwig's (2014) re-ranking.

This literature on the different methods for ranking RPS is an important part of this thesis, as it provides a base from which to identify states with strong RPS. As the focus of this thesis is the diffusion of innovative state policies, the diffusion literature provides an explanation as to how and why I have decided to focus on the internal determinants model and the internal factors that influence the adoption of RPS. Additionally, understanding why RPS have become the most used renewable energy policy provides a justification for focusing on them as opposed to other renewable policies.

Chapter 3: Methodology

This thesis seeks to identify the factors, within and across five states with strong RPS, that appear to influence the relative stringency of their regulations; a cross-case qualitative approach is taken for this purpose. This chapter presents the rationale for using a case study design, the method for selecting the sample of states and the internal factors on which they are compared, and the steps in conducting the within-state and cross-state analyses.

3.1 Case Study Rationale

Case study research is one method through which to conduct social science research. According to Yin (1994), it investigates a contemporary phenomenon in its real-world context and is most appropriate when answering the research question requires an extensive and in-depth description. It allows researchers to look intensively at a phenomenon in order to gain deep insight and understanding (Yin 1994). Case study evidence can be qualitative, quantitative, or both. It can be used to provide description, to test theory, or to generate theory (Eisenhardt 1989). This thesis uses two types of case study analysis: within-case and cross-case analysis.

Within-case analysis often involves "a staggering volume of data" that needs to be synthesized and written-up (Eisenhardt 1989, 540). These write-ups are often simply written descriptions of the data, but they help researchers cope with the large amount of research they have collected. As such, write-ups are central to the generation of insights in a within-case analysis (Eisenhardt 1989). Building on these initial insights, Miles et al. (2014) explain that within-case analysis "illustrates through a study's variables how one thing led to another in linear yet interwoven patterns" (237). It allows the author to conduct an analysis that is inclusive and explanatory. As such, within-case analysis is the key first step of this thesis. By gathering and analyzing data on the internal factors and the adoption process and structure of each state's RPS, an inclusive narrative can be developed for each case (which is a state).

This first step is integral to the second step – the cross-case analysis. A cross-case analysis "with its core list of variables found to have significance across several cases, is a powerful way to move from case-specific explanations to more generalizable constructs and theory" (Miles et al. 2014, 247). It develops a thematic narrative that is "derived from systematic comparison of within-case casual network displays" (247). Peter Starke (2013) describes a cross-case analysis as "the systematic investigation of qualitative similarities and differences of values on theoretically relevant variables across several cases" (Starke 2013, 567). This type of policy analysis assesses competing explanatory claims in a nonnumerical fashion, using what Starke calls "intuitive regression." As such, this thesis utilizes cross-case analysis to gain a deeper understanding of the relationship between internal state factors across five states.

It is important to remember that case study analysis does not allow for generalizable conclusions because it is focused on only a small number of cases. Eisenhardt (1989) explains that theories derived through case study analysis can be overly complex because of the extensive amount of data on which they rest. As a result, case studies can produce theories that are narrow and idiosyncratic meaning that they cannot be generalized. Case study analysis is an evidence-based, good faith effort to map causation that requires the analyst to find the "story lines in data" (Miles et al. 2014, 253). It does not prove anything, but it does raise likely explanations for the conclusions suggested by the data.

This thesis uses a case study design because it seeks to fill a gap in the current literature on RPS diffusion. As explained previously, the current literature is largely quantitative, looking broadly at RPS through regression analysis. While the findings are informative, in his paper on qualitative methods for the study of policy diffusion, Starke (2013) explains how quantitative measurements require the use of a number of assumptions. This is evident in the current RPS literature where assumptions are made first when developing measures of independent variables and, more importantly, when analyzing results. While this thesis does make assumptions as it selects its indicators of internal factors, the nature of case-study analysis allows for a more detailed evaluation. The measure provides a starting point for the analysis that is supplemented with contextual research and narrative. The results of traditional RPS diffusion studies provide generalizations about the direction of the influence of an internal factor on RPS adoption (it either makes the adoption of a strong RPS more or less likely) (Carley and Miller 2012; Berry et al. 2015). The results of this case study suggest under what circumstances an internal factor that usually would increase the likelihood of a strong RPS might actually decrease it because of its interaction with another factor in the state.

3.2 State Sample Selection

This thesis is, in essence, a "best case" study, intending to understand more fully what combination of internal state factors appears related to more stringent RPS. Its starting point is the ranking of state RPS, choosing states with strong regulations for the state sample. While there are a number of ranking lists from which to choose, Helwig's (2014) most recent re-ranking of the states using Carley and Miller's (2012) and Yin and Powers (2010) methodology appears the most appropriate for this study, primarily because it includes electric load coverage, while Berry et al.'s (2015) does not. In my view, electric load coverage would have to be considered to arrive as a relative stringency ranking for RPS. Otherwise, for example, a state might impose a RPS of 50% on only 25% of the electricity market, and this would appear stronger than a 20% RPS that covers 95% of the market, even though its limited coverage makes it less stringent.

Second, I wanted to achieve a degree of geographic representation across the United States in order to understand RPS on a national level. For that reason, no more than one state was chosen from each of the ten Environmental Protection Agency (EPA) regions that divide the country. The EPA regions are displayed in Figure 1. The initial step of this process was to choose the highest ranked state in each region based on the list developed by Helwig (2014). If the two lists of rankings did not agree on the highest state in a region, such as Region 2 with New York and New Jersey, the state ranked more highly in Carley and Miller's column was chosen because their method of ranking is a more accurate measure of stringency. (See Table 1 below for Helwig's lists of the ranked states.) The states that are ranked highest in each EPA region are highlighted in gray. According to Helwig, the states that are not ranked in the Carley and Miller column of the table are states that have renewable energy capacity goals, but not renewable energy production targets in the form of a mandated RPS. As such, these states' goals may be ambitious, but because they are not mandatory, the RPS cannot be considered stringent (Helwig 2014). (See Table 2 for a list of the highest ranked state in each EPA region.)

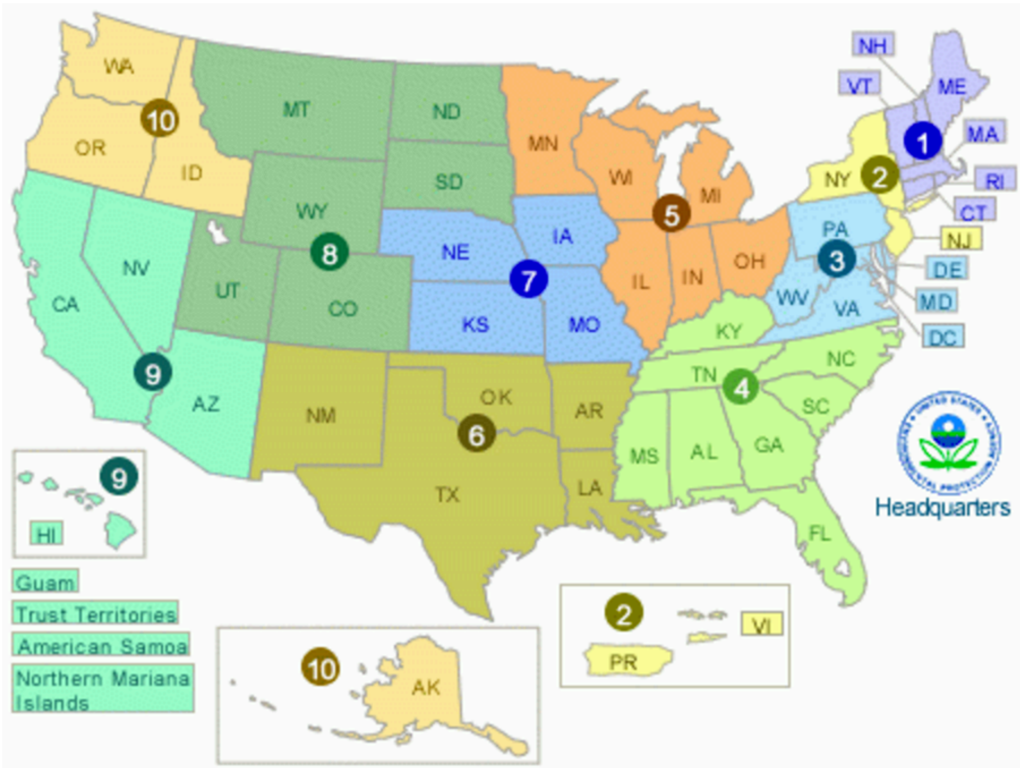

Figure 1: Environmental Protection Agency Regions as of 2017
Source: U.S. Environmental Protection Agency 2017a

Table 1: Helwig's (2014) Re-ranking of State RPS Using the Methodology of Yin and Powers (2010) and Carley and Miller (2012) Using 2013 RPS Targets

RPS Target Index Level of Effort Yin & Powers (2010)	Ranking	RPS Target Level Index With Coverage Carley & Miller (2012)	Ranking
MI	276.02	MI	173.33
NY	215.45	HI	150
CT	165.74	CT	146.77
DC	153.85	WA	127.05
OK	152.25	DC	123.08
CA	146.66	CO	121.92
WV	143.64	CA	116.61
HI	138.01	IL	114.71
NJ	118.2	MA	106.74
WA	114.32	OR	106.57
UT	112.95	NJ	105.24
RI	111.93	NH	103.98
IL	111.85	RI	99.3
PA	111.73	MD	96.32
MD	110.82	MT	92
KS	108.04	MO	91
NH	104.62	KS	90.56
NV	100.89	DE	89.44
MA	100.57	PA	85.49
MO	99.32	NV	83.79
VT	99.03	NC	77.27
DE	96.99	NM	72.54
NC	95.93	OH	72.36
CO	95.74	WI	71.56
MT	93.43	NY	67.76
WI	88.3	AZ	42.41
OR	87.31	MN	31.87
OH	71.81	OK	-
VA	69.1	WV	-
NM	63.14	UT	-
SD	54.06	VT	-
AZ	46.07	VA	-
MN	39.04	SD	-
IN	35.43	IN	-
ND	28.51	ND	-

Highlighted States are Strongest in their EPA Region

Source: Helwig (2014)

Table 2: The Highest Ranked State in each EPA Region (2013 RPS Targets)

EPA Region	Highest Ranked State in Region
1	Connecticut
2	New Jersey
3	District of Columbia
4	North Carolina
5	Michigan
6	New Mexico
7	Missouri
8	Colorado
9	Hawaii
10	Washington

Because this paper only intended to focus on five states, this initial list of ten states had to be reduced to the five most applicable for the cross-case analysis. In order to eliminate states, initial research was conducted to determine which five have the best information available around their RPS policy adoption decisions. The District of Columbia was excluded because of its small relative size, as was Hawaii due to its distant location and uniqueness in being an island. The five selected states are highlighted in gray in Table 3. They are: *Connecticut*, *New Jersey, Michigan, Colorado,* and *Washington*. (See Table 3 for the sample states and their respective EPA regions.) Because these states are distributed throughout the United States, the sample allows for some degree of representativeness in terms of geography.

Table 3: The Highest Ranked State in each EPA Region (2013 RPS Targets) with Sample States Highlighted

EPA Region	Highest Ranked State in Region
1	Connecticut
2	New Jersey
3	District of Columbia
4	North Carolina
5	Michigan
6	New Mexico
7	Missouri
8	Colorado
9	Hawaii
10	Washington

3.3 Innovation Factors Selection

The slate of state innovation factors have emerged both from the general diffusion literature and from the more focused work of authors studying the diffusion of RPS among states. While diffusion of innovation literature on environmental policies and RPS identifies a number of possible factors that lead to the adoption of RPS, this thesis focuses on those that yield statistically significant results in at least one study. The descriptions below highlight the chosen factors and the research in which they are identified. See Table 4 below for a brief description of the four factors.

