State and Federal Renewable Energy Policy: Understanding Influences and Impacts

By

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Abstract

Renewable energy has become a multi-billion dollar industry in the United States with the assistance of billions of dollars in state and federal financial incentives. As renewable energy continues to be discussed as the future of our electrical energy, this topic will become increasingly important in the years to come. To help this young industry, state governments have adopted several hundred policies that are designed to encourage the installation of renewable energy systems. With billions of dollars on the line, it is important to understand what influences the adoption of these policies. While examining the adoption of the twenty-two different types of renewable energy policies that states have adopted, I implement a strategy of analysis that is designed to address several methodological concerns that are typically associated with these types of studies. In the end, the statistical evidence supports my analytical innovations, and I provide a strong understanding of what influences a state to adopt these policies. While understanding what influences a state to adopt these policies is important to our understanding of state politics and policymaking in general, it is also essential to determine if these policies achieve their intended goals of encouraging the installation of renewable energy systems. Previous research suggests that using financial incentives to achieve a policy goal typically fails. Using an improved analytical approach, I examine the influence of these policies on the construction of wind turbines in each state. The results provide evidence that some of these policies provide a strong impact on the construction of wind turbines. Importantly, these results can inform policymakers as to which policies appear to be successful, and which may not be worth the loss of tax revenue.

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Chapter 1:
Renewable Energy Policy:
An Outline to a Dissertation

As the cost of fossil fuels continued to climb, policies that encouraged renewable energy became increasingly important to the public. Experimentation began at all levels of government to address these ever more worrisome problems. One such solution was renewable energy, which would simultaneously address both global warming and fossil fuel costs. Given a lack of federal direction regarding renewable energy policy, states have become more proactive in determining how to best use their natural energy resources (Brown, Brutoco, and Cusumano 2007).

One way states have addressed this is through creating an incentive structure to foster the still fledgling, yet potentially effective, renewable energy industry. The traditional way to do this has been to offer financial incentives to construct renewable energy production systems such as photovoltaic solar arrays or wind turbine units. In addition to financial incentives, states have adopted policies that offer rules and regulations that better facilitate the construction of these systems.

Surprisingly, despite the importance of addressing the escalating fossil fuel costs, there has been relatively little examination of renewable energy policymaking, which happens to be one of the few solutions to this problem that could have an obvious, long-term impact with relatively little impact on society. Those that have examined renewable energy have largely done so from a historical perspective (e.g. Laird 2001), an examination of public opinion (e.g. Firestone and Kempton 2007), or from an international perspective (e.g. Szarka 2004). With only two exceptions (Stoutenborough and Beverlin 2008; Wiener and Koontz 2010), there has been little examination of the policymaking process associated with the state adoption of the twenty-two different types of renewable energy policy.

This project seeks to offer a comprehensive examination of state renewable energy policy. To do so, it is divided into two sections. The first section examines the adoption of all twenty-two state renewable energy policies. This section will implement several innovative analytical procedures. It is divided into four chapters. The first, Chapter 2, examines the literature that is useful for understanding state renewable energy policy adoption. Chapter 3 establishes a universal analytical approach that will allow for comparisons across policies. Chapter 4 examines the adoption of state financial incentives, and Chapter 5 examines the adoption of state rules and regulations.

Section 2 attempts to determine if these policies have achieved their goals of promoting the construction of renewable systems. Meier (1994) argues that this is a critical part of the public policy process. Therefore, Chapter 6 evaluates the success or failures of these policies. Importantly, existing research suggests that attempts by government to achieve an environmental policy goal through financial incentives have failed (e.g. Caldwell 1970; Sagoff 1988). Clearly, renewable energy policies are attempting to achieve an environmental policy goal, usually through financial incentives, yet we find that the wind energy industry has been thriving in recent years. Have these policies succeeded when others have failed? To test this, I devise several methodological advancements that differentiate this project from those previous studies of policy impact, which allows for a proper examination of the true influence these policies have on the construction of wind turbines.

Finally, concluding remarks will be found in Chapter 7. In the end, I will have a good understanding of what influences a state to adopt renewable energy policies, and if these policies actually achieve their goals. I will also offer several analytical innovations that should improve comparative state policy adoption studies, as well as policy impact studies. Several interesting results will be identified, and future avenues of research will be suggested.

Section 1:
State Policy Adoption

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Chapter 2:
Renewable Energy Policy Adoption:
A Review of the Pertinent Literature

The focus of this section is to understand state renewable energy policy adoption. As laboratories of democracy, U.S. states have been very active in adopting policies regarding renewable energy. Generally, these policies fall into one of two categories – financial incentives or rules and regulations. Each category encompasses several different types of policies that each seek to encourage or facilitate renewable energy in a different manner.

Financial incentive policies are those that provide some sort of monetary assistance to encourage the installation of a renewable energy system. These include general tax incentives, state-backed loans and grants, and production incentives. Table 2.1 presents a summary of state adoption of financial incentive policies through July 2010. As Table 2.1 illustrates, states have experimented with several policies that provide financial incentives.

State rules and regulations represent policies that operate behind the scenes to encourage the development of renewable energy. Rules and regulations include policies that essentially require renewable energy installations, regulations that are designed to protect consumers, and those that regulate construction procedures. Table 2.2 presents a summary of state adoption of rules and regulations through July 2010. As Table 2.2 indicates, states have also been very active in creating rules and regulations for renewable energy systems.

Recognizing that states have adopted several hundred renewable energy policies since the mid-seventies, I seek to understand what influences a state to adopt one of these policies. This chapter proceeds in two parts. The first reviews previous research on energy and politics. The second identifies how policy adoption theory helps to explain state renewable energy policy adoption.

Table 2.1: State Adoption of Renewable Energy Financial Incentives through July 2010

State	Production Incentives	Personal Tax	Corporate Tax	Sales Tax	Property Tax	Production Rebates	Excise Tax	Grants	Loans	Bonds	Industry Support
Alabama								1	1		
Alaska								1	1		
Arizona		2	1	1	2						1
Arkansas											
California	1				1	6		1			
Colorado				2	2			1	1		
Connecticut				1	1	1		4	2		2
Delaware						1		2			
Florida			1	1	1	1		1			
Georgia		1	1								
Hawaii	1	1	1						1		1
Idaho		1		1	1				1	1	
Illinois				1	2	1		2	1	1	
Indiana					1			1			
Iowa		1	3	1	3		1	1	2		
Kansas					1				1		1
Kentucky		1	2	1				1	1		
Louisiana		1	1		1				2		
Maine	1			1		1		1			
Maryland		2	2	1	3	3		1	3		1
Massachusetts	1	1	1	1	1	2	2	3	1		3
Michigan					2			2			4
Minnesota	1			2	1	1		1	6		
Mississippi									1		
Missouri									1		
Montana		2	1		3				1		2
Nebraska		1	1	1					1		
Nevada	1			1	3	1			1		
New Hampshire					1	1			2		
New Jersey	2			1	1	2		1	1		1
New Mexico		4	3	4	1				1	1	1
New York		2	1	1	2	2		2	3		2
North Carolina	1	1	1		1			1	3		
North Dakota		1	1		2						
Ohio			1	1	1			4	2		1
Oklahoma			1						3		1
Oregon	1	1	1		1	4		2	2		1
Pennsylvania					1	1		7	5		3
Rhode Island	1	1	1	1	2			1	1		
South Carolina	1	1	2						1		
South Dakota					3						
Tennessee					1			1	1		1
Texas			1		1			2	2		1
Utah		1	1	1							1
Vermont	1	1	1	1	1	1		2	2		
Virginia					1	2					1
Washington	1			1							1
West Virginia		1	1		1						
Wisconsin				1	1	1		1			2
Wyoming				1		1					
Total	**14**	**28**	**32**	**29**	**50**	**33**	**3**	**48**	**58**	**3**	**32**

Table 2.2: State Adoption of Renewable Energy Rules and Regulation Policies through July 2010

State	Renewable Portfolio Standards	Green Power Purch.	Required Green Power	Public Benefits Fund	Constr. & Design	Access Laws	Interconnection	Net Metering	Extension Analysis	Contract License	Equip. Cert.
Alabama											
Alaska						1		1			
Arizona	1				3	1	1	1	1	1	1
Arkansas					1		1	1			
California	1			1	3	2	1	1		1	
Colorado	1		1		3	1	1	1	1		
Connecticut	1	1		1	2		1	1		1	
Delaware	1			1	1	1	1	1			
Florida					1	1	1	1		1	1
Georgia					1	1	1	1			
Hawaii	1				1	1	1	1		1	
Idaho						1					
Illinois	1	1		1	2		1	1			
Indiana		1			1	1	1	1			
Iowa	1		1			1	1	1			
Kansas	1					1	1	1			
Kentucky						1	1	2			
Louisiana							1	1			
Maine	1	1		1	1	2		1			
Maryland	1	1			1	1	1	1			
Massachusetts	1	1		2	3	1	1	1			
Michigan	1			1	2		1	1			
Minnesota	2			1	1	1	1	1			
Mississippi											
Missouri	1				1	1	1	1			
Montana	1		1	1		2	1	1			
Nebraska						1	1	1			
Nevada	1					1	1	1		1	
New Hampshire	1					1	1	1			
New Jersey	1			1	2	2	1	1			
New Mexico	1		1		1	1	1	1			
New York	1	1		1	2	1	1	1			
North Carolina	1				1	1	1	1			
North Dakota	1					1		1			
Ohio	1			1	1	1	1	1			
Oklahoma					1			1			
Oregon	1		1	1	3	2	1	1		1	1
Pennsylvania	1	1		1	1		1	1			
Rhode Island	1			1	1	1		1			
South Carolina					1		1				
South Dakota	1				1		1				
Tennessee						1					
Texas	1				1		1	1	1		
Utah	1					1	1	1		1	
Vermont	1			1		1	1	1			
Virginia	1		1		1	2	1	1			
Washington	1		1		1	1	1	1			
West Virginia	1							1			
Wisconsin	1	1		1	1	2	1	1			
Wyoming							1	1			
Total	**36**	**9**	**7**	**18**	**47**	**43**	**40**	**46**	**3**	**8**	**3**

Energy and Politics Literature

The examination of energy policies have traditionally focused on the activities of the national government. This is to be expected as Gormley (1986) recognizes that policy areas that are both complex and salient are typically the domain of the national government. Indeed, he specifically identifies nuclear licensing, electric utility regulation, gas utility regulation, and power plant siting as energy issues that the national government dominates (Gormley 1986, 600).

The majority of the relatively, recent examinations of energy and politics have tended to focus on nuclear energy, public opinion, and were conducted in the 1980s (e.g. Baumgartner 1989; Gamson 1989; Kasperson et al. 1980; Kitschelt 1986; Kluklinski, Metlay, and Kay 1982; Rothman and Lichter 1987; Thomas et al. 1980; Van der Pligt, Eiser, and Spears 1981). Perhaps the best known study of nuclear energy policymaking isn't even known for its emphasis on nuclear energy. Certainly, Baumgartner and Jones' (1991) examination of nuclear energy is one of the most cited studies of energy. However, this study isn't remembered for it analysis of nuclear energy policy, instead, it was influential for introducing the idea of punctuated equilibrium as a theory of policy adoption.

By the mid-1990s there were far fewer examinations of energy and politics, most of which were relegated to lesser known outlets (e.g. Koopmans and Duyvendak 1995; Miller 1995). This coincided with the release of books with dire titles like *The Demise of Nuclear Energy?* (Morone and Woodhouse 1989), and historical perspectives that essentially recognize that there is little more to be said about nuclear energy in America (e.g. Duffy 1997). With social scientific attention focusing on the more salient culture war issues of the mid 1990s and early 2000s (e.g. Allen 2005; Berry and Berry 1990; Haider-Markel 2001; Hays and Glick 1997;

Jones and Branton 2005; Langer and Brace 2005; Meier 1994; Mooney and Lee 1995; 2000; Soule and Earl 2001), energy politics saw relatively little attention.

The rise of energy prices as a salient issue eventually led many environmentalists to again identifying renewable energy as a possible solution to some of the traditional carbon dioxide producing, electrical energy options like coal and oil power plants. However, social scientists have been slow to respond with systematic examinations of this issue area. Unfortunately, most of this research focused on the history of renewable energy policymaking going back to the Truman administration (e.g. Laird 2001; Simon 2007) or the more technical aspects of renewable energy that were better suited for the hard sciences (e.g. Koroneos, Spachos, and Moussiopoulos 2003; Simon 2007; Voivontas et al. 1998).

Even as traditional social scientists began to focus their attention to renewable energy, studies of the United States have been few and far between (Carleyolsen 2006; Firestone and Kempton 2007; Houck and Rickerson 2009; Stoutenborough and Beverlin 2008; Wiener and Koontz 2010). However, European scholars have been more actively examining renewable energy politics for several years (e.g. Barry, Ellis, and Robinson 2008; Bell, Gray, and Hagett 2005; Christensen and Lund 1998; Devine-Wright 2005; Strachan and Lal 2004; Szarka 2004; Toke 2005; Toke and Lauber 2007). Nevertheless, the majority of the social scientific studies of renewable energy tend to focus on public opinion or case studies in another country.

Within the United States, it is clear that the states have been far more active in legislating renewable energy. This is counterintuitive since Gormley (1986) would certainly suggest the opposite should be occurring. The state-by-state patchwork quilt of renewable energy policymaking combined with the institution of federalism and the simultaneous policy adoptions by the national government creates an environment where previous research into renewable energy in other countries do little to inform policy adoption in the United States. As a result, my examination of policy adoption will focus heavily on the theories of policy adoption.

Theories of Public Policy Adoption

The past couple of decades have ushered in theories of public policy that have greatly advanced our understanding of the policymaking process. Policy theories tend to explain certain types of policy adoption better than others. They all differ in important ways, which typically requires the policy scholar to identify the type of policy theory that best fits the policy examined. Moreover, some policy theories seem better suited for case studies at either the national or sub-national level (e.g. Kingdon 1995; Ostrom 2007; Sabatier and Weible 2007; True, Jones and Baumgartner 2007). Others lend themselves to explaining policy adoption from a comparative perspective (e.g. Berry and Berry 2007; Dawson and Robinson 1963; Dye 1966; Hofferbert 1974; Ingram, Schneider and deLeon 2007; Sharkansky 1970).

I plan to analyze the adoption of all twenty-two state renewable energy policies across the fifty U.S. states with the intention of analyzing each policy type in a similar manner to allow comparisons across policies. This analytical design necessitates a comparative approach. Complicating this process, it is possible that a different policy theory may best explain each adoption if I were to conduct a case study of the adoption of each of these policies in each state. For instance, punctuated equilibrium may best explain adoption of a corporate tax incentive policy in Arizona, but institutional rational choice may better explain the adoption of this policy in Hawaii. Sadly, while it would be interesting to conduct a case study of the adoption of every policy in every state, it is far beyond the scope of this project. With this in mind, I need to identify a theory of policy adoption that is sufficiently broad enough to accurately analyze these various policies and simplify this process.

It is often suggested that "the devil is in the details." When examining policy adoption, this is certainly true. However, it is possible to identify several universal themes from the various policy adoption theories. By identifying the core elements that each of the policy theories has in common, it is possible to create a general, comparative policy analysis that identifies important influences on policy adoption. Additionally, this should allow for these analyses to capture several of the qualities that may cause different theories to better explain each individual policy.

Universal Themes

There are several theories of public policy that are useful to consider when identifying universal policy adoption themes. I will be drawing inspiration from institutional rational choice (IRC) (Kiser and Ostrom 1982; Ostrom 2005; 2007), multiple streams framework (MSF) (Cohen, March and Olsen 1972; Kingdon 1995; Zahariadis 2007), social construction (SC) (Ingram and Schneider 1990; 1993; Ingram, Schneider and deLeon 2007; Mannheim 1936; Schneider and Ingram 1988; 1993), the network approach (NA) (Adam and Kriesi 2007; Wasserman and Faust 1999), punctuated-equilibrium theory (PE) (Baumgartner and Jones 1991; 1993; True, Jones and Baumgartner 2007), the advocacy coalition framework (ACF) (Sabatier and Jenkins-Smith 1988; 1993; Sabatier and Weible 2007); innovation and diffusion (Berry and Berry 1990; 2007; Walker 1969), and the original conceptions of the policy process using large-n comparatives studies (e.g. Blomquist 2007; Dawson and Robinson 1963; Dye 1966; Hofferbert 1974; Sharkansky 1970). While policy diffusion and large-n comparative studies are sometimes not considered theories (e.g. Schlager 2007), they model characteristics that are fundamental to the other theories and offer useful guidance.

First, in a comparative state policy adoption study, perhaps the most important universal theme is best described by Berry and Berry (1990; 2007) as internal determinants. Berry and Berry (1990; 2007) argue that the differences in social, political, and economic characteristics between states influence policy adoption. Generally, social characteristics can be anything from public opinion, interest groups, percent minority, to measures of state urbanity. Political characteristics can represent ruling coalition changes or characteristics, systemic rules and regulations, and even characteristics of the bureaucracy. Economic considerations can be virtually anything relating to fiscal or economic policy such as tax rates, but it also includes economic measures like tax revenue, per capita household income, and industry specific revenues.

Indeed, while characterized in different ways, every policy adoption theory recognizes that these differences are important. For instance, the ACF recognizes that changes in socio-economic conditions, public opinion, and systemic governing coalitions all have the ability to influence the policy subsystem and adoption (Sabatier and Weible 2007). The NA likewise recognizes that macropolitical constraints influence adoption (e.g. Coleman 1991). These macropolitical constraints are often political, social or economic characteristics. Additionally, IRC also emphasizes how differences are important (Ostrom 2007). At the heart of IRC is the idea that differences in the social, political, and economic characteristics of an institution is going to influence policy action. Indeed, the importance of institutional norms is essentially the same as social characteristics, while its focus on common-pool resources inevitably link to economic characteristics. Certainly, when trying to understand state policy adoption, it is essential to understand the differences between states. Gray and Hanson argue that "These systematic comparisons are the social scientific equivalent of controlled experiments in natural science laboratories" (2008, xi).

With this in mind, the Stoutenborough and Beverlin (2008) and Wiener and Koontz (2010) studies provide a template from which my examinations can build. Stoutenborough and Beverlin (2008) identify three political and two social characteristics that they believe would be influential to the adoption of state net metering policies.[1] Of these, all three political characteristics – government ideology (Berry et al. 1998), legislative professionalism (Squire 2007), and the number of public utility commission employees – provided a statistically significant influence on adoption. However, neither of their social characteristics – citizen ideology (Berry et al. 1998) and population density – provided a significant influence.

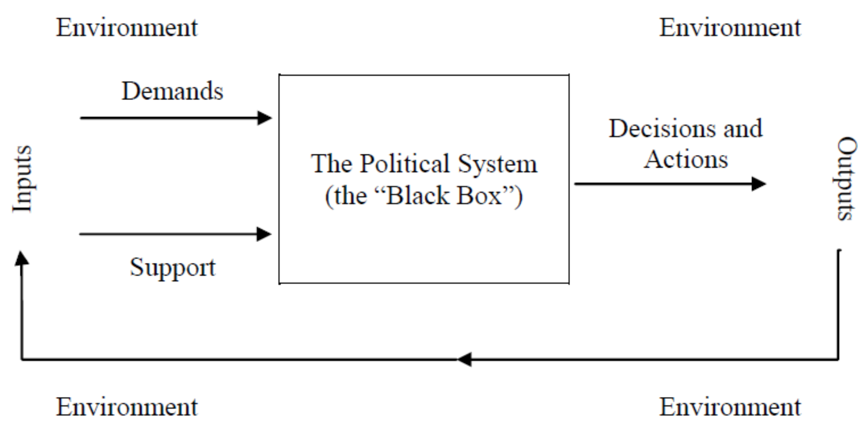
Weiner and Koontz (2010) conducted a case study of three states – Ohio, Oregon, and Oklahoma – and their adoption of policies to promote the use of small-scale wind energy. They also examine the influence of state characteristics and control for one political characteristic, each state's Congressional delegation's voting record on environmental legislation (LCV 2008). They also control for citizen ideology, a social characteristic, and add an economic characteristic, per capita wealth. Weiner and Koontz (2010) emphasize the nuanced nature of citizen ideology in promoting environmental protection.

In addition to the traditional definition of internal determinants, Stoutenborough and Beverlin (2008) argue that it is important to also consider issue specific characteristics that may not fit nicely into the social, political, and economic categories. Their approach is consistent with Gray and Hanson (2008), who argue that geographical differences are equally important to

[1] Stoutenborough and Beverlin (2008) do not include any economic characteristics because, as they argue, the policy they are examining, net metering, does not cost the state any money because it defers the cost to the utility company. Accordingly, they infer that economic considerations should not have played an important role in the adoption of this policy.

understanding state policymaking. A reading of the different policy theories would not eliminate these influences from being consistent with their theoretical underpinnings. Stoutenborough and Beverlin (2008) identify several issue specific characteristics that have the potential to influence renewable energy policy adoption. Specifically, they control for average wind speed, percent of the year with sunshine, electric energy consumption, green conditions (Hall and Kerr 1991), and the number of nuclear power plants. They find that, with the exception of percent sunshine, all of these have a significant influence on adoption.

Figure 2.1: The Systems Theory of Political Action



Source: Easton (1965a)

Second, all of the policy theories recognize that there is a feedback loop inherent in policy action. Indeed, it is expected that governments should consider prior policy activity when adopting new policies. As Figure 2.1 illustrates, at its simplest, the basic black box, or systems, theory of policymaking relies upon the idea that something influences policy activities within the mysterious black box, which produces some sort of output, usually a policy, and that this feeds back into the system in a never-ending loop (Easton 1953; 1965a; 1965b). In essence, all of our modern policy theories are simply attempts to identify what is happening in the black box and what influences the activities within that box.

Perhaps the most clearly articulated description of this feedback loop was done by Baumgartner and Jones (2002). For my purposes, their take-home points are that the system constantly feeds into itself, and that these feedbacks can be both positive and negative. Positive feedbacks provide a sort of band-wagon effect where policy adoption may build based on momentum gained by the adoption of previous policies. Negative feedbacks can be caused by a number of possible sources, but the end outcome is always a preference for equilibrium, or policy inaction.

The existence of other policies within an issue area may provide sufficient negative feedback to discourage the adoption of additional policies. Interestingly, nothing within Baumgartner and Jones's (2002) description of these feedbacks would suggest that both influences couldn't occur at the same time. It is reasonable to expect that the adoption of one renewable energy policy may not influence the adoption of another in a meaningful manner, but the adoption of another policy may have a positive impact. Indeed, Balla's (2001) examination of the adoption of the HMO Model Act, finds that one of the two related policies has a significant positive influence in half of the models, while the other has a significant negative influence in half.

Berry and Berry (2007) advocate the importance of including previously adopted policies in policy diffusion models. However, as they note, it has been a slow process to see previously adopted policies modeled. Aside from Balla (2001), I find few examples of this approach (e.g. Soule and Earl 2001; Stoutenborough and Beverlin 2008). Soule and Earl (2001) specifically test to see if the likelihood of a state adopting a hate crime policy is influenced by the adoption of other hate crime laws.

Stoutenborough and Beverlin (2008) crudely attempted to model this feedback loop on the adoption of net metering policies. However, a closer examination of Baumgartner and Jones's (2002) description of these loops reveal that Stoutenborough and Beverlin (2008) incorrectly aggregated several policies into two measures of previous policy adoption. Clearly, they should have modeled each policy on its own instead of aggregating. It is possible that these policies were cancelling each other out in the event that there were both positive and negative feedbacks within the aggregated measures.

Additionally, there must be some sort of evaluation process by which a legislative body can determine if existing policies are sufficient to address a specific policy problem. While all of the policy theories acknowledge the importance of this feedback loop, none of them do a particularly good job explaining how this actually works, with the exception of PE. The explanation within PE is that there is some learning occurring or that there is an event that causes a break from equilibrium (True, Jones and Baumgartner 2007). However, there is little to explain exactly what facilitates this learning.

In state comparative policy adoption, it is likely that the feedback loop is informed through learning and competition between states, from observations based on experience, as well as a specific event. In renewable energy policymaking, there does not appear to a critical event that caused the states to break from equilibrium, which suggests that learning in some form is likely what informs the evaluation process.

At the state level, this learning and competition process is generally thought to relate to policy diffusion (Berry and Berry 2007). Policy diffusion typically relies on the premise that a non-adopter is more likely to adopt as other states adopt a policy (e.g. Mooney 2001), however this relationship could be negative (e.g. Hays and Glick 1997). Diffusion more accurately represents the process by which the policy spreads throughout the country by means of this learning and competition process. Therefore, policy diffusion and feedback loops are not the same.

This still leaves us with two distinct patterns of learning. One form stems from the diffusion, or spreading of policy ideas across the country, and the other draws from experience. Unless a state is learning from the diffusion of international policies or city policies, the first state to adopt a new policy is likely to adopt the policy based upon experience. This appears to be the way Baumgartner and Jones (2002) primarily conceptualize this learning process. Unfortunately, this doesn't take into consideration the influences of policy diffusion.

Through policy diffusion, the learning process can be augmented, allowing for the traditional process of learning from experience to be circumvented. Generally, this augmentation is probably a good thing as it allows states to be more responsive than they might otherwise. In the quickly changing realm of renewable energy policy, this augmentation is likely to be essential. This is particularly true when it comes to trying to lure the burgeoning renewable energy system manufacturing to one's state.

Aside from augmenting the process, how exactly would policy diffusion influence this feedback loop? The answer is actually quite simple. While previously adopted policies certainly influence future legislative behavior, or lack thereof, knowledge of what other states have done will likely influence the way a state evaluates the adequacy these previously adopted policies. If a state learns that their neighbors have adopted a policy that they have not, the non-adopter is likely to evaluate their existing policies to determine if they are sufficient to achieve their policy goals. If the state determines that their existing policies are sufficient, they are likely to embrace equilibrium, but if the adoption of a new policy would be beneficial, they are more likely to adopt a similar policy.

Similarly, states are often competing with each other for some prize. In renewable energy, competition has the potential to be highly influential. Many of the wind farms that have been constructed around the country are owned by same companies. These companies can choose where they want to invest in a new project based on a number of characteristics, including the availability of financial incentives. If they are choosing between locations in two different states, the availability of these incentive policies may be important to the company. To land the wind farm, competing states may look to improve their competitive standing by adoption increasingly generous policies.

Moreover, states are frequently fighting for manufacturing plants that create renewable systems. The boost to the economy associated with renewable energy is unlike many other opportunities in today's society because the manufacturing of many products is cheaper in other countries. For a state to land a new manufacturing plant in an industry that is unlikely to see a slump in demand or to ship jobs overseas has the potential to be a huge economic boon.[2] If the state is competitive, they may choose to do nothing, but if it is no longer competitive, they may choose to adopt a new policy.

Further influencing this process is the cumulative effect of learning that additional states have adopted the same policy. Indeed, if thirty states have already adopted a policy, the non-adopter is likely to be far more critical of their current policies than it was when only six states

[2] The manufacturing of wind turbines is unlikely to be done overseas due to the size and weight of the products. For instance, many of the blades for the large wind turbines are eighty feet long. Logistically and economically, it is not likely that these are going to be manufactured overseas and shipped to the United States.

had adopted the new policy. This process could have a greater influence if the states that have adopted surround the non-adopter.

Again, policy diffusion and the feedback loop are two separate processes. However, it would appear that the two are inextricably linked. Policy diffusion is the mechanism that augments the normal learning process that is used to evaluate policies within the feedback loop. This means that policy diffusion does not always have to occur for learning to occur. But, when it does occur, it should augment the traditional learning process, which should alter the way a state evaluates its current policies.

This may explain why, as Tables 2.1 and 2.2 illustrate, some states have adopted several different policies of the same basic type. For instance, Minnesota has adopted six different state-backed loan policies. Each of these policies is slightly different from the others, with some applying to specific groups, and others applying to specific types of projects. It is likely that this piecemeal adoption process is associated with the evaluation process associated with the feedback loop. If this were true, the most likely explanation would be that Minnesota learned that other states had adopted slightly different state-backed loan programs, which would cause them to evaluate the current status of their state-backed loan policies to determine if they were sufficient. This would indicate that on five different occasions, Minnesota decided to adopt a new state-backed loan policy because they did not feel like the existing policies were sufficient.

Third, time is an important influence in adoption. All policy theories attempt to explain policy activity over some period of time. Sabatier (2007) argues that it may take a decade or more to study a policy (see also Kirst and Jung 1982; Sabatier and Jenkins-Smith 1993). It can take a number of years before everything involved in the policy activity becomes clear, and even after decades; it may not be clear what exactly happened. As MSF outlines, policy solutions are likely available long before there is an opportunity to actually enact them (Kingdon 1995). Indeed, even when a policy seems to appear overnight, the policy solution was probably floating around for a number of years before a window of opportunity presented itself.

Comparative state policy adoption studies clearly recognize the need to study a policy over a long period of time. In particularly, policy diffusion studies regularly examine adoption over several years or even decades (e.g. Allen, Pettus, and Haider-Markel 2004; Berry and Berry 1990; Haider-Markel 2001; Hays and Glick 1997; Mooney 2001; Shipan and Volden 2006; Stoutenborough and Beverlin 2008; Volden 2006). In renewable energy policymaking, states first began adopting policies in the mid-seventies, and continue today. This creates an environment that requires examinations over long periods of time.

Summary

I identified three core, or universal, components of all of the public policy theories, and explained how some of the more relevant previous studies of energy policy fit within these components. The first was the importance of what Berry and Berry (1990; 2007) would call internal determinants, or the political, social, and economic characteristics of a state. The second was the feedback loop where previously adopted policies influence the adoption of future policies. Finally, time was identified as an important influence on policy adoption.

These universal components of public policy theories will be used in Chapter 3 to build a methodological approach to study the adoption of twenty-two state renewable energy policies. By breaking these theories down to these core components, it is expected that comparisons will be able to be drawn across policies. Additionally, a reliance on these components should allow for analyses of the core influences on policy adoption, which could potentially be expanded upon in case studies in future projects.

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Chapter 3:
Policy Adoption Statistical Analysis and Methodology

This project seeks to understand what has influenced a state to adopt a renewable energy policy. Because these analyses are intended to examine every policy within the renewable energy policy arena, each policy adoption model will use the same general approach. Relying on the core components found in public policy theories outlined in Chapter 2, I designed a universal modeling scheme. I hope that this will allow for useful comparisons between the different models.

Dependent Variables & Models

There are many different approaches that can be used to analyze policy adoption. However, when comparing adoption across fifty states over thirty-five years, the standard approach has been through a discrete, cross-sectional time-series that is a non-repeating event history analysis (EHA) (Buckley and Westerland 2004; Mooney 2001).

The dependent variables for these analyses are coded based on when a state adopted each type of policy. Specifically, it is coded such that in the years in which a state does not have a policy it is given a "zero" and the year that a state adopts the policy is coded "one." As a combination between a time series and a cross-sectional model, data was collected for each state for every year between 1974 and 2008. Using a thirty-five year range ought to satisfy the third core component that is found in policy theories, which is that sufficient time must have passed before examining a policy.

For discrete-time data, the dependent variable is essentially the same as the duration time (Yamaguchi 1992). When coding a discrete-time event using a yearly duration period, the dummy variable for policy adoption always corresponds with the year the policy was adopted. In other words, the end of the duration is always the same as the year policy adoption takes place. Essentially, both measures reach the same conclusion, that policy A was adopted in year

X. This means that a dependent variable coded with zeroes and ones is the equivalent to an actual duration time (Beck, Katz and Tucker 1998; Box-Steffensmeier and Jones 2003). Consequently, it can be estimated in terms of maximum likelihood estimators (Allison 1984), which is traditionally accomplished using a logit model (Box-Steffensmeier and Jones 2003).

Because EHA models are predicting non-repeatable events each state is dropped from the years following the adoption of a policy. Thus, I make the assumption that the policy adopted cannot be readopted at some future time. This assumption is reasonable when considering innovative policy adoption.[3]

When using panel data, it is essential to allow for different intercepts for each panel member – each state.[4] When using a dichotomous dependent variable in a cross-sectional time-series model, random effects are the optimal option because of the limitations of the y-intercept inherent in these models (Kennedy 2003). Furthermore, Beck (2001, 290) notes that fixed effects should not be used on panel data. Beck and Katz (2001) go as far as to say that fixed effects should never be used when there is a dichotomous dependent variable in a paneled, time-series model. A random effects model is designed to overcome fixed effects concerns, which can create a more efficient estimator of slope coefficients (Kennedy 2003).[5]

When using discrete data, there are several distributions that can be used to estimate relationships between the dependent variable and independent variables. Estimation is done by treating the probability of adoption as conditional on remaining a non-adopter and various

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[3] A concern often associated with this approach is that a state can always repeal any given policy at any time. While this is a possibility for renewable energy policies, it is not a major concern of this examination. I am not attempting to explain policy continuance or the policy repeal process. Instead, these analyses are seeking to understand what influenced a state to adopt its first policy in each of the twenty-two policy areas.
[4] In time-series analysis, panel data and cross-sectional data are same. The terms are used interchangeably, but hold the same meaning.
[5] A fundamental assumption of a random effects model is that the independent variables are treated as strictly exogenous (Hsiao 2003).

independent variables. Generally, the two most common distributions that are used with a dichotomous dependent variable are the logit and probit distributions (Box-Steffensmeier and Jones 2003; Buckley and Westerland 2004).

There is an additional option available called the complementary log-log distribution (Cloglog). The Cloglog is not widely used within the social sciences (Box-Steffensmeier and Jones 2003), but it provides an alternative to the probit and logit distributions based on its treatment of the s-shaped curve. The probability, λ_i, of the logit and probit response curves are symmetric around $\lambda_i = 0.5$.[6] The Cloglog response curve begins slowly from $\lambda_i = 0.0$ and rapidly approaches $\lambda_i = 1$ (Agresti 1990, 248).[7] Because it more rapidly approaches $\lambda_i = 1$, the slope of the s-shaped curve for a Cloglog is closer to being perfectly vertical than a logit or probit. This means that estimated event probabilities based on the Cloglog model could be significantly different than the results found in a logit or probit-based model. Buckley and Westerland (2004) recommend that diffusion scholars use the Cloglog because it is the discrete analog of the Cox proportional hazards model, which is the most common type of duration model. They also argue that the Cloglog may be the best option because policy adoption is rare, and this treatment best accounts for rare events. Because the data for each policy contains more than one thousand "zeroes" and a maximum of fifty "ones", we are clearly examining rare events. Thus, the Cloglog uses the most appropriate functional form to use in the statistical models that follow.

EHA is a model that relies on the probability of a state adopting a policy that is constant over time (Allison 1984, 17-18). This probability is called the hazard rate, which is flat in

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[6] Here, λ_i represents the probability of adoption for the *i*th case, or state.

[7] The probability of the complementary log-log is: $\Pr(y_{it}, x_{it}\beta) = 1 - \exp[-\exp(x_{it}\beta)]$.

relation to time. If this proposition – the hazard rate – is violated, the estimated slope of the variable correlated with the hazard rate will be biased in the direction of that correlation (Beck, Katz, and Tucker 1998). Since policy diffusion has been illustrated as a strong influence on the adoption of policies, and it provides an explanation of how states learn what other states have adopted, which informs the feedback loop, it is essential to control for its influence. As such a diffusion variable is always increasing as each additional state adopts a policy. This causes the hazard rate to become unstable, which results in a positive effect (Rogers 1995). To correct for this instability, EHAs require either a trend variable (e.g. Greene 2000; Haider-Markel 2001; Hays and Glick 1997; Mooney and Lee 1995) or annual dummy variables (e.g. Allison 1984, 18; Beck, Katz, and Tucker 1998; Mintrom 1997; Mintrom and Vergari 1998; Stoutenborough and Beverlin 2008).

To create a trend variable, the researcher must make assumptions about the hazard rate that are conditional on the other variables in the model (Buckley and Westerland 2004; Mooney 2001). These two options would alleviate the problems associated with duration dependence, thus allowing for a more accurate estimation of the model. While a common solution to this problem is to simplify the process by using annual dummy variables (e.g. Balla 2001; Beck, Katz, and Tucker 1998; Mintrom 1997; Mooney 2001; Shipan and Volden 2008; Stoutenborough and Beverlin 2008), this option is not optimal in this situation because it would create up to thirty-four dummy variables for each policy. This would create estimation problems, which will be discussed in greater detail in a moment. To prevent these estimation concerns, a trend variable was created for each year for each policy. The trend variable was created by taking the square root of the number of years before and after the year in which each policy saw the most adoption. This approach should stabilize the hazard rate (e.g. Haider-Markel 2001), and it will ensure that there are not spurious relationships found as a result of an unstable hazard rate (Mooney 2001).