Table 4: Description and Application of Diffusion of Innovation Factors

State's Political Climate	Party control of the state Senate and House of Representatives. Democratic control yields a liberal political climate while Republican control yields a conservative political climate. Generally it is expected that a liberal political climate will result in a stronger RPS.
Strength of Relevant Interest Groups	Environmental interest groups are expected to support RPS. Fossil fuel producers and investor owned utilities may not support RPS. The relative strength of these groups may influence RPS adoption.
Problem Severity or Need	In this case, air pollution is the problem that the RPS could mitigate. The worse the air pollution in the state is, it is expected the more likely a state will be to adopt a policy that will mitigate the problem.
Policy's Compatibility with State's Current Practices	The state is more likely to adopt a policy if it is compatible. The state's renewable energy potential (how much energy it could produce with its available solar, wind, etc. resources) is used to determine if a RPS is compatible.

Source: Sapat (2004); Berry et al. (2015); Matisoff (2008); Berry and Berry (2007); Rogers (2003)

The first factor that this paper examines is the *state's political climate*. Sapat (2004) assumes that more liberal states will be more likely to adopt environmental policies because liberals are generally more willing to regulate private industry in the interest of the public good.

In their paper on RPS ambitiousness, Berry et al. (2015) find that the makeup of a state's legislature is the only statistically significant factor correlated with the adoption of a more ambitious RPS. States with Democratic majorities in both branches of the legislature are more likely to adopt more ambitious RPS, while RPS passed by legislatures with Republican majorities are far less ambitious (Berry et al. 2015). In their study on the stringency of RPS, Carley and Miller (2012) find liberal government ideology to be a statistically significant indicator of states adopting strong RPS. They also find that higher rates of liberal citizen ideology are associated with a state adopting a voluntary or weak RPS as opposed to no RPS at all (Carley and Miller 2012). To measure a state's government ideology, Berry et al.'s (2015) approach is applied here, using the party control of both the state Senate and House of Representatives in the year of the RPS adoption. This information is available on the Internet through Ballotpedia's State Legislature section (Ballotpedia 2017f).

The next factor that this paper examines is how the *strength of relevant interest groups* impacts what type of RPS a state adopts. Sapat (2004) explains that environmental regulations often face opposition from industries that believe they would be negatively impacted by the new regulations. Alternatively, pro-environmental groups who support the increased regulation could outweigh these industry interest groups (Sapat 2004). In the case of RPS, opposition interest groups will most likely be fossil fuel producers who feel their business will be hampered by a policy aimed at moving electricity production away from fossil fuels. Alternatively, renewable power producers and pro-environmental interest groups are likely to support RPS legislation.

This current analysis uses two methods to determine the strength of environmental interest groups in states. The primary indicator is the first method, but the second serves as an additional, supporting indicator when states share similar results within the primary measure.

The primary indicator is similar to that described by Sapat (2004), who uses the number of Sierra Club, Greenpeace, and National Wildlife Federation members per 1,000 persons in each state in 1991. Because there are considerably more environmental organizations in states than these three, this paper uses the number of environmental, conservation, and wildlife organizations in the state to measure the strength of environmental interest groups as opposed to the number of members in only three organizations. The ratio of the number of organizations per 100,000 people is also listed to provide a more sophisticated measure of strength. The assumption is that the more interest groups that are present in a state relative to the population, the more support, and therefore lobbying strength, these groups will have. These data are available via the American Community Survey for the years 2002 and 2007 (U.S. Census Bureau/American FactFinder 2017). For the states whose RPS were adopted closer to 2002 (Connecticut, Colorado, New Jersey), the 2002 data are used. The 2007 data are used for Washington and Michigan because their RPS were adopted closer to 2007.

The second method used to measure the strength of environmental interest groups is similar to that developed by Matthew Khan (2007). He measures the environmentalism of neighborhoods in California using the share of Green Party registered voters (Khan 2007). This thesis uses the share of people who voted for the Green party in the 2000 Presidential election since 2000 was the last year that a Ralph Nader ran under the Green Party. Comparing this percentage across the same year provides for increased accuracy since Nader's share of the vote drops dramatically between 2000 and 2004. These data are available on the Internet via the U.S. Election Atlas (U.S. Election Atlas 2016).

While environmental interest groups are important in the adoption of RPS, in his paper, Matisoff (2008) examines the strength of the interest groups who might be opposed to RPS.

Specifically, Matisoff looks at natural gas and coal production in a state, finding that more carbon intensive states are less likely to adopt a RPS. In order to measure the strength of interest groups opposing RPS, this paper adopts Matisoff's method using data provided by the U.S. Energy Information Association on coal and natural gas production by state. While all of this production may not be specifically for electricity production in the given state, total production information provides a proxy measure of the size of the organizations that are likely to oppose a policy that discourages fossil fuel use. Additionally, while other papers studying RPS have not used the presence of Investor Owned Utilities as a measure of interest group strength, this paper uses a count of Investor Owned Utilities as an additional measure of strength of relevant interest groups. Because utilities are directly impacted by RPS, their lobbying power may impact the type of policy that is adopted.

Another important innovation factor is *the problem severity or need*. Berry and Berry (2007) explain that problem severity can directly influence state officials to adopt a policy by highlighting the need for the policy or can indirectly influence policy adoption by generating demand for the policy within societal groups. More specific to environmental issues, Sapat (2004) hypothesizes that states that suffer from poor environmental quality will be more likely to adopt policies aimed at mitigating the problem. In relation to RPS, states that have high carbon dioxide emissions releases may be more likely to adopt stronger RPS seeing the health and environmental issues associated with these emissions as a problem that should be mitigated. Matisoff's (2008) study highlights the relevance of this factor, finding that the criteria pollutant index has a statistically significant impact on the adoption of RPS across states. As such, to measure the problem severity and need for RPS policies, this paper examines the *criteria pollutant index* for states. These data are available via the United States Environmental

Protection's Outdoor Air Quality Database that provides county level data on the number of days per year that where the air quality index was either *good, moderate, unhealthy for sensitive groups, unhealthy*, or *very unhealthy* (U.S. Environmental Protection Agency 2017b).

Because the air quality index takes into account all of the criteria air pollutants, including carbon monoxide, nitrogen dioxide, ozone and sulfur dioxide, as well as particulate matter 2.5 and 10, it is an indicator of overall air quality for the specified area (U.S. EPA 2016). For each state, the total number of unhealthy for sensitive groups, unhealthy, and very unhealthy days is used to measure the severity of air quality issues. The average of the median air quality index for each county is also used to estimate the air quality index for the state as a whole (U.S. EPA 2017b). Both of these data points are gathered for the year in which the RPS was adopted in the state of interest.

Another factor that this paper examines is the *policy's compatibility with the state's current practices*. Rogers (2003) defines compatibility as the degree to which a policy is perceived as being consistent with the state's existing values and past experiences. In terms of RPS, this can be thought of as how the policy requirements were influenced by the amount of renewable and nonrenewable resources available in the state. This paper examines the renewable energy technical potential of each state, as determined by the National Renewable Energy Laboratory, to determine if states that have greater renewable energy potential are more likely to adopt stronger RPS. This measure is a total of the state's solar, wind, biomass, geothermal, and hydroelectric potential measured in gigawatts per hour.

3.4 Background and Energy and Environmental Indicators

While the innovation factors are central to diffusion literature and to this thesis, there are other internal factors within a state that may impact its RPS adoption and structure. As such, background information and energy and environmental data for each state is provided and examined as part of the analysis. The first indicator included in the background information is the region in which the state is located which is determined by simply looking at a map. This identifies the geographic location of each of the states in order to determine if the sample is geographically representative of the United States. The next indicators are population and population density. These numbers are gathered from the U.S. Census for the year 2016 (U.S. Census Bureau 2016). Density may be important in understanding a state's reaction to air pollution as having people heavily clustered in high pollution areas is a more severe problem than if fewer people are experiencing pollution. Also included in the background information is the percent of the population within the state living below the poverty line. The U.S. Census provides these data for 2016 (U.S. Census Bureau 2016). This indicator illustrates the economic situation within the states which could influence a state's adoption of a RPS. If a state is struggling economically, it may choose to adopt a RPS that encourages economic development. Each of these data points (except for region) is compared to the United States average in order to provide a point of reference.

Information is also provided for each state on its energy and environmental situation. Included first in these indicators is the state's two main sources of energy. The U.S. Energy Information Association provides these data for each state in 2016, as well as for the United States as a whole (U.S. Energy Information Association. 2017a). Because the adoption of a RPS impacts the energy generation mix in a state, it is important to understand the current energy landscape. This could help explain why states adopt strong RPS or RPS with certain structures. The next indicator is the total number of air quality index unhealthy recordings in each state. As explained above in the innovation factors section, the U.S. Environmental Protection Agency provides these data (U.S. Environmental Protection Agency 2017b). While the air quality rating used as an indicator of problem severity is for the year in which the RPS was adopted, these data are intended to provide a mechanism through which to compare the states' current situations. As such, this measure of air quality is for the year 2015, the most recent year available.

The next indicator is the state's total carbon dioxide emissions in the year 2014 which is provided by the U.S. Energy Information Association (U.S. Energy Information Association 2017b). Carbon dioxide contributes to climate change, and climate change is one of the main issues that RPS seek to mitigate. As such, a state's emissions may help explain its adoption of a strong RPS. The final indicator is the total number of renewable energy and energy efficiency policies and incentives in each state as of 2017. DSIRE, which is operated by the North Carolina Clean Energy Technology Center, provides a database of these factors for each state (DSIRE 2017c). The logic behind including this measure is that a state that has a large number of renewable energy policies and incentives may be more supportive of renewable energy policies and therefore may be more likely to adopt a strong RPS.

3.5 Approach to Data Analysis

I undertook both *within-case* and a *cross-case analysis* to determine how and which combinations of internal factors appear to have shaped RPS stringency within and among the state cases identified here. The qualitative data analysis methods described by Miles et al. (2014) were generally followed here.

This first step of the analysis is the single state, within-case analysis, seeking to understand which factors are most important to the development of each state's RPS. This includes the four factors identified above, along with the background information and the environmental and energy data collected for each state. Also important is the specific information regarding the legislation adoption process and the structure of the RPS. These data are organized into a matrix for each state that highlights which aspects are most important to that particular state's RPS. Organizing data into matrices allows for the building of a "logical chain of evidence" because it presents the data in such a way as to visualize when some variables are present (or absent) together, whiles others appear to be random or unconnected (Miles et al. 2014, 242). While the matrices are the first step to developing case study findings by displaying relationships between the variables, Miles et al. (2014) explain how the written narrative of these relationships is equally important. This is because a narrative allows the author "to be honest and explicit about what [he or she thinks] is causing what" (245). It also provides the author an opportunity to explain why the variables are related and which ones matter more in specific cases (Miles et al. 2014). As such, a written narrative accompanies the matrix developed for each state.

Following this initial first step, the cross-case analysis begins. As described previously, cross-case analysis seeks to identify patterns of variables that exist across multiple cases. The cross-case analysis is divided into two parts, the first of which only analyzes the innovation factors identified above for each state in a single matrix. The rows represent states while the columns represent the factors. Within the boxes of the matrix is either a plus or minus symbol denoting whether the factor is either present or not present within the state as well as a short explanation of that factor's presence in the state. Miles et al. (2014) explain how to conduct the analysis of this cross-case matrix. First, for each case, "[y]ou look at each outcome measure and examine…the stream of variables leading to or 'determining' that outcome" (Miles et al. 2014, 247). In this case, the outcome is a strong RPS. The next step is to extract and thematically interpret "[s]treams that are similar or identical across cases, and that differ in some consistent way from other streams" (247). As such, I analyze the matrix in the described manner, looking for combinations or patterns (streams) of internal factors that result in the states adopting strong RPS.

The second part of the cross-case analysis, and its accompanying matrix, is more detailed. It includes the innovation factors mentioned above, as well as background information and environmental and energy data. Also included in this matrix is information regarding the adoption process and the structure of the RPS for each state. As such, this matrix is more complex than is the first and includes significantly more detail. The rows represent the five sample states and the columns represent the factors that have been "estimated to be the most influential in accounting for the outcome" (Miles et al. 2014, 247). Additionally, instead of using a plus or a minus symbol to denote the influence of the innovation factors, each box contains a more specific description of that factor's role in each particular state.

Analyzing the data displayed in this matrix is more complicated, but still relies on identifying streams (patterns or combinations) of internal factors that result in a strong RPS. The most significant difference from the first round of cross-case analysis is that, by including the structure of each state's RPS, this matrix allows for an understanding of how the internal factors may have shaped the provisions included in the RPS. While the first cross-case analysis uses a singular outcome (a strong RPS), this second analysis uses structural differences between the strong RPS as an outcome variable. As such, rather than only knowing that a specific combination of factors was related to a strong RPS, this matrix illustrates how a specific combination of factors was related to a RPS that was apparently strengthened through amendments and includes incentives for solar energy while allowing for the inclusion of coal.

Through a combination of single state and cross-state analysis, this thesis seeks to identify how combinations of the factors described above led to the adoption of strong RPS in five states across the United States. As such, the background information, the environmental and energy data, and the innovation factors are all integral to the analysis and findings.

Chapter 4: State Stories of RPS Adoption: Within-Case Findings

This findings chapter is divided into three sections, each focusing on information within states. The first section introduces background information on the five states (Connecticut, New Jersey, Michigan, Colorado, and Washington), including their location, population, and poverty status. The next section focuses on environmental and energy data for the five states including their main sources of energy. The final section includes information on the adoption and structure of each RPS, as well as analysis of the innovation factors for each state, seeking to understand how all of the factors within each state may have contributed to the adoption and structure of its RPS.

4.1 State Specific Background Characteristics

Table 5 below provides background information within each of the sample states compared to that of the United States as a whole. Much of these data, while interesting, do not illustrate meaningful variations between the sample states that work to explain their adoption of a strong RPS. Of most importance in Table 5 are the density and the percent of the population living below the poverty line. New Jersey is the most densely populated state, with a population density of 1,196 people per square mile. Connecticut is also relatively densely settled, with 738 people per square mile. Colorado is the least densely settled state, with only 49 people per square mile.

Also important to the following analysis is the fact that the percent of the population living below the poverty line in Michigan is higher than that in the sample and in the nation as a whole. With 16% living in poverty, Michigan has 4-5% more people in poverty than do the sample states and 2% more than the United States as a whole. The remaining states in the sample share a poverty level of either 11% or 12%, suggesting that Michigan may be struggling economically compared to the sample (U.S. Census Bureau 2016). These data points may aid in the understanding of what factors influence the adoption of a strong RPS.

Table 5: State Background Information in 2016 with Comparison to United States

	Connecticut	New Jersey	Michigan	Colorado	Washington	United States
Region	Northeast	Mid-Atlantic	Midwest	Rocky Mountain West	West	
Population	3,584,730	8,935,421	9,917,715	5,448,819	7,160,290	323,127,513
Population per Square Mile	738	1,196	175	49	101	84
Percent of Population Living below the Poverty Line	11%	11%	16%	12%	12%	14%

Source: U.S. Census Bureau 2016

4.2 State Specific Energy and Environmental Data

Table 6 below displays information on the energy and environmental landscape within the samples states. Similar to the background information, not all of these data points are important to the following analysis. Most important is the main sources of energy within states. While one of the two main sources of energy for the sample states is natural gas, the second source varies between states. In Washington, 35% of the electricity is produced using hydroelectric power (U.S. EIA 2017a). This is a significant variation from the sample states, and the United States, as only 6% of electricity is produced using hydroelectric power nationally. In both Michigan and Colorado, a main source of electricity is coal. In Michigan, 22% of the electricity is produced using coal while in Colorado, 24% of the electricity is produced using coal. While this is less than the amount of electricity that is produced nationally using coal (33%), this variation from the remaining sample states is important to note (U.S. EIA 2017a).

Also significant within the below data is the high number of unhealthy air quality days in Washington (143), Colorado (107), and New Jersey (109) (U.S. EPA 2017b). While these numbers are not nearly as high as the number of unhealthy air quality days in California, they do set these three states apart as having a higher incidence of air quality issues. Looking at the number of renewable energy and energy efficiency policies, Colorado (147) and Washington (158) have considerably more than the remaining sample states (DSIRE 2017c). This suggests that these states might be more interested in encouraging the use of renewable energy than the others. As such, the number of renewable policies, as well as the other aspects of the energy and environmental data highlighted above aid in the explanation of the adoption of strong RPS within the sample states.

Table 6: State Energy and Environmental Background Information with Comparison to National Statistics

	Connecticut	New Jersey	Michigan	Colorado	Washington	United States
Main Sources of Energy in 2016	Natural gas: 31% Nuclear: 22%	Natural gas: 36% Nuclear: 15%	Natural gas: 31% Coal: 22%	Natural gas: 34% Coal: 24%	Hydroelectric: 35% Natural gas: 15%	Natural gas: 33% Coal: 33% Nuclear: 20% Hydroelectric: 6%
Total Number of Air Quality Index Unhealthy Recordings in 2015	94	109	71	107	143	Range: 3 (Vermont) - 1,165 (California)
CO2 Emissions in 2014 (million metric tons)	35	114	163	92	73	Range: 6 (Vermont) - 642 (Texas)
Number of Renewable and Efficiency Policies and Incentives in State in 2016	66	57	72	147	158	Range: 15 (West Virginia) - 268 (California)

Source: U.S. EIA 2017a; U.S. EIA 2017b; U.S. EPA 2017b; DSIRE 2017c

4.3 Development of Individual State RPS

The development of each state's RPS is described in narrative form below in order to provide an explanation of how each was adopted, as well as to provide detail on the structure of each state's RPS. This is followed by an analysis of this adoption process, taking into consideration the background, energy and environmental factors, and innovation factors within each state. The innovation factors for each state are described prior to the analysis of the RPS adoption process. This section seeks to answer the first two questions of this thesis: "To what extent do individual state "stories" help to explain why states develop strong RPS?" and "To what extent do background information, energy and environmental data, and innovation factors contribute to the development of a strong RPS?"

4.3.1 Connecticut

Connecticut's RPS was originally approved on April 29, 1998 and became effective on July 1, 1998. The bill was introduced by the House of Representatives and was passed as Public Act 98-28, "An Act Concerning Electric Restructuring." The main purpose of the bill is to restructure the electric market in the state, dissolving the historic monopoly structure and creating competition among electric suppliers. The main goals of the bill are to: lower electricity rates that, at the time, were higher than the national average; give consumers the ability to choose their electric supplier and fuel source and to self-generate electricity if they so choose; and generate electricity that does not endanger public health or the environment.

The bill also stresses the importance of a safe and reliable supply of electricity that is provided to all customers in an equitable manner. Section 25 of the bill introduces the RPS, explaining that in order to retain a license as a utility, an applicant must demonstrate to the satisfaction of the Department of Public Utility Control that 0.5% of its electricity is generated with Class I renewable energy sources (wind, solar, etc.) and that an additional 5.5% is generated with Class I or Class II resources (waste-to-energy, older hydropower). This section also describes yearly increases of these percentage requirements ending with 13% (Class I and II) in 2009. Utilities may satisfy the requirements of the program by participating in a renewable energy trading program (Connecticut General Assembly 1998).

The Public Act became part of the General Statutes of Connecticut as Section 16-245a. This statute has experienced a number of technical amendments over the years, as well as three substantial amendments in 2011, 2013, and 2015. The 2011 amendment requires the development of a residential solar program as well as for utilities to enter into long-term contracts for renewable energy credits (RECs) from zero and low emission Class I renewable energy facilities on the customer side of the meter. These credits can be used towards RPS compliance (DSIRE 2015a).

Before the 2013 amendment, the Connecticut Department of Energy and Environmental Protection released a study on the RPS, citing its objectives to: “reduce dependence on fossil fuels, create a hedge against volatile oil and natural gas prices, lower air emissions, and promote clean energy jobs and economic development” (Connecticut Department of Energy and Environmental Protection 2013, 2). The study argues that the RPS is not meeting its objectives because a large percentage of the renewable energy is being generated out of the state with either biomass or landfill gas, two of the least clean sources that qualify under the RPS (Connecticut Department of Energy and Environmental Protection 2013). As such, the 2013 amendment gradually reduces the renewable energy credit assigned to certain biomass and landfill gas facilities. It also prohibits the counting of any RECs that are already claimed in another state towards meeting the RPS in Connecticut (DSIRE 2015a). The 2015 amendment aims to increase the amount of residential solar electricity produced in Connecticut and develops a system of solar renewable energy credits (SRECS). The most current renewable requirement is 27% by 2020 (DSIRE 2015a). (See Table 7 for an overview of Connecticut's RPS.)

Table 7: Relevant Aspects of Connecticut's RPS Legislation

First RPS Legislation	Connecticut General Statutes Section 16-245a
Year Adopted	1998 (has been amended)
Percent Required	27%
Year Required By	2020
Eligible Technologies	Geothermal Electric, Solar Thermal Electric, Solar Photovoltaics, Wind (All), Biomass, Hydroelectric, Municipal Solid Waste, Combined Heat & Power, Fuel Cells using Non-Renewable Fuels, Landfill Gas, Tidal, Wave, Ocean Thermal, Wind (Small), Anaerobic Digestion, Fuel Cells using Renewable Fuels

Source: DSIRE 2015a

In order to understand why Connecticut adopted its RPS, the innovation factors at the time of its adoption must also be explored (see Table 8). When Connecticut adopted its RPS in 1998, Democrats controlled both branches of its legislature, giving it a liberal political climate (Ballotpedia 2017a). Its environmental interest groups were stronger than were its fossil fuel interest groups, as there were 62 environmental, conservation, and wildlife organizations present in the state (U.S. Census Bureau/American FactFinder 2017). Relative to the state's population, this is approximately 1.73 environmental interest groups per 100,000 people. Additionally, in the 2000 presidential election, 4.42% of voters voted for the Green Party candidate Ralph Nader (U.S. Election Atlas 2016). The interest groups that would be expected to oppose the RPS, fossil fuel producers and investor owned utilities, appear to have little strength comparatively. Neither natural gas nor coal is produced in the state, and there are only two investor owned utilities (U.S. Energy Information Association 2017c; U.S. Energy Information Association 2017d).

Considering the problem severity or need for an RPS, Connecticut experienced 180 unhealthy air quality incidents in 1998, suggesting that its air quality could have been improved but may not have been the most dire issue facing the state (U.S. Environmental Protection Agency 2017b). Moving to the policy's compatibility with the state's current practices, there is limited renewable energy potential in Connecticut. Geothermal, solar, and wind all present the opportunity to produce electricity, although the potential is very small compared to that of the other sample states (National Renewable Energy Laboratory 2012).

Table 8: Connecticut Innovation Factors in 1998

State's Political Climate	*Senate Partisanship*	Democratic
	House Partisanship	Democratic
Strength of Relevant Interest Groups	*Number of Environment, Conservation, and Wildlife Organizations*	62
	Per 100,000 people	1.73
	Percent of Green Party Voters in 2000 Presidential Election	4.42%
	Natural Gas Production (million cubic feet)	0
	Coal Production (short tons)	0
	Number of Investor Owned Utilities	2
Problem Severity or Need	*Total Number of Air Quality Index Unhealthy Days*	180
Policy's Compatibility with State's Current Practices	*Solar Potential (GWh)*	33,961
	Wind Potential (GWh)	26,607
	Biopower Potential (GWh)	909
	Geothermal Potential (GWh)	56,078
	Hydroelectric Potential (GWh)	922
	Total Renewable Energy Potential (GWh)	118,478

Source: Ballotpedia 2017f; U.S. Census Bureau/American FactFinder 2017; U.S. Election Atlas 2016; U.S. Energy Information Association 2017c; U.S. Energy Information Association 2017d; U.S. Environmental Protection Agency 2017b; National Renewable Energy Laboratory 2012

Connecticut was one of the earlier states to adopt its RPS, but the concern at the time does not appear to have been focused on renewable energy. Rather, the RPS was a small section in a large bill, the purpose of which was to restructure the electricity market in the state. The RPS was viewed as one in a number of potential solutions to dissolving the electricity monopoly and providing a reliable supply of electricity to consumers. The goals of the legislation do mention generating electricity that does not endanger the public health or the environment, but the need to reduce air pollution was not the focus of the bill. Adding to the argument that increasing the state's supply of renewable energy was not the priority of this bill is its very small renewable energy goal (Connecticut General Assembly 1998). At the time of the legislation's adoption, the liberal political climate and limited strength of interest groups opposing the RPS may have allowed for the RPS to be included in the bill somewhat unnoticed. While it is not clear whether this was the intent of the authors, the RPS has since been amended a number of times on its way to becoming the strongest in EPA Region 1 and one of the stronger RPS in the country. This suggests that one way to achieve a strong policy is to begin by simply finding a way to pass it into law. Once adopted, it can be strengthened through amendments.