Independent Variables

The policymaking process is typically described as a fairly complex process composed of many moving parts (e.g. Sabatier and Weible 2007). Additionally, as noted in Chapter 2, every theory of the policymaking process includes some sort of a feedback loop that indicates that, within a policy arena, previously adopted policies ought to influence the adoption of future policies (e.g. Adam and Kriesi 2007; Berry and Berry 2007; Blomquist 2007; Ingram, Schneider and deLeon 2007; Ostrom 2007; Sabatier and Weible 2007; True, Jones and Baumgartner 2007). However, research into policy adoption typically either minimizes this influence or simply ignores it.[8]

One of the goals of this project is to determine the extent to which our statistical modeling of policy adoption has been limited due to our minimization of this influence. As we know, models that are better specified are going to provide better explanations of whatever phenomenon we are looking to examine. Simply put better statistical models and measures will provide a more accurate picture of the phenomena, and we have all witnessed the effects of adding and subtracting variables from our statistical models. Over time, social scientists have found that better models and measures force us to reconsider what we thought we knew about certain phenomena. Will the same be true in the policy adoption literature? In this tradition, two types of models will be estimated for each policy. The first will be a more traditional, reduced model of policy adoption. These will rely on variables that are more traditionally found in policy adoption studies. The second will model the influence of existing policy on the adoption of new

[8] Three exceptions to this are Balla (2001), Soule and Earl (2001), and Stoutenborough and Beverlin (2008).

policies, which will represent the feedback loop outlined in Chapter 2. In essence, the second approach will more accurately reflect policy theory, and it should allow for a better understanding of the policymaking process.

This influence of specific policies can take many forms, which makes them very difficult to predict. On one hand, in an ideal world, once an institution adopts a policy within an arena they should not have to adopt any others because they will have already addressed the problem. On the other hand, it is possible that once they have committed to a particular arena, they may be more likely to adopt additional policies to achieve a legislative goal. There are many examples of both of these outcomes, and Baumgartner and Jones (2002) probably best sum up the unexpected nature of these two options through their description of positive and negative feedbacks. The existence of other policies within a policy arena may provide sufficient negative feedback to discourage the adoption of additional policies. There is nothing to suggest that these feedbacks couldn't result in both influences at the same time. For instance, perhaps the adoption of one specific policy creates a positive feedback, while the adoption of a different policy creates a negative feedback within the same institution. Indeed, Balla (2001) finds that one of the two related policies has a significant positive influence in half of the models, while the other has a significant negative influence in half.

Accordingly, perhaps the most interesting independent variables found in these analyses will be those representing policies that have already been adopted within a state. There is little to suggest that most of these policies will either have a positive or negative impact on the adoption of other policies. Therefore, for the majority of the policies, the only expectation is that they will have an impact on the adoption of a different policy.

However, there are four policies that ought to have a positive impact on the adoption of other policies. The adoption of renewable portfolio standards potentially represents a change in the state legislature. These policies are designed to set production goals for the state, and their adoption should result in an increased likelihood of adoption of additional policies because incentive policies may be viewed as the best mechanism to enable the standards to be met. Therefore, it is anticipated that states that have adopted renewable portfolio standards are more likely to adopt additional legislation.

Likewise, states that have adopted a public benefits fund should be more likely to adopt additional policies. Public benefits funds are typically special taxes that are levied on energy consumption. The funds that are raised as a result of these taxes are then put into a large pool that is used to fund the financial incentives that the state offers. If a state adopts one of these policies, there ought to be subsequent legislation that instructs how that money should be used.[9]

Finally, states can adopt green power purchasing and required green power policies. For both of these policies to be successful, there must be green power being created. Green power purchasing policies require state agencies and facilities to purchase a predetermined percentage of their electrical energy from renewable sources. Required green power policies mandate that a predetermined percentage of an electrical company's energy be created by renewable sources. In short, both require that energy companies create energy using renewable sources. Therefore, it is expected that states that adopt either of these policies will be more likely to adopt additional policies to facilitate the construction of renewable systems.

[9] It is possible that the opposite could be true if the public benefits fund was created to fund existing programs. However, it is expected that, like the renewable portfolio standards, this will mark a change in the legislative emphasis on renewable energy.

Associated with this feedback process is the process known as policy diffusion. Policy diffusion is grounded in the idea that states will be influenced by what other states have attempted when addressing a problem. This process can occur through learning, competition, or public persuasion (Berry and Berry 2007). As noted in Chapter 2, it is likely that this process of diffusion helps to inform the feedback loop by allowing a state to augment the learning process and evaluate the effectiveness of their current approach to the problem. If they are satisfied with their policy solutions, they are not likely to adopt a new policy. However, if they are not satisfied, it is possible that a state may be more likely to adopt a new policy if other states have already done so.

Existing policy adoption research has recognized the importance of controlling for the influence of policy diffusion for a couple of decades (e.g. Berry and Berry 1990; Haider-Markel 2001; Mooney 2001; Stoutenborough and Beverlin 2008). While few of these examinations actually control for the influence of other policies, their inclusion of diffusion essentially serves the same function that I describe, which is that states evaluate their current solutions to the problem and determine if they should consider what other states have adopted. Because of this evaluation function, these studies tend to find that diffusion generally has a positive influence on adoption (Mooney 2001). This is to be expected since scholars tend to focus their studies on innovative policy solutions. If the solution is innovative, then it is more likely that an evaluation of the policy would conclude with a suggestion that the state should adopt a version of the policy. However, sometimes diffusion can actually have negative impact (e.g. Hays and Glick 1997). This would suggest that an evaluation of the policy revealed that it was not successful, or that it had negative externalities. Regardless, the wealth of studies into diffusion, particularly regional diffusion in its many forms, suggests that any policy adoption model with U.S. states as the unit of analysis needs to include a control for this influence.

While controlling for diffusion, it is important to recognize that there are many different forms of diffusion that can augment the learning process and influence the evaluation process. Because the mechanism responsible for the actual diffusion may not be obvious, diffusion is difficult to actually identify. As a result, diffusion studies tend to declare that one particular brand of diffusion is responsible for the spread of a policy across the country. Interestingly, this process is usually achieved through fiat, as there are seldom any justifications for choosing one form over another. Stoutenborough and Beverlin (2008) illustrate how this identification process can be systematically analyzed to try to use prima facie evidence that might suggest which form of diffusion is most appropriate. Examining their policy, they identify regional diffusion using EPA regions as the most likely route diffusion followed, as opposed to leader-laggard and neighbor diffusion. However, they felt it was more appropriate to test the prima facie evidence as opposed to blindly declaring it the best explanation. Stoutenborough and Beverlin (2008) estimated three nearly identical statistical models to verify that EPA-based regional diffusion was the most appropriate.[10] They also suggest that policy scholars should use this approach in their analyses. Indeed, if we use the wrong indicator of diffusion in our analyses, our analyses are not going to be properly specified, which should make us question their accuracy.

Stoutenborough and Beverlin (2008) also discuss the possibility that there might be leader-laggard influences within a region or among geographic neighbors. The basic idea is that the relative influence of every state within the region is unlikely to be identical, which is how traditional regional and neighbor diffusion treats these states. Stoutenborough (2009) has since

[10] The only difference between the models was the diffusion variable.

examined this phenomenon by replicating Stoutenborough and Beverlin's study and adding what he refers to as a "hybrid" measure of diffusion. Essentially, he argues that there is no reason to think that leader-laggard diffusion and regional/neighbor diffusion are mutually exclusive. His analysis reveals that a hybrid measure of EPA regional diffusion and leader-laggard diffusion create a better specified model than the standard EPA regional measure. Stoutenborough has since used the same hybrid technique to replicate Berry and Berry's (1990) original state lottery adoption study using three different leader-laggard measures. All three of these hybrid measures also resulted in statistically significantly better specified models than those used in the original study. Together, these replications indicate that it may be important to control for this "hybrid" approach to measuring policy diffusion.

Because the goal of these analyses is to create the best understanding of renewable energy policy adoption possible, five different measures of policy diffusion will be analyzed and compared to one another. As mentioned, policy diffusion is particularly difficult to pin down. Indeed, although Stoutenborough and Beverlin (2008) were able to find support for their prima facie evidence, Stoutenborough (2009) finds that the prima facie evidence was only partially correct, but ultimately not optimal. Aside from specification advantages, there is also no reason to believe that all of the renewable energy policies will spread in the same manner; therefore, it is advantageous to examine all five measures and compare them to one another for all of the policies.

The five diffusion measures are policy-specific replications of those used by Stoutenborough (2009) and Stoutenborough and Beverlin (2008). Specifically, these measures will represent diffusion within EPA regions, between neighbors, between leaders and laggards, and a hybrid measure of both EPA regions and neighbors that take into consideration leaders and laggards within these groups. EPA regions were chosen because they have been identified as possible conduits through which states may learn what other states are doing (e.g. Crotty 1987; Daley and Garand 2005; Stoutenborough and Beverlin 2008).[11] Relying on geographical neighbors has also been a common way to measure diffusion (e.g. Berry and Berry 1990). The influence of leader-laggard diffusion is examined using an inverted version of Hall and Kerr's (1991) Green Policy Index (e.g. Stoutenborough and Beverlin 2008).

To create the hybrid measures of diffusion, a weighted leader-laggard score was first created. Table 3.1 presents the weighted leader-laggard scores for each state. First, the Green Policy Index score (Hall and Kerr 1991) for each state was inverted to make them more intuitive. Inverting the index creates a score such that the "greenest" state, California, had the highest score, while the least "green" state, Arkansas, had the lowest score. Second, the weighted leader-laggard score was created by dividing the inverted green policy score by 1,925. This resulted in eighteen states with weighted scores that were greater than one. This approach allows us to identify leader states from laggard states.

The hybrid diffusion measures combine the influences of regional diffusion and leader-laggard diffusion. To create a hybrid measure, the relative impact of a given state on another state within a region, or to a neighbor, is multiplied by the weighted leader-laggard score. In essence, the hybrid measure will either give a state a greater influence or lessen its overall influence within its region or on its neighbors. For instance, within EPA Region 9, California ought to have a 0.333 impact on another state within that region under a normal regional diffusion measure. However, the hybrid model takes into consideration the leader status California holds on environmental issues. The hybrid regional measure would say that

[11] A list of the membership of each EPA region can be found in Appendix A.

Table 3.1: State Weighted Leader-Laggard Scores

State	Green Policy [a]	Inverted Green Policy [b]	Weighted L-L Score [c]	State	Green Policy [a]	Inverted Green Policy [b]	Weighted L-L Score [c]
Alabama	3,212	638	0.331	Montana	2,533	1,317	0.684
Alaska	3,043	807	0.419	Nebraska	2,510	1,340	0.696
Arizona	2,802	1,048	0.544	Nevada	2,917	933	0.484
Arkansas	3,230	620	0.322	New Hampshire	2,054	1,796	0.932
California	764	3,086	1.603	New Jersey	1,150	2,700	1.402
Colorado	2,330	1,520	0.789	New Mexico	2,729	1,052	0.546
Connecticut	1,225	2,625	1.363	New York	1,346	2,504	1.300
Delaware	2,261	1,589	0.825	North Carolina	1,873	1,977	1.027
Florida	1,604	2,246	1.166	North Dakota	2,762	1,088	0.565
Georgia	2,505	1,345	0.698	Ohio	2,010	1,840	0.955
Hawaii	2,239	1,611	0.836	Oklahoma	2,913	937	0.486
Idaho	2,708	1,142	0.593	Oregon	1,096	2,754	1.430
Illinois	1,865	1,985	1.031	Pennsylvania	2,058	1,792	0.930
Indiana	2,332	1,518	0.788	Rhode Island	1,384	2,466	1.281
Iowa	1,841	2,009	1.043	South Carolina	2,537	1,313	0.682
Kansas	2,478	1,372	0.712	South Dakota	3,154	696	0.361
Kentucky	2,625	1,225	0.636	Tennessee	2,843	1,007	0.523
Louisiana	2,644	1,206	0.626	Texas	2,659	1,191	0.618
Maine	1,246	2,604	1.352	Utah	2,888	962	0.499
Maryland	1,660	2,190	1.137	Vermont	1,578	2,272	1.180
Massachusetts	1,377	2,473	1.284	Virginia	2,181	1,669	0.867
Michigan	1,552	2,298	1.193	Washington	1,606	2,244	1.165
Minnesota	1,305	2,545	1.322	West Virginia	2,951	899	0.467
Mississippi	3,016	834	0.433	Wisconsin	1,261	2,589	1.344
Missouri	2,182	1,668	0.866	Wyoming	2,924	926	0.481

a. The Green Policy Index is recreated from Hall and Kerr (1991). The Green Policy Index is the sum of state rankings from 77 environmental policy and leadership indicators. Each score is out of a total of 3,850, which would be the score for a state that was ranked 50th in every indicator.

b. The Green Policy Index scores were inverted (3,850 – state green policy score) to make it more intuitive.

c. The Weighted Leader-Laggard Score is calculated by the equation

Weighted L-L Score = Inverted Green Policy / 1925

The denominator, 1,925, is half of the 3,850 possible, and represents the score of a state that was ranked exactly 25th in all 77 indicators would achieve.

California would now have a 0.534 (0.333 x 1.603) impact on another state within its region. On the other hand, Arkansas, who would usually have a 0.25 impact on states within EPA Region 6, would actually have a 0.08 (0.25 x 0.322) impact once their extreme laggard status is taken into account. This approach was used for each policy in each state for both the EPA regional and neighbor diffusion measures. The hybrid approach ought to more accurately measure the impact of any state on another if leaders and laggards are influential within either regional diffusion measure.

Each of these measures of diffusion is theoretically different from the others. The EPA regional measure anticipates that the EPA regional offices act as the conduits by which states are able to learn what other states are doing. While some regions may have a conflictual relationship (e.g. O'Leary and Raines 2001), the EPA regional offices are always in constant contact with their member states EPA offices.[12] This allows for the sharing of information through a relatively simple process. These offices are going to have the greatest information about their member states, which should cause the office to emphasize the policy actions of these states. However, because each regional office is a part of the U.S. EPA, they are able to learn what other EPA regions are doing, which should facilitate the spread of policy adoption across the country.

Neighbor diffusion is similar to EPA regional diffusion, except that it differentiates itself in an important manner. With neighbor diffusion, there is no administrative body that oversees the states and shares information about other states. Instead, states simply look to see what their geographical neighbors are doing to solve a particular problem. The mechanism of learning in neighbor diffusion can vary. However, the most obvious method of policy learning is going to occur by observation. State legislators that live along the border are more likely to become aware of what the neighbor state might be doing. It is also possible that the public could become aware of the neighbor's policies, and they might pressure their legislators to adopt similar policies. It is also possible that state Governors could learn what their neighbors have done when they attend meetings where all of the states Governors attend. In short, there are many

[12] O'Leary and Raines (2001) recognize that some regions are better than others, but they stress that the EPA has been taking the lead, amongst federal agencies, to try to resolve these conflicts through the use of their alternative dispute resolution programs and processes. This should improve the relationship between states and their EPA regional office, which should improve the likelihood that EPA regional diffusion occurring.

possible explanations for how information is spread through neighbor diffusion, and it is very difficult to directly identify exactly how this occurs.

Leader-laggard diffusion relies on the idea that leader states are more likely to adopt than laggard states. Policy learning occurs because leader states are aware of what other leader states are doing. These states are often quick to adopt because they strive to be the best in those policy areas, which means they must constantly monitor what other states have done. Using the Hall and Kerr (1991) green policy rankings, it is easy to identify which states are environmental leaders, and which are laggards.

The EPA hybrid measure relies on the same basic premise of the EPA regional model. However, it differs in that it recognizes that the EPA regional offices are going to emphasize the activities of the leader states within the EPA region. Again, the EPA regional offices are responsible for spreading the information about what other states have done, but they are going to accentuate the leaders, which should cause these leaders to have a greater influence on a non-adopter than the laggards.

The neighbor hybrid measure is also similar to the traditional neighbor model. However, it differs because it recognizes that a state is more likely to turn to a neighbor state that is considered to be a leader in the policy area than a state that is considered a laggard. The influence of these neighbors that are leaders should be far greater than the laggards. Policy learning should occur such that if a state has a problem, they are more likely to look to these leader neighbors for a solution.

To determine which measure of diffusion creates the best specified model, Davidson-MacKinnon (1993) tests will be estimated for every combination of the five competing models. Because coefficient estimates and probabilities appearing stronger does not automatically mean that one measure provides a better explanation than the others, this test is needed. For this to work, the two statistical analyses need to be identical with the exception of one variable, which will be the diffusion variable (e.g. Berry and Baybeck 2005; Stoutenborough 2009; Stoutenborough and Beverlin 2008). The Davidson-MacKinnon test is able to determine which model is best specified by estimating fitted values for each of the five statistical models and using these fitted values within a re-estimation of one of the original five models. If the fitted values from model A are statistically significant when inserted in model B, while the fitted values for model B are not statistically significant when inserted in the model A, then model A, with the statistically significant fitted values, is statistically significantly better specified than model B. Because the only difference between these models is the diffusion variables, this approach, when used for every combination of models, will identify which measure is most accurate.[13] Once the best model is identified, the results of the analyses will be discussed in terms of that model.[14]

Returning to the universal characteristics outlined in Chapter 2, it is important to control for the influences of state internal determinants (Berry and Berry 1990; 2007), and policy specific characteristics (Gray and Hanson 2008; Hall and Kerr 1991; Stoutenborough and Beverlin 2008). Typically, internal determinants are described as the social (e.g. Gray and Lowery 1988), economic (e.g. Downs 1957), and political (e.g. Berry et al. 1998; Squire 2007) characteristics of a state that influence policymaking and political behavior. In short, the differences between states in these various areas shape how these states behave in a political sense.

[13] In the event that none of the fitted values reveal a statistically significant influence within another model, the model that has the best p-values in head-to-head comparisons will be the model discussed. In these situations, while not significantly better than the others, it is still possible to identify the best measure.

[14] The other four models will not be discussed, unless attention needs to be drawn to variables that were inaccurately estimated because the improper measure of diffusion was used.

Several internal determinants will be examined in both the traditional and expanded statistical analyses. These analyses control for two social characteristics. Specifically, the models control for the influence of college graduates and citizen ideology (Berry et al. 1998) on policy adoption. Generally, I expect that those with more education are better able to process information. Furthermore, those with more education are generally more predisposed to be environmentalists (e.g. Buttel and Flinn 1974). Accordingly, I anticipate that states with more college graduates are more likely to adopt policies that encourage the development of renewable energy. Likewise, liberals are more predisposed to be environmentalists (e.g. Ellis and Thompson 1997). As such, I assume states with more liberal citizens ought to be more likely to adopt renewable energy promoting policies.

Differences in the political characteristics of states are understandably an important influence on the political process. Therefore, two political characteristics are analyzed in these models. Controls are included for state legislative professionalism (Squire 2007) and government ideology (Berry et al. 1998). State legislative professionalism scores are a particularly useful tool to use in policy analyses because of the wealth of information that they represent (see Squire 2007). Ringquist (1993) illustrated the importance of professional legislatures on the adoption of several environmental policies. However, Stoutenborough and Beverlin (2008) found that legislative professionalism had a negative influence on the likelihood of adopting net metering policies. Despite this more recent finding, it is still anticipated that states with more professional legislatures will be more likely to adopt renewable energy policies.[15] Similar to state citizen ideology, it is expected that more liberal state governments will be more likely to adopt a policy.

Finally, two economic internal determinants are included in these analyses. The first, tax revenue per capita, is intended to capture differences in the relative tax receipts in each state, while also taking into consideration the population of the state. Because most of the policies examined are financial incentive policies, it is expected that states with larger levels of tax revenue per capita are going to be more likely to adopt financial incentives. Second, while not always associated with economic factors, population density will be examined. Population density is considered an economic influence because of the characteristics usually associated with more densely population states. Certainly, there is a connection between density and economic development and wealth (Ciccone and Hall 1996) such that the two directly drive one another in a manner that as the economy becomes stronger in a region, more people move there, thus increasing density. As a result, more densely populated states are more likely to have, or have had, higher levels of manufacturing. More densely populated areas are also more likely to experience air pollution. Therefore, these areas ought to be more likely to pursue the use of clean alternatives to air polluting energy.

Additionally, it is important to control for the influence of issue specific state characteristics. Hall and Kerr (1991) suggest that some states have conditions that better suit

[15] Stoutenborough and Beverlin (2008) suggest that a possible cause of this negative outcome is that the net metering policy caused utility companies to pay private energy producers the same for extra energy generated as they charge their customers. Therefore, net metering laws would remove all profitability associated with private energy providers. As such, there was every incentive for these companies to lobby heavily against these policies. Combine this with Squire's (2007) observation that more professional legislatures have larger staffs, which increase the ability of lobbyists to influence the political process; it is not surprising that there may be a negative relationship between professionalism and net metering policies. However, this specific example shouldn't be interpreted to imply that legislative professionalism is going to have a negative influence on all renewable energy policies.

them to adopt environmental policies.[16] Renewable energy policy has often been considered an environmental policy. Therefore, conditions within each state ought to be important influences on the adoption of these policies. Specifically, these analyses will control for the influences of state wind potential, the percent of the year with sunshine, number of nuclear power plants, electric energy consumption, number of public utility commission employees, and green conditions (Hall and Kerr 1991).

Wind and solar are the most common sources of renewable energy. As such, the ability of a state to benefit from these sources ought to be important. Gray and Hanson (2008) have argued that the geography of a state has the potential to influence political behavior. With renewable energy, this is particularly important since specific conditions need to be met to warrant building a renewable system. Specifically, states that do not have a large capacity for wind energy ought to be less likely to adopt renewable policies. Similarly, states that do not have a lot of sunshine throughout the year should also be less likely to adopt policies.

Additionally, some characteristics do not fit well within the traditional social, political, economic, or geographic categories. Yet, it is likely that these characteristics would influence policy adoption. Nuclear energy was initially sold to the public as a cheap, clean alternative to coal and oil power plants (Ramey 1973). Because of this, and the fact that most nuclear power plants are operating well under their maximum capacity, I expect that states with more nuclear power plants are going to be less likely to adopt a renewable policy. I also anticipate that states with higher levels of energy consumption will be more likely to turn to clean, renewable energy as alternative to coal and oil power, which will cause them to be more likely to adopt a policy. Public utility commissions are generally expected to facilitate coordination between

[16] While applying specifically to environmental politics, there is no reason by believe that this same conditions are not important for a wide variety of policy arenas.

governmental entities and society. Therefore, I expect that states with higher numbers of public utility commission employees will be better able to facilitate this coordination, and states will be more likely to adopt policies because the resources will already be in place to help implement the new policy. Finally, Hall and Kerr (1991) find that environmental conditions vary greatly between states on a host of factors. As such, states with higher green condition scores ought to be more likely to adopt renewable energy policies because they should be less concerned with other environmental problems.

An additional set of control variables are designed to account for the influence of the national government on state policy adoption. Studies into vertical influence diffusion have found that the national government has a history of causing states to react, and adopt their own policies in response (e.g. Allen, Pettus and Haider-Markel 2004; Gray 1994; Grogan 1999; Soss et al. 2001; Welch and Thompson 1980). Diffusion in these instances tends to occur relatively quickly, particularly when there are incentives involved (Welch and Thompson 1980).

To what extent has the national government's activity in renewable energy influence states to adopt policies? Similar to state policies, it is hard to predict how national policies have influenced states. It is also possible that these policies are equally likely to have a positive impact as they are to have a negative impact. Again, the adoption of a federal policy may cause states to rethink adopting their own policy because the national government has already done so. On the other hand, it is also possible that this could serve as a sign that the state needs to get more involved in renewable energy. Unfortunately, it is difficult to predict how each of these policies is going to influence the states when they consider the adoption of their policies. Therefore, the expectation is that they will simply have an influence.[17]

Recall, two sets of models will be analyzed for each policy, a traditional set of models and an expanded set of models. The traditional set of models will all include the diffusion measure, estimated trend variable, internal determinants, and issue specific variables. These models will also control for the influence of Renewable Portfolio Standards. As described, this policy ought to represent a clear commitment to renewable energy by a state, and ought to be associated with the adoption of additional policies. The expanded set of models will use all of these variables, plus all of the national policies and the remainder of the state policies. If the traditional model is sufficient to estimate policy adoption, we should expect little differences between these and the expanded models. However, if the traditional model is not optimal, then we should see several differences between the models.

Estimation Concerns

As mentioned, the inclusion of up to thirty-four yearly dummy variables would create estimation concerns. Conventional statistical wisdom suggests that as long as your model has a large number of cases, you should not have to worry much about estimation problems due to a lack of degrees of freedom. Essentially, the larger one's *n*, the more variables the statistical model can handle. However, there appears to be one clear exception to this general rule. When working with rare event data, the statistical models can become overwhelmed by a large number of variables even if there is a large *n*. Simply put, there isn't enough variation within the dependent variable to handle estimating large models because there are very few actual events in

[17] Because several of the independent variables cannot have hypothesized directions for their relationships, all of the models will use a two-tailed test.

the dataset. I observed estimation problems for every policy when yearly dummy variables were included. Therefore the trend approach was necessary.

The lack of variation in the dependent variable created a few additional concerns. I found the first problem during the estimation process itself. Often, when there were problems, the statistical software was unable to fit the comparison model because the log-likelihood was "not concave." This meant that the software was unable to even begin to estimate coefficients, even after several thousand iterations. This problem presented itself even after all of the yearly dummy variables were reduced down to the single trend variable. To overcome this problem, when it appeared, variables were added one at a time to the analysis. If a variable caused the log-likelihood to become "not concave," previously added variables would be removed to determine if the problem variable was the new variable, or a combination of variables. In every circumstance where this occurred, the variable that was added when the problem occurred was the culprit, and it was removed from the analysis. For reasons that are unknown, one variable in particular, the national Modified Accelerated Cost-Recovery System policy, resulted in the log-likelihood problem in almost every model it was included, which is why it will only be presented in a couple of models.

I uncovered a second estimation problem in the output produced by the program. In the estimation of some of the more rare policies, the coefficient estimates for a variable or two would be nonexistent. In this situation, estimates would be present for all of the variables except one or two, which would have blanks. The same variables were blank when the analysis was replicated with an identical command and when the independent variables were rearranged. A procedure similar to the previous was used to determine if there was some sort of variable interaction problem, or if it was the variable itself that was causing a problem. In all instances, everything pointed to that particular variable creating a problem, so it was removed from the analysis.

The third estimation problem was that some variables contained standard errors that were so large that it influenced the estimation of other variables. Some variables had standard errors that were in the upper thousands, and usually associated with p-values of .999. Again, when trying to determine what was causing this, it was found that when the variable was removed, it would almost always result in significant changes to the estimates of the other variables.[18] However, the removal of other variables never had a significant impact on the estimation of these variables. Because of this, these variables were also removed from the analyses. It should be noted that when the inclusion of these variables did not have a discernable impact on any of the other variables, they were left in the analysis.

The final estimation problem was associated with over-specified models. This was a large problem with the more rare policies. This problem presented itself through statistically insignificant Wald Chi^2 estimates. The Wald Chi^2 tests the hypothesis that at least one of the independent variables is significantly different than zero (Greene 2008). If this test is not statistically significant, then that means that none of the coefficient estimates are significantly different than zero, even if the estimate itself is statistically significant. In short, without a significant Wald Chi^2, none of the coefficient estimates really mean anything. Therefore, it was essential to systematically remove variables from the analysis until the Wald Chi^2 was statistically significant.

[18] While the removal of these variables influenced other variables in the model, it did not correct for the problems associated in the first two types of estimation problems.

The removal of variables from the analysis was accomplished using Goodness-of-Fit tests.[19] A Goodness-of-Fit test is usually used to identify the model that fits the data best through identifying which interactions help explain the data, and which do not help as much (Agresti 1996). In this situation, it was not used to identify how complex our interactions need to be. Instead, by using the Likelihood-Ratio statistic, G^2, and Pearson statistic, χ^2, the variables that best fit the model are able to be identified, thus leaving the analysis with the model that best fits the data.[20] The model fit was determined by comparing the G^2 and χ^2 of each possible combination of variables.[21] The larger the values of the G^2 and χ^2, the worse the model fit (Agresti 1996). Therefore, the variable that decreased the G^2 and χ^2 the least was removed. After each round of Goodness-of-Fit tests, the cross-sectional time-series model was re-estimated without the variable that was identified as having the least influence on model fit. If the Wald Chi^2 was still not statistically significant, this process was continued until a usable model resulted. While this is not the most desirable manner in which to estimate statistical analyses, it was necessary to arrive at models that were best able to explain policy adoption.

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[19] Recall, the intent of this project is to obtain the most complete understanding of renewable energy policymaking as possible. The analyses are not intending to show that any particular variable is important. As such, relying upon a systematic approach to removal allows for the most non-arbitrary manner of identifying variables for removal.

[20] The likelihood-ratio statistic if found using the general equation

$$G^2 = 2\sum n_{ijk} \log\left(\frac{n_{ijk}}{\hat{\mu}_{ijk}}\right)$$

The Pearson statistic is found using the general equation

$$\chi^2 = \sum \frac{\left(n_{ijk} - \mu_{ijk}\right)^2}{\mu_{ijk}}$$

[21] A Goodness-of-Fit test was run for each combination of variables. Beginning with a baseline test with all of the variables, this means that the test was run with all of the variables except for one to determine the G^2 and χ^2. The next test was run with a different variable removed and the previous variable added back to the model.

Summary

Building from the literature outlined in Chapter 2, this chapter established the analytical approach that I will use to examine the adoption of state renewable energy policies. Briefly, the analyses will be cross-sectional time-series analyses using the complementary log-log distribution because of its superior ability to model rare events. The models are designed to account for the three core components identified in Chapter 2. Additionally, the methods outlined are designed to arrive at the most complete understanding of state renewable energy policy adoption. To illustrate that this is a desirable approach to examining adoption, comparisons will be made between a traditional examinations and an expanded analyses, and five competing explanations of policy learning will be modeled to identify the best specified model of adoption. The analyses that follow will be divided between the adoption of state financial incentive policies, Chapter 4, and state rules and regulations, Chapter 5, that are all designed to encourage the construction of renewable energy systems.

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Chapter 4:
Incentivizing Renewable Energy:
The Adoption of Financial Incentive Policies

Currently, states have adopted eleven different types of incentive policies. Each type of policy generally attempts to influence renewable energy in a specific manner. While there may be some similarities between policy types, each type is distinctly different from the others. For instance, corporate and personal tax incentives are quite similar in many respects, mostly because they offer the same basic incentive. However, they differ in one important manner in that they can only be accessed by a specific class of clientele. Because some states specifically adopted policies that only applied to corporations and others that only applied to individuals, it is appropriate to treat them as different types of policies.

These eleven policy types can be grouped into three categories – tax incentives, production support, and state-backed financing. Tax incentive policies allow the owner of a renewable energy resource to deduct certain costs from their taxes. Some of these policies are one-time only incentives that can only be applied in the year of purchase or construction, while others can be used every year.

Production support takes three basic forms. The first are tax write-offs based on actual energy production. Next, some states offer rebates that can be claimed following the construction of a renewable. Finally, states have begun to offer financial support to encourage the production of renewable systems, with the expectation that this will both create jobs and increase the use of the renewable within the state.

State-backed financing allows the state to provide funding for the construction of renewable systems. These take three forms. First, a state can offer loans at low interest rates. Second, some states offer large grants of money to help facilitate the purchasing and/or construction of renewable systems. The third option is for the state to issue bonds that are backed by the state on behalf of a corporation. Usually, these policies are mutually exclusive, preventing an entity from taking advantage of more than one incentive.

Analyses of these policies will begin with tax incentives and end with state-backed financing. Each policy will contain both a traditional and expanded analyses. As noted in Chapter 3 my strategy of analysis is intended to illustrate that the traditional approach may be underspecified, thus negatively influencing the accuracy of our analyses. The analysis of each policy will begin with the traditional approach followed by the expanded. Additionally, because it is difficult to identify what form of diffusion may best explain policy adoption, I will analyze five competing measures. To determine which offers the best specified model I perform Davidson-MacKinnon tests (Davidson and MacKinnon 1993).[22] The measure of diffusion that allows for the best specified model should best explain how states learn from one another, and will be the analysis discussed for each policy. Unless there are significant differences in the other models I will not provide a detailed discussion of their results.

Tax Incentive Policies

Tax incentive policies are probably the most recognized financial incentive that states offer. They come in five basic varieties – corporate, personal, sales, property, and excise. Below I model each policy separately (see Chapter 3 for a detailed discussion of the methods employed).

Corporate Tax Incentives

Corporate tax incentives tend to be created with renewable energy facilities in mind. These are often used for large projects, such as a wind farm. States have adopted several different varieties of these incentives. Some of the policies apply to very specific situations,

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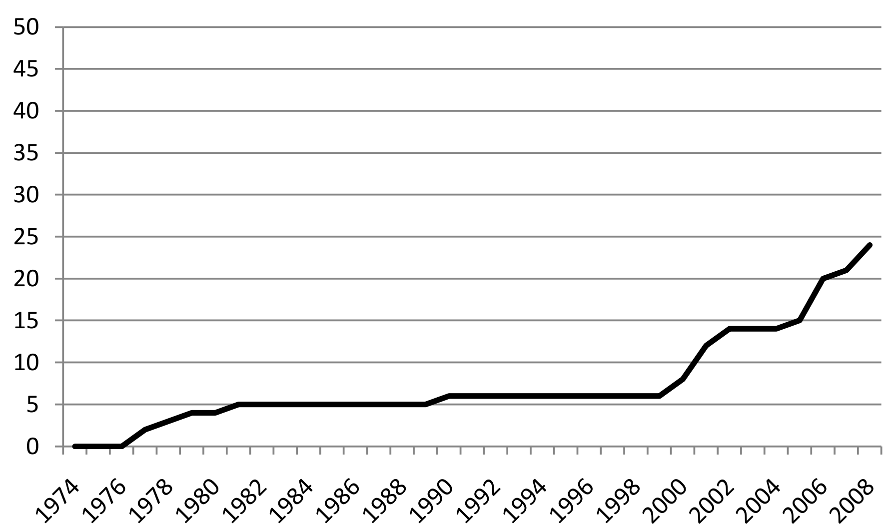
[22] From this point on, the Davidson-MacKinnon test (Davidson and MacKinnon 1993) will be abbreviated DMT. Any reference to DMT is a reference to the Davidson-MacKinnon test.

while others are far more general. Figure 4.1 illustrates the adoption of state corporate tax incentives over time.

Beginning with the traditional approach to examining policy adoption, the results of the traditional models of the adoption of state corporate tax incentives can be found in Table 4.1. Using a DMT, the EPA Hybrid measure of diffusion was identified as providing the best explanation of policy learning. The model fit statistics for this analysis indicate that the model performs well.

The results reveal that the only variable in the traditional model that has a statistically significant influence was electric energy consumption. This indicates that states that consume more energy are more likely to adopt a corporate tax incentive. The trend variable also reveals that without the inclusion of this control the hazard rate would have been biased.[23] In general,

Figure 4.1: State Adoption of Corporate Tax Incentive Policies, 1974-2008



Source: Compiled by the author based upon state adoption of its first corporate tax incentive policy

[23] See Chapter 3 for a discussion of the hazard rate.