In the case of Connecticut, it was through amendments that the liberal political climate and concerns about air pollution appear to have influenced the legislation. This influence is most clearly seen through the 2013 amendment in which the focus of the RPS shifted towards generating more electricity from solar energy, which is significantly cleaner than the biomass and landfill gas that was to be phased out. A study released by the Connecticut Department of Energy and Environmental Protection at the time of these amendments cited the desire to reduce air emissions and to eliminate the double counting of renewable energy credits, recommending also that the RPS requirement be increased (Connecticut Department of Energy and Environmental Protection 2013). The fact that a government agency was advocating for the increase of the RPS is evidence of the likely impact of the liberal political climate. By significantly increasing the amount of renewable energy to be produced in Connecticut, the amendments to the RPS highlight the fact that, in a state with a liberal political climate and relatively unopposed environmental interest groups, an avenue to achieving a strong RPS may be through incremental changes to existing legislation.

4.3.2. New Jersey

Similar to Connecticut, New Jersey's RPS was originally approved (on February 9, 1999) as part of the state's electricity restructuring legislation, the "Electric Discount and Energy Competition Act." The goals of the legislation are to: lower electricity costs and provide consumers with electricity choices in order to improve quality of life; ensure universal access to affordable and reliable energy; and prevent adverse impacts on environmental quality as a result of this legislation. The RPS is introduced on page 41 of the legislation, requiring the Board of Public Utilities (BPU) to adopt a renewable portfolio standard following the opportunity for comment and public hearing. The initial renewables targets are 2.5% Class I (solar, wind, etc.) or Class II (hydropower, waste-to-energy) and 0.5% Class I by 2001, increasing to 4% Class I by 2012. Providers can satisfy the requirement by participating in the renewable energy trading program to be approved by the BPU in consultation with the Department of Environmental Protection (New Jersey General Assembly 1999).

As instructed, the BPU enacted the RPS in 2001 as New Jersey Administrative Code 14:8-1 & 14:8-2, with the percentage requirements proposed by the legislation. The Legislature then amended the RPS in 2004, requiring that the initial targets be met by May 2008 and that at least 0.16% of the 4% Class I target be met using solar electricity. This created a solar carve-out which requires that a certain percentage of the renewable energy produced must be produced using only solar energy. There were a series of additional amendments to the RPS increasing the Class I, II, and solar percentages, redesigning the solar carve-out, and including an offshore wind requirement. The classification of hydropower facilities was also clarified based on their size.

These amendments were proposed through bills that originated in the New Jersey State Senate, were adopted into law by the Legislature, and are enforced by the BPU. The most current renewable requirement is 24.39% by 2028 (DSIRE 2017a). (See Table 9 for an overview of New Jersey's RPS.)

Table 9: Relevant Aspects of New Jersey's RPS Legislation

First RPS Legislation	New Jersey Statutes Section 48:3-49
Year Adopted	1999 (has been amended)
Percent Required	24.39%
Year Required By	2028
Eligible Technologies	Geothermal Electric, Solar Thermal Electric, Solar Photovoltaics, Wind (All), Biomass, Hydroelectric, Municipal Solid Waste, Landfill Gas, Tidal, Wave, Wind (Small), Anaerobic Digestion, Fuel Cells using Renewable Fuels

Source: DSIRE 2017a

In order to understand why New Jersey adopted its RPS, the innovation factors at the time of its adoption must also be explored (see Table 10). When New Jersey adopted its RPS in 1999, Republicans controlled both branches of its legislature, giving it a conservative political climate (Ballotpedia 2017b). There were 88 environmental, conservation, and wildlife organizations present in the state, approximately 0.98 per 100,000 people (U.S. Census Bureau/American FactFinder 2017). In the 2000 presidential election, 2.97% of voters voted for the Green Party candidate Ralph Nader (U.S. Election Atlas 2016). Together, it does not appear that the environmental interest groups had a strong presence in New Jersey at the time. The interest groups that would be expected to oppose the RPS, fossil fuel producers and investor owned utilities, appear to have limited strength as well. Neither natural gas nor coal is produced in the state, suggesting that the fossil fuel lobby would not be strong (U.S. Energy Information Association 2017c; U.S. Energy Information Association 2017d). With four investor owned utilities in New Jersey, it is possible that there may have been limited resistance to the RPS, as utilities generally oppose generation mix requirements. Considering the problem severity or need for an RPS, New Jersey experienced 512 unhealthy air quality incidents in 1998, highlighting a serious air quality issue (U.S. Environmental Protection Agency 2017b). A RPS is compatible with the renewable potential in New Jersey, as there is considerable opportunity to produce electricity using solar and wind (National Renewable Energy Laboratory 2012).

Table 10: New Jersey Innovation Factors 1999

State's Political Climate	*Senate Partisanship*	Republican
	House Partisanship	Republican
Strength of Relevant Interest Groups	*Number of Environment, Conservation, and Wildlife Organizations*	88
	Per 100,000 people	0.98
	Percent of Green Party Voters in 2000 Presidential Election	2.97%
	Natural Gas Production (million cubic feet)	0
	Coal Production (short tons)	0
	Number of Investor Owned Utilities	4
Problem Severity or Need	*Total Number of Air Quality Index Unhealthy Days*	512
Policy's Compatibility with State's Current Practices	*Solar Potential (GWh)*	499,848
	Wind Potential (GWh)	430,125
	Biopower Potential (GWh)	3,523
	Geothermal Potential (GWh)	35,230
	Hydroelectric Potential (GWh)	549
	Total Renewable Energy Potential (GWh)	969,276

Source: Ballotpedia 2017f; U.S. Census Bureau/American FactFinder 2017; U.S. Election Atlas 2016; U.S. Energy Information Association 2017c; U.S. Energy Information Association 2017d; U.S. Environmental Protection Agency 2017b; National Renewable Energy Laboratory 2012

Similar to Connecticut, New Jersey was one of the earlier states to adopt its RPS. Also similar to Connecticut, the concern at the time does not appear to have been focused on renewable energy, but rather on the restructuring of the electricity market. The RPS is a small section in a large bill offering one potential solution to dissolving the electricity monopoly and providing a reliable supply of electricity to consumers. The main goals of the legislation are to reduce electricity costs and to provide consumers with energy choices, but these choices are more likely referring to the opportunity to choose between electricity suppliers in order to pay a lower price than to the ability to choose between fuel sources. While the goals of the bill do acknowledge the environment, they were negatively framed. Aiming to not negatively impact the environment as a result of the legislation, it does not appear that the authors of the bill intended for the renewable portfolio section of the bill to lead to environmental improvements, but rather hoped that the electric restricting would not cause harm. Adding to the argument that increasing the state's supply of renewable energy was not the priority of this bill is its very small renewable energy goal (New Jersey General Assembly 1999).

New Jersey differs from Connecticut in that its environmental interest groups did not appear to be strong at the time of the adoption of the RPS, suggesting that the RPS was not a small and potentially unnoticed way for environmentalists to advance their interests within a larger energy bill. Alternatively, it is possible that the authors of the bill believed the RPS to be one in a number of ways of dismantling the monopoly in the electric market while limiting increases in pollution. Based on the negatively framed environmental goals of the bills, there was little belief that the RPS would play a dramatic role in the energy future of New Jersey; but given the serious air quality issues in New Jersey at the time of adoption, Republicans may have been more willing to include a policy that could mitigate negative environmental impacts even if they were not sure how effective the policy would be. The fact that New Jersey is very densely settled may also have impacted the desire to reduce air pollution with more people living in close proximity to the areas where unhealthy days were reported. As such, the severity of the air pollution problem in New Jersey may have led to the adoption of a policy that otherwise would not have been supported.

Although the RPS was adopted early on, its renewable requirement was initially small. It is only through a series of amendments that New Jersey's RPS became the strongest in EPA Region 2 and one of the stronger RPS in the country. With each amendment, the RPS has been increased and has been tailored to be compatible with the renewable potential in the state. The RPS now includes additional incentives for solar and wind energy, both of which appear at the top of the renewable energy potential list for New Jersey. As such, the policy's compatibility with the state's current practices may have led to it becoming a strong RPS.

4.3.3 Michigan

Michigan's RPS was approved on October 6, 2008. It is Act 295 of 2008, the "Clean, Renewable, and Efficient Energy Act." The goals of the bill are: to diversify the state's energy resources in order to reliably meet the energy needs of consumers, to provide greater energy security through the use of indigenous energy resources, to encourage private investment in renewable energy, and to provide improved air quality to citizens of the state (Michigan State Legislature 2008). Unlike New Jersey and Connecticut, the bill that introduced the RPS in Michigan focused solely on renewables and energy efficiency advancement in the state. Also unlike New Jersey and Connecticut, the applicable renewable energy is not divided into classes but rather credit multipliers are used to incentivize certain technologies. For example, facilities producing electricity using solar power receive two additional credits per megawatt-hour (MWh) produced. Electricity produced at facilities using equipment that was manufactured in MI or at facilities that were constructed using an in-state workforce also receive credit multipliers (DSIRE 2017b).

The legislation sets the renewable target at 10% by 2015 and allows utilities to use energy optimization and advanced cleaner energy to meet up to 10% of their requirement.

Energy optimization is essentially energy efficiency technology or programs that reduce customers' electricity consumption. Advanced cleaner energy facilities are identified as those that produce electricity using gasification or industrial co-generation, as well as coal-fired facilities that capture and sequester 85% of their carbon dioxide emissions (DSIRE 2017b).

The first year in which compliance with the RPS was required was 2012. A utility's requirement was determined by the amount of renewable energy already in that utility's portfolio (their renewable energy baseline). In 2012, utilities were required to provide their renewable energy baseline plus 20% of the gap between their baseline and the 10% requirement. This percentage over baseline was set to increase each year until reaching 100% of the total obligation in 2015 (DSIRE 2017b). (See Table 11 for an overview of Michigan's RPS.)

Table 11: Relevant Aspects of Michigan's RPS Legislation

First RPS Legislation	Michigan Compiled Laws Section 460.1001
Year Adopted	2008
Percent Required	10%
Year Required By	2015
Eligible Technologies	Geothermal Electric, Solar Thermal Electric, Solar Photovoltaics, Wind (All), Biomass, Hydroelectric, Municipal Solid Waste, Combined Heat & Power, Landfill Gas, Tidal, Wave, Anaerobic Digestion, Landfill Gas, Coal Fired with Carbon Capture and Storage, Gasification

Source: DSIRE 2017b

In order to understand why Michigan adopted its RPS, the innovation factors at the time of its adoption must also be explored (see Table 12). Michigan adopted its RPS in 2008, nearly a decade after Connecticut and New Jersey. At the time, Republicans controlled its Senate while Democrats controlled its House of Representatives (Ballotpedia 2017c). There were 152 environmental, conservation, and wildlife organizations present in the state, approximately 1.53 per 100,000 people (U.S. Census Bureau/American FactFinder 2017). In the 2000 presidential election, 1.99% of voters voted for the Green Party candidate Ralph Nader (U.S. Election Atlas

2016). As such, it had relatively strong environmental interest groups, although the percentage of Green Party voters was relatively low. The interest groups that would be expected to oppose the RPS, fossil fuel producers and investor owned utilities, were somewhat strong in Michigan. With eight investor owned utilities, this group may have enjoyed lobbying power. While coal is not produced in Michigan, natural gas is, suggesting that the fossil fuel lobby may have been an influencing factor as well (U.S. Energy Information Association 2017c; U.S. Energy Information Association 2017d). Considering the problem severity or need for a RPS, Michigan experienced 106 unhealthy air quality incidents in 2008 which is relatively low compared to the sample states (U.S. Environmental Protection Agency 2017b). Additionally, a RPS is compatible with the renewable potential in Michigan, as there is considerable opportunity to produce electricity using both solar and wind resources (National Renewable Energy Laboratory 2012).