Table 4.1: State Adoption of Corporate Tax Incentive Policies (Traditional Model)

	EPA		EPA Hybrid		Neighbor		Neighbor Hybrid		Leader-Laggard	
	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.
Internal Determinants										
Tax Revenue per Capita	-.077 (.505)	.878	-.059 (.506)	.906	-.084 (.528)	.873	-.049 (.526)	.926	-.099 (.527)	.850
Population Density	.0008 (.001)	.472	.0007 (.001)	.486	.0009 (.001)	.420	.001 (.001)	.363	.0008 (.001)	.494
College Graduates	-.017 (.049)	.153	-.072 (.050)	.151	-.073 (.054)	.179	-.071 (.054)	.189	-.077 (.055)	.164
Government Ideology	-.0007 (.011)	.944	.0009 (.011)	.939	-.001 (.011)	.871	-.001 (.011)	.922	-.002 (.011)	.838
Citizen Ideology	.026 (.020)	.189	.023 (.020)	.267	.028 (.021)	.182	.027 (.021)	.203	.028 (.021)	.186
Legislative Professionalism	1.641 (2.788)	.556	1.550 (2.786)	.578	2.012 (3.002)	.503	2.000 (2.980)	.502	1.922 (3.162)	.543
Energy Specific Conditions										
Wind Potential	010 (022)	.636	.007 (.022)	.722	.010 (.022)	.635	.009 (.022)	.690	.011 (.022)	.625
Percent Sunshine	.047 (.028)	.100	.040 (.029)	.160	.043 (.028)	.128	.039 (.028)	.165	.044 (.031)	.166
Nuclear Power Plants	-.214 (.153)	.163	-.211 (.151)	.162	-.249 (.180)	.167	-.250 (.182)	.169	-.250 (.173)	.149
Electric Energy Consumption	.013 (.007)	.072	.012 (.007)	.094	.014 (.008)	.071	.014 (.008)	.078	.014 (.008)	.076
PUC Employees	-.003 (.002)	.155	-.002 (.002)	.203	-.003 (.002)	.154	-.003 (.002)	.185	-.003 (.002)	.137
Green Conditions	.0002 (.0004)	.544	.0004 (.0005)	.432	.0003 (.0005)	.552	.0003 (.0005)	.480	.0002 (.0005)	.596
Renewable Portfolio Standard	-.849 (.686)	.216	-.840 (.686)	.221	-.844 (.702)	.229	-.829 (.703)	.239	-.857 (.722)	.235
Diffusion Variable	-.641 (1.252)	.609	-2.083 (1.758)	.263	-.550 (1.249)	.659	-1.076 (1.249)	.389	.00004 (.0007)	.946
Trend	-.890 (.267)	.001	-.977 (.273)	.000	-.910 (.275)	.001	-.918 (.271)	.001	-.888 (.272)	.001
Constant	-3.976 (2.575)	.123	-3.239 (2.642)	.220	-3.843 (2.599)	.139	-3.759 (2.545)	.140	-3.913 (2.635)	.138
Number of Cases	1514		1514		1514		1514		1514	
Wald Chi^2	37.39	.0011	39.56	.0005	27.10	.0279	26.47	.0333	30.63	.0098
Log Likelihood	-104.965		-104.337		-104.958		-104.680		-105.052	
rho	.027		.024		.156		.154		.172	

Davidson-MacKinnon Test

	EPA	EPA Hybrid	Neighbor	Neighbor Hybrid	Leader-Laggard
EPA	-	.211	.753	.817	.603
EPA Hybrid	.117	-	.287	.353	.235
Neighbor	.769	.979	-	.294	.663
Neighbor Hybrid	.441	.622	.202	-	.387
Leader-Laggard	.930	.948	.982	.942	-

Standard errors are in parentheses. Two-tailed test. Davidson-MacKinnon Test results are the reported p-values.

the traditional model does little to help us understand what influences a state to adopt a corporate tax incentive. Will the expanded model offer a better explanation?

The expanded analyses of corporate tax incentives are presented in Table 4.2. The DMT indicates that the neighbor hybrid measure of diffusion provides the best explanation of corporate tax incentive policy adoption. The model fit statistics indicate that the model performs well. These results also suggest that the traditional models were in fact underspecified. Indeed, three of the variables included from the traditional model are now significantly influencing adoption. This suggests that the expanded model is able to clarify the way each variable influences corporate tax incentive adoption.

The results indicate that states that have more liberal citizenries, less yearly sunshine, fewer nuclear power plants, and higher electrical energy consumption are more likely to have adopted a corporate tax incentive policy. The analysis of the influence of existing policies also provides a look into positive and negative feedbacks. The results suggest that states that had already adopted a personal tax incentive, sales tax incentive, industry support, and net metering policies were more likely to adopt a corporate tax incentive. All four of these policies indicate that there may be a positive feedback associated with the adoption of these policies. The trend variable also reveals that the hazard rate would again have been biased. However, it is worth noting that the z-score for the trend variable has dropped from 3.578 to 1.656, which indicates that a better specified model may decrease the likelihood of duration dependence.

These analyses also reveal the importance of modeling more than one version of diffusion. The measure of diffusion that was best specified changed between the traditional and expanded models. Note, in both sets of models, it is the hybrid model that best explains adoption. However, in neither the traditional nor expanded analyses were the best specified

Table 4.2: State Adoption of Corporate Tax Incentive Policies (Expanded Model)

	EPA		EPA Hybrid		Neighbor		Neighbor Hybrid		Leader-Laggard	
	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.
Internal Determinants										
Tax Revenue per Capita	1.157 (.984)	.240	1.404 (.873)	.108	1.043 (.860)	.225	.905 (.876)	.302	1.147 (1.040)	.270
College Graduates	-.333 (.196)	.090	-.240 (.193)	.215	-.234 (.182)	.198	-.227 (.181)	.211	-.322 (.201)	.109
Citizen Ideology	.079 (.038)	.038	.073 (.038)	.053	.085 (.038)	.027	.019 (.041)	.026	.079 (.037)	.035
Legislative Professionalism	3.169 (7.095)	.655	.381 (6.791)	.955	-1.284 (7.664)	.867	-.832 (7.500)	.912	3.437 (7.837)	.661
Energy Specific Conditions										
Wind Potential	-.005 (.042)	.893	-.003 (.039)	.931	.004 (.040)	.915	.003 (.040)	.931	-.009 (.045)	.831
Percent Sunshine	-.113 (.066)	.090	-.102 (.061)	.092	-.109 (.062)	.083	-.130 (.068)	.057	-.115 (.073)	.117
Nuclear Power Plants	-.926 (.393)	.018	-.768 (.340)	.024	-.771 (.331)	.020	-.748 (.331)	.024	-.874 (.386)	.024
Electric Energy Consumption	.056 (.017)	.001	.047 (.014)	.001	.044 (.014)	.002	.046 (.014)	.001	.055 (.019)	.004
PUC Employees	-.004 (.005)	.411	-.002 (.004)	.627	-.001 (.005)	.740	-.003 (.005)	.541	-.004 (.005)	.439
Green Conditions	-.001 (.001)	.283	-.001 (.001)	.215	-.001 (.001)	.219	-.001 (.001)	.211	-.001 (.001)	.386
National Policies										
Production Incentive	-2.605 (2.462)	.290	-2.396 (2.376)	.313	-2.985 (2.340)	.202	-2.814 (2.345)	.230	-2.326 (2.389)	.330
Modified Accelerated Cost-Recovery System	-1.236 (2.151)	.566	-1.575 (2.162)	.466	-1.434 (2.154)	.505	-1.372 (2.149)	.523	-1.365 (2.171)	.529
Business Energy Tax Credit	-2.570 (1.772)	.147	-2.037 (1.707)	.233	-1.995 (1.672)	.233	-2.013 (1.682)	.231	-2.394 (1.733)	.167
USDA Rural Energy Program	-1.434 (1.617)	.375	-1.244 (1.625)	.444	-.379 (1.883)	.840	-.785 (1.737)	.651	-1.394 (1.632)	.393
State Incentive Policies										
Personal Tax	12.072 (2.537)	.000	10.918 (2.260)	.000	11.124 (2.300)	.000	11.444 (2.432)	.000	12.007 (2.569)	.000
Sales Tax	2.572 (1.309)	.049	1.927 (1.223)	.115	2.060 (1.212)	.089	2.210 (1.257)	.079	2.493 (1.308)	.057
Property Tax	-.514 (1.139)	.652	-1.089 (1.107)	.325	-.887 (1.170)	.449	-.914 (1.172)	.436	-.560 (1.120)	.617
Production Rebate	1.535 (1.119)	.170	1.453 (1.018)	.153	1.672 (1.086)	.124	1.859 (1.180)	.115	1.662 (1.111)	.135
Grant	-.950 (1.31)	.468	-1.131 (1.394)	.417	-1.179 (1.466)	.421	-1.199 (1.501)	.424	-1.054 (1.321)	.425
Loan	1.731 (1.254)	.167	1.514 (1.240)	.222	1.524 (1.259)	.226	1.452 (1.224)	.236	1.726 (1.269)	.174
Excise Tax	2.402 (6.277)	.702	2.255 (8.469)	.790	1.581 (8.846)	.858	1.024 (9.989)	.918	2.460 (6.766)	.716
Industry Support	2.796 (1.429)	.050	2.652 (1.266)	.036	2.725 (1.336)	.042	2.676 (1.326)	.049	2.793 (1.396)	.045
State Rules & Regulations										
Renewable Portfolio Standard	-1.018 (2.705)	.706	-.553 (2.404)	.818	-1.139 (2.476)	.645	-1.149 (2.530)	.650	-.782 (2.706)	.772
Required Green Power	-4.777 (6.749)	.479	-5.310 (8.732)	.543	-5.167 (9.046)	.568	-4.652 (10.134)	.646	-5.197 (7.234)	.472
Public Benefits Fund	-5.910 (3.421)	.084	-5.073 (3.082)	.100	-4.851 (3.318)	.144	-4.523 (3.403)	.184	-6.051 (3.363)	.072
Net Metering	3.185 (1.654)	.054	2.836 (1.583)	.073	3.288 (1.659)	.048	3.276 (1.679)	.051	3.518 (1.889)	.063

Diffusion Variable	1.770 (2.918)	.544	-3.352 (4.184)	.423	-3.657 (3.069)	.234	-4.009 (3.207)	.211	-.0005 (.001)	.761
Trend	-1.547 (.915)	.091	-1.466 (.875)	.094	-1.420 (.883)	.108	-1.449 (.875)	.098	-1.513 (.896)	.091
Constant	5.660 (6.623)	.393	5.457 (6.269)	.384	5.842 (6.365)	.359	6.812 (6.501)	.295	5.800 (6.629)	.382
Number of Cases	1514		1514		1514		1514		1514	
Wald Chi^2	38.88	.0828	41.22	.0513	40.91	.0547	40.20	.0635	38.67	.0864
Log Likelihood	-31.265		-31.904		-31.478		-31.409		-31.397	
rho	.449		.214		.214		.211		.444	

Davidson-MacKinnon Test

	EPA	EPA Hybrid	Neighbor	Neighbor Hybrid	Leader-Laggard
EPA	-	.014	.473	.569	.590
EPA Hybrid	.014	-	.660	.668	.330
Neighbor	.195	.318	-	.904	.209
Neighbor Hybrid	.198	.285	.699	-	.201
Leader-Laggard	.898	.527	.620	.705	-

Standard errors are in parentheses. Two-tailed test. Davidson-MacKinnon Test results are the reported p-values.

models statistically significantly better specified than the others. While at first glance, this may suggest that the actual measure used isn't important, a closer examination of the results illustrates the importance of reporting the best model possible.

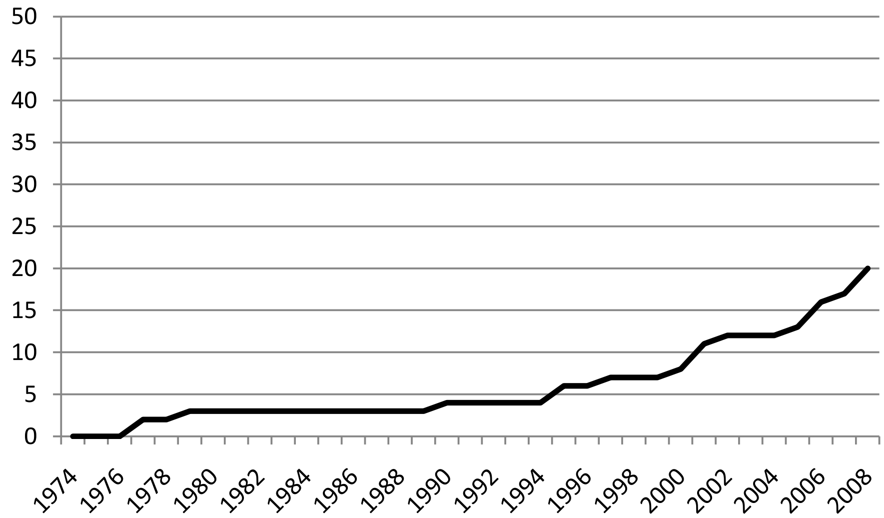
Looking closely across the alternative estimates, there are several discrepancies in the results. For instance, if the leader-laggard measure was reported, the measure of the percent of the year a state has sunshine would not be statistically significant, and public benefits funds would be. These are two incorrect estimations that rely upon a sub-optimal representation of diffusion. If the EPA hybrid approach were still the best, then sales tax incentives would no longer be significant. The same is true for public benefits funds within the original EPA model.

Personal Tax Incentives

Personal tax incentive policies are similar to corporate tax incentives except that they apply only to privately, produced renewable energy. Like corporate incentives, some policies apply to very specific situations, such as only solar power. As before, the analyses that follow will begin with a traditional model, and conclude with an expanded model. An illustration of state adoption of personal tax incentives over time can be found in Figure 4.2.

The results of the traditional model of state adoption of personal tax incentives can be found in Table 4.3. The DMT indicates that the neighbor hybrid measure of diffusion provides the best specified estimation of the impact of diffusion. Unlike the corporate tax incentive model, the traditional model for personal tax incentives provides a fairly strong explanation of what may influence a state to adopt these policies. Indeed, the data suggests that states with higher per capita tax revenue, higher percentage of the year with sunshine, and greater green conditions are more likely to have adopted personal tax incentive policies to promote renewable

Figure 4.2: State Adoption of Personal Tax Incentive Policies, 1974-2008



Source: Compiled by the author based upon state adoption of its first personal tax incentive policy

energy. As before, the trend variable suggests that the hazard rate would become biased if the model did not contain a control for duration dependence.

The expanded model of personal tax incentive policy adoption can be found in Table 4.4. The DMT clearly indicates that the measure for leader-laggard diffusion produces the best specified model. The model fit statistics indicate that the model performs well. These results also provide a much better understanding of personal tax incentive policy adoption than the traditional model. Also, the trend variable suggests that the hazard rate would have been unstable in its absence.

The estimations indicate that states with higher per capita tax revenue, more conservative citizen ideology, a larger percentage of the year with sunshine, more nuclear power plants, and less electrical energy consumption are more likely to adopt personal tax incentives. The data also reveal that the activities of the national government also influence state adoption of these policies. Following the adoption of the national production incentive program, states were more

Table 4.3: State Adoption of Personal Tax Incentive Policies (Traditional Model)

	EPA		EPA Hybrid		Neighbor		Neighbor Hybrid		Leader-Laggard	
	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.
Internal Determinants										
Tax Revenue per Capita	.844 (.370)	.023	.894 (.365)	.014	.998 (.373)	.007	1.009 (.357)	.005	.910 (.351)	.010
Population Density	-.0001 (.001)	.882	-.0001 (.001)	.904	-.0003 (.001)	.976	.00005 (.001)	.960	-.0002 (.001)	.856
College Graduates	-.035 (.059)	.548	-.038 (.060)	.520	-.040 (.061)	.511	-.037 (.061)	.536	-.041 (.061)	.504
Government Ideology	-.009 (.012)	.464	-.009 (.012)	.456	-.010 (.012)	.438	-.009 (.012)	.446	-.009 (.013)	.448
Citizen Ideology	.016 (.023)	.487	.015 (.023)	.527	.013 (.023)	.562	.013 (.023)	.559	.014 (.023)	.548
Legislative Professionalism	.190 (3.124)	.951	-.025 (3.102)	.994	-.691 (3.145)	.826	-.875 (3.088)	.777	-.194 (3.126)	.950
Energy Specific Conditions										
Wind Potential	-.022 (.022)	.312	-.023 (.022)	.307	-.026 (.022)	.251	-.030 (.023)	.202	.023 (.022)	.296
Percent Sunshine	.051 (.026)	.050	.051 (.027)	.059	.050 (.026)	.052	.046 (.026)	.073	.053 (.029)	.073
Nuclear Power Plants	.069 (.149)	.644	.063 (.148)	.669	.074 (.152)	.623	.086 (.154)	.575	.061 (.149)	.678
Electric Energy Consumption	-.001 (.009)	.832	-.001 (.009)	.852	-.002 (.009)	.802	-.003 (.009)	.718	-.002 (.009)	.821
PUC Employees	-.001 (.002)	.638	-.0009 (.002)	.692	-.0004 (.002)	.853	-.00007 (.002)	.974	-.0009 (.002)	.687
Green Conditions	.0008 (.0006)	.169	.0009 (.0006)	.150	.001 (.0006)	.099	.001 (.0006)	.078	.0008 (.0006)	.186
Renewable Portfolio Standard	-.726 (.704)	.303	-.684 (.709)	.334	-.606 (.703)	.389	-.576 (.703)	.413	-.697 (.702)	.321
Diffusion Variable	.465 (1.216)	.702	.068 (1.426)	.961	-.810 (1.187)	.495	-1.187 (1.159)	.306	.0001 (.0006)	.858
Trend	-.372 (.228)	.103	-.378 (.228)	.098	-.401 (.232)	.084	-.411 (.232)	.077	-.381 (.229)	.096
Constant	-8.760 (2.493)	.000	-8.693 (2.532)	.001	-8.780 (2.465)	.000	-8.778 (2.443)	.000	-8.713 (2.533)	.001
Number of Cases	1560		1560		1560		1560		1560	
Wald Chi^2	22.40	.0978	22.18	.1030	21.75	.1146	22.38	.0983	22.25	.1014
Log Likelihood	-95.103		-95.173		-94.937		-94.638		-95.158	
rho	.023		.022		.022		.022		.022	

Davidson-MacKinnon Test

	EPA	EPA Hybrid	Neighbor	Neighbor Hybrid	Leader-Laggard
EPA	-	.380	.381	.348	.661
EPA Hybrid	.445	-	.724	.635	.933
Neighbor	.306	.442	-	.313	.507
Neighbor Hybrid	.190	.260	.210	-	.313
Leader-Laggard	.781	.848	.945	.971	-

Standard errors are in parentheses. Two-tailed test. Davidson-MacKinnon Test results are the reported p-values.

Table 4.4: State Adoption of Personal Tax Incentive Policies (Expanded Model)

	EPA		EPA Hybrid		Neighbor		Neighbor Hybrid		Leader-Laggard	
	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.
Internal Determinants										
Tax Revenue per Capita	1.663 (2.978)	.576	1.024 (3.393)	.763	2.292 (2.877)	.426	2.438 (2.916)	.403	3.230 (1.960)	.099
Citizen Ideology	-.048 (.060)	.419	-.071 (.062)	.255	-.082 (.067)	.220	-.087 (.068)	.207	-.128 (.066)	.052
Energy Specific Conditions										
Wind Potential	.015 (.052)	.769	.019 (.052)	.714	-.007 (.047)	.882	-.001 (.048)	.978	-.050 (.058)	.388
Percent Sunshine	.261 (.080)	.001	.300 (.098)	.002	.274 (.081)	.001	.283 (.086)	.001	.322 (.092)	.000
Nuclear Power Plants	1.179 (.445)	.008	1.280 (.464)	.006	1.308 (.497)	.009	1.334 (.507)	.009	1.116 (.467)	.017
Electric Energy Consumption	-.076 (.026)	.004	-.084 (.028)	.003	-.086 (.030)	.004	-.089 (.031)	.005	-.088 (.028)	.002
National Policies										
Production Incentive	4.636 (2.990)	.121	4.76 (2.975)	.110	6.491 (3.283)	.048	6.617 (3.382)	.050	6.437 (3.779)	.089
USDA Rural Energy Program	-7.544 (3.811)	.048	-7.658 (4.158)	.066	-9.151 (4.327)	.034	-9.425 (4.487)	.036	-8.604 (3.194)	.007
State Incentive Policies										
Corporate Tax	16.448 (4.924)	.001	18.227 (5.581)	.001	17.938 (5.587)	.001	18.552 (5.930)	.002	17.343 (4.272)	.000
Sales Tax	-3.258 (2.352)	.166	-3.695 (2.452)	.132	-3.342 (2.159)	.122	-3.460 (2.231)	.121	-3.907 (1.996)	.050
Property Tax	1.923 (1.226)	.117	2.591 (1.459)	.076	2.231 (1.251)	.075	2.190 (1.264)	.083	2.438 (1.481)	.100
State Rules & Regulations										
Renewable Portfolio Standard	-2.935 (2.416)	.224	-3.733 (3.022)	.217	-2.911 (2.429)	.231	-3.305 (2.805)	.239	-4.008 (2.421)	.098
Public Benefits Fund	6.628 (2.971)	.026	8.073 (3.691)	.029	5.931 (2.565)	.021	6.054 (2.694)	.025	2.854 (1.978)	.149
Net Metering	1.208 (1.683)	.473	1.251 (1.756)	.476	1.157 (1.772)	.514	1.159 (1.805)	.521	1.786 (1.660)	.282
Diffusion Variable	5.580 (4.167)	.181	9.740 (5.872)	.097	2.662 (2.960)	.368	3.110 (3.144)	.322	.003 (.001)	.017
Trend	2.765 (1.158)	.017	2.874 (1.246)	.021	3.185 (1.275)	.013	3.261 (1.311)	.013	2.482 (1.127)	.028
Constant	-36.395 (10.135)	.000	-38.892 (11.410)	.001	-39.197 (10.897)	.000	-40.045 (11.420)	.000	-42.737 (11.043)	.000
Number of Cases	1560		1560		1560		1560		1560	
Wald Chi^2	24.94	.0709	22.06	.1413	26.55	.0468	25.35	.0638	28.05	.0312
Log Likelihood	-18.500		-17.608		-18.963		-18.846		-15.484	
rho	.024		.025		.024		.024		.023	

	Davidson-MacKinnon Test				
	EPA	EPA Hybrid	Neighbor	Neighbor Hybrid	Leader-Laggard
EPA	-	.339	.270	.298	.171
EPA Hybrid	.142	-	.144	.165	.047
Neighbor	.546	.760	-	.818	.225
Neighbor Hybrid	.507	.827	.608	-	.183
Leader-Laggard	.019	.023	.018	.020	-

Standard errors are in parentheses. Two-tailed test. Davidson-MacKinnon Test results are the reported p-values.

likely to adopt personal incentives. However, following the adoption of the USDA Rural Energy Program the states that had not yet adopted personal tax incentive policies became less likely to do so. It is probable that this is a direct reaction to the individual-level incentives found in this program, which may have caused states to feel that they didn't need to adopt a redundant policy.

The analysis also reveals that the adoption of other renewable energy policies influenced the likelihood of adopting a personal tax incentive. Interestingly, these results indicate that there can be both a positive and negative feedback from the adoption of other policies in a policy arena. Not surprisingly, when a state has adopted a corporate tax incentive, they are also much more likely to adopt a personal tax incentive. This may suggest that many of these states may have adopted the personal tax incentive to satisfy critics. Unexpectedly, the results indicate that states that have already adopted sales tax incentives and renewable portfolio standards are less likely to adopt personal tax incentives. Perhaps the negative influence of sales tax incentives indicates that these policies may have been intended to serve as an incentive for corporations and not individuals. A bit more perplexing is the negative relationship between renewable portfolio standards and adoption. It is possible that state legislatures have recognized that individual-level incentives will only have a minimal impact towards achieving the goals outlined in their renewable portfolio standards, and have decided to focus on supporting large-scale renewable energy projects instead.

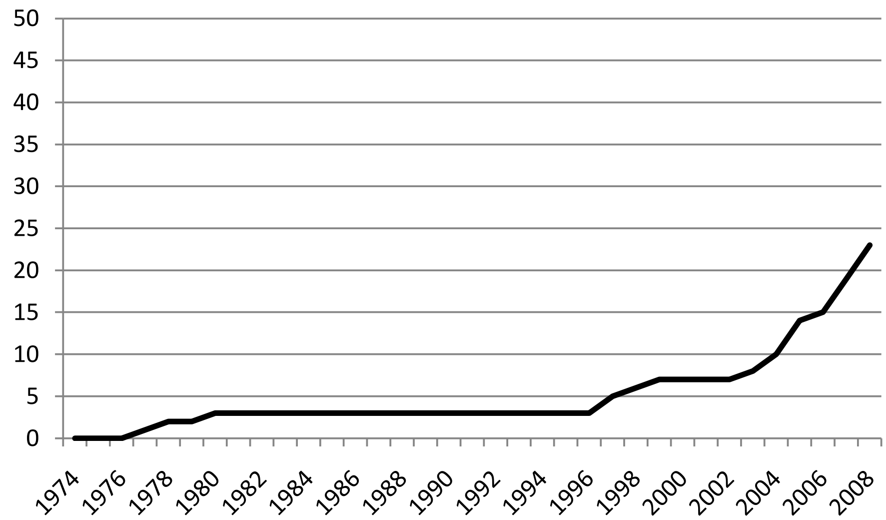
The results illustrate the need for policy scholars to consider modeling the many possible influences of diffusion. The comparison between a traditional approach to understanding policy adoption to the expanded analyses reveal that the best specified model, based on the different measures of diffusion, changed in the expanded analysis. This suggests that the expanded analysis is providing a much clearer picture of policy adoption, which allows the influence of diffusion to be better estimated. Moreover, the leader-laggard measure in the expanded models creates a significantly better specified model than the four alternative measures.

An examination of the leader-laggard model compared to the others reveals that the estimations from this model differ greatly from the others. The better specified leader-laggard model reveals that tax revenue per capita, citizen ideology, sales tax incentives and renewable portfolio standards have a statistically significant influence on adoption, while none of these variables were statistically significant in any of the other four models. Furthermore, the national production incentive program was significant in two of the other four models. Additionally, three models identify property tax incentives as having a significant influence and all four suggest public benefits funds were important, but neither of these was found to have a statistically significant influence when estimated in the best specified model. In short, the use of any of the other models would have resulted in less accurate estimations because these analyses were all significantly worse specified than the leader-laggard model.

Sales Tax Incentives

Many states have adopted sales tax incentives to help encourage the purchase of renewable resources within the state. These policies vary in several ways, but perhaps the most important is that most of these incentives can only be used if the renewable source was purchased within the state. This can make it difficult to actually use this incentive because the purchase of many of these systems requires working directly with an out-of-state manufacturer and not a retailer within the state. Analyses of policy adoption will begin with the traditional models and will be followed by expanded models. Figure 4.3 displays the adoption of state sales tax incentives over time.

Figure 4.3: State Adoption of Sales Tax Incentive Policies, 1974-2008



Source: Compiled by the author based upon state adoption of its first sales tax incentive policy

Table 4.5 presents the results of the traditional adoption models of state sales tax incentive adoption. The DMT reveals that the leader-laggard measure model provides the best specified model. The DMT also reveals that this measure is statistically significantly better than either of the EPA measures, and is comparatively better than the neighbor measures. The model fit statistics indicate that the model performs well. The model indicates that states that have higher per capita tax revenue, higher levels of population density, more conservative citizens, and have already adopted a renewable portfolio standard are more likely to adopt a sales tax incentive. Additionally, the data reveal that without a trend variable, the hazard rate would have become unstable.

The results of the expanded state sales tax incentive adoption model are presented in Table 4.6. Until now, the DMT has revealed that the expanded models have clarified the analysis in such a way that a different measure of diffusion provides a better specified model. However, for sales tax incentives, the DMT still suggests that the leader-laggard measure

Table 4.5: State Adoption of Sales Tax Incentive Policies (Traditional Model)

	EPA		EPA Hybrid		Neighbor		Neighbor Hybrid		Leader-Laggard	
	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.
Internal Determinants										
Tax Revenue per Capita	.001 (.0004)	.010	.001 (.0005)	.018	.001 (.0004)	.014	.001 (.0004)	.011	.001 (.0004)	.016
Population Density	.002 (.001)	.024	.002 (.001)	.019	.002 (.001)	.039	.002 (.001)	.023	.002 (.001)	.072
College Graduates	-.006 (.045)	.879	-.006 (.045)	.888	-.011 (.043)	.791	-.007 (.045)	.876	-.020 (.046)	.664
Government Ideology	.002 (.015)	.859	.003 (.015)	.809	.007 (.015)	.619	.004 (.015)	.790	.004 (.015)	.772
Citizen Ideology	-.045 (.024)	.072	-.046 (.024)	.058	-.048 (.024)	.050	-.048 (.024)	.048	-.055 (.025)	.030
Legislative Professionalism	1.220 (3.032)	.687	1.213 (1.036)	.689	1.280 (2.991)	.669	1.210 (3.034)	.690	-.241 (3.218)	.940
Energy Specific Conditions										
Wind Potential	.002 (.024)	.911	.003 (.023)	.891	.005 (.023)	.823	.004 (.023)	.857	.007 (.023)	.757
Percent Sunshine	.006 (.025)	.789	.006 (.026)	.810	.009 (.025)	.704	.007 (.025)	.760	.036 (.037)	.324
Nuclear Power Plants	.068 (.187)	.714	-.059 (.187)	.750	-.075 (.189)	.691	-.069 (.188)	.712	-.126 (.202)	.532
Electric Energy Consumption	.002 (.006)	.732	.001 (.006)	.757	.002 (.006)	.690	.001 (.006)	.774	.002 (.006)	.709
PUC Employees	-.001 (.002)	.473	-.001 (.002)	.457	-.001 (.002)	.409	-.001 (.002)	.459	-.002 (.002)	.305
Green Conditions	.0009 (.0006)	.120	.0009 (.0006)	.136	0008 (.0006)	.161	.0008 (.0006)	.156	.0006 (.0006)	.312
Renewable Portfolio Standard	1.619 (.629)	.010	1.560 (.616)	.011	1.411 (.615)	.022	1.536 (.609)	.012	1.267 (.607)	.037
Diffusion Variable	-1.067 (1.326)	.421	-.689 (1.164)	.554	.514 (1.084)	.635	-.456 (1.045)	.662	.001 (.0006)	.113
Trend	-.601 (.204)	.003	-.584 (.202)	.004	-.551 (.204)	.007	-.586 (.202)	.004	-.646 (.204)	.002
Constant	-2.805 (2.032)	.167	-2.766 (2.026)	.172	-3.017 (2.067)	.144	-2.720 (2.037)	.182	-3.730 (2.495)	.135
Number of Cases	1589		1589		1589		1589		1589	
Wald Chi^2	55.98	.0000	55.58	.0000	56.98	.0000	55.94	.0000	54.89	.0000
Log Likelihood	-92.398		-92.544		-92.618		-92.632		-91.473	
rho	.020		.020		.021		.020		.020	

Davidson-MacKinnon Test

	EPA	EPA Hybrid	Neighbor	Neighbor Hybrid	Leader-Laggard
EPA	-	.505	.202	.498	.251
EPA Hybrid	.682	-	.363	.670	.241
Neighbor	.257	.380	-	.023	.594
Neighbor Hybrid	.996	.900	.031	-	.601
Leader-Laggard	.095	.078	.131	.126	-

Standard errors are in parentheses. Two-tailed test. Davidson-MacKinnon Test results are the reported p-values.

provides the best specification for adoption. Again, this is significantly better than either EPA measure and comparatively better than the neighbor measures. The model fit statistics indicate that the model performs well.

The expanded model reveals that states with higher per capita tax revenues, higher levels of population density, and more conservative citizens are more likely to adopt a sales tax incentive. However, the expanded analysis is now able to more accurately estimate the relationship between the percentage of the year a state has sunshine and adoption, revealing that states with more sunshine are more likely to adopt. The results also indicate that states are reacting positively to the actions of the national government. Indeed, states were more likely to adopt following the national government adopting their production incentive program and the Business Energy Tax Credit.

As the previous expanded models have illustrated, the existence of similar policies can influence the likelihood of adopting a sales tax incentive. Specifically, the data suggest that states that have adopted an excise tax incentive and required green power were more likely to adopt. Interestingly, the expanded model suggests that renewable portfolio standards in the traditional model were reflecting something other than these policies since they are no longer significantly likely to influence adoption. Additionally, the expanded model not only provides a model that is better specified, it also removes the duration dependence that was found in the traditional model, as illustrated by the trend variable.

A comparison between the different models reconfirms the need to ensure that adoption models are properly measuring diffusion. Although misspecification is less prevalent in the sales tax models than in the personal tax models, there are differences that would lead to inaccurately identifying what influences adoption. For example, in the four alternative models, the data

Table 4.6: State Adoption of Sales Tax Incentive Policies (Expanded Model)

	EPA		EPA Hybrid		Neighbor		Neighbor Hybrid		Leader-Laggard	
	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.
Internal Determinants										
Tax Revenue per Capita	.001 (.0009)	.058	.001 (.0009)	.067	.001 (.0006)	.072	.001 (.0007)	.045	.001 (.0006)	.056
Population Density	.004 (.001)	.005	.004 (.001)	.003	.004 (.001)	.008	.005 (.001)	.003	.003 (.001)	.009
College Graduates	-.043 (.054)	.421	-.047 (.054)	.390	-.077 (.054)	.154	-.050 (.055)	.365	-.070 (.053)	.187
Government Ideology	-.021 (.018)	.244	-.020 (.018)	.272	-.017 (.019)	.355	-.023 (.019)	.235	-.027 (.020)	.175
Citizen Ideology	-.042 (.027)	.126	-.046 (.026)	.080	-.047 (.025)	.067	-.048 (.026)	.069	-.052 (.026)	.050
Legislative Professionalism	-.339 (3.567)	.924	-.609 (3.614)	.866	-.318 (3.463)	.927	-.044 (3.441)	.990	-3.126 (3.993)	.434
Energy Specific Conditions										
Wind Potential	.007 (.026)	.786	.007 (.026)	.772	.007 (.026)	.768	.008 (.026)	.740	.012 (.026)	.648
Percent Sunshine	.046 (.039)	.236	.046 (.039)	.234	.057 (.040)	.156	.050 (.038)	.190	.092 (.052)	.079
Nuclear Power Plants	-.063 (.221)	.773	-.038 (.216)	.857	-.039 (.214)	.855	-.024 (.214)	.910	-.078 (.223)	.727
Electric Energy Consumption	.004 (.008)	.575	.004 (.008)	.613	.004 (.008)	.571	.004 (.008)	.597	.003 (.008)	.668
PUC Employees	-.002 (.001)	.186	-.002 (.001)	.212	-.001 (.001)	.273	-.002 (.001)	.229	-.001 (.001)	.315
Green Conditions	.001 (.0008)	.050	.001 (.0008)	.057	.001 (.0008)	.093	.001 (.0008)	.059	.001 (.0008)	.214
National Policies										
Production Incentive	2.420 (1.329)	.069	2.315 (1.315)	.078	2.157 (1.291)	.095	2.223 (1.307)	.089	2.334 (1.306)	.074
Business Energy Tax Credit	3.198 (1.043)	.002	2.973 (.985)	.003	2.577 (.943)	.006	2.878 (.952)	.003	2.857 (.936)	.002
USDA Rural Energy Program	1.024 (1.186)	.388	.883 (1.175)	.452	.449 (1.152)	.696	.718 (1.141)	.529	.770 (1.149)	.503
State Incentive Policies										
Corporate Tax	.323 (1.018)	.751	.318 (1.019)	.755	.389 (1.012)	.701	.364 (.998)	.715	.452 (1.006)	.653
Personal Tax	-.605 (.976)	.536	-.558 (.979)	.569	-.231 (.961)	.809	-.526 (.970)	.588	-.257 (.945)	.785
Property Tax	-.892 (.418)	.033	-.923 (.417)	.027	-1.025 (.448)	.022	-.832 (.414)	.044	-.657 (.426)	.124
Production Incentive	.264 (.975)	.536	.221 (.973)	.820	.386 (.965)	.689	.194 (.983)	.843	.407 (.963)	.673
Production Rebate	.275 (.482)	.568	.279 (.478)	.559	.241 (.501)	.630	.270 (.471)	.566	.135 (.485)	.780
Grant	-.516 (.486)	.288	-.537 (.493)	.276	-.711 (.559)	.204	-.404 (.554)	.465	-.416 (.500)	.406
Loan	.680 (.445)	.127	.670 (.451)	.137	.734 (.491)	.135	.645 (.462)	.163	.540 (.478)	.259
Excise Tax	5.216 (1.731)	.003	5.361 (1.726)	.002	5.907 (1.842)	.001	5.079 (1.767)	.004	5.783 (1.741)	.001
Industry Support	-.283 (.683)	.678	-.353 (.692)	.609	-.414 (.716)	.563	-.389 (.690)	.573	-.202 (.706)	.775

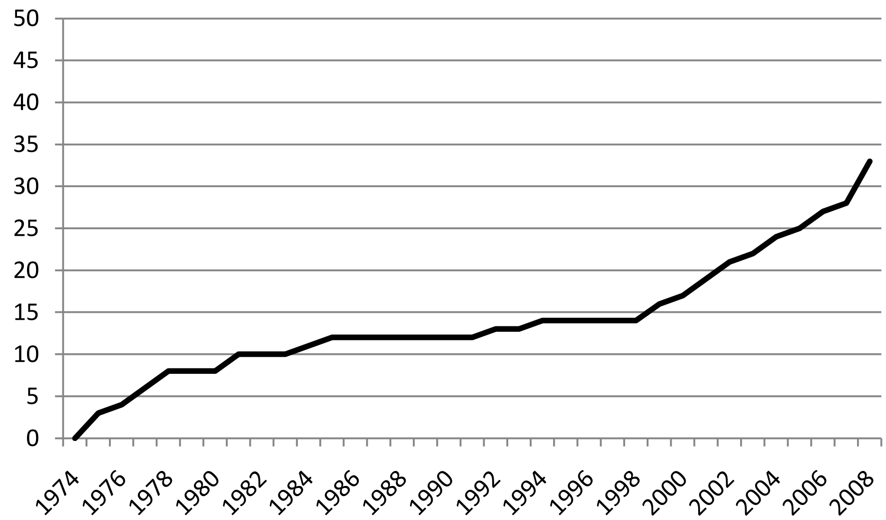
State Rules & Regulations										
Renewable Portfolio Standard	.687 (.986)	.486	.726 (.991)	.464	.755 (.970)	.436	.659 (.986)	.504	.388 (.993)	.696
Green Power Purchasing	1.607 (1.133)	.156	1.844 (1.128)	.102	2.240 (1.232)	.069	1.690 (1.173)	.150	1.532 (1.118)	.171
Required Green Power	2.205 (1.177)	.061	2.226 (1.200)	.064	2.341 (1.231)	.057	2.482 (1.177)	.035	2.228 (1.223)	.068
Public Benefits Fund	-.228 (.971)	.814	-.315 (.986)	.749	-.685 (.941)	.466	-.567 (.917)	.536	-1.070 (.959)	.265
Net Metering	.872 (.845)	.302	.866 (.841)	.303	.909 (.846)	.282	.899 (.840)	.284	.829 (.854)	.332
Diffusion Variable	.570 (.483)	.245	-1.253 (1.621)	.439	1.336 (1.637)	.415	-.779 (1.598)	.626	.001 (.001)	.132
Trend	.570 (.483)	.238	.509 (.473)	.282	.386 (.453)	.394	.446 (.456)	.328	.386 (.454)	.395
Constant	-10.550 (3.665)	.004	-10.001 (3.560)	.005	-9.576 (3.609)	.008	-9.863 (3.522)	.005	-11.659 (4.061)	.004
Number of Cases	1589		1589		1589		1589		1589	
Wald Chi^2	61.38	.0009	60.96	.0010	62.32	.0007	61.62	.0009	59.71	.0015
Log Likelihood	-73.070		-73.445		-73.433		-73.639		-72.533	
rho	.020		.020		.020		.020		.020	

Davidson-MacKinnon Test

	EPA	EPA Hybrid	Neighbor	Neighbor Hybrid	Leader-Laggard
EPA	-	.237	.088	.289	.083
EPA Hybrid	.389	-	.203	.535	.132
Neighbor	.119	.180	-	.004	.455
Neighbor Hybrid	.942	.925	.007	-	.559
Leader-Laggard	.045	.045	.138	.126	-

Standard errors are in parentheses. Two-tailed test. Davidson-MacKinnon Test results are the reported p-values.

Figure 4.4: State Adoption of Property Tax Incentive Policies, 1974-2008



Source: Compiled by the author based upon state adoption of its first property tax incentive policy

indicates that better green conditions increases the likelihood of adoption, while having previously adopted a property tax incentive decreases the likelihood. In both instances, using a model that wasn't specified as well would have lead to misleading results.

Property Tax Incentives

Many states have adopted property tax incentives in hope of providing a long-term incentive to invest in renewable energy. Unlike most incentive policies, property tax incentives can be used every year. However, these policies vary in their definition of exactly what qualifies. Some states allow the value of the renewable systems that are on the land to be deducted, while other simply allow for a deduction in the value of the land itself. A visualization of the adoption of state property tax incentives can be found in Figure 4.4.

The results of the traditional model of the adoption of state property tax incentives can be found in Table 4.7. The DMT suggests that the EPA regional diffusion measure provides the best specified measure of adoption. In fact, the DMT reveals that the EPA measure is

Table 4.7: State Adoption of Property Tax Incentive Policies (Traditional Model)

	EPA		EPA Hybrid		Neighbor		Neighbor Hybrid		Leader-Laggard	
	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.
Internal Determinants										
Tax Revenue per Capita	-.895 (.468)	.056	-.912 (.468)	.051	-.965 (.486)	.047	-.980 (.488)	.045	-.960 (.480)	.046
Population Density	.001 (.0008)	.186	.001 (.0009)	.179	.0006 (.0008)	.434	.0006 (.0008)	.471	.0007 (.0009)	.388
College Graduates	.052 (.042)	.215	.050 (.043)	.247	.040 (.043)	.350	.037 (.042)	.378	.038 (.042)	.366
Government Ideology	-.020 (.009)	.028	-.018 (.009)	.044	-.017 (.009)	.057	-.017 (.009)	.058	-.017 (.009)	.062
Citizen Ideology	.038 (.017)	.028	.036 (.017)	.040	.036 (.017)	.038	.035 (.017)	.040	.037 (.017)	.037
Legislative Professionalism	2.143 (2.021)	.289	1.633 (1.976)	.409	.873 (1.922)	.649	.851 (1.935)	.660	1.188 (2.099)	.571
Energy Specific Conditions										
Wind Potential	.042 (.018)	.024	.036 (.018)	.042	.027 (.017)	.113	.029 (.016)	.086	.029 (.017)	.081
Percent Sunshine	-.008 (.021)	.687	-.017 (.022)	.438	-.006 (.023)	.784	-.003 (.024)	.885	-.011 (.021)	.596
Nuclear Power Plants	-.074 (.101)	.463	-.087 (.100)	.379	-.125 (.096)	.195	-.124 (.096)	.195	-.117 (.096)	.225
Electric Energy Consumption	.006 (.005)	.251	.008 (.005)	.138	.012 (.005)	.024	.012 (.005)	.022	.012 (.005)	.038
PUC Employees	-.001 (.001)	.292	-.001 (.001)	.251	-.001 (.001)	.200	-.001 (.001)	.196	-.001 (.001)	.223
Green Conditions	-.0001 (.0004)	.731	-.0001 (.0004)	.761	-.0001 (.0004)	.782	-.0001 (.0004)	.751	-.00004 (.0005)	.935
Renewable Portfolio Standard	1.232 (.584)	.035	1.279 (.591)	.030	1.139 (.594)	.055	1.102 (.594)	.064	1.162 (.609)	.056
Diffusion Variable	-2.095 (1.067)	.050	-1.268 (.908)	.163	.538 (.789)	.495	.587 (.787)	.455	-.0001 (.0005)	.842
Trend	-.686 (.273)	.012	-.594 (.266)	.026	-.484 (.279)	.083	-.507 (.272)	.062	-.519 (.271)	.056
Constant	-.317 (2.519)	.900	-.508 (2.531)	.841	-1.937 (2.718)	.476	-1.840 (2.661)	.489	-1.406 (2.452)	.566
Number of Cases	1292		1292		1292		1292		1292	
Wald Chi^2	47.70	.0000	46.98	.0000	45.93	.0001	45.97	.0001	45.58	.0001
Log Likelihood	-132.125		-133.021		-133.789		-133.742		-134.007	
rho	.019		.019		.020		.020		.021	

Davidson-MacKinnon Test

	EPA	EPA Hybrid	Neighbor	Neighbor Hybrid	Leader-Laggard
EPA	-	.097	.041	.043	.048
EPA Hybrid	.329	-	.169	.160	.165
Neighbor	.347	.514	-	.938	.488
Neighbor Hybrid	.342	.437	.751	-	.438
Leader-Laggard	.763	.954	.817	.774	-

Standard errors are in parentheses. Two-tailed test. Davidson-MacKinnon Test results are the reported p-values.

statistically significantly better specified than all four of the other measures. The model fit statistics suggest that the model performs well.

The results of the analysis indicate that states with lower tax revenue per capita, more conservative government ideology, more liberal citizen ideology, greater wind potential, and have adopted renewable portfolio standards are more likely to adopt property tax incentives. Interestingly, the data also suggests that as states within an EPA region adopted property tax policies the remaining states were less likely to adopt. Typically, it is expected that diffusion will have a positive influence (Mooney 2001), but in this situation, the results actually suggest the opposite.

The expanded models of property tax incentive policy adoption are presented in Table 4.8. As found in the sales tax models, the DMT reveals that the EPA regional measure offers the best specified models of adoption. The DMT also finds that the EPA model significantly fits the data better than either neighbor or the leader-laggard models. The model fit statistics indicate that the model performs well.

The results indicate that an expanded model can provide a more nuanced explanation of policy adoption than the traditional model. The results also suggest that states with lower per capita tax revenue, higher wind potential, and fewer nuclear power plants are more likely to adopt property tax incentives. Interestingly, the expanded analysis reveals that government ideology and citizen ideology no longer have a statistically significant influence on adoption. Furthermore, the results suggest that states that had already adopted a state-backed grant program and industry support policies were more likely to adopt a property tax incentive. Again, the results suggest that as states within an EPA region adopt property tax incentives the remaining states become less likely to do so.

Table 4.8: State Adoption of Property Tax Incentive Policies (Expanded Model)

	EPA		EPA Hybrid		Neighbor		Neighbor Hybrid		Leader-Laggard	
	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.
Internal Determinants										
Tax Revenue per Capita	-2.051 (.665)	.002	-2.143 (.667)	.001	-2.370 (.708)	.001	-2.412 (.714)	.001	-2.270 (.678)	.001
Population Density	.0009 (.0009)	.309	.001 (.0009)	.278	.0006 (.0009)	.473	.0006 (.0009)	.525	.0007 (.001)	.456
College Graduates	.065 (.053)	.224	.055 (.052)	.288	.052 (.051)	.314	.048 (.051)	.344	.049 (.051)	.329
Government Ideology	-.010 (.011)	.343	-.009 (.011)	.417	-.008 (.010)	.406	-.008 (.010)	.408	-.008 (.011)	.421
Citizen Ideology	.030 (.018)	.107	.027 (.019)	.154	.027 (.018)	.149	.027 (.018)	.147	.027 (.019)	.156
Legislative Professionalism	3.502 (2.195)	.111	3.003 (2.137)	.160	2.454 (2.073)	.237	2.478 (2.088)	.235	2.676 (2.284)	.241
Energy Specific Conditions										
Wind Potential	.040 (.019)	.041	.034 (.019)	.069	.024 (.018)	.186	.027 (.018)	.132	.026 (.018)	.143
Percent Sunshine	-.015 (.025)	.555	-.025 (.025)	.324	-.014 (.028)	.620	-.010 (.029)	.713	-.021 (.025)	.405
Nuclear Power Plants	-.230 (.134)	.087	-.239 (.133)	.072	-.312 (.130)	.017	-310 (.130)	.017	-.290 (.127)	.023
Electric Energy Consumption	.003 (.007)	.689	.006 (.007)	.394	.011 (.006)	.081	.010 (.006)	.085	.010 (.006)	.146
PUC Employees	-.0008 (.001)	.475	-.001 (.001)	.360	-.001 (.001)	.188	-.001 (.001)	.192	-.001 (.001)	.231
Green Conditions	-.0002 (.0005)	.612	-.0001 (.0005)	.762	-.00009 (.0005)	.853	-.0001 (.0005)	.781	-.00006 (.0005)	.906
National Policies										
Production Incentive	-.136 (.910)	.881	-.045 (.902)	.960	.301 (.903)	.738	.323 (.901)	.720	.132 (.891)	.882
Business Energy Tax Credit	.139 (1.023)	.892	.119 (1.0003)	.905	.150 (.982)	.878	.170 (.983)	.863	.127 (.969)	.895
USDA Rural Energy Program	-.957 (.859)	.265	-1.001 (.860)	.245	-1.020 (.858)	.235	-1.032 (.859)	.230	-1.017 (.843)	.228
State Incentive Policies										
Corporate Tax	.091 (.935)	.922	.068 (.972)	.944	.472 (.936)	.614	.484 (.922)	.600	.358 (.942)	.703
Personal Tax	1.026 (1.034)	.321	.969 (1.060)	.360	.711 (1.056)	.500	.758 (1.038)	.465	.918 (1.049)	.381
Sales Tax	1.017 (.812)	.210	.938 (.815)	.249	.739 (.785)	.346	.791 (.779)	.310	.696 (.780)	.372
Production Incentive	.426 (.937)	.649	.619 (.948)	.514	.729 (.986)	.460	.715 (.981)	.466	.552 (.990)	.577
Production Rebate	1.183 (.781)	.130	1.238 (.785)	.115	.987 (.770)	.200	.938 (.773)	.225	1.024 (.781)	.190
Bond	.710 (1.712)	.678	1.147 (1.702)	.500	1.603 (1.664)	.335	1.509 (1.653)	.361	1.507 (1.683)	.371
Grant	1.165 (.635)	.067	1.080 (.629)	.086	1.363 (.665)	.041	1.383 (.669)	.039	1.222 (.653)	.061
Loan	-.104 (.574)	.856	.034 (.565)	.952	.159 (.559)	.775	.138 (.557)	.803	.150 (.556)	.786
Industry Support	1.637 (.829)	.048	1.671 (.817)	.041	1.598 (.805)	.047	1.612 (.803)	.045	1.595 (.791)	.044

State Rules & Regulations										
Renewable Portfolio Standard	.459 (.838)	.583	.562 (.844)	.505	.546 (.877)	.534	.482 (.878)	.583	.485 (.882)	.583
Green Power Purchasing	-.081 (1.359)	.952	.011 (1.313)	.993	-.332 (1.280)	.795	-.344 (1.276)	.788	-.148 (1.251)	.906
Required Green Power	-22.116 (6663.382)	.997	-22.639 (9627.414)	.998	-22.734 (10836.07)	.998	-23.306 (13066.74)	.999	-21.310 (5048.209)	.997
Public Benefits Fund	.546 (.826)	.508	.631 (.821)	.442	.492 (.840)	.558	.458 (.841)	.586	.625 (.859)	.467
Net Metering	-.121 (.742)	.870	-.218 (.744)	.769	-.299 (.758)	.692	-.276 (.750)	.713	-.157 (.746)	.833
Diffusion Variable	-2.265 (1.259)	.072	-1.394 (1.066)	.191	.978 (.938)	.297	1.009 (.903)	.264	-.00001 (.0006)	.979
Trend	-1.109 (.481)	.021	-1.034 (.476)	.030	-.814 (.478)	.089	-.854 (.471)	.070	-.896 (.465)	.054
Constant	2.774 (3.401)	.415	2.822 (3.449)	.413	.558 (3.581)	.876	.795 (3.497)	.820	1.574 (3.304)	.634
Number of Cases	1292		1292		1292		1292		1292	
Wald Chi^2	68.67	.0001	70.24	.0001	71.54	.0000	71.22	.0001	70.79	.0001
Log Likelihood	-120.346		-121.221		-121.586		-121.506		-122.148	
rho	.020		.020		.019		.019		.020	

Davidson-MacKinnon Test

	EPA	EPA Hybrid	Neighbor	Neighbor Hybrid	Leader-Laggard
EPA	-	.129	.042	.040	.070
EPA Hybrid	.432	-	.150	.124	.191
Neighbor	.125	.215	-	.977	.295
Neighbor Hybrid	.112	.151	.689	-	.259
Leader-Laggard	.830	.931	.916	.867	-

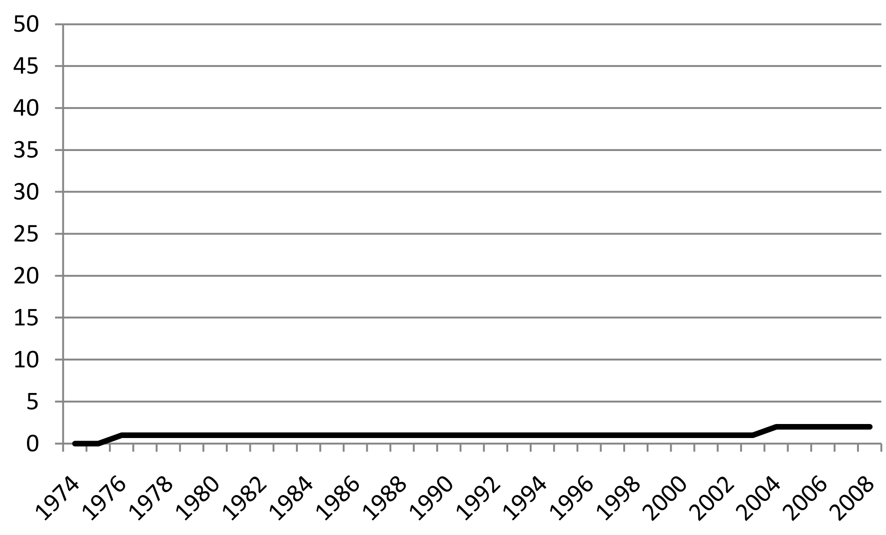
Standard errors are in parentheses. Two-tailed test. Davidson-MacKinnon Test results are the reported p-values.

Excise Tax Exemptions

State excise tax policies are usually associated with the production of goods that can physically harm the public either directly (e.g. alcohol, tobacco, etc.) or indirectly through pollution created during the production process (e.g. coal or oil-based electricity generation, steel production, chemical solvent production, etc.). Because renewable energy is a pollution-free alternative to coal or oil-based energy production, many have argued that it should be exempt from excise taxes. Thus far, only two states, Iowa and Massachusetts, have adopted excise tax exemptions.

With only two states having adopted this policy, there is not sufficient variation within the dependent variable to allow for a proper statistical analysis. If more states adopt this policy researchers will then be able to effectively model policy adoption. Until that time, the current adoption trend is depicted in Figure 4.5.

Figure 4.5: State Adoption of Excise Tax Incentive Policies, 1974-2008



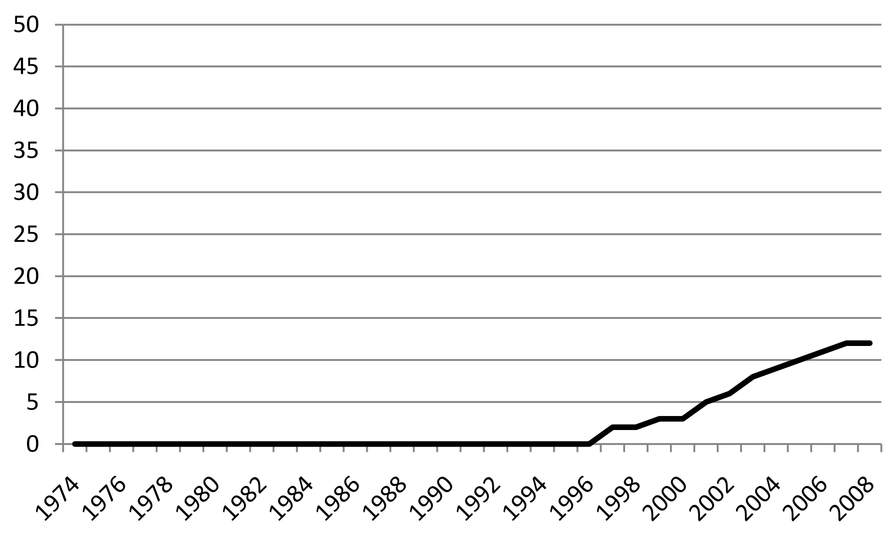
Source: Compiled by the author based upon state adoption of its first excise tax incentive policy

Production Support

Production Incentives

State production incentives are similar to those offered in the national production incentive program. While the rates vary, the basic idea is that states allow a tax deduction of predetermined rates for every Kilo-Watt hour or Mega-Watt hour of energy produced. State production incentives are typically long-term programs that allow producers to claim the tax deduction for however long the program exists. In some states, these policies are sunset laws similar to the program offered by the national government, but others do not have a predetermined end date. To date, no state has allowed their sunset provisions to activate, and have adopted policies that extend the sunset provision for several years. Figure 4.6 illustrates state adoption of production incentives over time.

Figure 4.6: State Adoption of Production Incentive Policies, 1974-2008



Source: Compiled by the author based upon state adoption of its first production incentive policy

The results of the traditional model of state production incentives are presented in Table 4.9. The DMT suggest that the neighbor measure offers the best specified model of adoption. The model fit statistics suggest that the model performs well. The data indicate that states with higher levels of electrical energy consumption, better green conditions, and renewable portfolio standards are more likely to adopt production incentive policies.

Table 4.10 offers a look at the results of the expanded analyses of production incentive policy adoption. The DMT reveals that the neighbor measure again provides the best specified model of adoption. The model fit statistics for the neighbor model suggest that it performs well. The data reveals that states with higher levels of population density, fewer college graduates, more nuclear power plants, and better green conditions were more likely to adopt production incentive policies. It also appears that states were more likely to adopt production incentives after the national government adopted its USDA Rural Energy Program.

This analysis illustrates the importance of controlling for the adoption of other policies in the policy arena. Indeed, it is clear that existing policies can both serve as positive and negative feedbacks toward the adoption of production incentive policies. The results find that states that have adopted corporate tax incentives, renewable portfolio standards, required green power policies, and net metering were more likely to adopt production incentives. On the other hand, if a state had adopted a personal tax incentive or a state-backed grant program, they were less likely to adopt production incentives.

Similar to the results in modeling several of the other policies, the selection of the diffusion variable does influence our understanding of production incentive policy adoption. For instance, college graduates are found to only have a statistically significant influence on adoption in the two neighbor models. The leader-laggard and EPA regional models both find that

Table 4.9: State Adoption of Production Incentive Policies (Traditional Model)

	EPA		EPA Hybrid		Neighbor		Neighbor Hybrid		Leader-Laggard	
	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.
Internal Determinants										
Tax Revenue per Capita	-.002 (.013)	.854	-.002 (.013)	.854	-.002 (.014)	.860	-.002 (.014)	.861	-.001 (.012)	.876
Population Density	.0005 (.001)	.714	.0005 (.001)	.737	.0003 (.001)	.840	.0003 (.001)	.848	.0006 (.001)	.729
College Graduates	-.016 (.068)	.806	-.015 (.068)	.821	-.017 (.065)	.792	-.016 (.065)	.801	-.009 (.068)	.895
Government Ideology	.008 (.020)	.695	.007 (.020)	.732	.009 (.022)	.655	.009 (.022)	.659	.003 (.020)	.851
Citizen Ideology	.042 (.042)	.320	.043 (.042)	.307	.045 (.042)	.280	.045 (.042)	.279	.046 (.041)	.264
Legislative Professionalism	-.787 (4.560)	.863	-.950 (4.551)	.835	-1.225 (4.627)	.791	-1.233 (4.616)	.789	-1.360 (4.556)	.765
Energy Specific Conditions										
Wind Potential	-.044 (.041)	.290	-.044 (.041)	.290	-.036 (.042)	.394	-.036 (.042)	.384	-.040 (.041)	.330
Percent Sunshine	.012 (.042)	.767	.013 (.042)	.751	.025 (.042)	.557	.024 (.042)	.573	.005 (.055)	.914
Nuclear Power Plants	.362 (.246)	.141	.350 (.241)	.147	.374 (.249)	.133	.371 (.248)	.134	.324 (.231)	.161
Electric Energy Consumption	.015 (.009)	.102	.014 (.009)	.110	.015 (.009)	.094	.015 (.009)	.096	.013 (.009)	.135
PUC Employees	-.001 (.002)	.549	-.001 (.002)	.592	-.001 (.002)	.576	-.001 (.002)	.583	-.0008 (.002)	.782
Green Conditions	.002 (.001)	.098	.002 (.001)	.099	.002 (.001)	.089	.002 (.001)	.089	.002 (.001)	.105
Renewable Portfolio Standard	2.661 (.818)	.001	2.685 (.815)	.001	2.646 (.806)	.001	2.650 (.806)	.001	2.709 (.807)	.001
Diffusion Variable	1.532 (1.416)	.279	.974 (1.117)	.383	1.970 (1.811)	.277	1.476 (1.474)	.316	-.0001 (.001)	.849
Trend	-.794 (.319)	.013	-.777 (.316)	.014	-.766 (.313)	.014	-.763 (.312)	.015	-.733 (.305)	.016
Constant	-13.621 (3.927)	.001	-13.599 (3.893)	.000	-14.517 (4.127)	.000	-14.443 (4.112)	.000	-12.916 (4.458)	.004
Number of Cases	1687		1687		1687		1687		1687	
Wald Chi^2	27.59	.0243	28.06	.0212	27.25	.0268	27.33	.0262	30.41	.0105
Log Likelihood	-43.785		-43.971		-43.747		-43.823		-44.285	
rho	.026		.026		.025		.025		.026	

Davidson-MacKinnon Test

	EPA	EPA Hybrid	Neighbor	Neighbor Hybrid	Leader-Laggard
EPA	-	.147	.600	.569	.242
EPA Hybrid	.217	-	.781	.754	.342
Neighbor	.557	.463	-	.481	.276
Neighbor Hybrid	.631	.530	.578	-	.317
Leader-Laggard	.663	.699	.842	.854	-

Standard errors are in parentheses. Two-tailed test. Davidson-MacKinnon Test results are the reported p-values.

Table 4.10: State Adoption of Production Incentive Policies (Expanded Model)

	EPA		EPA Hybrid		Neighbor		Neighbor Hybrid		Leader-Laggard	
	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.
Internal Determinants										
Population Density	.005 (.002)	.009	.005 (.002)	.009	.006 (.002)	.005	.006 (.002)	.005	.006 (.003)	.025
College Graduates	-.174 (.112)	.120	-.177 (.111)	.109	-.206 (.113)	.070	-.202 (.113)	.073	-.164 (.107)	.126
Government Ideology	.041 (.025)	.096	.041 (.025)	.106	.033 (.022)	.144	.032 (.023)	.160	.046 (.026)	.075
Energy Specific Conditions										
Wind Potential	-.014 (.051)	.771	-.016 (.050)	.748	-.037 (.052)	.481	-.035 (.052)	.501	.010 (.061)	.863
Percent Sunshine	.078 (.049)	.109	.079 (.049)	.106	.071 (.051)	.165	.072 (.051)	.163	.082 (.052)	.115
Nuclear Power Plants	1.440 (.422)	.001	1.431 (.428)	.001	1.467 (.407)	.000	1.439 (.401)	.000	1.616 (.520)	.002
Green Conditions	.006 (.002)	.001	.006 (.001)	.001	.007 (.002)	.000	.007 (.002)	.000	.007 (.002)	.002
National Policies										
USDA Rural Energy Program	3.362 (1.632)	.039	3.543 (1.643)	.031	4.473 (1.641)	.006	4.457 (1.643)	.007	3.948 (1.458)	.007
State Incentive Policies										
Corporate Tax	4.985 (2.020)	.014	4.955 (2.030)	.015	5.486 (2.052)	.008	5.310 (2.030)	.009	5.145 (2.053)	.012
Personal Tax	-6.096 (2.385)	.011	-6.138 (2.388)	.010	-6.871 (2.484)	.006	-6.699 (2.460)	.006	-6.567 (2.487)	.008
Property Tax	-.537 (.537)	.317	-.548 (.545)	.315	-.809 (.597)	.175	-.789 (.591)	.182	-.706 (.557)	.205
Grant	-2.892 (1.310)	.027	-2.865 (1.290)	.026	-3.204 (1.326)	.016	-3.164 (1.324)	.017	-2.900 (1.275)	.023
State Rules & Regulations										
Renewable Portfolio Standard	3.242 (1.252)	.010	3.255 (1.243)	.009	3.507 (1.236)	.005	3.453 (1.226)	.005	3.278 (1.270)	.010
Required Green Power	4.201 (2.014)	.037	4.075 (2.075)	.050	3.607 (1.803)	.048	3.541 (1.806)	.050	4.257 (1.882)	.024
Net Metering	2.009 (1.244)	.106	2.026 (1.243)	.103	2.321 (1.303)	.078	2.333 (1.309)	.075	2.138 (1.244)	.086
Diffusion Variable	.938 (3.286)	.775	.295 (2.772)	.915	-2.820 (2.487)	.257	-2.202 (1.981)	.266	-.0008 (.001)	.440
Trend	-1.465 (.522)	.005	-1.463 (.518)	.005	-1.549 (.531)	.004	-1.535 (.528)	.004	-1.488 (.519)	.004
Constant	-24.142 (7.313)	.001	-24.182 (7.358)	.001	-24.175 (7.320)	.001	-23.969 (7.309)	.001	-26.742 (7.932)	.001
Number of Cases	1687		1687		1687		1687		1687	
Wald Chi^2	25.38	.0864	25.51	.0839	25.88	.0768	25.94	.0755	24.25	.1129
Log Likelihood	-31.853		-31.888		-31.195		-31.225		-31.567	
rho	.022		.022		.022		.022		.022	

	Davidson-MacKinnon Test				
	EPA	EPA Hybrid	Neighbor	Neighbor Hybrid	Leader-Laggard
EPA	-	.252	.280	.277	.632
EPA Hybrid	.271	-	.367	.365	.803
Neighbor	.129	.150	-	.737	.274
Neighbor Hybrid	.131	.152	.815	-	.276
Leader-Laggard	.395	.423	.483	.461	-

Standard errors are in parentheses. Two-tailed test. Davidson-MacKinnon Test results are the reported p-values.

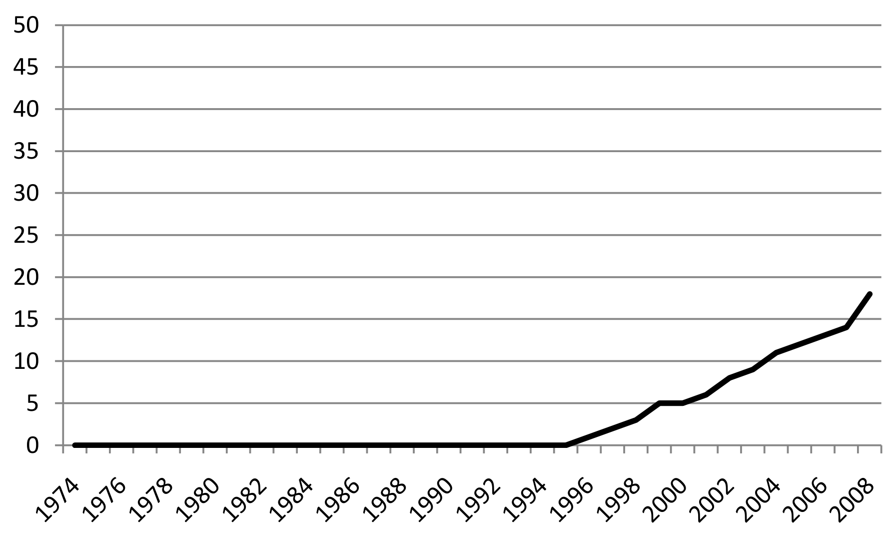
government ideology has a significant influence, but the other three do not. Finally, net metering does not appear to have a significant influence when using either of the EPA measures. Again, this highlights the need to ensure that the best measure of diffusion is modeled.

Production Rebates

Perhaps more so than any of the other incentive policies, production rebates are approached in a variety of manners by the states. Some states allow the rebates to be taken advantage of more than once. Others only allow a one-time rebate. Some offer rebates on the construction costs. Others allow a rebate on the purchase price. Yet others offer a flat rebate the moment energy is actually produced. While there are certainly differences, production rebates are all similar in that they offer lump sum payments from the state. State adoption of production rebate policies is presented in Figure 4.7.

The results of the traditional model are presented in Table 4.11. The DMT suggest that the leader-laggard measure provides the best specified model of production rebate adoption. The

Figure 4.7: State Adoption of Production Rebate Policies, 1974-2008



Source: Compiled by the author based upon state adoption of its first production rebate policy model fit statistics indicate that the model performs well. The analysis suggests that states with a higher percentage of college graduates and more nuclear power plants are more likely to adopt production rebates. The data also finds that leader states are more likely to adopt production rebates than laggard states.

The expanded analyses can be found in Table 4.12. Here, the DMT suggests that the EPA measure provides the best specified model of adoption. However, it should be noted that, as with the traditional analysis, the difference between the EPA and leader-laggard measures are minimal. In this situation, the results clearly indicate that an expanded model does little to clarify what influences adoption. It does indicate that states with more college graduates and better green conditions are more likely to adopt. However, these were the same results found in the traditional EPA model. None of the existing policies or national policies yields a statistically significant influence on adoption. The only real difference is that the expanded model is now able to more accurately model the influence of EPA regional diffusion, which suggests that as more states adopt production rebates, the remaining states are less likely to adopt their own policy.

Industry Support

States have started to adopt industry support policies as a backdoor way to incentivize renewable energy. Industry support policies are an odd combination of goals that ultimately influence job creation, renewable energy advocacy, and renewable energy system construction. These policies tend to provide financial support for constructing a manufacturing plant in the state. Some states offer a flat rate to help offset costs, while others offer to cover a set percentage of the costs up to a certain amount. In any event, these policies are designed to create "green" jobs, but they can also influence the construction of renewable systems because it will be

Table 4.11: State Adoption of Production Rebate Policies (Traditional Model)

	EPA		EPA Hybrid		Neighbor		Neighbor Hybrid		Leader-Laggard	
	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.
Internal Determinants										
Tax Revenue per Capita	.0002 (.0002)	.423	.0002 (.0002)	.402	.00004 (.0002)	.875	.00006 (.0002)	.829	-.0001 (.0002)	.669
Population Density	.0004 (.001)	.735	.0004 (.001)	.732	.0003 (.001)	.811	.0003 (.001)	.774	-.0005 (.001)	.697
College Graduates	.077 (.043)	.075	.076 (.043)	.077	.074 (.038)	.050	.074 (.038)	.052	.072 (.039)	.071
Government Ideology	-.018 (.014)	.210	-.016 (.014)	.246	-.014 (.014)	.319	-.014 (.014)	.310	-.019 (.015)	.208
Citizen Ideology	.018 (.029)	.537	.017 (.030)	.569	.025 (.031)	.419	.024 (.031)	.437	.015 (.034)	.647
Legislative Professionalism	.295 (3.533)	.933	.434 (3.510)	.902	-.423 (3.330)	.899	-.489 (3.330)	.883	-1.616 (3.769)	.668
Energy Specific Conditions										
Wind Potential	-.023 (.031)	.444	-.025 (.031)	.411	-.015 (.028)	.588	-.015 (.029)	.592	-.016 (.034)	.637
Percent Sunshine	-.039 (.030)	.192	-.040 (.030)	.187	-.034 (.031)	.269	-.035 (.031)	.262	.008 (.040)	.828
Nuclear Power Plants	.348 (.166)	.036	.326 (.164)	.047	.253 (.163)	.121	.262 (.162)	.105	.282 (.167)	.092
Electric Energy Consumption	.004 (.007)	.597	.004 (.007)	.536	.007 (.007)	.325	.007 (.007)	.337	-.002 (.009)	.982
PUC Employees	.0002 (.001)	.894	.0001 (.001)	.931	-.0002 (.001)	.893	-.0002 (.001)	.904	-.0004 (.001)	.814
Green Conditions	.001 (.0009)	.043	.001 (.0009)	.047	.001 (.0009)	.119	.001 (.0009)	.109	.0008 (.0008)	.351
Renewable Portfolio Standard	1.148 (.773)	.137	1.099 (.768)	.153	.852 (.736)	.247	.871 (.736)	.237	.591 (.732)	.419
Diffusion Variable	-2.289 (1.449)	.114	-1.529 (1.075)	.155	.438 (1.245)	.725	.205 (.948)	.828	.002 (.0009)	.021
Trend	-.881 (.312)	.005	-.833 (.306)	.007	-.578 (.310)	.062	-.600 (.305)	.049	-.864 (.299)	.004
Constant	-6.673 (2.582)	.010	-6.816 (2.586)	.008	-7.256 (2.700)	.007	-7.121 (2.663)	.007	-9.027 (3.200)	.005
Number of Cases	1661		1661		1661		1661		1661	
Wald Chi^2	46.86	.0000	47.46	.0000	51.89	.0000	51.19	.0000	46.08	.0001
Log Likelihood	-64.754		-65.023		-66.118		-66.156		-63.170	
rho	.022		.022		.023		.023		.022	

Davidson-MacKinnon Test

	EPA	EPA Hybrid	Neighbor	Neighbor Hybrid	Leader-Laggard
EPA	-	.388	.026	.031	.052
EPA Hybrid	.633	-	.050	.050	.058
Neighbor	.054	.095	-	.465	.709
Neighbor Hybrid	.077	.099	.507	-	.846
Leader-Laggard	.011	.009	.021	.021	-

Standard errors are in parentheses. Two-tailed test. Davidson-MacKinnon Test results are the reported p-values.