Table 12: Michigan Innovation Factors in 2008

State's Political Climate	*Senate Partisanship*	Republican
	House Partisanship	Democratic
Strength of Relevant Interest Groups	*Number of Environment, Conservation, and Wildlife Organizations*	152
	Per 100,000 people	1.53
	Percent of Green Party Voters in 2000 Presidential Election	1.99%
	Natural Gas Production (million cubic feet)	149,209
	Coal Production (short tons)	0
	Number of Investor Owned Utilities	8
Problem Severity or Need	*Total Number of Air Quality Index Unhealthy Days*	106
Policy's Compatibility with State's Current Practices	*Solar Potential (GWh)*	5,290,013
	Wind Potential (GWh)	1,883,708
	Biopower Potential (GWh)	11,897
	Geothermal Potential (GWh)	457,850
	Hydroelectric Potential (GWh)	1,181
	Total Renewable Energy Potential (GWh)	7,644,650

Source: Ballotpedia 2017f; U.S. Census Bureau/American FactFinder 2017; U.S. Election Atlas 2016; U.S. Energy Information Association 2017c; U.S. Energy Information Association 2017d; U.S. Environmental Protection Agency 2017b; National Renewable Energy Laboratory 2012

Unlike Connecticut and New Jersey, Michigan's RPS was the focus of the bill that introduced it. By this time in the history of RPS, many had been adopted throughout the nation with the sole purpose of increasing renewable energy use. As such, the goals of the bill were more environmentally focused, one of which was to improve the air quality for the citizens of the state. While air pollution was not a severe issue at the time, the environmental interest groups in Michigan were numerous and may have influenced the passing of the RPS. Investor owned utility interest groups may have also influenced the structure of the RPS in that a utility's requirement was determined by the amount of renewable energy already in that utility's portfolio, making compliance a less burdensome task. The fact that the state has strong renewable energy potential allowed the policy to be compatible with the state as well, especially considering that the RPS incentivizes the use of solar energy using credit multipliers.

Although these internal factors appear important to the adoption of the RPS in Michigan, it appears that additional factors may have been even more important in shaping the development of the policy. First, looking back to the environmental background information for Michigan, its two main sources of fuel are natural gas and coal. Unlike most states with a RPS, Michigan includes coal-fired facilities that capture carbon emissions in their RPS. This suggests that the policy was tailored to accommodate coal use while incentivizing coal users to reduce their carbon emissions.

Even more important to Michigan's RPS adoption was its economic status at the time. Again, looking back to the background information, it is clear that Michigan has a greater percentage of people living below the poverty line (16%) than do the other states in the sample. In 2008, 14.5% of the population was living below the poverty line in Michigan (U.S. Census Bureau 2010). Evidence of this poverty impacting the adoption and structure of the RPS is clear in both the goals of the bill and the incentives of the RPS. One of the goals is to encourage private investment in renewable energy, which would create jobs and bring capital to Michigan. The RPS incentivizes electricity production at facilities using equipment that was manufactured in Michigan or at facilities that were constructed using an in-state workforce by giving these sources credit multipliers. This suggests that the Legislature was attempting to use the RPS as a way to stimulate economic development and job creation within the state. As such, although other factors within Michigan played a role in the development of a strong RPS, the economic situation might well have been the strongest influencing factor. Rabe (2004) explains that states often adopt renewable energy policies by framing their policies in terms of concerns that are most salient to that particular state. One such concern is economic development (Rabe 2004). As such, the economic development frame may have allowed for the adoption of a strong RPS in a state that otherwise would not have adopted one.

4.3.4 Colorado

Colorado was the first state to adopt a RPS through a ballot initiative. Known as Initiative 37, the Colorado Renewable Energy Requirement Initiative appeared on the November 2, 2004 ballot in Colorado. Information provided to the public before the election in the state Blue Book explained that utilities in the state produced power mainly using coal and natural gas, but that about 2% of electricity is produced using the renewable sources defined in the proposed legislation. The Blue Book also explained that 16 other states already had a RPS and that the percentage of required renewable energy varied from 1.1% in Arizona to 30% in Maine. "Coloradans For Clean Energy spent a total of $1,446,578 in support of the measure, whereas Citizens For Sensible Energy Choices spent $1,284,341, and Intermountain Rural Electric Association spent $15,874, both in opposition of the measure." The ballot initiative was approved with 53.61% of the voters in favor, adding a RPS to the Colorado Revised Statutes, Section 40-2-124 (Ballotpedia 2014). The initial requirement began with 3% renewable by 2007, increased to 10% by 2015, and applied to all utilities except those that serve 40,000 customers or less (Colorado Revised Statutes 2013).

The Colorado Legislature has amended the renewable requirement a number of times since the initial ballot initiative (Colorado Energy Office 2017). Signed in March of 2010, HB10-1001 increased the investor owned utilities requirement to 30% renewable by 2020. It also required that 3% of this be produced through distributed generation which is renewable energy that is produced on the site of customer facilities primarily to serve the customer's load

(Colorado Energy Office 2015). In June of 2013, SB 13-252 added coalmine methane (methane released at coalmines is captured and used to generate energy) and pyrolysis of municipal solid waste to the list of eligible energy resources. It also required that cooperative electric utilities serving 100,000 or more meters provide 20% of its electricity from renewable sources by 2020 (Colorado General Assembly 2013). Municipal utilities serving more than 40,000 customers and cooperative utilities that serve fewer than 100,000 meters are required to provide 10% of their electricity from renewable sources by 2020 (DSIRE 2015b). Further amendments to the legislation have added and amended credit multipliers for electricity generated at community-based projects owned by the residents of a community and for solar electric generation located in the territory of a cooperative or municipal utility, among others (DSIRE 2015b). (See Table 13 for an overview of Colorado's RPS.)

Table 13: Relevant Aspects of Colorado's RPS Legislation

First RPS Legislation	Colorado Revised Statutes 40-2-124 Adopted through a ballot initiative
Year Adopted	2004 (has been amended)
Percent Required	Investor-owned utilities: 30% Electric cooperatives serving 100,000 or more meters: 20% Electric cooperatives serving fewer than 100,000 meters: 10% Municipal utilities serving more than 40,000 customers: 10%
Year Required By	2020
Eligible Technologies	Geothermal Electric, Solar Thermal Electric, Solar Photovoltaics, Wind (All), Biomass, Hydroelectric, Landfill Gas, Wind (Small), Anaerobic Digestion, Fuel Cells using Renewable Fuels Recycled Energy, Coal Mine Methane (if the PUC determines it is a greenhouse gas neutral technology), Pyrolysis of Municipal Solid Waste (if the Commission determines it is a greenhouse gas neutral technology)

Source: DSIRE 2015b

In addition to these amendments, Governor Hickenlooper signed two Executive Orders in 2013 creating an Advisory Committee to examine the effectiveness of increases made to the RPS (Colorado Office of the Governor 2013). In 2011, Energy and Environment Legal Institute sued the Colorado Public Utilities Commission, questioning the constitutionally of the RPS (Troutman and Sanders 2015). In 2015, the U.S. Court of Appeals for the Tenth Circuit upheld the RPS (U.S. Court of Appeals Tenth Circuit 2015).

In order to understand why Colorado adopted its RPS, the innovation factors at the time of its adoption must also be explored (see Table 14). In 2004, Colorado was the first state to adopt a RPS through a ballot initiative. At the time, Republicans controlled both the Senate and the House of Representatives (Ballotpedia 2017d). Environmental interest groups were strong, with 143 environmental, conservation, and wildlife organizations present in the state, approximately 2.62 per 100,000 people (U.S. Census Bureau/American FactFinder 2017). Additionally, in the 2000 presidential election, 5.25% of voters voted for the Green Party candidate Ralph Nader, the highest in the sample (U.S. Election Atlas 2016). The interest groups that would be expected to oppose the RPS, fossil fuel producers, were strong as well with significant amounts of coal and natural gas being produced in Colorado (U.S. Energy Information Association 2017c; U.S. Energy Information Association 2017d). This suggests that there would be meaningful opposition to the RPS in the form of both people and money. With only two investor owned utilities, it does not appear that this group had substantial influence. Considering the problem severity or need for a RPS, Colorado experienced only 59 unhealthy air quality incidents in 2004, which is the lowest of the sample states (U.S. Environmental Protection Agency 2017b). Additionally, a RPS is compatible with the renewable potential in Colorado, as there is considerable opportunity to produce electricity using both solar and wind resources. Its solar potential is nearly four times that of the next largest state, Michigan (National Renewable Energy Laboratory 2012).

Table 14: Colorado Innovation Factors in 2004

State's Political Climate	*Senate Partisanship*	Republican
	House Partisanship	Republican
Strength of Relevant Interest Groups	*Number of Environment, Conservation, and Wildlife Organizations*	143
	Per 100,000 people	2.62
	Percent of Green Party Voters in 2000 Presidential Election	5.25%
	Natural Gas Production (million cubic feet)	1,043,414
	Coal Production (short tons)	39,870,097
	Number of Investor Owned Utilities	2
Problem Severity or Need	*Total Number of Air Quality Index Unhealthy Days*	59
Policy's Compatibility with State's Current Practices	*Solar Potential (GWh)*	19,452,241
	Wind Potential (GWh)	1,096,036
	Biopower Potential (GWh)	4,138
	Geothermal Potential (GWh)	1,260,612
	Hydroelectric Potential (GWh)	7,789
	Total Renewable Energy Potential (GWh)	21,820,815

Source: Ballotpedia 2017f; U.S. Census Bureau/American FactFinder 2017; U.S. Election Atlas 2016; U.S. Energy Information Association 2017c; U.S. Energy Information Association 2017d; U.S. Environmental Protection Agency 2017b; National Renewable Energy Laboratory 2012

Colorado's adoption of the RPS differs from the first three states in the sample in that it was adopted through a ballot initiative. This, coupled with the fact that there were strong environmental interest groups and fossil fuel interest groups present in the state at the time, suggests that the adoption of a RPS was controversial. With the Legislature being controlled by Republicans, finding support for the passage of a bill may have been difficult. Describing the "long, hard road for a renewable energy standard in Colorado," Broehl (2004) explains how proposed RPS legislation has been rejected by the Legislature four times before appearing on the ballot. The political climate was not conducive to the passage of a RPS, especially considering the strong fossil fuel and electric utility lobbyists who donated almost as much money in opposition to the bill as did the supporters. Despite strong resistance, the strength and persistence of the environmental interest groups allowed for the adoption of the policy (Broehl 2004). Although the political climate in the Legislature was more conservative, the environmentalists were able to circumvent this by having the RPS put on the ballot. The idea that the adoption of the RPS may have been controversial is also evident in the small margin by which it passed, receiving only 53.61% of the vote. Additionally, in 2011, Energy and Environment Legal Institute sued the Colorado Public Utilities Commission, questioning the constitutionally of the RPS (Troutman and Sanders 2015). This again suggests significant opposition to the RPS within Colorado.

While the strength of relevant interest groups and the political climate appear to be the most important factors influencing the adoption of the RPS, the strength of relevant interest groups is also evident in the current structure of the legislation. A 2013 amendment to the RPS allowed for the inclusion of coalmine methane as a renewable resource, suggesting that the coalmining lobby exercised its strength in its passage. Although sources of energy are not included as an internal factor measure, the amendment may also have been influenced by the fact the one of Colorado's main sources of energy is coal. As such, it makes sense that there would be support for the inclusion of coal in the RPS even though coal is not considered a renewable resource. Aside from adding coal to the list of acceptable renewable resources, additional amendments to the RPS have increased the renewable energy required, strengthening the RPS. While Colorado differs from Connecticut and New Jersey in that its RPS was adopted through a ballot initiative, its path to becoming the strongest RPS in its EPA region is similar. What began as a weaker standard has been strengthened through a series of amendments, highlighting the fact that one way to achieve a strong standard is through adopting and then amending a weaker one.

4.3.5 Washington

Washington was the second state in the U.S. to adopt a RPS through a ballot initiative on November 7, 2006. Initiative 937, the Clean Energy Initiative, was adopted into the Revised Code of Washington as Chapter 19.285 upon receiving 61.7% of the vote in favor. On the ballot, the Initiative was accompanied by a fiscal impact statement stating that it would cost the state $2.34 million in administrative costs over 14 years. A number of state senators supported the ballot initiative, as did organizations such as the American Lung Association and the American Cancer Society. There were numerous opponents including small cooperative electric providers, Public Utility Districts, and Chambers of Commerce. Washington for Clean Energy donated $1,674,310 in favor of the legislation, while No On I-937 donated $592,190 against (Ballotpedia 2013).