Table 4.12: State Adoption of Production Rebate Policies (Expanded Model)

	EPA		EPA Hybrid		Neighbor		Neighbor Hybrid		Leader-Laggard	
	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.
Internal Determinants										
Tax Revenue per Capita	.0002 (.0004)	.480	.0003 (.0004)	.396	.0003 (.0003)	.443	.0002 (.0004)	.492	.0002 (.0004)	.505
Population Density	.0002 (.001)	.911	.0004 (.001)	.779	.0009 (.001)	.554	.0008 (.001)	.580	.0002 (.001)	.872
College Graduates	.121 (.066)	.069	.108 (.062)	.082	.104 (.051)	.043	.108 (.051)	.035	.093 (.054)	.090
Government Ideology	-.022 (.021)	.301	-.017 (.020)	.408	-.009 (.020)	.621	-.009 (.020)	.649	-.020 (.021)	.338
Citizen Ideology	.009 (.034)	.782	.006 (.035)	.854	.010 (.038)	.794	.010 (.038)	.790	.004 (.039)	.920
Legislative Professionalism	4.737 (5.051)	.348	3.839 (5.026)	.445	1.777 (4.728)	.707	1.774 (4.719)	.707	-1.799 (5.252)	.732
Energy Specific Conditions										
Wind Potential	-.024 (.044)	.582	-.023 (.044)	.598	-.002 (.038)	.934	-.0006 (.038)	.987	.007 (.043)	.858
Percent Sunshine	-.007 (.041)	.862	-.007 (.041)	.852	.011 (.043)	.798	.016 (.044)	.713	.048 (.056)	.393
Nuclear Power Plants	.275 (.234)	.219	.274 (.231)	.236	.297 (.244)	.224	.297 (.244)	.223	.449 (.244)	.066
Electric Energy Consumption	.0002 (.010)	.979	.001 (.010)	.902	.002 (.009)	.782	.002 (.009)	.808	-.002 (.011)	.800
PUC Employees	-.001 (.002)	.542	-.0009 (.002)	.646	-.0008 (.002)	.711	-.0008 (.002)	.697	-.0009 (.002)	.730
Green Conditions	.002 (.001)	.070	.002 (.001)	.073	.002 (.001)	.110	.002 (.001)	.118	.002 (.001)	.135
National Policies										
Business Energy Tax Credit	-1.551 (1.167)	.184	-1.658 (1.136)	.145	-2.123 (1.098)	.053	-2.168 (1.098)	.048	-2.264 (1.160)	.051
USDA Rural Energy Program	-.440 (.905)	.626	-.457 (.897)	.610	-.611 (.884)	.489	-.649 (.887)	.464	-.485 (.918)	.597
State Incentive Policies										
Corporate Tax	1.774 (1.364)	.193	1.755 (1.434)	.221	2.020 (1.553)	.193	2.079 (1.558)	.182	2.172 (1.456)	.136
Personal Tax	-2.237 (1.479)	.130	-2.267 (1.540)	.141	-2.714 (1.588)	.088	-2.777 (1.588)	.080	-2.548 (1.536)	.097
Sales Tax	.958 (.773)	.215	.968 (.764)	.205	1.126 (.770)	.144	1.195 (.783)	.127	.758 (.775)	.328
Property Tax	.053 (.525)	.919	.032 (.525)	.951	-.034 (.523)	.947	-.058 (.524)	.911	.159 (.586)	.785
Production Incentive	-.071 (1.109)	.949	-.231 (1.105)	.834	-.522 (1.082)	.629	-.553 (1.086)	.610	-.111 (1.093)	.919
Grant	.124 (.446)	.780	.107 (.442)	.808	.195 (.441)	.658	.202 (.441)	.646	.467 (.477)	.327
Loan	-.043 (.411)	.915	-.039 (.412)	.924	-.091 (.410)	.824	-.111 (.411)	.786	-.256 (.413)	.534
Excise Tax	-3.489 (2.579)	.176	-3.089 (2.571)	.230	-2.395 (2.466)	.332	-2.454 (2.470)	.321	-.782 (2.001)	.696
Industry Support	-.008 (.488)	.987	.042 (.480)	.929	.210 (.476)	.659	.228 (.477)	.632	.034 (.428)	.937
State Rules & Regulations										
Renewable Portfolio Standard	.404 (.892)	.650	.412 (.894)	.645	.299 (.920)	.745	.254 (.931)	.785	.129 (.925)	.888
Green Power Purchasing	2.142 (1.367)	.117	1.765 (1.288)	.171	1.319 (1.217)	.278	1.417 (1.211)	.242	.854 (1.216)	.482
Public Benefits Fund	.958 (.978)	.328	.822 (.980)	.401	.271 (.901)	.763	.286 (.898)	.750	-.583 (.900)	.517
Net Metering	.385 (.990)	.697	.327 (.987)	.740	.326 (.984)	.740	.297 (.987)	.763	.616 (.980)	.530

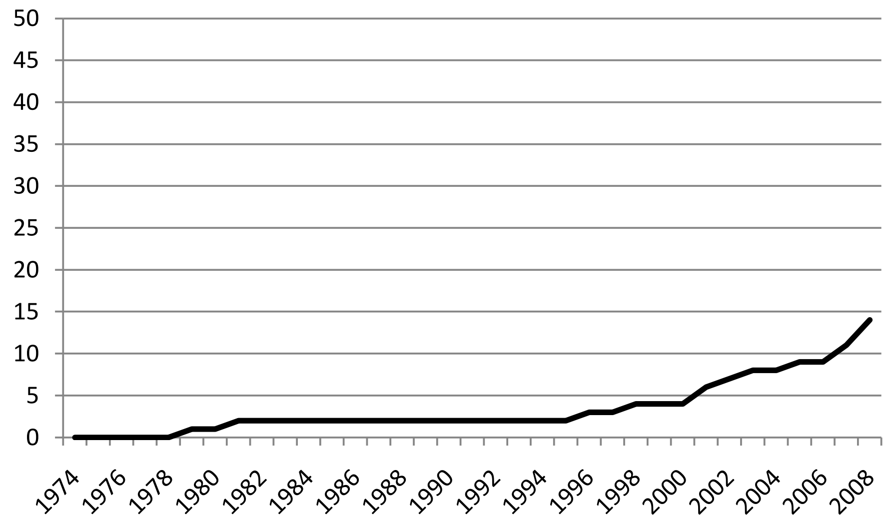
Diffusion Variable	-3.659 (1.888)	.053	-1.886 (1.276)	.139	1.125 (1.368)	.411	1.078 (1.097)	.326	.002 (.001)	.057
Trend	-1.475 (.627)	.019	-1.397 (.614)	.023	-1.161 (.620)	.061	-1.161 (.614)	.059	-1.540 (.644)	.017
Constant	-8.205 (3.935)	.037	-8.192 (3.995)	.040	-9.535 (4.359)	.029	-9.769 (4.405)	.027	-10.818 (4.896)	.027
Number of Cases	1661		1661		1661		1661		1661	
Wald Chi^2	47.67	.0159	48.16	.0141	51.39	.0064	51.80	.0057	44.79	.0308
Log Likelihood	-55.323		-56.346		-57.234		-57.086		-55.653	
rho	.023		.023		.029		.023		.022	

Davidson-MacKinnon Test

	EPA	EPA Hybrid	Neighbor	Neighbor Hybrid	Leader-Laggard
EPA	-	.020	.000	.000	.050
EPA Hybrid	.041	-	.011	.004	.100
Neighbor	.001	.013	-	.450	.305
Neighbor Hybrid	.000	.003	.356	-	.243
Leader-Laggard	.062	.048	.046	.045	-

Standard errors are in parentheses. Two-tailed test. Davidson-MacKinnon Test results are the reported p-values.

Figure 4.8: State Adoption of Industry Support Policies, 1974-2008



Source: Compiled by the author based upon state adoption of its first industry support policy

easier for manufacturers to meet demand with increased manufacturing. Currently, demand for renewable sources is far greater than supply. In recent years there has been up to a three year delay on the shipment of wind turbines from the moment an order is placed (e.g. Kanellos 2008). If a state is able to manufacture renewable systems in their back yard, it should be easier to meet demand, while simultaneously possibly increasing demand since the producer could buy the renewable that their neighbor built. State adoption of industry support policies are illustrated in Figure 4.8.

The results of the traditional adoption models are presented in Table 4.13. The DMT suggest that the neighbor hybrid measure provides the best specified model of adoption. The model fit statistics indicate that the model performs well. The data suggests that states with higher per capita tax revenue and higher energy consumption are more likely to adopt an industry support policy.

Table 4.13: State Adoption of Industry Support Policies (Traditional Model)

	EPA		EPA Hybrid		Neighbor		Neighbor Hybrid		Leader-Laggard	
	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.
Internal Determinants										
Tax Revenue per Capita	.0005 (.0002)	.032	.0006 (.0002)	.031	.0007 (.0003)	.031	.0008 (.0003)	.022	.0005 (.0002)	.031
Population Density	.001 (.001)	.283	.001 (.001)	.254	.002 (.001)	.185	.002 (.001)	.131	.001 (.001)	.298
College Graduates	-.076 (.061)	.213	-.080 (.062)	.198	-.081 (.061)	.186	-.088 (.063)	.161	-.075 (.060)	.216
Government Ideology	-.010 (.015)	.473	-.009 (.014)	.521	-.012 (.014)	.382	-.013 (.014)	.371	-.011 (.014)	.438
Citizen Ideology	.021 (.026)	.408	.020 (.026)	.441	.026 (.027)	.327	.025 (.026)	.330	.022 (.026)	.406
Legislative Professionalism	2.760 (2.755)	.317	2.709 (2.752)	.325	2.821 (2.730)	.301	2.981 (2.731)	.275	2.780 (3.091)	.368
Energy Specific Conditions										
Wind Potential	.047 (.030)	.123	.047 (.031)	.134	.046 (.031)	.132	.045 (.031)	.144	.047 (.031)	.127
Percent Sunshine	-.022 (.033)	.509	-.025 (.034)	.463	-.019 (.033)	.569	-.020 (.033)	.542	-.022 (.034)	520
Nuclear Power Plants	-.336 (.217)	.122	-.345 (.222)	.121	-.376 (.235)	.110	-.391 (.242)	.106	-.333 (.216)	.123
Electric Energy Consumption	.019 (.009)	.039	.019 (.009)	.040	.019 (.009)	.045	.019 (.009)	.039	.019 (.009)	.048
PUC Employees	-.003 (.002)	.238	-.003 (.002)	.245	-.003 (.002)	.225	-.003 (.002)	.212	-.003 (.002)	.228
Green Conditions	-.00003 (.0006)	.958	.00001 (.0006)	.980	-.00003 (.0006)	.955	.00004 (.0006)	.944	-.00004 (.0006)	.945
Renewable Portfolio Standard	1.053 (.733)	.151	1.107 (.746)	.138	1.089 (.733)	.137	1.142 (.742)	.124	1.035 (.767)	.177
Diffusion Variable	-.275 (2.081)	.895	-.887 (1.966)	.652	-1.296 (1.851)	.484	-1.437 (1.487)	.334	.000009 (.0007)	.990
Trend	-.714 (.256)	.005	-.750 (.249)	.003	-.760 (.236)	.001	-.772 (.232)	.001	-.697 (.231)	.003
Constant	-.350 (2.937)	.905	-.017 (3.008)	.995	-.371 (2.792)	.894	-.294 (2.774)	.915	-.451 (2.868)	.875
Number of Cases	1642		1642		1642		1642		1642	
Wald Chi^2	43.67	.0001	43.84	.0001	42.82	.0002	42.63	.0002	43.58	.0001
Log Likelihood	-62.798		-62.700		-62.568		-62.346		-62.807	
rho	.026		.026		.026		.026		.026	

Davidson-MacKinnon Test

	EPA	EPA Hybrid	Neighbor	Neighbor Hybrid	Leader-Laggard
EPA	-	.383	.912	.875	.895
EPA Hybrid	.344	-	.816	.895	.651
Neighbor	.486	.567	-	.363	.484
Neighbor Hybrid	.333	.391	.262	-	.333
Leader-Laggard	.998	.977	.996	.955	-

Standard errors are in parentheses. Two-tailed test. Davidson-MacKinnon Test results are the reported p-values.

While the traditional approach reveals relatively little about what influences a state to adopt industry support policies, the expanded analysis offers much greater insight. The results of the expanded models are presented in Table 4.14. The DMT reveal that the neighbor hybrid measure of diffusion provides the best specified model. In fact, it is statistically significantly better than all of the other models. The model fit statistics suggest that the model performs well.

The data suggest that states with higher per capita tax revenue, higher levels of population density, and fewer nuclear power plants are more likely to adopt industry support policies. Interestingly, all of the expanded models reveal that electric energy consumption no longer has a statistically significant influence on adoption, which suggest that the traditional models were underspecified. It also appears as though states have reacted to the national government such that they have been less likely to adopt industry support policies since the national government adopted its production incentive program. Additionally, the results suggest that as neighbors that are leaders in environmental politics adopt policies, a state is less likely to adopt their own policy. It is possible that manufacturers of renewable sources are predisposed to set up shop in environmentally friendly states, which could cause a neighbor state to be less likely to try to compete.

Existing policies also play an important role in influencing the likelihood of adoption. States that have already adopted corporate tax incentives, production incentives, state-backed bonds, and required green power policies are more likely to adopt industry support policies. However, states that have adopted a sales tax incentive are less likely. Most likely this is associated with the eligibility of the sales tax incentive only being able to be used if the renewable was purchased within the state. If a state helps to finance the construction of a manufacturing plant, it would guarantee that the sales tax incentive would be used far more often

Table 4.14: State Adoption of Industry Support Policies (Expanded Model)

	EPA		EPA Hybrid		Neighbor		Neighbor Hybrid		Leader-Laggard	
	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.
Internal Determinants										
Tax Revenue per Capita	.001 (.0004)	.032	.001 (.0004)	.029	.001 (.0005)	.005	.001 (.0005)	.003	.001 (.0004)	.031
Population Density	.002 (.002)	.228	.003 (.002)	.190	.005 (.002)	.024	.006 (.002)	.013	.002 (.002)	.187
College Graduates	-.073 (.089)	.413	-.074 (.090)	.409	-.089 (.093)	.337	-.100 (.093)	.282	-.068 (.089)	.447
Government Ideology	-.025 (.027)	.352	-.023 (.027)	.391	-.037 (.027)	.172	-.040 (.027)	.142	-.023 (.026)	.375
Citizen Ideology	-.013 (.037)	.724	-.015 (.037)	.685	-.005 (.039)	.897	-.006 (.038)	.873	-.007 (.038)	.856
Legislative Professionalism	3.000 (4.202)	.475	2.737 (4.263)	.521	3.266 (4.314)	.449	3.342 (4.428)	.450	4.354 (4.570)	.341
Energy Specific Conditions										
Wind Potential	.057 (.045)	.211	.058 (.045)	.204	.058 (.044)	.187	.054 (.043)	.217	.043 (.048)	.368
Percent Sunshine	-.011 (.047)	.802	-.012 (.046)	.784	-.003 (.049)	.950	-.003 (.049)	.942	-.019 (.042)	.655
Nuclear Power Plants	-.516 (.373)	.166	-.559 (.391)	.153	-.790 (.424)	.062	-.840 (.440)	.057	-.501 (.364)	.169
Electric Energy Consumption	.018 (.014)	.197	.018 (.014)	.198	.017 (.013)	.190	.019 (.013)	.155	.023 (.015)	.135
PUC Employees	-.003 (.003)	.378	-.002 (.003)	.401	-.002 (.003)	.486	-.002 (.003)	.465	-.003 (.003)	.329
Green Conditions	.0006 (.001)	.589	.0006 (.001)	.582	.0005 (.001)	.611	.0006 (.001)	.528	.0008 (.001)	.454
National Policies										
Production Incentive	-2.637 (1.842)	.152	-2.681 (1.853)	.148	-3.557 (2.130)	.095	-3.705 (2.196)	.092	-2.631 (1.830)	.151
Business Energy Tax Credit	-1.650 (1.426)	.247	-1.583 (1.416)	.264	-1.274 (1.377)	.355	-1.260 (1.370)	.358	-1.575 (1.425)	.269
USDA Rural Energy Program	-2.143 (1.141)	.060	-2.066 (1.146)	.071	-1.687 (1.161)	.146	-1.608 (1.162)	.166	-2.100 (1.140)	.066
State Incentive Policies										
Corporate Tax	2.491 (1.244)	.045	2.480 (1.242)	.046	2.412 (1.288)	.061	2.287 (1.279)	.074	2.387 (1.235)	.053
Personal Tax	-.863 (1.401)	.538	-.940 (1.393)	.500	-.573 (1.408)	.684	-.480 (1.402)	.732	-.937 (1.362)	.491
Sales Tax	-2.214 (1.240)	.074	-2.280 (1.260)	.071	-2.812 (1.367)	.040	-2.873 (1.361)	.035	-2.133 (1.234)	.084
Property Tax	-.257 (.646)	.690	-.255 (.644)	.692	-.432 (.637)	.497	-.467 (.638)	.465	-.334 (.640)	.602
Production Incentive	2.913 (1.494)	.051	2.921 (1.484)	.049	3.138 (1.484)	.035	3.348 (1.529)	.029	2.552 (1.490)	.087
Production Rebate	-.206 (.521)	.693	-.199 (.514)	.698	-.297 (.525)	.572	-.323 (.536)	.547	-.166 (.529)	.756
Bond	4.644 (3.186)	.145	5.145 (3.108)	.098	6.009 (3.155)	.057	5.674 (3.161)	.073	4.589 (2.907)	.114
Grant	.585 (.500)	.242	.608 (.499)	.222	.549 (.495)	.267	.537 (.493)	.276	.380 (.544)	.484
Loan	.047 (.575)	.935	.039 (.585)	.947	.367 (.635)	.563	.429 (.635)	.499	.136 (.594)	.818
Excise Tax	.604 (2.376)	.735	.674 (2.301)	.770	.568 (2.363)	.810	1.058 (2.337)	.651	1.239 (2.403)	.606

State Rules & Regulations										
Renewable Portfolio Standard	.636 (1.087)	.558	.659 (1.102)	.550	.282 (1.192)	.813	.215 (1.206)	.859	.795 (1.112)	.475
Green Power Purchasing	2.189 (1.564)	.162	2.298 (1.584)	.147	2.321 (1.585)	.143	2.398 (1.599)	.134	2.166 (1.603)	.177
Required Green Power	2.433 (1.554)	.118	2.369 (1.509)	.116	2.511 (1.549)	.105	2.607 (1.572)	.097	2.640 (1.598)	.099
Public Benefits Fund	.716 (1.100)	.515	.804 (1.130)	.477	1.178 (1.113)	.290	1.431 (1.152)	.214	1.278 (1.322)	.333
Net Metering	.684 (1.284)	.594	.660 (1.281)	.606	1.151 (1.415)	.416	1.131 (1.450)	.436	.875 (1.333)	.512
Diffusion Variable	.344 (3.545)	.923	-.888 (3.114)	.775	-4.385 (2.544)	.085	-4.016 (2.023)	.047	-.001 (.001)	.421
Trend	-1.617 (.612)	.008	-1.673 (.605)	.006	-1.856 (.632)	.003	-1.861 (.633)	.003	-1.566 (.596)	.009
Constant	4.853 (5.227)	.353	5.265 (5.202)	.311	5.830 (5.152)	.258	5.884 (5.175)	.256	4.332 (5.013)	.388
Number of Cases	1642		1642		1642		1642		1642	
Wald Chi^2	55.07	.0068	55.01	.0069	52.51	.0126	52.50	.0126	54.45	.0079
Log Likelihood	-48.409		-48.372		-46.947		-46.437		-48.082	
rho	.023		.023		.023		.023		.023	

Davidson-MacKinnon Test

	EPA	EPA Hybrid	Neighbor	Neighbor Hybrid	Leader-Laggard
EPA	-	.334	.466	.455	.925
EPA Hybrid	.339	-	.688	.582	.869
Neighbor	.064	.083	-	.221	.071
Neighbor Hybrid	.036	.044	.092	-	.040
Leader-Laggard	.421	.441	.327	.315	-

Standard errors are in parentheses. Two-tailed test. Davidson-MacKinnon Test results are the reported p-values.

than it would be if there wasn't a manufacturer. Again, these results illustrate the importance of positive and negative feedback associated with the previous adoption of other policies in an arena.

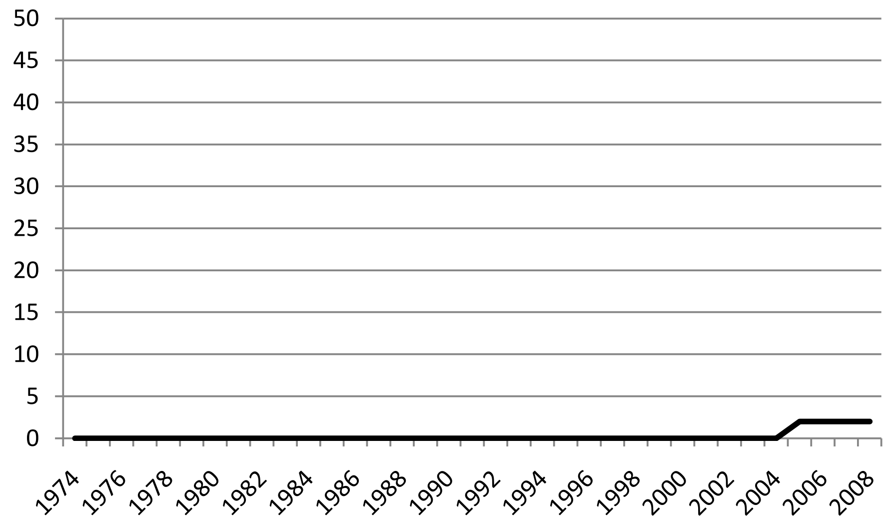
A comparison of the different models reveals that the choice of diffusion measure can impact the ability of a scholar to properly identify what influences adoption. Both neighbor models reveal that population density, nuclear power plants, and the adoption of the national production incentive program play an important role, but none of the others find similar results. On the other hand, the USDA Rural Energy Program is only found to be statistically insignificant in the two neighbor models. Additionally, state-backed bonds are not significant in the EPA regional and leader-laggard models, and required green policies are only significant in the neighbor hybrid and leader-laggard models. In short, this illustrates the importance of identifying the best measure of a control for diffusion.

State-Backed Financing

State-Backed Bonds

State-backed bond programs allow the government to raise money for the construction of a renewable system on behalf of a corporation. The state issues the bonds, which are purchased by investors. Under normal circumstances, the state would pay off the bonds themselves. However, under this type of a program the state serves as a middle-man for the corporation that is building the renewable. As such, the bond is actually paid off by the corporation even though it was taken out under the government's authority. In the event that the corporation fails to make payments on the bond, the government would become the owner of the renewable system. Thus far, only Idaho, Illinois, and New Mexico have adopted bond policies. However, the Illinois

Figure 4.9: State Adoption of State-Backed Bond Policies, 1974-2008



Source: Compiled by the author based upon state adoption of its first state-backed bond policy

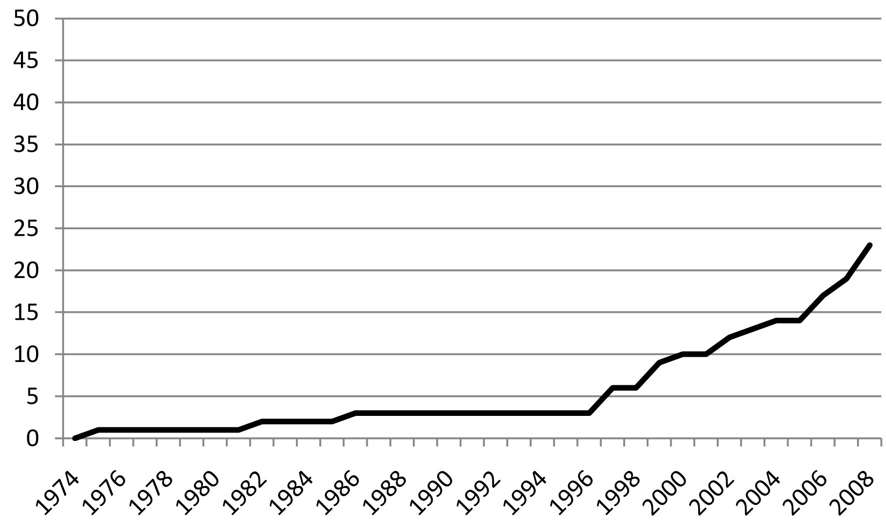
policy wasn't adopted until 2009, which places it outside of the time period covered by the data. Figure 4.9 illustrates the adoption of state-backed bond policies over time.

With only two states having adopted this policy, within the time period analyzed, there is not sufficient variation within the dependent variable to allow for a proper statistical analysis. If more states adopt this policy researchers will then be able to effectively model policy adoption.

State-Backed Grants

Several states have adopted state-backed grant policies. These are one-time grants of aid for the construction or purchase of renewable systems. Some state-backed grants are to help offset the cost associated with purchasing the renewable system, while others are to be applied to the construction costs. Usually, these are available to both individuals and corporations. However, preference appears to be given to corporations. An illustration of state adoption of state-backed grants can be found in Figure 4.10.

Figure 4.10: State Adoption of State-Backed Grant Policies, 1974-2008



Source: Compiled by the author based upon state adoption of its first state-backed grant policy

Table 4.15 presents the results of traditional analyses of the adoption of state-backed grant policies. The DMT finds that the leader-laggard model provides the best specified model. The DMT also reveals that this model is significantly better specified than the others. The model fit statistics suggest that the model performs well. The results indicate that states with more professional legislatures and renewable portfolio standards policies are more likely to adopt a state-backed grant. Additionally, the results suggest that states that are leaders are more likely to adopt than states that are laggards.

My analysis of the adoption of state-backed grants using the expanded approach reveals several interesting findings, which are presented in Table 4.16. The DMT finds that the neighbor hybrid measure creates the best specified model. This is interesting because this measure is significantly better specified than the other four, while in the traditional model the leader-laggard model was significantly better than the others. The conflicting DMT findings represent the first time both the traditional and expanded models contained measures that resulted in significantly

Table 4.15: State Adoption of Grant Policies (Traditional Model)

	EPA		EPA Hybrid		Neighbor		Neighbor Hybrid		Leader-Laggard	
	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.
Internal Determinants										
Tax Revenue per Capita	-.117 (.547)	.830	-.088 (.555)	.874	-.136 (.544)	.802	-.139 (.543)	.798	-.096 (.588)	.869
Population Density	-.0005 (.0009)	.518	-.0005 (.0009)	.593	-.0005 (.001)	.599	-.0006 (.001)	.516	-.001 (.0009)	.125
College Graduates	-.014 (.048)	.765	-.014 (.048)	.767	-.015 (.048)	.743	-.016 (.048)	.732	-.041 (.050)	.419
Government Ideology	-.010 (.011)	.347	-.019 (.011)	.341	-.011 (.011)	.341	-.010 (.011)	.353	-.009 (.011)	.400
Citizen Ideology	.039 (.021)	.066	.039 (.021)	.065	.039 (.021)	.063	.039 (.021)	.065	.036 (.022)	.103
Legislative Professionalism	5.659 (2.011)	.005	5.631 (2.010)	.005	5.640 (2.025)	.005	5.680 (2.025)	.005	3.885 (2.270)	.087
Energy Specific Conditions										
Wind Potential	-.032 (.022)	.148	-.031 (.021)	.146	-.033 (.023)	.163	-.031 (.022)	.165	-.021 (.022)	.338
Percent Sunshine	-.065 (.026)	.012	-.065 (.025)	.011	-.065 (.027)	.016	-.063 (.027)	.021	-.045 (.030)	.134
Nuclear Power Plants	.193 (.115)	.094	.192 (.113)	.091	.187 (.113()	.097	.187 (.113)	.099	.131 (.121)	.278
Electric Energy Consumption	.001 (.004)	.740	.001 (.004)	.770	.001 (.004)	.680	.001 (.004)	.680	-.0001 (.005)	.969
PUC Employees	.00006 (.001)	.963	.00009 (.001)	.945	.00006 (.001)	.963	.00002 (.001)	.983	-.0006 (.001)	.672
Green Conditions	-.0003 (.0005)	.569	-.0003 (.0005)	.565	-.0003 (.0005)	.590	-.0003 (.0005)	.588	-.0009 (.0006)	.144
Renewable Portfolio Standard	1.692 (.713)	.018	1.724 (.717)	.016	1.684 (.711)	.018	1.649 (.715)	.021	1.246 (.670)	.063
Diffusion Variable	-.286 (1.206)	.812	-.367 (1.007)	.715	-.271 (1.285)	.833	-.041 (1.032)	.968	.001 (.0008)	.064
Trend	-.726 (.232)	.002	-.722 (.227)	.001	-.724 (.231)	.002	-.715 (.229)	.002	-.880 (.252)	.000
Constant	-1.789 (2.187)	.413	-1.796 (2.167)	.407	-1.789 (2.181)	.412	-1.865 (2.212)	.399	-1.573 (2.453)	.521
Number of Cases	1573		1573		1573		1573		1573	
Wald Chi^2	57.35	.0000	57.39	.0000	57.66	.0000	57.72	.0000	59.73	.0000
Log Likelihood	-89.508		-89.469		-89.514		-89.535		-87.637	
rho	.023		.023		.023		.023		.022	

Davidson-MacKinnon Test

	EPA	EPA Hybrid	Neighbor	Neighbor Hybrid	Leader-Laggard
EPA	-	.787	.889	.799	.563
EPA Hybrid	.699	-	.765	.667	.521
Neighbor	.932	.986	-	.693	.496
Neighbor Hybrid	.920	.817	.735	-	.599
Leader-Laggard	.054	.054	.049	.053	-

Standard errors are in parentheses. Two-tailed test. Davidson-MacKinnon Test results are the reported p-values.

better models, but these models were not the same in both sets of analyses. This illustrates the importance of exploring the adoption of a policy in this manner since the expanded analysis clearly allows for a much more nuanced and revealing explanation of adoption. Moreover, the model fit statistics reveal that the models performed very well. It should also be noted that only one of the independent variables is not included in these analyses, and it was removed because the two states that have adopted state-backed bonds did so after they had both adopted grants, which meant that the variable did not vary within the analysis.

The results of the expanded analysis reveals that states with more professional legislatures, more nuclear power plants, worse green conditions, and a lower percentage of the year with sunshine were all more likely to adopt a state-backed grant policy. It also appears that national policies have little influence over the adoption of state-backed grants. The existence of previously adopted policies has a strong influence on the adoption of state-backed grants. This influence appears to be stronger with state-backed grants than other policies. The data suggest that states that have already adopted production rebates, excise tax incentives, renewable portfolio standards, required green power, and public benefits funds are more likely to adopt state-backed grants. On the other hand, states that have already adopted production incentives and industry support policies are less likely to adopt state-backed grants.

This analysis is the first that estimates a statistically significant, positive coefficient estimate for the constant. In the previous analyses, if the constant was significant it was always negative. This estimation is interesting because it suggests that the expanded analysis of state-backed grants is better able to explain why a state would not adopt the policy than why it would.