The legislation begins by explaining the desire to promote energy independence for the state, stabilize electricity prices, provide economic benefits for farmers, create opportunities for training and employment, and protect clean air and water. The legislation also hopes to position Washington as a national leader in clean energy. It requires that utilities serving more than 25,000 customers obtain 15% of their electricity from new renewable sources by 2020. The first target was set at 3% renewable by 2012. The legislation also requires these utilities to undertake all cost-effective energy conservation which is defined as increases in the efficiency of energy use, production, or distribution (Washington State Legislature 2006). In order to be eligible for producing renewable energy credits (RECs), the renewable energy facilities must be located in the Pacific Northwest or the electricity must be delivered into Washington on a real time basis. The RPS includes credit multipliers for distributed generation and facilities whose developer used an apprenticeship program during construction (DSIRE 2015c). The legislation is implemented and enforced by the Utilities and Transportation Commission which has filed rules regarding the RPS in the Washington State Code. The legislation has not been amended. (See Table 15 for an overview of Washington's RPS.)

Table 15: Relevant Aspects of Washington's RPS Legislation

First RPS Legislation	Revised Code of Washington 19.285 Adopted through a ballot initiative
Year Adopted	2006
Percent Required	15%
Year Required By	2020
Eligible Technologies	Geothermal Electric, Solar Thermal Electric, Solar Photovoltaics, Wind (All), Biomass, Hydroelectric, Landfill Gas, Tidal, Wave, Ocean Thermal, Wind (Small), Anaerobic Digestion

Source: DSIRE 2015c

In order to understand why Washington adopted its RPS, the innovation factors at the time of its adoption must also be explored (see Table 16). In 2006, Washington was the second state to adopt a RPS through a ballot initiative. At the time, Democrats controlled both the Senate and the House of Representatives, resulting in a liberal political climate (Ballotpedia 2017e). Environmental interest groups were the strongest of the sample, with 206 environmental, conservation, and wildlife organizations present in the state, approximately 2.88 per 100,000 people (U.S. Census Bureau/American FactFinder 2017). Additionally, in the 2000 presidential election, 4.14% of voters voted for the Green Party candidate Ralph Nader (U.S. Election Atlas 2016). The interest groups that would be expected to oppose the RPS, fossil fuel producers, were present as well. Although natural gas was not produced in the state, Washington did produce coal (U.S. Energy Information Association 2017c; U.S. Energy Information Association 2017d). Compared to the significantly larger coal production in Colorado, it can be assumed that the fossil fuel interest groups in Washington were not nearly as powerful. With three investor owned utilities, it does not appear that this group had substantial influence either. Considering the problem severity or need for a RPS, Washington experienced 124 unhealthy air quality incidents in 2006 (U.S. Environmental Protection Agency 2017b). While this is about average for the sample states, for a state that is as environmentally focused as is Washington, air pollution may have been an issue of concern. A RPS is compatible with the renewable potential in Washington, as there is considerable opportunity to produce electricity using solar, wind, and hydroelectric resources (National Renewable Energy Laboratory 2012).

Table 16: Washington Innovation Factors in 2006

State's Political Climate	*Senate Partisanship*	Democratic
	House Partisanship	Democratic
Strength of Relevant Interest Groups	*Number of Environment, Conservation, and Wildlife Organizations*	206
	Per 100,000 people	2.88
	Percent of Green Party Voters in 2000 Presidential Election	4.14%
	Natural Gas Production (million cubic feet)	0
	Coal Production (short tons)	2,579,549
	Number of Investor Owned Utilities	3
Problem Severity or Need	*Total Number of Air Quality Index Unhealthy Days*	124
Policy's Compatibility with State's Current Practices	*Solar Potential (GWh)*	1,947,153
	Wind Potential (GWh)	535,275
	Biopower Potential (GWh)	13,826
	Geothermal Potential (GWh)	565,571
	Hydroelectric Potential (GWh)	27,249
	Total Renewable Energy Potential (GWh)	3,089,074

Source: Ballotpedia 2017f; U.S. Census Bureau/American FactFinder 2017; U.S. Election Atlas 2016; U.S. Energy Information Association 2017c; U.S. Energy Information Association 2017d; U.S. Environmental Protection Agency 2017b; National Renewable Energy Laboratory 2012

Although Washington is similar to Colorado in that it adopted its RPS through a ballot initiative, there was more support and consensus behind Washington's RPS. With a liberal political climate and strong environmental interest groups, the initiative had considerable support from legislatures, interest groups, and voters. A number of state Senators publicly supported the initiative, as did a number of environmental and public health organizations. These groups outweighed the opponents of the initiative, donating significantly more money in favor of the legislation. Passing with 61.7% of the vote, it is clear that the support and consensus behind Washington's RPS was stronger than was that of Colorado's (Ballotpedia 2013).

While the strength of interest groups and the liberal political climate were important to the adoption of the RPS, there was also a need for the policy due to the air pollution in the state. As such, one of the stated goals of the initiative was to protect clean air. Highlighting the impact of the desire to control air pollution on the adoption of the RPS is the fact that two of the largest supporters of the ballot initiative were the American Lung Association and the American Cancer Society. These public health organizations' support suggests that they believed reducing the amount of fossil fuel use in Washington would positively impact health through the reduction of air pollution which they saw as a problem in need of mitigation. Also important to the adoption of the RPS is that it was compatible with the state practices in Washington at the time. There was significant renewable energy potential from solar and wind, and the main source of electricity in the state at the time was hydroelectric. The RPS was written to only include new hydroelectric electricity, but its current success in the state provided a strong knowledge base from which to begin.

Additionally, similar to Michigan, the goals of the legislation focus on the potential economic benefits of the RPS. These include providing economic benefits for farmers and creating opportunities for training and employment. While the poverty rate in Washington at the time was not high relative to the other states, the authors of the legislation saw the RPS as a way to stimulate the economy. To further incentivize job creation, the RPS offers credit multipliers to facilities that were constructed using apprenticeship programs. As such, it appears that there was extensive support for the RPS beginning with the strong environmental interest groups and the legislature, but also from groups who would benefit economically.

Chapter 5: Patterns among State Stories: Cross-Case Findings

The cross-state analysis seeks to answer the third and fourth questions of this thesis. These are: "What commonalities and differences exist across the states among these factors?" and "How do these factors contribute to the structural development and different characteristics of the RPS?" These factors include both the innovation factors identified in the RPS diffusion literature and those identified during the background information data collection process. The first part of the analysis focuses only on the innovation factors identified in the RPS diffusion literature, seeking to understand which combinations led to the adoption of a strong RPS. This is similar to the analysis often carried out by scholars (see Carley and Miller 2012; Matisoff 2008) seeking to understand how internal factors influence the adoption of RPS across the country, using regression analysis that allows for broad and generalizable conclusions. Because this paper only examines five states, considering data qualitatively, the conclusions are not generalizable in the same way.

The second component of this analysis includes the additional background factors, as well as information gathered on the adoption and structure of each state's RPS. Because the purpose of this paper is to look beyond the traditional analysis method used in papers on RPS that do not consider the differences between the actual policies that are adopted and the processes that led up to the policy adoption (Carley and Miller 2012; Matisoff 2008), this more extensive and comprehensive analysis will be the focus of the cross-state analysis.

5.1 Innovation Factor Analysis

A cross-state comparison of the innovation factors begins to highlight which combinations of factors led states to adopt strong RPS. The data are displayed in Table 17 both in words and with positive and negative signs denoting either the presence of or lack of presence of each factor. Looking at the factors individually, two of the states have a liberal political climate, two have a conservative political climate, and one is split (Senate controlled by Republicans and House controlled by Democrats). Three states have strong favorable interest groups while two have strong opposition interest groups. Air pollution is a problem in three of the states, and all five have renewable energy potential. Although the RPS diffusion literature "predicts" that a liberal political climate, strong favorable interest groups, the need for the policy (in this case, air pollution), and compatibility with the state (in this case, renewable energy potential), will lead to the adoption of a strong RPS, the relationship is not that simple.

Table 17: Diffusion of Innovation Factor Cross-Case Analysis Matrix

	Liberal Political Climate	Strong Favorable Interest Groups	Strong Opposition Interest Groups	Air Pollution (Problem Severity)	Renewable Potential (Compatibility)
Connecticut	Liberal +	Environmental +	None -	Problematic +	Low (solar, wind, geothermal) +
New Jersey	Conservative -	Environmental (very limited) -	Investor owned utilities (very limited) -	Severe +	Medium (solar, wind) +
Michigan	Split **Neutral**	Environmental (very limited) -	Investor owned utilities, fossil fuels (natural gas -- limited) +	Problematic but not severe -	High (solar, wind, geothermal) +
Colorado	Conservative -	Environmental (very strong) +	Fossil fuel (coal and natural gas) +	Not an issue -	Very high (solar, wind, geothermal) +
Washington	Liberal +	Environmental (very strong) +	Fossil fuel (coal -- very limited) -	Viewed as severe +	High (solar, wind, geothermal) +

Comparing the factors between the states, Connecticut and Washington have the same result for each (their positive and negative signs match up for each factor in Table 17). Neither has strong opposition interest groups but they do have remaining factors (liberal political climate, strong favorable interest groups, an air pollution problem, and renewable energy potential). These are the factors that the RPS diffusion literature predicts would lead to a strong RPS. As such, two of the five states match the predictions of the literature while three do not.

Although the remaining three states do not exactly match the predictions, they do exhibit patterns that are informative. *The fact that all five states have renewable energy potential suggests that this may be a necessary component in order for a state to adopt a strong RPS*. The presence of strong environmental interest groups appears to be important, but a state may be able to adopt a strong RPS without them if other factors are present. In the case of New Jersey, the severe problem of air pollution may have outweighed the lack of supporting interest groups. A liberal political climate does not appear to be necessary either. Again, in New Jersey, it appears that the air pollution problem triumphed over the more conservative legislature. In Colorado, the strong environmental interest groups may have worked against the conservative political climate and strong opposition interest groups to adopt a strong RPS. As such, there is not one simple explanation for how these factors combine to lead to a strong RPS. Instead, there are a number of ways to combine the factors, each way logically resulting in a strong RPS.

However, this is not the case in one of the sample states. These data do not offer a sound explanation as to why Michigan was able to overcome a split political climate in the Legislature, the absence of environmental interest groups, and the presence of strong opposition interest groups to adopt a strong RPS. Despite this, as described earlier, there is a plausible explanation for why Michigan adopted a strong RPS, but it includes factors outside of the innovation ones chosen here. Most importantly, it is rooted in the fact that Michigan was able to tailor its RPS to meet its specific needs. As such, a surface level analysis like the one conducted by RPS diffusion scholars (Carley and Miller 2012; Matisoff 2008) may overlook important details when attempting to understand policy development. While their analysis provides both generalizable conclusions and a solid base from which to begin when studying RPS diffusion, there is much to be gained from a more in-depth cross-state analysis as well.

5.2 Analysis with Background Information and Energy and Environmental Data

Table 18 displays a combination of the innovation factors explored above with the relevant aspects of the background information and energy and environmental data. Most importantly, the table also includes data on both the adoption process of the RPS and the structure of the RPS for each state. This additional information clarifies the patterns that emerge among the states by explaining why states in similar circumstances adopted specific types of strong RPS. One characteristic of interest is the focus of the legislation. In the states that adopted their RPS early, Connecticut and New Jersey, the focus of the legislation was not renewable energy but rather electricity restructuring. The first renewable targets were set very low and were subsequently increased through numerous amendments. While Connecticut's RPS was supported by a liberal political climate and strong environmental interest groups, New Jersey's appears to have been adopted as a result of the severe air pollution in the state. The very high population density may have increased the salience of the air pollution issue by concentrating a large number of people in polluted areas.