Following a pattern of results observed in the earlier models, the selection of diffusion measures influences the estimation of the data. However, there was more consistency in the

Table 4.16: State Adoption of Grant Policies (Expanded Model)

	EPA		EPA Hybrid		Neighbor		Neighbor Hybrid		Leader-Laggard	
	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.
Internal Determinants										
Tax Revenue per Capita	-1.567 (.912)	.086	-1.538 (.909)	.091	-1.532 (.928)	.099	-1.482 (.951)	.119	-1.507 (.905)	.096
Population Density	-.001 (.001)	.482	-.001 (.001)	.564	-.0001 (.001)	.930	.0004 (.001)	.798	-.001 (.001)	.386
College Graduates	-.026 (.072)	.711	-.018 (.072)	.795	-.016 (.069)	.807	-.021 (.071)	.765	-.024 (.066)	.710
Government Ideology	-.002 (.017)	.866	-.002 (.017)	.877	-.003 (.017)	.831	-.004 (.016)	.802	-.0007 (.017)	.968
Citizen Ideology	.016 (.025)	.520	.015 (.025)	.547	.014 (.025)	.576	.016 (.025)	.527	.009 (.026)	.732
Legislative Professionalism	7.337 (3.477)	.035	7.320 (3.479)	.035	7.167 (3.460)	.038	7.400 (3.453)	.032	6.313 (3.802)	.097
Energy Specific Conditions										
Wind Potential	-.021 (.035)	.537	-.024 (.034)	.481	-.035 (.036)	.341	-.035 (.036)	.322	-.020 (.034)	.542
Percent Sunshine	-.084 (.047)	.077	-.088 (.048)	.070	-.098 (.045)	.030	-.107 (.046)	.020	-.084 (.048)	.077
Nuclear Power Plants	.287 (.162)	.077	.287 (.161)	.076	.263 (.162)	.104	.283 (.163)	.082	.275 (.161)	.088
Electric Energy Consumption	.003 (.008)	.659	.002 (.008)	.723	.003 (.008)	.672	.003 (.008)	.700	.001 (.008)	.861
PUC Employees	-.003 (.002)	.153	-.003 (.002)	.164	-.003 (.002)	.141	-.004 (.002)	.103	-.003 (.002)	.157
Green Conditions	-.001 (.0009)	.059	-.001 (.0009)	.056	-.001 (.0009)	.061	-.001 (.0009)	.062	-.002 (.001)	.042
National Policies										
Production Incentive	-.579 (1.530)	.705	-.605 (1.532)	.693	-.794 (1.559)	.610	-1.048 (1.618)	.517	-.540 (1.518)	.722
Modified Accelerated Cost-Recovery System	-.755 (1.498)	.614	-.796 (1.501)	.596	-.741 (1.478)	.616	-.920 (1.477)	.534	-.749 (1.481)	.613
Business Energy Tax Credit	.185 (1.188)	.876	.225 (1.193)	.850	.183 (1.190)	.878	-.027 (1.196)	.982	.410 (1.256)	.744
USDA Rural Energy Program	.859 (1.146)	.453	.804 (1.140)	.481	.885 (1.128)	.433	1.106 (1.167)	.343	.811 (1.128)	.472
State Incentive Policies										
Corporate Tax	.630 (1.001)	.529	.690 (1.004)	.491	.679 (1.024)	.507	.791 (1.031)	.443	.675 (.988)	.494
Personal Tax	-.755 (1.181)	.522	-.830 (1.194)	.487	-.956 (1.220)	.434	-1.192 (1.246)	.338	-.863 (1.176)	.463
Sales Tax	-.514 (.966)	.594	-.483 (.951)	.612	-.522 (.938)	.578	-.595 (.937)	.525	-.410 (.958)	.669
Property Tax	-.901 (.669)	.178	-.902 (.671)	.179	-.976 (.695)	.160	-.952 (.720)	.186	-.818 (.678)	.228
Production Incentive	-3.199 (1.490)	.032	-3.086 (1.460)	.035	-2.859 (1.404)	.042	-2.722 (1.352)	.044	-.034 (1.399)	.030
Production Rebate	1.711 (1.059)	.106	1.719 (1.062)	.106	1.873 (1.085)	.084	1.998 (1.096)	.068	1.582 (1.070)	.139
Loan	-.554 (.491)	.260	-.511 (.474)	.281	-.533 (.461)	.247	-.622 (.464)	.180	-.660 (.530)	.213
Excise Tax	6.824 (2.288)	.003	6.707 (2.307)	.004	6.660 (2.250)	.003	6.419 (2.253)	.004	6.911 (2.270)	.002
Industry Support	-3.966 (1.343)	.003	-3.945 (1.339)	.003	-4.160 (1.376)	.003	-4.396 (1.422)	.002	-3.893 (1.330)	.003

State Rules & Regulations										
Renewable Portfolio Standard	2.911 (1.249)	.020	2.893 (1.241)	.020	3.098 (1.247)	.013	3.319 (1.247)	.008	2.889 (1.236)	.020
Green Power Purchasing	2.423 (2.103)	.249	2.343 (2.105)	.266	2.391 (2.116)	.258	2.273 (2.134)	.287	2.536 (2.100)	.227
Required Green Power	3.939 (1.338)	.003	3.881 (1.333)	.004	4.092 (1.340)	.002	4.308 (1.371)	.002	3.741 (1.340)	.005
Public Benefits Fund	6.414 (1.414)	.000	6.334 (1.396)	.000	6.316 (1.362)	.000	6.602 (1.388)	.000	6.301 (1.373)	.000
Net Metering	-.427 (.896)	.633	-.439 (.897)	.624	-.312 (.900)	.729	-.060 (.891)	.857	-.639 (.957)	.504
Diffusion Variable	.593 (1.856)	.749	-.042 (1.660)	.979	-1.817 (1.735)	.295	-2.460 (1.570)	.117	.0007 (.001)	.541
Trend	-1.336 (.563)	.018	-1.383 (.566)	.015	-1.497 (.564)	.008	-1.565 (.569)	.006	-1.405 (.550)	.011
Constant	5.962 (4.759)	.210	6.251 (4.768)	.190	7.083 (4.639)	.127	7.849 (4.725)	.097	6.440 (4.732)	.174
Number of Cases	1573		1573		1573		1573		1573	
Wald Chi^2	65.64	.0004	66.58	.0003	68.77	.0002	69.92	.0001	67.79	.0002
Log Likelihood	-59.743		-59.794		-59.272		-58.578		-59.607	
rho	.024		.024		.023		.023		.023	

	Davidson-MacKinnon Test				
	EPA	EPA Hybrid	Neighbor	Neighbor Hybrid	Leader-Laggard
EPA	-	.338	.250	.172	.744
EPA Hybrid	.365	-	.503	.229	.996
Neighbor	.139	.227	-	.406	.219
Neighbor Hybrid	.051	.059	.088	-	.080
Leader-Laggard	.539	.542	.375	.289	-

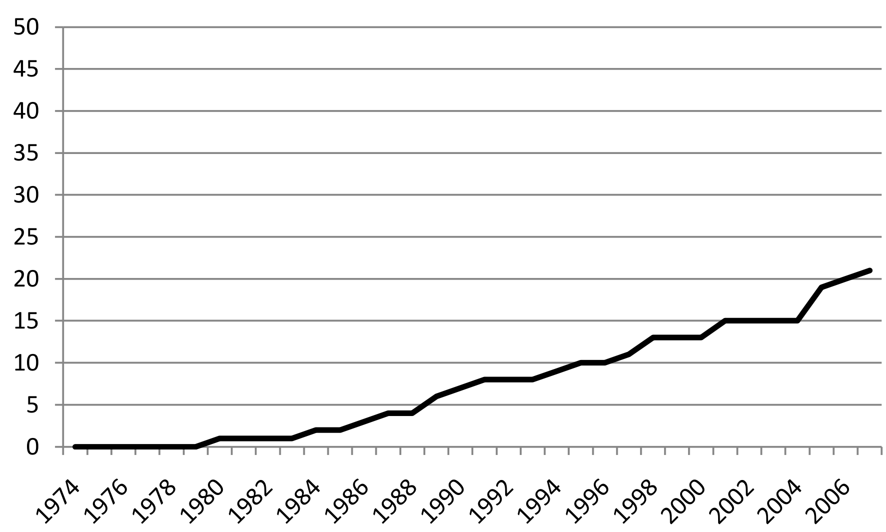
Standard errors are in parentheses. Two-tailed test. Davidson-MacKinnon Test results are the reported p-values.

models of state-backed grants than in many of the others. The results reveal that tax revenue per capita is statistically significant in all of the models except the neighbor hybrid model. Nuclear power plants are important in all but the basic neighbor model. Finally, production rebates are only found to have a significant influence in the two neighbor models.

State-Backed Loans

Most states have adopted state-backed loan policies. Although some loans are for construction costs, others are for purchase costs. Still other loan programs help with the cost of hooking to the electrical grid. Some states allow entities to apply for more than one type of loan. Because the state is backing the loan, the interest rates tend to be lower than those offered by private lending institutions, and it is easier to qualify because if the recipient defaults on the loan, the state would take ownership of the renewable system. A visual depiction of state adoption of state-backed loans can be found in Figure 4.11.

Figure 4.11: State Adoption of State-Backed Loan Policies, 1974-2008



Source: Compiled by the author based upon state adoption of its first state-backed loan policy

The results from the traditional model of the adoption of these state-backed loan programs can be found in Table 4.17. The DMT suggests that the leader-laggard model is the best specified. The model fit statistics indicate that the model performs well. While this may be the best specified model, the model itself doesn't reveal much about what is influencing adoption. A state was more likely to adopt a loan policy after they had adopted a renewable portfolio standards policy. Interestingly, the trend variable is not significant, indicating that duration dependence may not create an unstable hazard rate.

An expanded analysis of adoption clearly allows the statistical model to better estimate the influence of certain conditions, which suggests that the traditional model was underspecified. The results of the expanded analyses can be found in Table 4.18. The DMT suggests that the basic neighbor diffusion measure provides the best specified model of adoption. The model fit statistics for this model indicate that it performs well. Again, the model results reveal that the trend variable is not significant.

The results from the expanded model reveal that states with less per capita tax revenue, more college graduates, and a lower percentage of days with sunshine are more likely to adopt state-backed loans. While one might be tempted to presume that a state with lower tax revues would be less likely to adopt a renewable energy policy, it is reasonable to presume that a state-backed loan program would be preferred to many of the other options because the state will get their money back with interest as opposed to the other policies that only pay out without a direct return of revenue.

The data also reveals that states were motivated by the activities of the national government. Surprisingly, following the adoption of the Modified Accelerated Cost-Recovery System states were more likely to adopt a loan program. Also, after the national government

Table 4.17: State Adoption of Loan Policies (Traditional Model)

	EPA		EPA Hybrid		Neighbor		Neighbor Hybrid		Leader-Laggard	
	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.
Internal Determinants										
Tax Revenue per Capita	-.280 (.489)	.567	-.251 (.484)	.603	-.279 (.487)	.567	-.279 (.488)	.568	-.299 (.482)	.535
Population Density	-.0006 (.0009)	.483	-.0005 (.001)	.612	-.0006 (.0009)	.478	-.0006 (.0009)	.480	-.0005 (.001)	.593
College Graduates	.050 (.046)	.276	.052 (.046)	.259	.051 (.046)	.268	.051 (.046)	.264	.052 (.046)	.259
Government Ideology	.002 (.011)	.812	.003 (.011)	.739	.002 (.011)	.791	.003 (.011)	.784	.003 (.011)	.782
Citizen Ideology	.004 (.018)	.813	.002 (.019)	.891	.004 (.018)	.830	.004 (.018)	.829	.005 (.019)	.761
Legislative Professionalism	.392 (2.491)	.875	.065 (2.462)	.979	.371 (2.412)	.878	.354 (2.388)	.882	.507 (2.406)	.833
Energy Specific Conditions										
Wind Potential	-.005 (.019)	.775	-.003 (.019)	.850	-.005 (.018)	.776	-.005 (.018)	.782	-.006 (.019)	.734
Percent Sunshine	-.023 (.022)	.306	-.027 (.024)	.259	-.023 (.021)	.287	-.023 (.022)	.306	-.026 (.022)	.227
Nuclear Power Plants	.020 (.118)	.865	.019 (.117)	.866	.019 (.118)	.872	.019 (.118)	.869	.028 (.120)	.815
Electric Energy Consumption	-.002 (.005)	.646	-.002 (.005)	.609	-.002 (.005)	.641	-.002 (.005)	.641	-.002 (.005)	.689
PUC Employees	-.0004 (.001)	.817	-.0002 (.001)	.894	-.0004 (.001)	.819	-.0004 (.001)	.814	-.0002 (.001)	.894
Green Conditions	-.0001 (.0005)	.760	-.0002 (.0005)	.691	-.0001 (.0005)	.743	-.0001 (.0005)	.724	-.00008 (.0005)	.874
Renewable Portfolio Standard	1.392 (.609)	.022	1.435 (.611)	.019	1.391 (.608)	.022	1.390 (.609)	.023	1.440 (.613)	.019
Diffusion Variable	.120 (1.044)	.908	-.319 (1.069)	.765	.121 (.922)	.896	.113 (.887)	.898	-.0002 (.0005)	.694
Trend	-.333 (.257)	.195	-.355 (.256)	.167	-.332 (.258)	.198	-.332 (.258)	.198	-.335 (.250)	.179
Constant	-2.783 (2.527)	.271	-2.328 (2.596)	.370	-2.758 (2.439)	.258	-2.756 (2.442)	.259	-2.662 (2.293)	.246
Number of Cases	1495		1495		1495		1495		1495	
Wald Chi^2	28.69	.0176	28.67	.0177	28.71	.0175	28.72	.0175	28.68	.0177
Log Likelihood	-114.619		-114.580		-114.617		-114.618		-114.548	
rho	.023		.022		.023		.023		.022	

Davidson-MacKinnon Test

	EPA	EPA Hybrid	Neighbor	Neighbor Hybrid	Leader-Laggard
EPA	-	.330	.963	.954	.864
EPA Hybrid	.323	-	.677	.681	.823
Neighbor	.938	.750	-	.975	.887
Neighbor Hybrid	.937	.755	.992	-	.878
Leader-Laggard	.680	.735	.691	.687	-

Standard errors are in parentheses. Two-tailed test. Davidson-MacKinnon Test results are the reported p-values.

Table 4.18: State Adoption of Loan Policies (Expanded Model)

	EPA		EPA Hybrid		Neighbor		Neighbor Hybrid		Leader-Laggard	
	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.
Internal Determinants										
Tax Revenue per Capita	-1.246 (.734)	.090	-1.224 (.730)	.094	-1.245 (.733)	.090	-1.231 (.703)	.092	-1.203 (.717)	.093
Population Density	-.0006 (.001)	.658	-.0006 (.001)	.677	-.0006 (.001)	.658	-.0006 (.001)	.666	-.0004 (.001)	.746
College Graduates	.114 (.057)	.047	.115 (.057)	.047	.116 (.057)	.043	.117 (.057)	.040	.117 (.058)	.043
Government Ideology	.017 (.015)	.256	.018 (.015)	.242	.018 (.015)	.228	.019 (.015)	.221	.018 (.015)	.236
Citizen Ideology	-.025 (.023)	.288	-.025 (.024)	.281	-.027 (.024)	.249	-.027 (.024)	.249	-.025 (.024)	.293
Legislative Professionalism	2.656 (2.893)	.359	2.512 (2.880)	.383	2.661 (2.849)	.350	2.564 (2.835)	.366	2.372 (2.820)	.400
Energy Specific Conditions										
Wind Potential	-.012 (.024)	.622	-.011 (.024)	.648	-.010 (.024)	.651	-.009 (.023)	.677	-.010 (.024)	.669
Percent Sunshine	-.060 (.028)	.031	-.060 (.029)	.038	-.062 (.027)	.023	-.061 (.027)	.026	-.064 (.027)	.019
Nuclear Power Plants	-.013 (.148)	.925	-.013 (.148)	.928	-.017 (.148)	.904	-.014 (.147)	.921	-.011 (.150)	.938
Electric Energy Consumption	.001 (.008)	.874	.001 (.008)	.857	.0009 (.008)	.903	.001 (.008)	.901	.001 (.008)	.847
PUC Employees	-.001 (.002)	.525	-.001 (.002)	.529	-.001 (.002)	.542	-.001 (.002)	.532	-.001 (.002)	.564
Green Conditions	-.0002 (.0005)	.619	-.0003 (.0005)	.581	-.0003 (.0005)	.576	-.0003 (.0005)	.535	-.0003 (.0006)	.646
National Policies										
Production Incentive	-1.056 (.994)	.288	-1.034 (.991)	.297	-1.057 (.993)	.287	-1.033 (.991)	.297	-1.041 (.992)	.294
Modified Accelerated Cost-Recovery System	2.362 (1.047)	.024	2.381 (1.045)	.023	2.358 (1.049)	.025	2.374 (1.045)	.023	2.394 (1.043)	.022
Business Energy Tax Credit	2.438 (1.064)	.022	2.506 (1.050)	.017	2.412 (1.065)	.024	2.460 (1.059)	.020	2.550 (1.033)	.014
State Incentive Policies										
Corporate Tax	-.992 (1.032)	.337	-.976 (1.035)	.346	-1.026 (1.040)	.324	-1.005 (1.037)	.333	-.994 (1.037)	.338
Personal Tax	2.300 (.922)	.013	2.299 (.922)	.013	2.347 (.927)	.011	2.335 (.927)	.012	2.295 (.924)	.013
Sales Tax	-1.818 (1.102)	.099	-1.830 (1.113)	.100	-1.750 (1.096)	.111	-1.792 (1.095)	.102	-1.780 (1.082)	.100
Property Tax	.271 (.485)	.576	.254 (.483)	.599	.232 (.473)	.624	.232 (.473)	.623	.218 (.483)	.651
Production Incentive	.241 (1.256)	.848	.288 (1.238)	.816	.228 (1.254)	.855	.253 (1.246)	.839	.325 (1.215)	.789
Production Rebate	-1.113 (.952)	.242	-1.148 (.953)	.228	-1.165 (.958)	.224	-1.188 (.962)	.217	-1.173 (.952)	.218
Bond	2.678 (1.847)	.147	2.755 (1.845)	.135	2.758 (1.839)	.134	2.786 (1.844)	.131	2.725 (1.838)	.138
Grant	-.106 (.583)	.856	-.116 (.581)	.843	-.096 (.579)	.868	-.091 (.584)	.876	-.128 (.576)	.823
Excise Tax	-2.590 (2.088)	.215	-2.579 (2.101)	.220	-2.775 (2.095)	.185	-2.712 (2.082)	.193	-2.730 (2.157)	.206
Industry Support	-.368 (.483)	.446	-.380 (.482)	.430	-.299 (.513)	.559	-.322 (.508)	.526	-.372 (.486)	.443

State Rules & Regulations										
Renewable Portfolio Standard	1.562 (.785)	.047	1.552 (.782)	.047	1.589 (.791)	.044	1.582 (.790)	.045	1.556 (.782)	.047
Green Power Purchasing	-18.346 (3961.136)	.996	-18.477 (4241.869)	.997	-18.793 (5067.701)	.997	-18.269 (3957.922)	.996	-18.349 (4249.544)	.997
Required Green Power	-.190 (1.362)	.889	-.119 (1.338)	.929	-.294 (1.405)	.834	-.281 (1.371)	.873	-.117 (1.338)	.930
Public Benefits Fund	2.744 (1.001)	.006	2.740 (1.0002)	.006	2.712 (1.0009)	.007	2.702 (1.005)	.007	2.770 (1.038)	.008
Net Metering	.344 (.717)	.631	.333 (.715)	.641	.318 (.711)	.654	.311 (.710)	.661	.329 (.720)	.647
Diffusion Variable	.565 (1.422)	.691	.334 (1.362)	.806	.549 (1.180)	.642	.384 (1.048)	.714	-.00008 (.0006)	.900
Trend	.214 (.416)	.607	.220 (.417)	.597	.204 (.417)	.625	.212 (.417)	.611	.219 (.417)	.599
Constant	-4.613 (3.185)	.148	-4.581 (3.244)	.158	-4.361 (3.142)	.165	-4.397 (3.140)	.161	-4.392 (3.116)	.159
Number of Cases	1495		1495		1495		1495		1495	
Wald Chi^2	58.17	.0031	57.94	.0033	58.31	.0030	58.18	.0031	57.77	.0035
Log Likelihood	-95.986		-96.035		-95.956		-95.997		-96.057	
rho	.021		.021		.021		.021		.021	

Davidson-MacKinnon Test

	EPA	EPA Hybrid	Neighbor	Neighbor Hybrid	Leader-Laggard
EPA	-	.678	.906	.826	.683
EPA Hybrid	.784	-	.968	.991	.795
Neighbor	.784	.690	-	.713	.645
Neighbor Hybrid	.872	.785	.820	-	.713
Leader-Laggard	.875	.879	.914	.898	-

Standard errors are in parentheses. Two-tailed test. Davidson-MacKinnon Test results are the reported p-values.

adopted its Business Energy Tax Credit, states that had not already adopted a loan policy were more likely to do so.

The results also suggest that the prior adoption of other renewable energy policies influenced the adoption of state-backed loans. States that had already adopted personal tax incentives, renewable portfolio standards, and public benefits funds were more likely to adopt a loan program. The importance of public benefits funds coincides with the lower tax revenue per capita since the funds raised by the public benefits fund are likely to be used to issue the loans.

Discussion and Conclusions

In this chapter I explored the adoption of state renewable energy policy incentives. I employed a universal modeling approach to allow a comparison between the adoptions of state renewable energy incentive policies. Unfortunately, it was not possible to analyze every policy due to too few states having adopted state-backed bond and excise tax policies. However, taken as a whole, the analyses reveal several important observations.

Recall, I presented an argument that the policymaking process is an inherently complex process (e.g. Sabatier and Weible 2007), and that our traditional models may be underspecified, which can lead to improperly estimating the relationships between the independent and dependent variables. These analyses assessed the validity of these concerns by estimating a traditional model of adoption along with an expanded model. In nearly every set of analyses, the results indicated that the expanded models provided a more complete picture of the forces influencing policy adoption. In several of the models, the expanded models revealed that the traditional model misestimated the proper influence of the variables normally included in the traditional model.

Table 4.19: Summary of Statistically Significant Independent Variables

	Traditional			Expanded		
	Positive	Negative	Total	Positive	Negative	Total
Internal Determinants						
Tax Revenue per Capita	33.3%	11.1%	44.4%	33.3%	22.2%	55.5%
Population Density	11.1%	0%	11.1%	33.3%	0%	33.3%
College Graduates	11.1%	0%	11.1%	22.2%	11.1%	33.3%
Government Ideology	0%	11.1%	11.1%	0%	0%	0%
Citizen Ideology	11.1%	11.1%	22.2%	11.1%	22.2%	33.3%
Legislative Professionalism	11.1%	0%	11.1%	11.1%	0%	11.1%
Energy Specific Conditions						
Wind Potential	11.1%	0%	11.1%	11.1%	0%	11.1%
Percent Sunshine	11.1%	0%	11.1%	22.2%	33.3%	55.5%
Nuclear Power Plants	11.1%	0%	11.1%	33.3%	33.3%	66.6%
Electric Energy Consumption	33.3%	0%	33.3%	11.1%	11.1%	22.2%
PUC Employees	0%	0%	0%	0%	0%	0%
Green Conditions	22.2%	0%	22.2%	22.2%	11.1%	33.3%
National Policies						
Production Incentive	-	-	-	22.2%	11.1%	33.3%
Modified Accelerated Cost-Recovery System	-	-	-	11.1%	0%	11.1%
Business Energy Tax Credit	-	-	-	22.2%	0%	22.2%
USDA Rural Energy Program	-	-	-	11.1%	11.1%	22.2%
State Incentive Policies						
Corporate Tax	-	-	-	37.5%	0%	37.5%
Personal Tax	-	-	-	25%	12.5%	37.5%
Sales Tax	-	-	-	12.5%	25%	37.5%
Property Tax	-	-	-	0%	0%	0%
Production Incentive	-	-	-	12.5%	12.5%	25%
Production Rebate	-	-	-	12.5%	0%	12.5%
Bond	-	-	-	11.1%	0%	11.1%
Grant	-	-	-	12.5%	12.5%	25%
Loan	-	-	-	0%	0%	0%
Excise Tax	-	-	-	22.2%	0%	22.2%
Industry Support	-	-	-	25%	12.5%	37.5%
State Rules & Regulations						
Renewable Portfolio Standard	55.5%	0%	55.5%	33.3%	11.1%	44.4%
Green Power Purchasing	-	-	-	0%	0%	0%
Required Green Power	-	-	-	44.4%	0%	44.4%
Public Benefits Fund	-	-	-	22.2%	0%	22.2%
Net Metering	-	-	-	22.2%	0%	22.2%

Note: All percentages represent the number of statistically significant results for each variable that identified in the best specified model for each of the nine policies, except for the variables representing the policies that were examined in this chapter, which were only modeled in eight analyses because they all had to be removed from their own analysis.

To illustrate these differences, Table 4.19 presents a summary of the statistically significant independent variables that were found in the models that were best specified. This summary reveals that the internal determinants and energy specific conditions were consistently misestimated in the traditional models, whereas the expanded models were better able to identify how these variables and the dependent variable related. For instance, the variable representing the number of nuclear power plants was significant in only 11.1% of the traditional models, but it was significant in 66.6% of the expanded models, with half of those be positive and the other half negative. Certainly, our explanation of the influence of nuclear power plants on policy adoption would be completely different if we were to only rely on the traditional models. The same can be said for the percent sunshine in each state, which went from 11.1% to 55.5%. Even smaller changes are noteworthy. For instance population density, college graduates, and citizen ideology all increased from 11.1% to 33.3%. Perhaps more importantly, only three variables were found to have a significant negative influence on adoption in the traditional models, but the expanded models reveal a massive increase in significant negative influences amongst these variables. This clearly indicates that the traditional model may be underspecified, and that adoption scholars would be better suited to consider expanding their models to better reflect the complexity of policy adoption.

The results presented provide an interesting view into the dynamics of federalism. Recall, Gormley (1986) would suggest that renewable energy policy is an area that the national government ought to dominate. However, the states have been heavily involved in adopting policies creating financial incentives to encourage the construction of these resources. An important issue was to determine if states were motivated by national action on this topic. As Table 4.19 illustrates, the analyses indicate that the states were acting primarily independent of national action. In only a few policies were national policy adoption a significant influence on state adoption. Nevertheless, in some instances national adoption encouraged states to adopt a policy. In others, it appears as though states chose not to adopt a policy because the national government may have provided an incentive that was sufficient to not necessitate adoption of their own. Regardless, it seems that it would be beneficial to control for the influence of the national government on state policy adoption.

These analyses should illustrate the importance of controlling for previously adopted policies within the policy arena. The basic idea underlying the feedback loops that are inherent to every theory of policymaking is that previous behaviors are going to influence future behavior. To borrow from Baumgartner and Jones (2002) previously adopted policies could be thought of as positive or negative feedbacks. However, existing research rarely examines these relationships, with the exception of Balla (2001) and Stoutenborough and Beverlin (2008). These analyses attempted to fully test the influence of pre-existing policies on the adoption of a new policy. As Table 4.19 reveals, not every previously adopted policy has a significant influence on the adoption of a different policy (i.e. property tax incentives, state-backed loans, and green power purchasing). However, the cumulative results clearly suggest that existing policies can provide both positive and negative feedbacks. These feedbacks tended to be overwhelmingly positive, which was to be expected. However, there were clearly situations where the existence of a specific policy decreased the likelihood of adoption. Certainly these results should encourage policy adoption scholars to model the effects of other policies in the policy arena.

Another goal of these analyses was to determine if our conceptualization of diffusion influenced the analyses. Rarely is it clear prior to analyzing adoption how states learn from one another. It was expected that there were many equally plausible explanations, and that the only way to know for certain which best represents policy learning was to model each in a competing measures. Using a Davidson-MacKinnon test, I was able to fit each model into the others to determine which measure of diffusion created the best specified model.[24] Table 4.20 presents the breakdown of best measure of diffusion for each policy and type of model.

Interestingly, this approach revealed that learning about renewable energy incentive policies followed several paths, and that these paths were rarely statistically significant. While individually none of these results are wholly inconsistent with previous research using diffusion, it is remarkable that in the eighteen separate analyses discussed, the control for diffusion was only significant in seven – three in the traditional models and four in the expanded models. This is interesting primarily because we typically expect that diffusion is occurring (Mooney 2001). Fascinatingly, of these seven, four were a negative relationship. This relationship is normally expected to be positive (Mooney 2001), but some have found a negative relationship (e.g. Hays and Glick 1997).

Table 4.20 reveals a very interesting pattern in the results. In every instance when the EPA appears to have inserted itself into the process the EPA region diffusion variable was statistically significant and in a negative direction. But why would this be? As noted, there have been EPA regions that have had confrontational relationships with its member states (e.g. O'Leary and Raines 2001), but it isn't clear exactly why this would cause a state to be less likely

Table 4.20: Summary of Diffusion Measures and Model Specification

	Traditional Models				Expanded Models			
	Best Model[a]	DMT Significant[b]	Estimate Significant[c]	Estimate Negative[d]	Best Model[a]	DMT Significant[b]	Estimate Significant[c]	Estimate Negative[d]
EPA	1	1	1	1	2	1.75	2	2
EPA Hybrid	1	0	0	n/a	0	n/a	n/a	n/a
Neighbor	1	0	0	n/a	2	0	0	n/a
Neighbor Hybrid	2	0	0	n/a	3	1	1	1
Leader-Laggard	4	2.5	2	0	2	1.5	1	0

Notes:
a: The number of times each measure of diffusion was identified as the measure that provided the best specified model
b: The number of times the Davidson-MacKinnon Test identified the measure as being statistically significantly better that the other measures. If a measure was not significantly better than all four measures, a decimal was added to represent the percent of that it was significantly better.
c: The number of times the best specified measure resulted in a statistically significant coefficient estimate.
d: The number of times a significant result was negative.

[24] See Chapter 3 for an explanation of this procedure.

to adopt a policy if the learning appears to be facilitated by these regional offices. If anything, this would suggest that the EPA regional offices would be less likely to influence these states.

Another possibility is that the EPA is somehow administering the process of providing states with the resources to back some of their incentives, and that this administration process is complicated, which would make the EPA less enthusiastic about encouraging states to adopt these policies because it would create more work for these regional offices. Certainly, the American Recovery and Reinvestment Act of 2009 provides several grant opportunities that would allow states to use federal funding to cover the cost of their incentive, and that several state have taken advantage of these grants in 2009 and 2010 by adopting policies that are funded through these grants. However, I am unable to find a link between production rebates and property tax incentives and federal grants that may be administered by the EPA. This doesn't mean that they are not there, but that I cannot find them. Given data limitations these are simply open questions that await future analysis.

When conceptualizing diffusion in several different manners, it is expected that not all of the policies will spread in the same manner. It is possible that certain policies are more likely to follow a leader-laggard approach, while others may be spread through the assistance of the EPA. Despite all of the policies examined thus far generally falling under the category of renewable energy incentive policies, the method of policy learning within the states varied greatly. As Table 4.20 illustrates, clearly diffusion is not consistent within a policy arena. This suggests that policy scholars should not rely solely on the results of previous policy research in a policy arena to determine what type of diffusion should be modeled. Moreover, of the eight policies examined, the measure of diffusion that presented the best specified model changed five times, suggesting that better models can drastically alter estimations. Together, these results suggest that this approach to identifying the best measure ought to be used by policy scholars.

Finally, although it was not always the case, several models revealed that one form of measuring diffusion created models that were statistically significantly better specified than the others. When this occurred, there can be no doubt that that particular measure was the best. In seven of the eighteen models, the DMT reveals that one measure of diffusion created a model that was significantly better specified than the four others. Two measures were significantly better than two of the four alternatives. In both of these situations, the other two were close to being statistically significantly better. Finally, one measure was significantly better than three of the four, with the exception being the hybrid version of the measure. This is important to note because more than half of the eighteen models resulted in a measure that created a model that significantly better specified than the others. If any of the other options were used, it would have resulted in inaccurate estimations. It is also interesting to note that all four of the significant negative estimates for the diffusion controls were associated with models that were significantly better specified than the alternatives. In the remaining situations, the best model was only comparatively the best.

Chapter 5:
Regulating Renewable Energy:
The Adoption of State Rules and Regulations

States have been quite active legislating renewable energy. Because this is an inherently complex issue (Gormley 1986), there ought to be a number of rules and regulations that are needed to overcome the litany of technological, political, and unforeseen delays that prevent a policy from achieving its legislative goal (Kraft and Vig 2005). Accordingly, states have begun to adopt rules that aid in promoting renewable energy and regulations that are designed to overcome some of these concerns. For the most part, the public knows little about these policies, but they prove to be essential to promoting renewable energy.

To fully understand state renewable energy, it is necessary to analyze these rules and regulations. Are the same influences that shaped the likelihood of a state to adopt a financial incentive policy in play with these policies? Are these policies more reactive in nature? In other words, are they adopted following the adoption of an incentive policy to facilitate the success of the incentive?

The analyses of state rules and regulations that follow are operationalized using the same methodology outlined in Chapter 3. As noted in earlier chapters, my strategy of analysis is to allow for comparisons across policies, in addition to simply understanding what influenced the likelihood of adoption for each policy. As before, a traditional model and an expanded model are estimated using five alternative explanations for policy diffusion. Will the estimation differences uncovered in the analyses of financial incentive policies continue to be present when examining the adoption of state rules and regulations?

Rules Promoting Renewable Energy

Of these peripheral policies, the rules that promote renewable energy tend to generate the most attention. These tend to be the most visible and often the most controversial of the nonfinancial incentive policies. These are also the policies that one would expect would have the most recognizable influence on the construction of renewable energy.

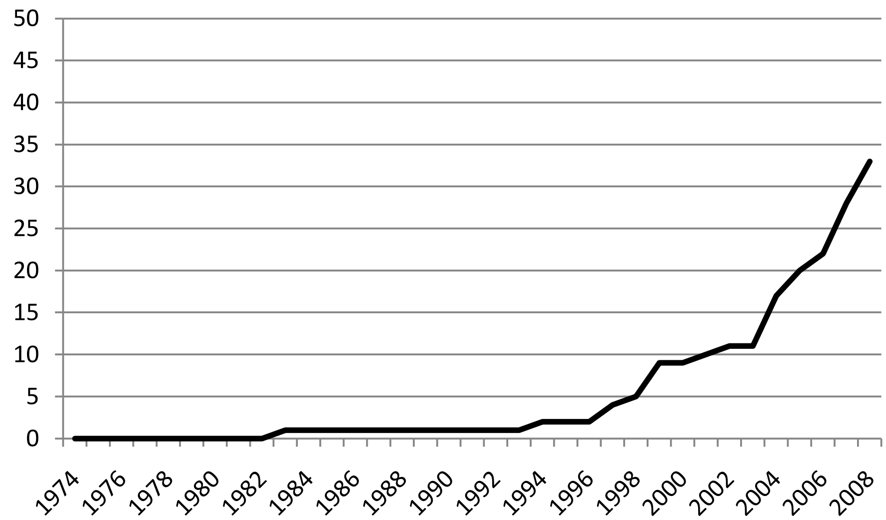
Renewable Portfolio Standards

Renewable Portfolio Standards (RPS) are designed to push a states electrical energy production in the direction of renewable energy. An RPS generally establishes goals for energy production that identify the desired percentage of the electrical energy that should come from renewable systems. As one might expect, some states have set more lofty goals than others, but the end result has generally been an increase in renewable energy in the states that have adopted these policies (Wiser et al. 2007).

RPS policies are generally considered to be relatively uncontroversial (Rabe 2007). Policymakers have the luxury of touting the benefits of RPS without any serious drawbacks. RPS encourages the further development of renewable systems, which lead to “green” jobs, cleaner air, and possibly the establishment of the industry that builds these systems (i.e. Mastrull 2010) all at no direct cost to the taxpayers because the energy companies are responsible for the investment in the infrastructure. Upon closer examination, this argument isn’t completely truthful since many of the state’s financial incentives will help finance this development and it is probable that energy costs will go up as well, but that doesn’t seem to dissuade support of an investment in renewable energy.

While in principle RPS is generally supported by the public and policymakers, the policies themselves tend to have little bite. RPS may establish goals, which tend to be popular, but they typically do not have an enforcement mechanism. There is little a state can do if its goals are not met. Usually, RPS do not contain language that would allow the state to force utilities to invest in renewable energy, although it is possible that these policies could open the

Figure 5.1: State Adoption of Renewable Portfolio Standards Policies, 1974-2008



Source: Compiled by the author based upon state adoption of its first renewable portfolio standards policy

state to litigation challenges if the goals are not met. It is thought that competition, public opinion, and financial incentives would provide the necessary enticement for action. Indeed, some energy producers allow their customers to request energy that was specifically created by renewable systems, usually at a premium, even though it is impossible to control the source of the energy entering a building. Figure 5.1 illustrates the adoption of RPS policies over time.

Traditional analyses examining the adoption of RPS can be found in Table 5.1. The Davidson-Mackinnon Test (DMT) reveals that the measure of neighbor diffusion provides the best specified model of adoption. The DMT also finds that this measure created a model that was statistically significantly better specified than the other four. The model fit statistics indicate that the model performs well. The results reveal that states with a higher percentage of college graduates, more liberal citizens, greater wind potential, higher levels of electric energy consumption, and fewer public utility commission employees are more likely to have adopted

Table 5.1: State Adoption of Renewable Portfolio Standards Policies (Traditional Model)

	EPA		EPA Hybrid		Neighbor		Neighbor Hybrid		Leader-Laggard	
	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.
Internal Determinants										
Population Density	.0008 (.0008)	.313	.0007 (.0008)	.423	-.0002 (.0009)	.818	-.0001 (.0009)	.843	.0001 (.0009)	.898
College Graduates	.091 (.035)	.010	.096 (.036)	.008	.103 (.033)	.002	.104 (.034)	.002	.102 (.036)	.005
Government Ideology	.006 (.010)	.522	.005 (.010)	.614	.008 (.010)	.440	.007 (.010)	.472	-.0008 (.009)	.930
Citizen Ideology	.033 (.017)	.056	.036 (.017)	.036	.037 (.017)	.034	.036 (.017)	.039	.042 (.017)	.018
Legislative Professionalism	.242 (2.067)	.906	.179 (2.055)	.931	1.840 (2.029)	.364	1.570 (2.040)	.441	-.553 (2.244)	.805
Energy Specific Conditions										
Wind Potential	.047 (.019)	.016	.043 (.019)	.022	.039 (.019)	.044	.039 (.019)	.043	.041 (.019)	.030
Percent Sunshine	.020 (.022)	.371	.027 (.022)	.236	.029 (.023)	.204	.032 (.023)	.169	.046 (.028)	.104
Nuclear Power Plants	-.058 (.109)	.593	-.064 (.109)	.555	-.052 (.103)	.613	-.066 (.105)	.527	-.038 (.104)	.715
Electric Energy Consumption	.013 (.004)	.004	.011 (.004)	.010	.012 (.004)	.006	.011 (.004)	.010	.008 (.005)	.091
PUC Employees	-.002 (.001)	.037	-.002 (.001)	.077	-.002 (.001)	.028	-.002 (.001)	.057	-.002 (.001)	.096
Green Conditions	.0003 (.0004)	.500	.0002 (.0004)	.553	.00004 (.0004)	.913	.00004 (.0004)	.924	.00005 (.0004)	.907
Diffusion Variable	1.990 (.668)	.003	1.046 (.509)	.040	2.519 (.725)	.001	1.639 (.588)	.005	.0008 (.0006)	.190
Trend	-.609 (.185)	.001	-.668 (.182)	.000	-.550 (.187)	.003	-.613 (.182)	.001	-.775 (.177)	.000
Constant	-7.909 (2.004)	.000	-8.155 (2.001)	.000	-9.204 (2.089)	.000	-8.933 (2.055)	.000	-9.287 (2.152)	.000
Number of Cases	1587		1587		1587		1587		1587	
Wald Chi^2	79.17	.0000	76.44	.0000	80.16	.0000	78.41	.0000	69.04	.0000
Log Likelihood	-107.876		-110.280		-106.217		-108.468		-111.447	
rho	.019		.019		.019		.019		.019	

Davidson-MacKinnon Test

	EPA	EPA Hybrid	Neighbor	Neighbor Hybrid	Leader-Laggard
EPA	-	.000	.670	.200	.003
EPA Hybrid	.004	-	.409	.741	.048
Neighbor	.059	.003	-	.001	.001
Neighbor Hybrid	.491	.050	.021	-	.007
Leader-Laggard	.211	.231	.318	.280	-

Standard errors are in parentheses. Two-tailed test. Davidson-MacKinnon Test results are the reported p-values.