Table 18: Combination of All Internal Factors (Background Information, Energy and Environmental Data, Innovation Factors) and RPS Adoption Process and Structure Information

	Political Climate	Strong Favorable Interest Groups	Strong Opposition Interest Groups	Air Pollution	Renewable Potential	Density	Poverty Status	State's Electricity Sources	Focus of Legislation	Method of Adoption	Strengthened Through Amendments	RPS Structure
CT	Liberal	Env	None	Problematic but not severe	Low	High	Average	Natural gas; nuclear	Electricity restructuring	Legislation	Yes -- multiple	Solar incentives
NJ	Conservative	Env (very limited)	IOUs (very limited)	Severe	Medium	Very high	Average	Natural gas; nuclear	Electricity restructuring	Legislation	Yes -- multiple	Solar and wind incentives
MI	Split	Env (limited)	IOUs, FF (natural gas -- limited)	Problematic but not severe	High	Low	High	Coal; natural gas	Renewable energy	Legislation	No	Economic stimulus and solar incentives, tailored towards investor owned utilities and coal
CO	Conservative	Env (very strong)	FF (coal and natural gas)	Not an issue	Very high	Low	Average	Coal; natural gas	Renewable energy	Ballot initiative	Yes -- multiple	Solar incentives, tailored towards coal
WA	Liberal	Env (very strong)	FF (coal -- very limited)	Viewed as severe	High	Low	Average	Hydro; natural gas	Renewable energy	Ballot initiative	No	Economic stimulus incentives

Abbreviations and Acronyms: ENV = Environmental; FF = Fossil Fuel; IOUs = Investor Owned Utilities; Hydro = Hydroelectric

Colorado and Washington share data points in common. Both adopted their RPS through ballot initiatives, have high renewable energy potential, and very strong environmental interest groups. These factors contributed to the states adopting strong RPS. However, there are a number of differences between these states that highlight the importance of being able to tailor a RPS to meet the needs of a state. The political climate in Colorado was conservative while in Washington it was liberal. Additionally, while both states had very strong environmental interest groups, there were also strong fossil fuel (coal) interest groups in Colorado opposing the RPS. As such, in Colorado it was necessary to adopt the RPS through a hard-fought ballot initiative, while in Washington the opposition was much weaker. This explains why in Colorado, the RPS began with a smaller renewable requirement and has since been amended a number of times to become strong. The combination of a conservative political climate and strong opposition interest groups would have not allowed for a more stringent policy. Additionally, as the policy was amended to become stronger, amendments also allowed for the inclusion of coalmine methane in the RPS, garnering the support of the opposition interest groups.

Another characteristic of interest that emerges through this more detailed cross-state analysis is the mechanism through which the state arrived at its strong RPS. Three of the five sample states began by adopting a weaker RPS and strengthened it through amendments. Two of the three states, New Jersey and Colorado, had a conservative political climate at the time of adoption. This suggests that one way to overcome an unsupportive political climate to achieve a strong RPS is through an incremental approach, the first step of which is simply finding a way to have the policy be adopted into legislation. Once adopted, it can be strengthened incrementally through amendments as the political climate shifts, interest group strength changes, or the need for a stronger policy presents itself.

Looking specifically at the states' sources of electricity, another pattern emerges. Both states that depend on coal as a major source of electricity, Michigan and Colorado, also have tailored their RPS to include cleaner forms of coal. This is not the case in states that do not depend on coal as a main source of electricity (Connecticut and New Jersey depend on natural gas and nuclear and Washington depends on hydroelectric and natural gas), suggesting that the coal industry in Michigan and Colorado may have exerted pressure in the RPS development process. In Michigan, with its higher poverty level, this pressure may have come from the desire to retain as may jobs as possible. As such, the RPS needed to find a way to bolster an industry that it otherwise may have harmed. In Colorado, this pressure may have come from the strong fossil fuel interest groups in the state. Because support for the RPS in Colorado was only strong enough to accept the ballot initiative with 53% of the vote, appeasing opposition interest groups may have been the only way for the state to achieve a strong RPS. While there were a number of combinations of factors that led to strong RPS depending on the internal circumstances of each state, the most important point is that without the opportunity to tailor the policy to meet the needs of the state, it is likely that states with unfavorable internal factors may not have chosen a strong RPS.

The fact that the innovation factors alone were not able to explain Michigan's strong RPS highlights the importance of including additional background and energy factors, as well as elements of the adoption process and structure of the RPS, in the analysis. As explained in the single state analysis section, Michigan had a significant percentage of its population living below the poverty line at the time of its RPS adoption. As such, it appears to have tailored its RPS to work as an economic development tool. Additionally, to overcome the strong investor owned utilities interest group opposing the RPS, Michigan designed its RPS in such a way that reduced the burden on individual investor owned utilities by setting each of their requirements based off of the amount of renewable energy they already provided. If the RPS did not include this provision, it is likely that it would not have received the support of the utilities. Also important is that coal is one of the main sources of electricity in Michigan. By including coal facilities that capture carbon emissions in the RPS, the authors of the legislation were able to gain the support of an industry that otherwise would have been threatened by the policy. Again this highlights the importance of being able to tailor a policy to meet the specific needs of a state.

Chapter 6: Implications and Limitations

Understanding which combinations of factors within a state drive it to adopt a strong RPS provides the opportunity to advance renewable energy policy throughout the nation. Because only 37 states currently have any form of RPS, significant progress could be made towards increasing the amount of renewable energy used throughout the country and reducing the air pollution and climate change effects of fossil use by finding ways to encourage the remaining 13 states to adopt RPS. Understanding that states that depend on coal are more likely to adopt a strong RPS if it includes provisions for coal could aid in this process, as many of the states without a RPS currently are located in the Rust Belt. The knowledge that one option for achieving a strong RPS is through first adopting a weak RPS and then incrementally amending it offers opportunities for states with a conservative political climate or strong opposition interest groups but also with either strong environmental interest groups or a dire need for the policy because of air pollution. These states could take advantage of a small opportunity to put a weak RPS in place and could then work to strength it as circumstances allow.

Additionally, while 37 states have some form of a RPS, a number of these are weak, only requiring a small amount of renewable energy. Strengthening these RPS would provide the same climate change and air pollution benefits, and as such, a solid understanding of how to strengthen policies is important. As exhibited in Colorado, amendments to a controversial policy should work to appease the opposition groups. Although the inclusion of cleaner coal in a RPS may not be the most environmentally friendly option, this provision allowed the legislation to simultaneously increase the renewable energy requirement.

On a broader level, it is clear that each one of the innovation factors identified through the RPS diffusion research contributes, in at least some cases, to states adopting a strong RPS.

What this paper has found is that these factors can also work together and against each other to make it more likely for a state to adopt a strong policy. While diffusion research typically uses regressions to identify whether factors either make it more or less likely for a state to adopt a strong RPS, this paper has found that under different internal circumstances, it is possible for a factor to have varying degrees of influence. Understanding how a factor's influence changes based on other factors is integral to understanding how a strong RPS can be achieved across as many states as possible.

6.1 Areas for Further Research

Stepping back from the policy development implications, this paper has identified two important areas that could be further explored within RPS diffusion research. First, based on the work of the scholars mentioned in the methodology section, there is little agreement on how to measure the strength of RPS. Each scholar used a different method and found results that do not agree with one another. While this paper chose to call most heavily on the ranking methodology employed by Carley and Miller (2012), agreement on a singular method within the RPS diffusion research community would be beneficial. Because understanding how internal factors impact the type of RPS adopted depends on how the states' RPS are ranked, different ranking methodologies result in a wide-range of conclusions. As such, beginning with a sound ranking methodology would lead to more robust results and a stronger understanding of how internal factors influence RPS adoption.

An additional area within RPS diffusion research that would benefit from further exploration is in-depth, cross-case analysis. While this paper has examined in greater detail the policy adoption process and RPS structure, most RPS research is conducted at a national level. While the results of these studies are generalizable, they may overlook important details that have been identified in this paper because they do not delve deeply into the specific legislation. Focused research provides the opportunity to understand the particular factors within a state on a more nuanced level, leading to conclusions that can be more prescriptive in terms of advancing strong RPS in the future.

6.2 Limitations

There are several noteworthy limitations to this thesis. One is the fact that it only examines the RPS of five states. Although the chosen states are geographically distributed throughout the country, there are regions that are unrepresented. For example, because there are no states in the Southeast with a RPS, there was no opportunity to represent this region. As such, the conclusions from this paper may not be as applicable to the Southeast as they are to better represented regions. It is also possible that the state chosen in a region may not represent all of the states in that region. As such, the same factors in different states or regions may produce different results. Additionally, because this thesis only looks at states with strong RPS, its conclusions cannot be generalized to states with weaker RPS. It is possible that the internal factors interact differently in states with weak RPS.

Another limitation of this paper is the indicators that were chosen for each of the innovation factors. While most were identified in prior research and appear to be sound measures, the compatibility of the policy with the state's current practices appears to have left out an important measure – current fuel sources. While the renewable energy potential of a state measures how compatible the RPS is in terms of available renewable resources, it does not account for the energy sources that are already in use. This oversight is clear with both Michigan and Colorado, both of which depend on coal as a main source of energy and both of which allow for coal to be included in their RPS. Although this link is clear when examining the background environmental data that were gathered for the analysis, the inclusion of the main sources of electricity would strengthen both the singular state and cross-case analysis by identifying a clear link between the current practices in the state and the structure of the RPS.

Another potential limitation is the indicator chosen for political climate. While this thesis assumes that a legislature where both the Senate and House of Representatives is controlled by a majority of Republicans is conservative and therefore would not support renewable energy policies, this assumption may not be true. It is possible that Republicans could support renewable energy generation because they see it as a way to reduce electricity prices and spur economic development. As such, a stronger measure of state political climate may have involved ideology instead of party control.

The small number of innovation factors (four) examined is another limitation of this thesis. This is highlighted by the RPS diffusion scholars (Carley and Miller 2012; Matisoff 2008) use of a larger number of factors in their analysis. Time and space constraints played a role in the decision to choose only four innovation factors, but this thesis' findings suggest that important factors were not included. Economic status of the state should have been included as an innovation factor as opposed to only appearing in the background information. Considering the importance of poverty in Michigan on the adoption and structure of its RPS, it is clear that economic factors may play an integral role in RPS diffusion. While the percentage of the population living below the poverty line offers one method to measure the economic situation within a state, a combination of poverty and unemployment would be a more robust measure.

Chapter 7: Conclusions

Based on a cross-case analysis of the RPS adoption in Connecticut, New Jersey, Michigan, Colorado, and Washington, this paper finds that a state's political climate, the strength of its relevant interest groups, the presence of a problem severe enough to require a policy solution, and the compatibility of that policy with the current practices of the state all increase the likelihood that a state will adopt a strong RPS. Even more important is that there are specific combinations of these internal factors that exert a stronger influence than others. While traditional RPS diffusion research uses the internal determinants model to explain what factors encourage the adoption of RPS across the country, this paper differs in that it focuses specifically on only five states. As such, its conclusions are more detailed, looking deeply into the policy adoption process and the resulting RPS structure.

Highlighting a point made by Rogers (2003) in his early diffusion research, the adaptability of a policy is one of the most important diffusion-causing factors. By promoting the practice of tailoring states' RPS to meet their specific needs, it is more likely that states will be willing to adopt the policies. Because the ultimate goal of RPS is to increase the amount of renewable energy supplied to consumers, therefore reducing the amount of fossil fuel use, greenhouse gas emissions, and air pollution, the importance of adaptability cannot be overstated. This paper found that each state, in one way or another, tailored its RPS to meet its needs while still adopting a strong policy. Therefore, while the specific combinations of internal factors that result in strong RPS are important, an understanding of each state's circumstances is necessary in order to develop sound policy.

Bibliography

American Presidency Project. "Election of 2000." Accessed February 3, 2017. http://www.presidency.ucsb.edu/showelection.php?year=2000.

Ballotpedia. 2013. "Washing Energy Conservation, Initiative 937 (2006)." Accessed January 5, 2017. https://ballotpedia.org/Washington_Energy_Conservation,_Initiative_937_(2006).

Ballotpedia. 2014. "Colorado Renewable Energy Requirement, Initiative 37 (2004)." Accessed January 5, 2017. https://ballotpedia.org/Colorado_Renewable_Energy_Requirement,_ Initiative_37_(2004).

Ballotpedia. 2017a. "Connecticut General Assembly." Accessed February 3, 2017. https://ballotpedia.org/Connecticut_General_Assembly.

Ballotpedia. 2017b. "New Jersey State Legislature." Accessed February 3, 2017. https://ballotpedia.org/New_Jersey_State_Legislature.

Ballotpedia. 2017c. "Michigan State Legislature." Accessed February 3, 2017. https://ballotpedia.org/Michigan_State_Legislature.

Ballotpedia. 2017d. "Colorado General Assembly." Accessed February 3, 2017. https://ballotpedia.org/Colorado_General_Assembly.

Ballotpedia. 2017e. "Washington State Legislature." Accessed February 3, 2017. https://ballotpedia.org/Washington_State_Legislature.

Ballotpedia. 2017f. "State Legislatures." Accessed February 3, 2017. https://ballotpedia.org/State_Legislatures.

Beck, Fredric and Eric Martinot. "Renewable Energy Policies and Barriers." 2004. *Encyclopedia of Energy*: 365-383.

Berry, Frances and William Berry. 2007. "Innovation and Diffusion Models in Policy Research." *Theories of the Policy Process*. 2nd edition. Boulder: Westview Press.

Berry, Michael J., Frank N. Laird, and Christoph H. Stefes. 2015. "Driving energy: The enactment and ambitiousness of state renewable energy policy." *Journal of Public Policy 35* (2): 297-328.

Berry, Trent, and Mark Jaccard. 2001. "The renewable portfolio standard: Design considerations and an implementation survey." *Energy Policy* 29 (4): 263-77.

Broehl, Jesse. 2004. "Colorado Voters Pass Renewable Energy Standard." *Renewable Energy World."* November 3. http://www.renewableenergyworld.com/articles/2004/11/colorado-voters-pass-renewable-energy-standard-17736.html.

Carley, Sanya. 2009. "State renewable energy electricity policies: An empirical evaluation of effectiveness." *Energy Policy* 37 (8): 3071-3081.

Carley, Sanya, and Tyler R. Browne. 2013. "Innovative US energy policy: A review of states' policy experiences." *Wiley Interdisciplinary Reviews-Energy and Environment* 2 (5): 488-506.

Carley, Sanya, and Chris J. Miller. 2012. "Regulatory stringency and policy drivers: A reassessment of renewable portfolio standards." *Policy Studies Journal* 40 (4): 730-56.

Colorado Energy Office. 2015. "HB 10-1001 Colorado's new 30% Renewable Portfolio Standard." Accessed January 5, 2017. https://energy.gov/sites/prod/files/2015/07/f25/tom%20Plant%20Presentation.pdf.

Colorado Energy Office. 2017. "Renewable Energy Standard." Accessed January 5, 2017. https://www.colorado.gov/pacific/energyoffice/renewable-energy-standard.

Colorado General Assembly. 2013. Senate Bill 13-252 An Act Concerning Measures to Increase Colorado's Renewable Energy Standard. https://statepowerproject.files.wordpress.com/2014/03/sb13252_enr.pdf.

Colorado Office of the Governor. 2013. Executive Order B 2013-006. https://www.colorado.gov/governor/sites/default/files/executive_orders/b_2013-006.pdf.

Colorado Revised Statutes. 2013. Title 40, Article 2: Renewable Energy Standard. http://tornado.state.co.us/gov_dir/leg_dir/olls/2013TitlePrintouts/CRS%20Title%2040%20(2013).pdf.

Connecticut Department of Energy and Environmental Protection. 2013. "Restructuring Connecticut's Renewable Portfolio Standard." http://www.ct.gov/deep/lib/deep/energy/rps/rpsexecsummary.pdf.

Connecticut General Assembly. 1998. Public Act 98-28, An Act Concerning Electric Restructuring. https://www.cga.ct.gov/ps98/Act/pa/1998PA-00028-R00HB-05005-PA.htm.

Chandler, Jess. 2009. "Trendy Solutions: Why Do States Adopt Sustainable Energy Portfolio Standards?" *Energy Policy* 37 (8): 3274-81.

DSIRE. 2015a. "Renewable Portfolio Standard: Connecticut." Accessed January 1, 2017. http://programs.dsireusa.org/system/program/detail/195.

DSIRE. 2015b. "Renewable Energy Standard: Colorado." Accessed January 1, 2017. http://programs.dsireusa.org/system/program/detail/133.

DSIRE. 2015c. "Renewable Energy Standard: Washington." Accessed January 1, 2017. http://programs.dsireusa.org/system/program/detail/2350.

DSIRE. 2015d. "Program Type: Renewable Portfolio Standards." Accessed January 1, 2017. http://programs.dsireusa.org/system/program.

DSIRE. 2017a. "Renewable Portfolio Standard: New Jersey." Accessed January 1, 2017. http://programs.dsireusa.org/system/program/detail/564.

DSIRE. 2017b. "Renewable Energy Standard: Michigan." Accessed January 1, 2017. http://programs.dsireusa.org/system/program/detail/3094.

DSIRE. 2017c. "Find Policies and Incentives by State." Accessed March 5, 2017. http://www.dsireusa.org/.

Eisenhardt, Kathleen M. 1989. "Building theories from case study research." *The Academy of Management Review* 14 (4): 532-50.

Helwig, Laurence Douglas. 2014. "Examining the target levels of state renewable portfolio standards." PhD diss., University of Nevada.

Kahn, Matthew E. 2002. "Demographic change and the demand for environmental regulation." *Journal of Policy Analysis and Management* 21 (1): 45-62.

Kahn, Matthew E. 2007. "Do greens drive hummers or hybrids? environmental ideology as a determinant of consumer choice." *Journal of Environmental Economics and Management* 54 (2): 129-45.

Lesser, Jonathan A., and Xuejuan Su. 2008. "Design of an economically efficient feed-in tariff structure for renewable energy development." *Energy Policy* 36 (3): 981-90.

Martinot, Eric, Ryan Wiser, and Jan Hamrin. "Renewable Energy Policies and Markets in the United States." 2005. *Center For Resource Solutions*. http://www.martinot.info/Martinot_et_al_CRS.pdf.

Matisoff, Daniel C. 2008. "The Adoption of State Climate Change Policies and Renewable Portfolio Standards: Regional Diffusion or Internal Determinants?" *Review of Policy Research* 25 (6): 527-46.

Michigan State Legislature. 2008. Enrolled Senate Bill No. 213. 94th Legislature, Regular Session of 2008. http://www.michigan.gov/documents/mpsc/2007-SNB-0213_254495_7.pdf.

Miles, Matthew B., A. M. Huberman, and Johnny Saldaña. 2014. *Qualitative data analysis: A methods sourcebook*. Third ed. Thousand Oaks, Califorinia: SAGE Publications, Inc.

National Conference of State Legislatures. 2016. “State Renewable Portfolio Standards and Goals.” Accessed January 1, 2017. http://www.ncsl.org/research/energy/renewable-portfolio-standards.aspx.

National Renewable Energy Laboratory. 2012. “U.S. Renewable Energy Potentials: A GIS-Based Analysis.” Accessed December 15, 2017. http://www.nrel.gov/gis/re_potential.html.

New Jersey General Assembly. 1999. Chapter 23, Section 48:3 Electric Discount and Energy Competition Act. http://www.njcleanenergy.com/files/file/23_.pdf.

Park, Sunjoo. 2015. “State renewable energy governance: Policy instruments, markets, or citizens.” *Review of Policy Research* 32 (3): 273-96.

Public Utility Regulatory Policies Act. Public Law 95-617. U.S. Statutes at Large 92 (1978): 3117.

Rabe, Barry George. 2004. *Statehouse and greenhouse: The emerging politics of American climate change policy*. Washington, D.C: Brookings Institution Press.

Reisinger, William T. 2010. “Federal and state renewable portfolio standards: Conflict or harmony?” *The University of Toledo Law Review* 41 (4): 877-887.

Rogers, Everett M. 2003. *Diffusion of Innovations.* 5th Edition. New York: Free Press.

Sapat, Alka. 2004. “Devolution and Innovation: The Adoption of State Environmental Policy Innovations by Administrative Agencies.” *Public Management Review* 64 (2): 141-51.

Sawin, Janet L. 2004. “National Policy Instruments: Policy Lessons for the Advancement & Diffusion of Renewable Energy Technologies Around the World.” Bonn: International Conference for Renewable Energies.

Shipan, Charles R. and Craig Volden. 2012. “Policy Diffusion: Seven Lessons for Scholars and Practitioners.” *Public Administration Review* 72 (6): 788-96.

Starke, Peter. 2013. “Qualitative methods for the study of policy diffusion: Challenges and available solutions.” *Policy Studies Journal* 41 (4): 561-82.

The Pew Charitable Trusts. 2014 “Clean Economy Rising: Wind Energy Propels North Dakota Forward.” http://www.pewtrusts.org/~/media/assets/2014/10/clean_energy_north_dakota_web.pdf.

Troutman and Sanders. 2015. “Tenth Circuit Upholds Colorado’s Renewable Portfolio Standard.” July 20. http://www.troutmansandersenergyreport.com/2015/07/tenth-circuit-upholds-colorados-renewable-portfolio-standard/.

Union of Concerned Scientists. 2015. "Public Utility Regulatory Policy Act (PURPA)." Accessed October 20, 2017. http://www.ucsusa.org/clean_energy/smart-energy-solutions/strengthen-policy/public-utility-regulatory.html#.ViqVX53BzGc.

U.S. Census Bureau/American FactFinder. 2017. "Economy-Wide Key Statistics: 2002." *2002 Economic Census of the United States.* Accessed February 3, 2017. https://factfinder.census.gov.

U.S. Census Bureau. 2016. "Quick Facts." Accessed January 5, 2017. https://www.census.gov/quickfacts/table/PST045216/00.

U.S. Census Bureau. 2010. "Poverty: 2008 and 2009." *American Community Survey Briefs.* Accessed March 1, 2017. https://www.census.gov/prod/2010pubs/acsbr09-1.pdf.

U.S. Court of Appeals Tenth Circuit. 2015. No. 14-1216 Appeal from the U.S. District Court for the District of Colorado (D.C. No. 1:11-CV-00859-WJM-BNB). https://www.ca10.uscourts.gov/opinions/14/14-1216.pdf.

U.S. Election Atlas. 2016. "2000 Presidential General Election Results." Accessed February 3, 2017. http://uselectionatlas.org/RESULTS/national.php?year=2000.

U.S. Energy Information Association. 2017a. "U.S. States." Accessed January 8, 2017. http://www.eia.gov/state/rankings/?sid=US.

U.S. Energy Information Association. 2017b. "Total Carbon Dioxide Emissions." Accessed January 8, 2017. http://www.eia.gov/state/rankings/?sid=US#/series/226.

U.S. Energy Information Association. 2017c. "Natural Gas Gross Withdrawals and Production." Accessed February 3, 2017. http://www.eia.gov/dnav/ng/ng_prod_sum_a_EPG0_VGM_mmcf_a.htm.

U.S. Energy Information Association. 2017d. "Coal Data Browser." Accessed February 3, 2017. https://www.eia.gov/beta/coal/data/browser/.

U.S. Environmental Protection Agency. 2016. "About Air Data Reports." Accessed March 8, 2017. https://www.epa.gov/outdoor-air-quality-data/about-air-data-reports.

U.S. Environmental Protection Agency. 2017a. "Visiting a Regional Office." Accessed January 5, 2017. https://www.epa.gov/aboutepa/visiting-regional-office.

U.S. Environmental Protection Agency. 2017b. "Outdoor Air Quality Data." Accessed March 5, 2017. https://www.epa.gov/outdoor-air-quality-data/air-quality-index-report.

Washington State Legislature. 2006. Revised Code of Washington 19.285.030. http://app.leg.wa.gov/RCW/default.aspx?cite=19.285.030.

Yin, Haitao, and Nicholas Powers. 2010. “Do state renewable portfolio standards promote in-state renewable generation?” *Energy Policy* 38 (2): 1140-9.

Yin, Robert K. 1994. *Case study research: Design and methods*. 2nd ed. Vol. 5. Thousand Oaks: Sage Publications.