RPS. The findings also indicate that a non-adopter is much more likely to adopt as other states that share their border adopt.

What influence, if any, will the existence of other policies concerning renewable energy have on the adoption of RPS? An expanded set of analyses are presented in Table 5.2. The DMT finds that the neighbor measure of diffusion continues to provide the best specified model of adoption. Again, this measure provides a model that is statistically significantly better specified than the others. The model fit statistics indicate that the model performs well.

The model estimates indicate that states with lower per capita tax revenue, more liberal citizens, greater wind potential, more sunshine, and fewer public utility commission employees are more likely to adopt a RPS. Notably, the expanded model reveals two new state characteristics, tax revenue and percent sunshine, as having an important impact on adoption, and reveals that two others, college graduates and electric energy consumption, may not have the influence revealed in the traditional model.[25] The analysis also finds that states were more likely to adopt following the national government adopting its Business Energy Tax Credit.

The model estimates also reveal that states are still more likely to adopt as more of their neighbors adopt their own RPS. Interestingly, despite fairly widespread adoption, the results indicate that the expanded model was able to better account for what was influencing adoption, and that the trend variable is no longer statistically significant, which suggests that the expanded model removes the threat of an unstable hazard rate.[26]

The results also indicate that existing policy action within a state influenced the likelihood of adoption. The analysis indicates that states were more likely to adopt a RPS if they

[25] Tax revenue per capita was removed from the traditional model for reasons outlined in the first estimation concern found in Chapter 3. When included in the traditional model, tax revenue prevented the statistical software from being able to fit a comparison model. When the model was expanded, the tax revenue variable did not create any estimation concerns.
[26] The hazard rate is discussed in Chapter 3.

Table 5.2: State Adoption of Renewable Portfolio Standards Policies (Expanded Model)

	EPA		EPA Hybrid		Neighbor		Neighbor Hybrid		Leader-Laggard	
	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.
Internal Determinants										
Tax Revenue per Capita	-1.345 (.705)	.056	-1.314 (.706)	.063	-1.246 (.698)	.074	-1.260 (.710)	.076	-1.312 (.739)	.076
Population Density	.0007 (.001)	.656	.0004 (.001)	.770	.00003 (.001)	.983	.0001 (.001)	.930	-.000007 (.001)	.996
College Graduates	.084 (.055)	.126	.094 (.055)	.089	.080 (.055)	.152	.081 (.055)	.137	.067 (.055)	.229
Government Ideology	.005 (.016)	.738	.004 (.016)	.804	.005 (.016)	.763	.006 (.016)	.693	.0008 (.016)	.960
Citizen Ideology	.055 (.028)	.053	.057 (.028)	.043	.056 (.030)	.068	.054 (.029)	.066	.049 (.029)	.091
Legislative Professionalism	4.813 (4.574)	.293	4.716 (4.508)	.296	6.053 (4.518)	.180	5.550 (4.543)	.222	2.179 (4.899)	.657
Energy Specific Conditions										
Wind Potential	.062 (.031)	.051	.057 (.031)	.069	.059 (.030)	.050	.060 (.030)	.048	.060 (.031)	.056
Percent Sunshine	.238 (.052)	.000	.241 (.051)	.000	.252 (.053)	.000	.251 (.052)	.000	.270 (.058)	.000
Nuclear Power Plants	.201 (.214)	.347	.179 (.214)	.401	.209 (.214)	.330	.188 (.215)	.382	.146 (.226)	.519
Electric Energy Consumption	-.014 (.010)	.167	-.014 (.010)	.150	-.014 (.009)	.142	-.015 (.009)	.128	-.018 (.011)	.105
PUC Employees	-.005 (.002)	.045	-.005 (.002)	.048	-.006 (.002)	.025	-.005 (.002)	.037	-.004 (.002)	.075
Green Conditions	.0001 (.0007)	.828	.0001 (.0007)	.816	-.0001 (.0007)	.861	-.00008 (.0007)	.906	-.00005 (.0007)	.938
National Policies										
Production Incentive	1.475 (1.524)	.333	1.430 (1.533)	.351	1.616 (1.483)	.276	1.609 (1.489)	.280	1.384 (1.549)	.372
Business Energy Tax Credit	2.495 (.914)	.006	2.561 (.901)	.005	2.117 (.936)	.024	2.357 (.922)	.011	2.599 (.920)	.005
USDA Rural Energy Program	-.476 (.939)	.612	-.367 (.936)	.695	-.744 (.960)	.439	-.599 (.945)	.526	-.387 (.936)	.679
State Incentive Policies										
Corporate Tax	1.190 (1.046)	.255	1.122 (1.068)	.293	1.474 (1.010)	.144	1.412 (1.036)	.173	1.289 (1.079)	.232
Personal Tax	-2.876 (1.068)	.007	-2.880 (1.077)	.008	-3.093 (1.041)	.003	-3.037 (1.055)	.004	-3.008 (1.107)	.007
Sales Tax	1.392 (.960)	.147	1.484 (.970)	.126	1.502 (.896)	.094	1.592 (.923)	.085	1.500 (.968)	.121
Property Tax	1.214 (.473)	.010	1.261 (.470)	.007	1.370 (.478)	.004	1.361 (.478)	.004	1.408 (.500)	.005
Production Incentive	2.304 (.923)	.013	2.342 (.927)	.012	2.594 (.944)	.006	2.463 (.928)	.008	2.362 (.943)	.012
Production Rebate	1.256 (.694)	.070	1.169 (.662)	.078	1.424 (.714)	.046	1.368 (.706)	.053	.897 (.682)	.188
Grant	.889 (.566)	.138	.810 (.586)	.167	1.065 (.587)	.070	.938 (.593)	.114	.909 (.596)	.127
Loan	1.247 (.672)	.064	1.203 (.655)	.066	1.457 (.697)	.036	1.359 (.693)	.050	1.183 (.650)	.069
Excise Tax	-1.234 (2.490)	.620	-1.529 (2.678)	.568	-.566 (2.235)	.800	-.871 (2.345)	.710	-.737 (2.560)	.773
Industry Support	.350 (.491)	.476	.340 (.485)	.483	.464 (.489)	.342	.417 (.490)	.395	.339 (.478)	.479

State Rules & Regulations										
Green Power Purchasing	2.561 (1.293)	.048	2.763 (1.316)	.036	2.609 (1.241)	.036	2.617 (1.253)	.037	2.870 (1.292)	.026
Required Green Power	4.646 (1.531)	.002	4.384 (1.455)	.003	5.752 (1.686)	.001	5.216 (1.637)	.001	4.474 (1.472)	.002
Public Benefits Fund	.216 (1.094)	.843	.423 (1.095)	.699	-.328 (.974)	.759	-.066 (1.097)	.952	.006 (1.083)	.995
Net Metering	3.207 (.958)	.001	3.261 (.952)	.001	3.181 (.974)	.001	3.170 (.964)	.001	3.051 (.941)	.001
Diffusion Variable	.738 (.979)	.451	.074 (.780)	.923	2.365 (1.126)	.036	1.310 (.920)	.154	.001 (.001)	.210
Trend	-.256 (.477)	.592	-.259 (.476)	.586	-.143 (.483)	.767	-.197 (.482)	.683	-.430 (.496)	.386
Constant	-24.400 (5.013)	.000	-24.828 (4.944)	.000	-25.757 (5.194)	.000	-25.400 (5.083)	.000	-25.108 (4.910)	.000
Number of Cases	1587		1587		1587		1587		1587	
Wald Chi^2	61.94	.0008	61.15	.0010	64.23	.0004	62.88	.0006	61.90	.0008
Log Likelihood	-67.245		-67.527		-65.282		-66.516		-66.746	
rho	.020		.020		.020		.020		.020	

Davidson-MacKinnon Test

	EPA	EPA Hybrid	Neighbor	Neighbor Hybrid	Leader-Laggard
EPA	-	.035	.145	.547	.312
EPA Hybrid	.047	-	.035	.084	.819
Neighbor	.016	.004	-	.007	.015
Neighbor Hybrid	.180	.028	.024	-	.071
Leader-Laggard	.154	.204	.075	.093	-

Standard errors are in parentheses. Two-tailed test. Davidson-MacKinnon Test results are the reported p-values.

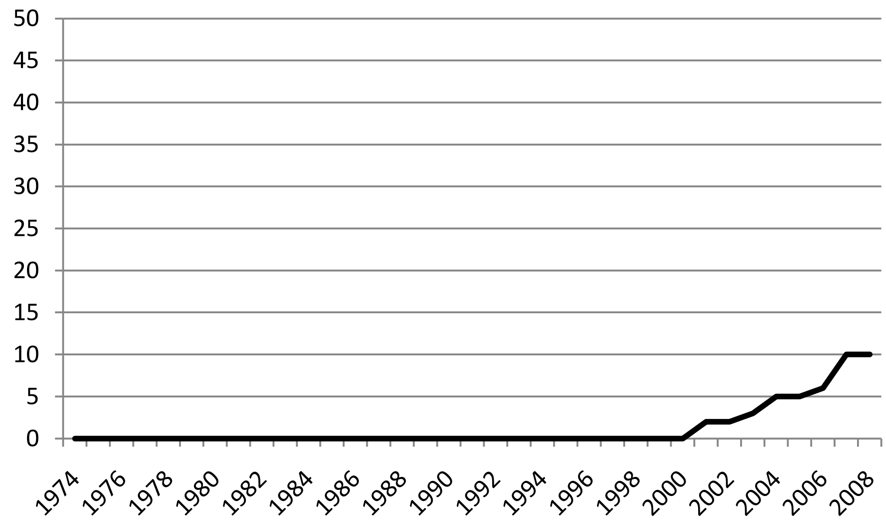
had already adopted a sales tax incentive, property tax incentive, production incentive, production rebate, state-backed grant, state-backed loan, green power purchasing, required green power, or a net metering policy. It also finds that states that had adopted a personal tax incentive were less likely to adopt RPS. Certainly, it appears that RPS were adopted to encourage renewable energy in a new manner. It appears that this may be a reaction to the incentive policies and other rules and regulations may not have been doing enough to achieve their legislative goals. Regardless, it is clear that existing policies have influenced the adoption of RPS.

In addition to differences between the traditional and expanded analyses, the selection of a control for diffusion also has an impact on our ability to understand what influences policy adoption. For instance, using the EPA hybrid measure, one would find that college graduates have a significant impact, but this is the only measure that finds this relationship. The existence of sales tax policies having a significant influence are found in both neighbor measures, but not the others. The neighbor measure is the only to find that state-backed grants have a significant influence. A comparison finds that using the leader-laggard measure would improperly estimate the influence of production rebates. In short, the results again illustrate that it is essential that we use the best measure of diffusion if we want to truly understand adoption.

Green Power Purchasing

Several states have adopted green power purchasing policies. These policies require that state owned facilities purchase a certain percentage of their power from renewable systems. These policies are designed to achieve two goals. First, it stands as a demonstration of a states commitment toward renewable energy through this purchasing requirement. Second, it forces utility companies to invest in renewable systems in order for the state entities to satisfy their

Figure 5.2: State Adoption of Green Power Purchasing Policies, 1974-2008



Source: Compiled by the author based upon state adoption of its first green power purchasing policy

requirement. In many states, energy from renewable systems is charged to customers at a higher rate to recoup costs. This may require that states with this mandate ultimately pay more for their energy. As such, it is important to understand what would influence a state to adopt such a policy. State adoption of green power purchasing policies can be found in Figure 5.2.

A traditional set of analyses of the adoption of green power purchasing laws can be found in Table 5.3. The DMT identifies the leader-laggard measure as offering the best specified model. The model fit statistics suggest that the model performs well. However, the analysis reveals only one significant relationship – states with more nuclear power plants are more likely to adopt green power purchasing. The interesting part of this result is that none of the state policies appear to allow nuclear energy as a qualifying energy source. Will an expanded analysis allow for a better understanding of green power purchasing adoption?

Table 5.3: State Adoption of Green Power Purchasing Policies (Traditional Model)

	EPA		EPA Hybrid		Neighbor		Neighbor Hybrid		Leader-Laggard	
	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.
Internal Determinants										
Tax Revenue per Capita	.386 (.976)	.692	.363 (.970)	.708	.319 (1.020)	.754	.288 (1.010)	.775	.128 (1.012)	.899
Population Density	.001 (.001)	.442	.001 (.001)	.417	.0009 (.001)	.528	.0009 (.001)	.527	-.001 (.001)	.509
College Graduates	.020 (.064)	.744	.023 (.065)	.714	.007 (.065)	.909	.008 (.066)	.898	.023 (.063)	.716
Government Ideology	-.006 (.019)	.745	-.005 (.019)	.765	-.009 (.018)	.610	-.010 (.018)	.594	-.013 (.020)	.528
Citizen Ideology	.006 (.041)	.868	.006 (.041)	.880	.014 (.040)	.724	.015 (.040)	.703	.015 (.045)	.733
Legislative Professionalism	6.894 (4.314)	.110	6.987 (4.318)	.106	7.014 (4.163)	.092	6.963 (4.163)	.094	5.490 (4.457)	.218
Energy Specific Conditions										
Wind Potential	-.048 (.052)	.353	-.050 (.052)	.344	-.048 (.051)	.349	-.048 (.051)	.345	-.059 (.053)	.267
Percent Sunshine	-.053 (.047)	.255	-.054 (.047)	.247	-.050 (.047)	.290	-.051 (.047)	.285	.021 (.077)	.781
Nuclear Power Plants	.379 (.191)	.048	.385 (.193)	.046	.360 (.184)	.050	.363 (.183)	.048	.354 (.188)	.059
Electric Energy Consumption	-.013 (.015)	.379	-.014 (.015)	.367	-.011 (014)	.420	-.011 (.014)	.423	-.022 (.017)	.204
PUC Employees	.0004 (.003)	.897	.0004 (.003)	.889	.00007 (.003)	.982	.00004 (.003)	.989	-.0005 (.003)	.891
Green Conditions	-.00006 (.001)	.957	-.00001 (.001)	.993	.00001 (.001)	.992	.00006 (.001)	.956	-.0009 (.001)	.532
Renewable Portfolio Standard	1.291 (.986)	.191	1.246 (.975)	.201	1.194 (.976)	.221	1.193 (.976)	.221	.430 (1.077)	.689
Diffusion Variable	-2.157 (1.928)	.263	-1.839 (1.557)	.238	-1.594 (2.126)	.453	-1.349 (1.767)	.445	.002 (.001)	.199
Trend	-1.160 (.444)	.009	-1.181 (.448)	.008	-1.140 (.448)	.011	-1.142 (.449)	.011	-1.199 (.451)	.008
Constant	-4.623 (3.607)	.200	-4.689 (3.592)	.192	-4.657 (3.636)	.200	-4.717 (3.612)	.192	-8.944 (6.105)	.143
Number of Cases	1718		1718		1718		1718		1718	
Wald Chi^2	25.09	.0488	25.09	.0488	24.88	.0516	24.93	.0509	25.48	.0438
Log Likelihood	-35.639		-35.566		-35.988		-35.975		-35.204	
rho	.024		.024		.025		.025		.026	

Davidson-MacKinnon Test

	EPA	EPA Hybrid	Neighbor	Neighbor Hybrid	Leader-Laggard
EPA	-	.698	.406	.419	.272
EPA Hybrid	.583	-	.356	.368	.236
Neighbor	.845	.785	-	.964	.453
Neighbor Hybrid	.913	.838	.869	-	.441
Leader-Laggard	.207	.200	.205	.204	-

Standard errors are in parentheses. Two-tailed test. Davidson-MacKinnon Test results are the reported p-values.

Table 5.4 presents the results for the expanded analyses of green power purchasing policy adoption. The DMT indicates that the leader-laggard measure provides the best specified model of adoption. This model is also significantly better specified than the other models. The model fit statistics indicate that the model performs well.

The data indicates that states that have a more liberal government ideology, have more professional legislatures, less wind potential, and more nuclear power plants are more likely to adopt. These results illustrate that an expanded model will certainly help to clarify the relationships between the independent variables and the dependent variable. The addition of the feedback influence of existing policies allows the model to identify the true relationship between government ideology, legislative professionalism, and wind potential.

The expanded results also indicate that states were less likely to adopt green power purchasing requirements following the national government's adoption of the Business Energy Tax Credit. The expanded analysis is also better able to estimate the role of the control for leader-laggard diffusion. With these additional variables, the model is able to identify that leader states are more likely to adopt than laggard states.

The results also allow for a look into the positive and negative feedback roles that existing policies can have in shaping future policy adoption. States that have adopted production incentives or production rebates were less likely to adopt. However, states that had adopted a public benefits fund were more likely to adopt green power purchasing regulations.

As witnessed in previous analyses, the choice of diffusion control will have an influence in our ability to understand adoption. Here, the data indicates that government ideology would not be significant if we relied on either EPA measure. Wind potential and production rebates are only significant in the leader-laggard model. The difference between diffusion measures is

Table 5.4: State Adoption of Green Power Purchasing Policies (Expanded Model)

	EPA		EPA Hybrid		Neighbor		Neighbor Hybrid		Leader-Laggard	
	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.
Internal Determinants										
Government Ideology	.031 (.020)	.131	.030 (.020)	.136	.039 (.023)	.086	.036 (.022)	.096	.043 (.024)	.069
Legislative Professionalism	12.524 (5.192)	.016	12.136 (5.087)	.017	14.072 (5.463)	.010	13.452 (5.298)	.011	12.989 (6.066)	.032
Energy Specific Conditions										
Wind Potential	-.069 (.053)	.193	-.064 (.053)	.229	-.093 (.058)	.110	-.085 (.056)	.132	-.097 (.058)	.094
Nuclear Power Plants	.387 (.192)	.044	.379 (.190)	.046	.439 (.205)	.032	.428 (.200)	.032	.601 (.244)	.014
Electric Energy Consumption	-.013 (.013)	.319	-.012 (.012)	.325	-.016 (.014)	.260	-.015 (.014)	.261	-.019 (.014)	.188
National Policies										
Business Energy Tax Credit	-4.406 (2.021)	.029	-4.462 (1.986)	.025	-4.744 (2.212)	.032	-4.740 (2.174)	.029	-5.620 (2.417)	.020
State Incentive Policies										
Corporate Tax	.881 (.776)	.257	.950 (.765)	.214	.716 (.795)	.368	.778 (.783)	.320	1.107 (.753)	.412
Production Incentive	-4.811 (1.736)	.006	-4.707 (1.704)	.006	-5.625 (1.979)	.004	-5.272 (1.886)	.005	-4.900 (1.545)	.002
Production Rebate	-.695 (.808)	.389	-.623 (.807)	.441	-.993 (.829)	.231	-.906 (.823)	.271	-1.472 (.867)	.090
State Rules & Regulations										
Renewable Portfolio Standard	1.753 (1.025)	.087	1.737 (1.019)	.088	2.089 (1.074)	.052	2.058 (1.078)	.056	1.050 (1.082)	.332
Public Benefits Fund	2.470 (1.071)	.021	2.288 (1.024)	.026	3.222 (1.268)	.011	2.966 (1.175)	.012	1.620 (.894)	.070
Diffusion Variable	-1.308 (2.705)	.629	-.395 (2.316)	.864	-3.694 (2.706)	.172	-2.638 (2.376)	.267	.002 (.001)	.040
Trend	-3.116 (1.054)	.003	-3.012 (1.016)	.003	-3.531 (1.186)	.003	-3.388 (1.146)	.003	-4.307 (1.446)	.003
Constant	-5.888 (3.457)	.089	-5.753 (3.378)	.089	-6.688 (3.755)	.075	-6.323 (3.614)	.080	-8.609 (3.847)	.025
Number of Cases	1718		1718		1718		1718		1718	
Wald Chi^2	26.29	.0155	27.15	.0119	23.87	.0324	24.97	.0233	21.01	.0728
Log Likelihood	-25.269		-25.374		-24.332		-24.680		-22.819	
rho	.024		.024		.024		.024		.024	

Davidson-MacKinnon Test

	EPA	EPA Hybrid	Neighbor	Neighbor Hybrid	Leader-Laggard
EPA	-	.099	.123	.436	.508
EPA Hybrid	.099	-	.029	.118	.602
Neighbor	.076	.030	-	.149	.105
Neighbor Hybrid	.237	.099	.210	-	.133
Leader-Laggard	.038	.039	.025	.022	-

Standard errors are in parentheses. Two-tailed test. Davidson-MacKinnon Test results are the reported p-values.

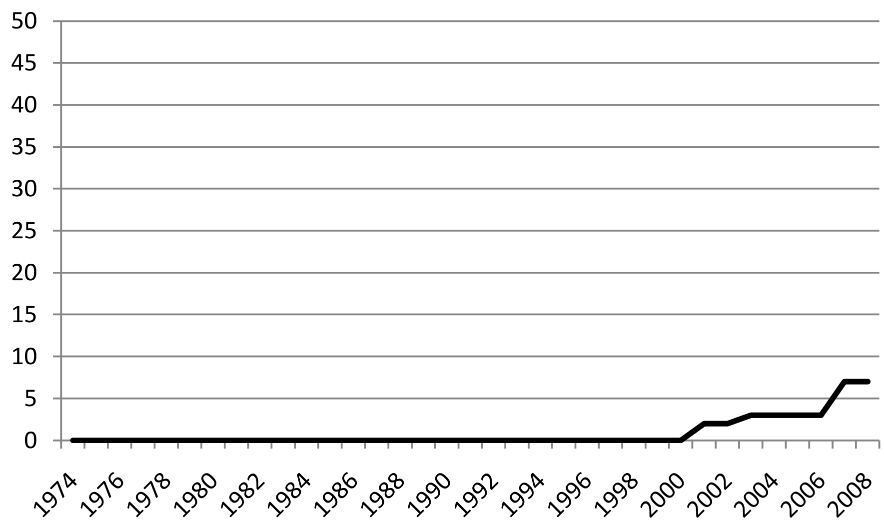
greatest for production rebates where there is nearly a one point shift in the z-scores from the EPA hybrid model to the leader-laggard model. Additionally, the leader-laggard model is the only model where we do not find renewable portfolio standards to have a significant influence. This is also the model where the diffusion control was significant, so it is probable that the renewable portfolio standards measures in the other models were inadvertently tapping into the idea of leaders and laggards.

Required Green Power

A few states have adopted required green power policies. These policies require that utility companies within the state must have a predetermined percentage of their energy come from renewable systems. These are the most direct efforts by states to move toward clean, renewable energy. The penalties for not complying with this requirement varies from state to state but generally result in a substantial fine. If the utility is in the process of installing the renewable system, they are usually not penalized, or at least the penalty is reduced. Utility companies are generally not enthusiastic about these policies, even if they were moving in the renewable direction on their own. State adoption of required green power policies is depicted in Figure 5.3.

The traditional analyses of the adoption of required green power policies are presented in Table 5.5. The DMT finds that the EPA measure of diffusion provides the best specified model. This measure is also significantly better specified than all of the other measures except the EPA hybrid measure, where it is comparatively better specified. The model fit statistics indicate that the model performs well.

Figure 5.3: State Adoption of Required Green Power Policies, 1974-2008



Source: Compiled by the author based upon state adoption of its first required green power policy

The results reveal that states with less per capita tax revenue, higher wind potential, and less sunshine are more likely to adopt a required green power policy. These results suggest that states may be assuming that the utilities that have to abide by these policies are more likely to install wind turbines as opposed to solar to satisfy the requirements. Additionally, the results reveal that as states within an EPA region adopt these policies, non-adopters are less likely to do so. Interestingly, as identified in Chapter 4, when the EPA regional measure of diffusion is statistically significant, it has a negative influence on diffusion. Will this same pattern hold in the expanded analyses?

The expanded analyses of the adoption of required green powers can be found in Table 5.6. The DMT reveals that the EPA regional measure still provides the best specified model. As before, this model is significantly better specified than all of the others, expect the EPA hybrid model, where it is comparatively better specified. The model fit statistics indicate that the model performs well.

Table 5.5: State Adoption of Required Green Power Policies (Traditional Model)

	EPA		EPA Hybrid		Neighbor		Neighbor Hybrid		Leader-Laggard	
	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.
Internal Determinants										
Tax Revenue per Capita	-3.515 (1.579)	.026	-3.054 (1.449)	.035	-2.721 (1.313)	.038	-2.621 (1.273)	.040	-2.492 (1.214)	.040
Population Density	-.002 (.005)	.689	-.002 (.005)	.656	-.003 (.006)	.598	-.003 (.005)	.586	-.003 (.005)	.569
College Graduates	.002 (.086)	.974	-.005 (.089)	.951	-.00001 (.071)	.999	-.00001 (.072)	.999	.006 (.068)	.925
Government Ideology	.061 (.037)	.102	.068 (.037)	.071	.052 (.036)	.150	.054 (.035)	.126	.060 (.034)	.080
Citizen Ideology	.005 (.062)	.926	-.009 (.058)	.864	-.002 (.050)	.963	-.006 (.049)	.895	-.023 (.047)	.619
Energy Specific Conditions										
Wind Potential	.173 (.078)	.027	.152 (.072)	.037	.091 (.058)	.119	.085 (.056)	.133	.090 (.056)	.113
Percent Sunshine	-.147 (.071)	.038	-.142 (.069)	.041	-.053 (.044)	.230	-.054 (.044)	.224	-.041 (.045)	.359
Nuclear Power Plants	-.262 (.550)	.633	-.206 (.538)	.701	.076 (.402)	.849	.076 (.408)	.852	-.036 (.440)	.934
Electric Energy Consumption	-.019 (.015)	.205	-.020 (.015)	.183	-.019 (.013)	.150	-.019 (.013)	.150	-.021 (.014)	.131
PUC Employees	.003 (.002)	.210	.003 (.002)	.229	.003 (.002)	.092	.003 (.002)	.098	.003 (.002)	.135
Green Conditions	-.0008 (.001)	.605	-.0007 (.001)	.660	-.0006 (.001)	.635	-.0005 (.001)	.667	-.001 (.001)	.412
Renewable Portfolio Standard	1.429 (1.536)	.352	1.542 (1.493)	.302	2.380 (1.361)	.080	2.383 (1.381)	.085	2.042 (1.253)	.103
Diffusion Variable	-12.796 (5.578)	.022	-10.933 (5.565)	.049	-4.021 (4.416)	.363	-3.621 (4.720)	.443	.0005 (.0009)	.574
Trend	-3.055 (.854)	.000	-2.832 (.782)	.000	-1.940 (.568)	.001	-1.875 (.542)	.001	-1.835 (.540)	.001
Constant	16.678 (7.476)	.026	15.110 (7.131)	.034	6.508 (5.006)	.194	6.135 (4.902)	.211	6.067 (5.056)	.230
Number of Cases	1727		1727		1727		1727		1727	
Wald Chi^2	21.87	.0813	21.88	.0812	27.76	.0153	28.00	.0142	28.81	.0111
Log Likelihood	-22.163		-22.862		-24.719		-24.837		-24.989	
rho	.533		.530		.028		.029		.028	

Davidson-MacKinnon Test

	EPA	EPA Hybrid	Neighbor	Neighbor Hybrid	Leader-Laggard
EPA	-	.211	.039	.036	.023
EPA Hybrid	.563	-	.069	.074	.046
Neighbor	.724	.485	-	.559	.329
Neighbor Hybrid	.738	.596	.746	-	.346
Leader-Laggard	.527	.429	.497	.431	-

Standard errors are in parentheses. Two-tailed test. Davidson-MacKinnon Test results are the reported p-values.

Table 5.6: State Adoption of Required Green Power Policies (Expanded Model)

	EPA		EPA Hybrid		Neighbor		Neighbor Hybrid		Leader-Laggard	
	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.
Internal Determinants										
Tax Revenue per Capita	-4.878 (1.767)	.006	-4.768 (1.727)	.006	-4.251 (1.660)	.010	-4.280 (1.668)	.010	-3.778 (1.560)	.015
Government Ideology	.062 (.028)	.028	.065 (.028)	.021	.054 (.029)	.064	.056 (.029)	.053	.054 (.029)	.067
Energy Specific Conditions										
Wind Potential	.178 (.071)	.014	.162 (.065)	.013	.131 (.062)	.037	.125 (.060)	.037	.104 (.056)	.063
Percent Sunshine	-.127 (.052)	.016	-.137 (.054)	.011	-.069 (.045)	.125	-.070 (.045)	.155	-.070 (.048)	.144
Electric Energy Consumption	-.027 (.010)	.010	-.026 (.010)	.008	-.025 (.010)	.013	-.025 (.010)	.012	-.022 (.009)	.017
PUC Employees	.004 (.002)	.058	.003 (.002)	.067	.004 (.002)	.067	.003 (.002)	.072	.003 (.001)	.078
National Policies										
Business Energy Tax Credit	-4.093 (2.090)	.050	-4.297 (2.145)	.045	-3.376 (1.732)	.051	-3.455 (1.737)	.047	-3.615 (1.838)	.049
State Incentive Policies										
Corporate Tax	.496 (.719)	.490	.642 (.686)	.349	.855 (.751)	.255	.858 (.756)	.256	.607 (.734)	.408
Production Rebate	.351 (.829)	.672	.533 (.818)	.515	.244 (.925)	.792	.507 (.994)	.610	-.594 (1.031)	.564
Industry Support	1.425 (.952)	.135	1.411 (.900)	.119	1.270 (.868)	.144	1.286 (.841)	.126	1.248 (.804)	.120
State Rules & Regulations										
Renewable Portfolio Standard	2.168 (1.589)	.172	2.095 (1.533)	.172	2.425 (1.494)	.105	2.349 (1.488)	.114	2.131 (1.424)	.135
Diffusion Variable	-10.461 (5.014)	.037	-10.656 (5.228)	.042	-7.670 (6.079)	.207	-8.626 (7.366)	.242	.0004 (.001)	.698
Trend	-4.125 (1.165)	.000	-4.107 (1.176)	.000	-3.394 (.952)	.000	-3.378 (.949)	.000	-3.160 (.929)	.001
Constant	19.717 (6.462)	.002	19.694 (6.459)	.002	13.013 (4.922)	.008	13.0008 (4.981)	.009	10.931 (4.802)	.023
Number of Cases	1727		1727		1727		1727		1727	
Wald Chi^2	21.74	.0596	21.29	.0674	23.45	.0366	23.83	.0328	24.48	.0270
Log Likelihood	-18.514		-18.780		-20.119		-20.259		-20.946	
rho	.029		.028		.026		.026		.028	

Davidson-MacKinnon Test

	EPA	EPA Hybrid	Neighbor	Neighbor Hybrid	Leader-Laggard
EPA	-	.464	.092	.074	.040
EPA Hybrid	.878	-	.107	.091	.046
Neighbor	.751	.514	-	.582	.167
Neighbor Hybrid	.723	.562	.837	-	.201
Leader-Laggard	.812	.851	.467	.469	-

Standard errors are in parentheses. Two-tailed test. Davidson-MacKinnon Test results are the reported p-values.

The analysis indicates that states with less per capita tax revenue, more liberal governments, greater wind potential, less sunshine, less electric energy consumption, and more public utility commission employees are more likely to adopt required green power policies. The expanded model was better able to estimate the relationships and was able to identify government ideology, electric energy consumption, and public utility commission employees as having an important influence when the traditional model was unable to do so.

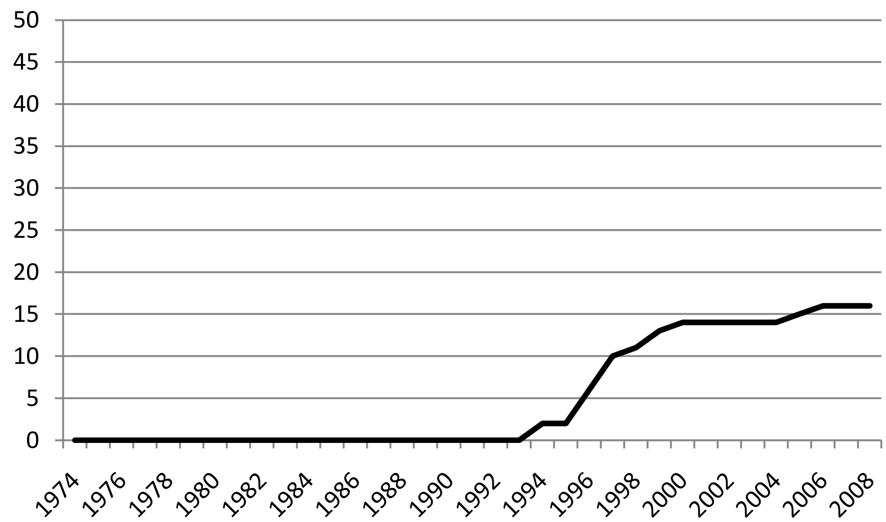
The model finds that states were less likely to adopt this policy after the national government adopted its Business Energy Tax Credit. Again, the data suggests that a state is less likely to adopt after other states within their EPA region have adopted their policies. While none of the existing state policies appear to have a statistically significant influence of the likelihood of adopting required green power policies, it is clear that their inclusion allowed for a more nuanced analysis of the independent variables.

Unlike many of the previous comparisons between models, there is only one important estimation difference between the EPA regional measure and the others. Both EPA models found that states with less sunshine were more likely to adopt than those with more, but none of the others found this relationship.

Public Benefits Funds

In an effort to raise tax revenue specifically to fund renewable energy financial incentive policies, several states have adopted public benefits funds. These policies are designed to create an electrical usage charge that is less noticeable to the public. These come in two forms. First, a state may directly tax the amount of energy an entity uses, and this tax can be found lined out on an energy bill. The second is a special tax on the utility companies, which results in higher utility rates and are ultimately paid by the utility's customers. Either way, this tax creates

Figure 5.4: State Adoption of Public Benefits Fund Policies, 1974-2008



Source: Compiled by the author based upon state adoption of its first public benefits fund policy

revenues that are then used to fund the financial incentives offered by the state. Figure 5.4 illustrates the state adoption of public benefits funds over time.

Traditional analyses of public benefits fund policy adoption can be found in Table 5.7. The DMT identifies the leader-laggard measure as providing the best specified model. This model is statistically significantly better specified than any of the others. The model fit statistics indicate that the model performs well.

The model reveals that states with higher per capita tax revenue and more liberal citizens are more likely to adopt public benefits fund policies. The data also suggests that states that have already adopted a renewable portfolio standard are more likely to adopt, as well. There also appears to be a relationship between adoption and being a leader in environmental policies such that leaders are more likely to adopt than laggards.

An expanded set of analyses are presented in Table 5.8. The DMT indicates that the leader-laggard measure of diffusion provides the best specified model of adoption. This model is

Table 5.7: State Adoption of Public Benefits Funds (Traditional Model)

	EPA		EPA Hybrid		Neighbor		Neighbor Hybrid		Leader-Laggard	
	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.
Internal Determinants										
Tax Revenue per Capita	1.294 (.596)	.030	1.290 (.587)	.028	1.259 (.584)	.031	1.271 (.590)	.031	1.862 (.691)	.007
Population Density	.0001 (.001)	.935	.0001 (.001)	.920	.0003 (.001)	.833	.0001 (.001)	.891	-.0004 (.001)	.791
College Graduates	-.058 (.120)	.631	-.051 (.118)	.667	-.044 (.115)	.700	-.047 (.117)	.682	-.093 (.125)	.456
Government Ideology	-.033 (.018)	.068	-.034 (.018)	.061	-.036 (.018)	.056	-.034 (.018)	.061	-.029 (.019)	.125
Citizen Ideology	.082 (.032)	.011	.083 (.032)	.010	.085 (.033)	.010	.084 (.032)	.010	.080 (.035)	.022
Legislative Professionalism	-2.648 (2.955)	.370	-2.507 (2.929)	.392	-2.560 (2.875)	.373	-2.559 (2.877)	.374	-5.167 (3.189)	.105
Energy Specific Conditions										
Wind Potential	.001 (.033)	.956	-.0003 (.033)	.992	.0001 (.031)	.996	.0002 (.031)	.995	.022 (.036)	.547
Percent Sunshine	-.072 (.030)	.018	-.073 (.030)	.017	-.076 (.031)	.015	-.075 (.031)	.018	-.050 (.035)	.155
Nuclear Power Plants	.168 (.136)	.217	.170 (.136)	.210	.161 (.135)	.236	.164 (.136)	.230	.163 (.144)	.260
Electric Energy Consumption	.010 (.009)	.258	.009 (.008)	.284	.009 (.008)	.299	.009 (.008)	.277	.009 (.009)	.313
PUC Employees	.002 (.001)	.174	.002 (.001)	.171	.002 (.001)	.152	.002 (.001)	.163	.001 (.001)	.384
Green Conditions	.001 (.001)	.214	.001 (.001)	.225	.001 (.0009)	.222	.001 (.0009)	.215	.0005 (.001)	.612
Renewable Portfolio Standard	2.303 (.823)	.005	2.365 (.833)	.005	2.465 (.854)	.004	2.411 (.850)	.005	1.848 (.779)	.018
Diffusion Variable	.134 (1.289)	.917	-.120 (1.028)	.907	-.533 (1.247)	.669	-.261 (1.043)	.802	.001 (.0008)	.073
Trend	-1.453 (.304)	.000	-1.446 (.300)	.000	-1.447 (.298)	.000	-1.452 (.299)	.000	-1.365 (.303)	.000
Constant	-4.762 (2.641)	.071	-4.866 (2.645)	.066	-4.717 (2.564)	.066	-4.771 (2.578)	.064	-5.989 (2.931)	.041
Number of Cases	1589		1589		1589		1589		1589	
Wald Chi^2	43.64	.0001	43.95	.0001	44.08	.0001	43.85	.0001	42.44	.0002
Log Likelihood	-51.444		-51.443		-51.357		-51.418		-49.694	
rho	.022		.022		.022		.022		.022	

Davidson-MacKinnon Test

	EPA	EPA Hybrid	Neighbor	Neighbor Hybrid	Leader-Laggard
EPA	-	.292	.534	.705	.925
EPA Hybrid	.293	-	.800	.950	.742
Neighbor	.455	.630	-	.351	.394
Neighbor Hybrid	.660	.818	.381	-	.450
Leader-Laggard	.075	.072	.058	.060	-

Standard errors are in parentheses. Two-tailed test. Davidson-MacKinnon Test results are the reported p-values.

also statistically significantly better specified than any of the others. The model fit statistics suggest that the model performs well.

The results indicate that an expanded analysis provides a much better understanding of adoption. The data suggests that states with less professional legislatures and greener conditions were more likely to adopt public benefits funds. This is a substantial difference than what was found in the traditional model. Indeed, the expanded results indicate that neither per capita tax revenue nor citizen ideology appears to have a statistically significant influence on adoption when the influences of previously adopted policies are included. Moreover, both legislative professionalism and green conditions become statistically significant when these policies are included.

The results indicate that states that have already adopted state-backed grants, state-backed loans, and green power purchasing policies were more likely to adopt public benefits funds. The findings also indicate that leader states were more likely to adopt than laggards.

In addition to the differences between the traditional and expanded analyses, there are also several estimation differences between the expanded models. For instance, both neighbor diffusion models found that the citizen and government ideology measures had a statistically significant influence. Legislative professionalism is only significant in the leader-laggard model, while tax revenue per capita and electrical energy consumption are only not significant in the leader-laggard model. The green conditions measure is not significant in the neighbor diffusion model.

Differences are found when analyzing the influence of existing policy too. Corporate tax incentive policies are important influences in all but the EPA hybrid and leader-laggard models. The results also suggest that state-backed loans are not a significant influence in any of the

Table 5.8: State Adoption of Public Benefits Fund Policies (Expanded Model)

	EPA		EPA Hybrid		Neighbor		Neighbor Hybrid		Leader-Laggard	
	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.
Internal Determinants										
Tax Revenue per Capita	1.832 (1.043)	.079	1.811 (1.045)	.083	1.871 (1.006)	.063	1.835 (1.018)	.072	1.845 (1.545)	.232
Population Density	.003 (.002)	.219	.003 (.002)	.186	.003 (.002)	.123	.003 (.002)	.119	.003 (.002)	.199
College Graduates	.023 (.138)	.864	.007 (.140)	.957	.061 (.132)	.640	.052 (.135)	.699	-.003 (.153)	.981
Government Ideology	-.041 (.029)	.162	-.038 (.028)	.180	-.053 (.031)	.094	-.051 (.031)	.099	-.045 (.032)	.157
Citizen Ideology	.080 (.060)	.183	.079 (.060)	.188	.108 (.064)	.094	.107 (.063)	.093	.032 (.065)	.622
Legislative Professionalism	-7.914 (6.646)	.234	-8.391 (6.527)	.199	-7.717 (5.986)	.197	-7.894 (5.970)	.186	-11.152 (6.317)	.078
Energy Specific Conditions										
Wind Potential	.030 (.066)	.652	.040 (.066)	.538	.041 (.0634)	.512	.044 (.062)	.479	.088 (.068)	.192
Percent Sunshine	-.047 (.053)	.382	-.050 (.053)	.350	-.065 (.055)	.238	-.067 (.055)	.227	-.035 (.060)	.556
Nuclear Power Plants	-.324 (.335)	.324	-.294 (.336)	.380	-.361 (.313)	.249	-.346 (.312)	.267	-.152 (.295)	.605
Electric Energy Consumption	.037 (.020)	.067	.037 (.020)	.063	.033 (.020)	.094	.033 (.020)	.096	.032 (.020)	.120
PUC Employees	-.001 (.003)	.741	-.0008 (.003)	.807	-.0005 (.003)	.870	-.0003 (.003)	.907	-.002 (.003)	.502
Green Conditions	.003 (.001)	.039	.003 (.001)	.043	.002 (.001)	.103	.002 (.001)	.094	.002 (.001)	.090
National Policies										
Production Incentive	1.819 (3.372)	.589	1.88 (3.357)	.574	.729 (3.363)	.828	.786 (3.269)	.810	3.958 (3.525)	.260
Business Energy Tax Credit	-2.353 (2.548)	.356	-1.994 (2.468)	.419	-2.371 (2.425)	.328	-2.155 (2.385)	.366	-.716 (2.412)	.766
State Incentive Policies										
Corporate Tax	-4.656 (2.744)	.090	-4.448 (2.825)	.115	-5.249 (2.843)	.065	-5.139 (2.881)	.074	-4.109 (2.995)	.170
Personal Tax	1.41 (2.372)	.552	1.316 (2.421)	.587	2.023 (2.488)	.416	1.869 (2.497)	.454	1.553 (2.629)	.555
Sales Tax	-3.388 (3.579)	.344	-3.313 (3.57)	.353	-2.426 (3.265)	.457	-2.503 (3.192)	.433	-3.888 (3.397)	.252
Property Tax	-.385 (.879)	.661	-.3105 (.855)	.717	-.360 (.762)	.637	-.330 (.777)	.670	-.015 (.799)	.985
Production Incentive	1.819 (3.372)	.589	1.888 (3.357)	.574	.729 (3.363)	.828	.786 (3.269)	.810	3.968 (3.525)	.260
Production Rebate	2.239 (2.294)	.329	1.953 (2.288)	.393	1.682 (2.248)	.454	1.654 (2.226)	.457	1.633 (2.224)	.466
Grant	5.364 (1.854)	.004	4.921 (1.79)	.006	5.062 (1.547)	.001	4.850 (1.501)	.001	4.754 (1.732)	.006
Loan	2.311 (1.502)	.124	2.126 (1.431)	.137	2.204 (1.399)	.115	2.110 (1.360)	.121	2.422 (1.374)	.078
Excise Tax	-.654 (6.442)	.919	-.496 (6.406)	.938	-1.336 (6.426)	.835	-1.212 (6.288)	.847	-1.376 (6.084)	.821
Industry Support	1.939 (2.449)	.429	1.723 (2.445)	.481	1.731 (2.330)	.458	1.778 (2.333)	.446	2.586 (2.372)	.276

State Rules & Regulations										
Renewable Portfolio Standard	-1.238 (2.614)	.636	-.951 (2.476)	.701	-.662 (2.601)	.799	-.526 (2.506)	.834	-3.327 (2.820)	.238
Green Power Purchasing	6.586 (3.118)	.035	5.948 (2.988)	.047	6.913 (3.004)	.021	6.503 (2.962)	.028	4.457 (2.660)	.094
Net Metering	.779 (1.246)	.532	.582 (1.217)	.632	1.107 (1.246)	.374	.9567 (1.233)	.438	.711 (1.231)	.564
Diffusion Variable	-3.044 (2.832)	.282	-1.703 (2.436)	.484	-3.759 (2.019)	.063	-2.696 (1.658)	.104	.002 (.001)	.037
Trend	-1.401 (.486)	.004	-1.408 (.480)	.003	-1.55 (.516)	.003	-1.553 (.511)	.002	-1.197 (.529)	.024
Constant	-11.077 (5.394)	.040	-10.374 (5.154)	.044	-10.423 (4.952)	.035	-10.135 (4.808)	.035	-9.967 (5.038)	.048
Number of Cases	1589		1589		1589		1589		1589	
Wald Chi^2	41.46	.0627	41.24	.0656	42.75	.0480	42.41	.0516	41.50	.0622
Log Likelihood	-30.415		-30.797		-29.099		-29.615		-29.615	
rho	.023		.023		.023		.023		.023	

Davidson-MacKinnon Test

	EPA	EPA Hybrid	Neighbor	Neighbor Hybrid	Leader-Laggard
EPA	-	.127	.789	.915	.186
EPA Hybrid	.159	-	.447	.675	.230
Neighbor	.098	.058	-	.086	.054
Neighbor Hybrid	.199	.115	.124	-	.065
Leader-Laggard	.032	.027	.031	.026	-

Standard errors are in parentheses. Two-tailed test. Davidson-MacKinnon Test results are the reported p-values.

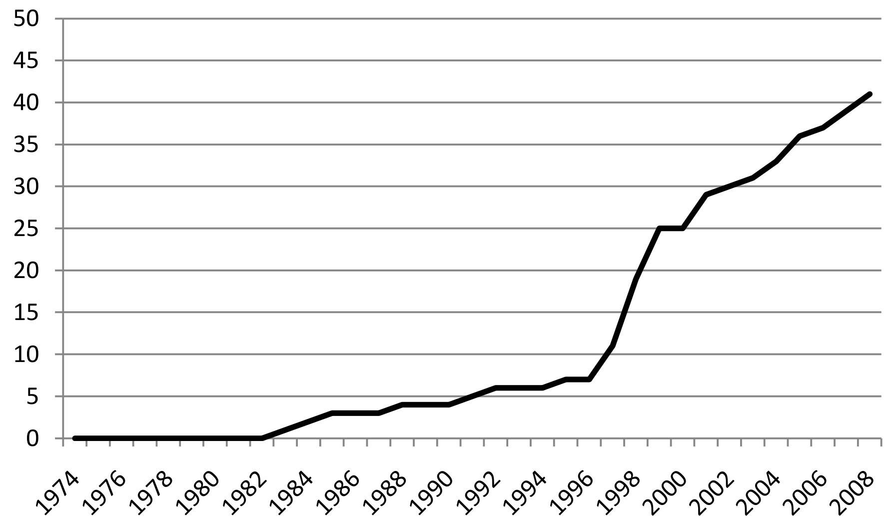
models except leader-laggard. Again, these differences suggest that using an incorrect measure of diffusion can result in misestimated explanations of policy adoption.

Net Metering

Nearly every state has adopted net metering policies. These policies are designed to force utility companies to pay private energy producers the same amount of money that they charge per kilowatt-hour of energy as opposed to the fraction of their fee. If a private entity has a renewable system that has a net surplus of energy at any point during the day, the extra energy is fed onto the electrical grid. In theory, this extra power supply ought to be fairly consistent over time, and the utility can then schedule when to decrease energy production to take advantage of this extra power source. This is called the deferred cost, which could save the utility company a great deal of money and raw materials while still providing sufficient energy for their consumers.

Stoutenborough and Beverlin (2008) first examined the adoption of net metering policies through 2004 and found that EPA regional diffusion provided the best specified model and explanation for how states learned about this policy. Recognizing that there may be an underlying pattern within both EPA regions and amongst neighbors, Stoutenborough (2009) replicated these results while testing the influence of leaders and laggards within regions. When leaders were introduced, Stoutenborough found that the EPA hybrid measure actually provided the best specified model of adoption. However, these analyses offer what can now be considered an ill-conceived method of evaluating the influence of existing policy on the adoption. Their formulations aggregated tax incentive policies into one variable and grants and loans into another. As the analyses prior to this illustrate, these existing policies all have differing influences on the adoption of any given policy. Therefore, it is appropriate to re-examine the

Figure 5.5: State Adoption of Net Metering Policies, 1974-2008



Source: Compiled by the author based upon state adoption of its first net metering policy

adoption of this policy using the current methodology. Will the results be similar to those originally found by Stoutenborough and Beverlin (2008) or Stoutenborough (2009)? Or, have things changed in the four additional years analyzed that the influence of the independent variables have changed? State adoption of net metering policies is presented in Figure 5.5.

The results of the traditional analyses are presented in Table 5.9. The DMT finds that the best specified model is the neighbor hybrid model. This is significantly better specified than the rest of the models. Obviously, this differs from the findings of both Stoutenborough and Beverlin (2008) and Stoutenborough (2009), further illustrating the need to conduct comparison analyses between the different types of controls for diffusion.

The results of the neighbor hybrid model reveal that states with higher per capita tax revue, more electric energy consumption, and more public utility commission employees are more likely to adopt a net metering policy. The data also reveal that states that have already adopted renewable portfolio standards are more likely to adopt. Finally, the traditional model

Table 5.9: State Adoption of Net Metering Policies (Traditional Model)

	EPA		EPA Hybrid		Neighbor		Neighbor Hybrid		Leader-Laggard	
	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.
Internal Determinants										
Tax Revenue per Capita	1.084 (.335)	.001	1.068 (.345)	.002	1.056 (.345)	.002	1.040 (.351)	.003	1.525 (.342)	.000
Population Density	.0001 (.0009)	.899	-.00002 (.0009)	.977	.000006 (.0009)	.994	-.0002 (.0009)	.778	-.001 (.001)	.298
College Graduates	.024 (.042)	.554	.029 (.042)	.479	.022 (.042)	.595	.031 (.042)	.463	-.007 (.044)	.868
Government Ideology	.003 (.009)	.707	.004 (.009)	.652	.006 (.009)	.509	.007 (.009)	.410	-.003 (.009)	.667
Citizen Ideology	.017 (.017)	.317	.018 (.017)	.280	.014 (.017)	.403	.010 (.017)	.523	.024 (.017)	.168
Legislative Professionalism	-5.086 (2.544)	.046	-5.692 (2.567)	.027	-3.403 (2.553)	.183	-3.328 (2.454)	.175	-6.753 (2.595)	.009
Energy Specific Conditions										
Wind Potential	.007 (.015)	.649	.010 (.015)	.509	.005 (.015)	.714	.008 (.015)	.586	.011 (.014)	.446
Percent Sunshine	-.007 (.015)	.639	-.004 (.015)	.760	-.001 (.015)	.925	.005 (.016)	.730	.016 (.018)	.363
Nuclear Power Plants	-.093 (.090)	.300	-.119 (.090)	.183	-.106 (.091)	.245	-.137 (.092)	.135	-.124 (.092)	.176
Electric Energy Consumption	.007 (.003)	.021	.009 (.003)	.007	.006 (.003)	.067	.008 (.003)	.018	.005 (.003)	.170
PUC Employees	.002 (.001)	.018	.002 (.001)	.023	.002 (.001)	.042	.002 (.001)	.065	.002 (.001)	.115
Green Conditions	.0003 (.0003)	.309	.0003 (.0003)	.317	.0002 (.0003)	.438	.0001 (.0003)	.599	-.0002 (.0004)	.507
Renewable Portfolio Standard	2.287 (.616)	.000	2.330 (.599)	.000	2.146 (.605)	.000	2.125 (.588)	.000	3.243 (.605)	.000
Diffusion Variable	1.230 (.593)	.038	1.291 (.529)	.015	1.755 (.566)	.002	2.153 (.556)	.000	.001 (.005)	.022
Trend	-.600 (.166)	.000	-.560 (.169)	.001	-.636 (.166)	.000	-.568 (.170)	.001	-.619 (.163)	.000
Constant	-5.559 (1.529)	.000	-5.754 (1.525)	.000	-5.845 (1.624)	.000	-6.323 (1.658)	.000	-5.891 (1.643)	.000
Number of Cases	1375		1375		1375		1375		1375	
Wald Chi^2	96.68	.0000	96.71	.0000	101.95	.0000	108.60	.0000	90.92	.0000
Log Likelihood	-122.757		-122.038		-120.273		-117.746		-122.177	
rho	.018		.018		.018		.018		.018	

Davidson-MacKinnon Test

	EPA	EPA Hybrid	Neighbor	Neighbor Hybrid	Leader-Laggard
EPA	-	.672	.930	.576	.016
EPA Hybrid	.215	-	.655	.800	.016
Neighbor	.027	.055	-	.013	.003
Neighbor Hybrid	.002	.004	.001	-	.000
Leader-Laggard	.010	.024	.035	.063	-

Standard errors are in parentheses. Two-tailed test. Davidson-MacKinnon Test results are the reported p-values.

suggests that a non-adopter was more likely to adopt as their neighbors that are leaders in environmental policies adopted.

Expanded analyses of the adoption of net metering policies can be found in Table 5.10. These results also indicate the extent to which model choice influences the results. When including the influence of previously adopted policies, the DMT finds that the neighbor hybrid measure of diffusion again provides the best specified model. This model is statistically significantly better specified than any of the other four models. Interestingly, in four separate examinations of net metering policy adoption, one found that EPA regional diffusion provides the best explanation (Stoutenborough and Beverlin 2008), one found that the EPA hybrid measure was best specified (Stoutenborough 2009), while the two presented here find that the neighbor hybrid models provide the best specified explanation of adoption. The model fit statistics indicate that the model performs well.

The results indicate that states with higher per capita tax revenue, fewer nuclear power plants, higher levels of electric energy consumption, and a larger number of public utility commission employees were more likely to adopt a net metering policy. Of these, only nuclear power plants were not significant in the traditional model, which illustrates the importance of fully modeling adoption. The results indicate that none of the federal policies have a significant influence on adoption.

While their inclusion clarified the influence of the internal determinants and energy specific conditions, the existence of other state policies generally did not influence the adoption of net metering policies. Of all of the policies analyzed, the data finds that states that have already adopted a production incentive and renewable portfolio standards are more likely to

Table 5.10: State Adoption of Net Metering Policies (Expanded Model)

	EPA		EPA Hybrid		Neighbor		Neighbor Hybrid		Leader-Laggard	
	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.
Internal Determinants										
Tax Revenue per Capita	.910 (.441)	.039	.949 (.447)	.034	.896 (459)	.051	.949 (462)	.040	1.186 (.481)	.014
Population Density	-.0006 (.001)	.678	-.0008 (.001)	.588	-.0009 (.001)	.543	-.001 (.001)	.374	-.0007 (.0014)	.603
College Graduates	.021 (.047)	.649	.026 (.047)	.580	.022 (.048)	.635	.032 (.048)	.513	-.006 (.050)	.900
Government Ideology	.009 (.012)	.462	.007 (.012)	.532	.012 (.012)	.345	.011 (.012)	.373	.007 (.013)	.583
Citizen Ideology	-.003 (.023)	.888	-.002 (.022)	.928	-.005 (.023)	.822	-.005 (.023)	.827	-.006 (.024)	.781
Legislative Professionalism	-4.959 (3.144)	.115	-5.549 (3.173)	.080	-4.075 (3.271)	.213	-4.302 (3.244)	.185	-5.924 (3.173)	.062
Energy Specific Conditions										
Wind Potential	-.007 (.019)	.706	-.006 (.019)	.727	-.008 (.020)	.666	-.005 (.020)	.785	-.001 (.018)	.942
Percent Sunshine	.009 (.020)	.631	.015 (.020)	.451	.014 (.021)	.504	.023 (.022)	.313	.026 (.023)	.269
Nuclear Power Plants	-.326 (.134)	.015	-.333 (.135)	.014	-.332 (.136)	.015	-.347 (.132)	.011	-.299 (.131)	.022
Electric Energy Consumption	.011 (.005)	.058	.012 (.005)	.036	.010 (.006)	.089	.012 (.006)	.044	.006 (.006)	.316
PUC Employees	.003 (.001)	.008	.003 (.001)	.008	.003 (.001)	..016	.003 (.001)	.022	.003 (.001)	.032
Green Conditions	.0006 (.0004)	.162	.0006 (.0004)	.129	.0005 (.0004)	.212	.0004 (.0004)	.296	.0002 (.0004)	.618
National Policies										
Production Incentive	-.909 (1.033)	.379	-.914 (1.039)	.379	-.802 (1.035)	.438	-.795 (1.045)	.447	-.879 (1.024)	.390
Modified Accelerated Cost-Recovery System	-1.057 (.994)	.288	-1.009 (.997)	.312	-.993 (.999)	.320	-.912 (1.006)	.365	-1.059 (.994)	.287
Business Energy Tax Credit	.860 (.772)	.266	.819 (.774)	.290	.685 (.790)	.386	.632 (.793)	.425	1.067 (.785)	.174
USDA Rural Energy Program	.817 (.868)	.347	.748 (.860)	.384	.498 (.880)	.571	.460 (.857)	.591	1.247 (.837)	.136
State Incentive Policies										
Corporate Tax	-.339 (.801)	.672	-.279 (.795)	.726	-.369 (.813)	.650	-.340 (.807)	.673	-.035 (.825)	.966
Personal Tax	-.169 (.767)	.825	-.357 (.766)	.641	-.364 (.765)	.634	-.443 (.767)	.563	-.438 (.816)	.592
Sales Tax	-.617 (1.007)	.540	-.688 (1.011)	.496	-.567 (1.060)	.593	-.534 (1.057)	.613	-.613 (.987)	.534
Property Tax	,225 (.365)	.538	.245 (.368)	.505	.274 (.378)	.469	.263 (.384)	.493	.325 (.378)	.390
Production Incentive	3.525 (1.374)	.010	3.635 (1.454)	.012	3.368 (1.452)	.020	3.335 (1.373)	.015	2.925 (1.222)	.017
Production Rebate	.482 (1.065)	.651	.328 (1.133)	.772	.744 (1.112)	.503	.591 (1.103)	.592	.317 (.995)	.750
Grant	.634 (.461)	.169	.565 (.466)	.225	.738 (.467)	.114	.701 (.473)	.139	.680 (.461)	.140
Loan	-.393 (.637)	.537	-.281 (.639)	.659	-.485 (.647)	.454	-.390 (.649)	.548	-.385 (.622)	.535
Excise Tax	-2.965 (8.279)	.720	-2.507 (8.835)	.777	-2.255 (6.953)	.746	-1.503 (7.157)	.834	-2.88 (7.403)	.697
Industry Support	.287 (.613)	.639	.197 (.624)	.752	.262 (.618)	.671	.078 (.613)	.898	.303 (.590)	.607

State Rules & Regulations										
Renewable Portfolio Standards	1.774 (.875)	.043	1.835 (.881)	.037	1.741 (.877)	.047	1.776 (.857)	.038	2.363 (.849)	.005
Public Benefits Fund	1.452 (.665)	.029	1.483 (.681)	.029	1.107 (.704)	.116	1.087 (.722)	.132	1.144 (.673)	.089
Diffusion Variable	1.113 (.805)	.167	1.322 (.764)	.084	1.836 (.810)	.023	2.18 (.761)	.004	.0008 (.0006)	.154
Trend	-.993 (.346)	.004	-.934 (.355)	.009	-.952 (.350)	.007	-.878 (.361)	.015	-1.110 (.337)	.001
Constant	-4.088 (2.362)	.084	-4.695 (2.428)	.053	-4.641 (2.54)	.068	-5.369 (2.646)	.042	-3.811 (2.468)	.123
Number of Cases	1375		1375		1375		1375		1375	
Wald Chi^2	100.51	.000	97.37	.000	101.09	.000	102.14	.000	99.72	.000
Log Likelihood	-109.632		-109.101		-107.979		-106.375		-109.559	
rho	.018		.018		.018		.018		.018	

Davidson-MacKinnon Test

	EPA	EPA Hybrid	Neighbor	Neighbor Hybrid	Leader-Laggard
EPA	-	.711	.828	.574	.085
EPA Hybrid	.276	-	.720	.772	.069
Neighbor	.077	.136	-	.016	.016
Neighbor Hybrid	.012	.024	.011	-	.004
Leader-Laggard	.081	.132	.104	.137	-

Standard errors are in parentheses. Two-tailed test. Davidson-MacKinnon Test results are the reported p-values.

adopt net metering. Additionally, the results suggest that non-adopters are more likely to adopt as their neighbors, particularly the leaders, adopted.

There were several differences between the coefficient estimates from model to model. Two models, EPA hybrid and leader-laggard, found that legislative professionalism influence adoption. The leader-laggard model found that electric energy consumption did not play a significant influence. Additionally, neither neighbor model found the existence of public benefits funds to have an important role in the adoption of net metering policies.

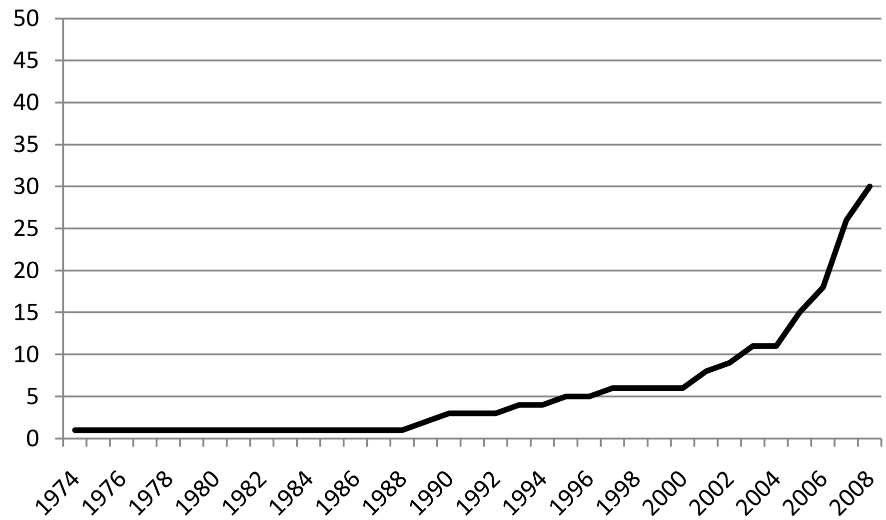
Regulations in Support of Renewable Energy

Because renewable energy is an inherently complex issue area (Gormley 1986), it is inevitable that states will need to adopt policies that are designed to work behind the scenes to help support its growth. At best, these policies operate in the periphery, but they certainly help lay the groundwork for a transition to renewable systems. These regulations also tend to focus on the individual or small group that wants to install a renewable system as opposed to corporate, high capacity projects.

Construction & Design

Over the past couple of decades, states have adopted a number of construction and design policies that concern renewable energy systems. Generally, construction and design policies fall into one of two camps. First, some of these policies concern the retrofitting of a system to an existing structure. These policies are primarily concerned with establishing building codes that ensure that the system is safely integrated to an existing building. For instance, these policies will dictate code for installing a solar array to your roof. The second type of construction and design policy concerns new builds. Building codes are different for new construction and

Figure 5.6: State Adoption of Construction and Design Regulations, 1974-2008



Source: Compiled by the author based upon state adoption of its first construction and design regulation

renewable systems. Generally, these codes ensure that the system was properly integrated to the new structure. These policies typically focus on the installation of solar panels, which should suggest the importance of sunshine. State adoption of construction and design regulations are presented in Figure 5.6.

The traditional sets of analyses are presented in Table 5.11. The DMT finds that the leader-laggard measure creates the best specified model of adoption. This model is statistically significantly better specified than the other models. The model fit statistics indicate that the model performs well. The results indicate that states with fewer college graduates, more sunshine, greater electrical energy consumption, and stronger green conditions are more likely to adopt a construction and design policy. The model also indicates that environmental policy leaders are more likely to adopt than laggards.

Table 5.11: State Adoption of Construction & Design Regulations (Traditional Model)

	EPA		EPA Hybrid		Neighbor		Neighbor Hybrid		Leader-Laggard	
	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.
Internal Determinants										
Tax Revenue per Capita	-.668 (.618)	.279	-.753 (.612)	.218	-.634 (.583)	.276	-.651 (.584)	.265	-.378 (.540)	.484
Population Density	.001 (.001)	.147	.001 (.001)	.139	.001 (.001)	.179	.001 (.001)	.185	.0007 (.001)	.480
College Graduates	-.071 (.037)	.054	-.071 (.036)	.047	-.074 (.036)	.044	-.072 (.036)	.049	-.083 (.038)	.029
Government Ideology	-.001 (.011)	.901	-.0007 (.011)	.947	-.002 (.011)	.799	-.002 (.011)	.849	-.012 (.012)	.325
Citizen Ideology	.031 (.020)	.128	.032 (.020)	.114	.032 (.020)	.116	.033 (.020)	.113	.029 (.020)	.149
Legislative Professionalism	.062 (2.267)	.978	-.071 (2.287)	.975	.114 (2.279)	.960	.071 (2.287)	.975	-4.035 (3.045)	.185
Energy Specific Conditions										
Wind Potential	-.001 (.022)	.962	.001 (.022)	.939	-.006 (.022)	.789	-.004 (.022)	.824	-.0001 (.022)	.994
Percent Sunshine	.014 (.026)	.581	.017 (.026)	.500	.021 (.027)	.432	.025 (.028)	.373	.067 (.035)	.059
Nuclear Power Plants	-.031 (.090)	.727	-.033 (.088)	.704	-.040 (.090)	.659	-.048 (.090)	.594	-.083 (.093)	.374
Electric Energy Consumption	.031 (.007)	.000	.031 (.007)	.000	.032 (.007)	.000	.032 (.007)	.000	.031 (.008)	.000
PUC Employees	-.0007 (.0008)	.394	-.0005 (.0008)	.509	-.0008 (.0008)	.312	-.0007 (.0008)	.384	-.0006 (.0008)	.452
Green Conditions	.001 (.0006)	.009	.001 (.0006)	.011	.001 (.0006)	.005	.001 (.0005)	.008	.001 (.0006)	.049
Renewable Portfolio Standard	.669 (.539)	.215	.651 (.540)	.228	.621 (.548)	.257	.601 (.552)	.276	.522 (.527)	.322
Diffusion Variable	.794 (.994)	.424	.944 (.775)	.223	.995 (1.075)	.354	.833 (.881)	.345	.001 (.0006)	.015
Trend	-1.284 (.265)	.000	-1.293 (.262)	.000	-1.270 (.266)	.000	-1.291 (.261)	.000	-1.427 (.260)	.000
Constant	-4.784 (2.318)	.039	-4.780 (2.297)	.037	-5.471 (2.585)	.034	-5.495 (2.582)	.033	-7.124 (2.829)	.012
Number of Cases	1585		1585		1585		1585		1585	
Wald Chi^2	79.92	.0000	80.42	.0000	79.47	.0000	78.97	.0000	77.09	.0000
Log Likelihood	-93.244		-92.861		-93.117		-93.103		-90.485	
rho	.020		.020		.020		.020		.019	

Davidson-MacKinnon Test

	EPA	EPA Hybrid	Neighbor	Neighbor Hybrid	Leader-Laggard
EPA	-	.185	.683	.690	.297
EPA Hybrid	.115	-	.368	.395	.191
Neighbor	.521	.614	-	.918	.226
Neighbor Hybrid	.509	.650	.848	-	.230
Leader-Laggard	.013	.014	.011	.012	-

Standard errors are in parentheses. Two-tailed test. Davidson-MacKinnon Test results are the reported p-values.

Table 5.12 presents the expanded analyses of adoption. The DMT again finds that the leader-laggard measure of diffusion provides the best specified model of adoption. As in the traditional model, the leader-laggard model is significantly better specified than the others. The model fit statistics indicate that the model performs well.

The results suggest that states with less per capita tax revenue, more sunshine, and higher electric energy consumption were more likely to adopt construction and design regulations. The expanded model differs from the traditional model in three of its estimates. The expanded model reveals that college graduates and green conditions may not have a significant influence on adoption. On the other hand, the clarifications provided by the expanded model reveals that tax revenue may be important.

The results indicate that states were more likely to adopt construction and design regulations after the national government adopted its Business Energy Tax Credit. The analysis also suggests that three previously adopted policies influenced adoption. Specifically, the findings indicate that states that had already adopted a sales tax incentive or green power purchasing requirements were more likely to adopt. However, states that had adopted an excise tax incentive were less likely to adopt construction and design regulations. Finally, the results suggest that leader states were more likely to adopt than laggard states.

Unlike several of the other policies examined, there are only a couple differences between the models of construction and design regulation adoption. The results suggest that the combination of the leader-laggard measure and the measures for previous policy adoption were able to more accurately measure the influence of green conditions, which is found to be statistically significant in the other four models. Additionally, the two neighbor models found

Table 5.12: State Adoption of Construction and Design Regulations (Expanded Model)

	EPA		EPA Hybrid		Neighbor		Neighbor Hybrid		Leader-Laggard	
	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.
Internal Determinants										
Tax Revenue per Capita	-3.057 (.975)	.002	-3.040 (.952)	.001	-2.863 (.949)	.003	-2.818 (.940)	.003	-2.776 (.957)	.069
Population Density	.0008 (.001)	.487	.0008 (.001)	.474	.0007 (.001)	.532	.0007 (.001)	.555	-.0003 (.001)	.818
College Graduates	-.034 (.048)	.485	-.040 (.048)	.408	-.034 (.049)	.489	-.033 (.0494)	.492	-.050 (.049)	.307
Government Ideology	.007 (.016)	.646	.007 (.016)	.641	.007 (.016)	.653	.007 (.016)	.647	.0006 (.016)	.969
Citizen Ideology	.033 (.027)	.218	.033 (.027)	.218	.035 (.027)	.206	.034 (.027)	.207	.039 (.029)	.174
Legislative Professionalism	4.419 (3.470)	.203	4.279 (3.449)	.215	4.33 (3.57)	.225	4.255 (3.60)	.237	.042 (4.481)	.993
Energy Specific Conditions										
Wind Potential	-.011 (.029)	.704	-.008 (.029)	.774	-.015 (.029)	.601	-.014 (.029)	.615	-.009 (.028)	.747
Percent Sunshine	.088 (.044)	.048	.090 (.044)	.041	.092 (.045)	.041	.093 (.046)	.043	.135 (.053)	.011
Nuclear Power Plants	-.074 (.140)	.597	-.076 (.140)	.586	-.078 (.142)	.580	-.087 (.141)	.534	-.071 (.138)	.606
Electric Energy Consumption	.027 (.011)	.018	.026 (.011)	.020	.026 (.011)	.021	.025 (.011)	.025	.021 (.012)	.069
PUC Employees	-.001 (.001)	.202	-.001 (.001)	.240	-.001 (.001)	.251	-.001 (.001)	.288	-.001 (.001)	.473
Green Conditions	.001 (.0008)	.034	.001 (.0008)	.036	.001 (.0008)	.045	.001 (.0008)	.065	.001 (.0008)	.188
National Policies										
Production Incentive	1.211 (1.041)	.245	1.222 (1.040)	.240	1.199 (1.045)	.251	1.169 (1.044)	.263	1.515 (1.130)	.180
Modified Accelerated Cost-Recovery System	2.041 (1.471)	.165	2.051 (1.467)	.162	1.930 (1.459)	.186	1.874 (1.448)	.196	2.281 (1.491)	.126
Business Energy Tax Credit	1.768 (.850)	.038	1.779 (.851)	.037	1.719 (.849)	.043	1.713 (.847)	.043	1.829 (.882)	.038
USDA Rural Energy Program	.608 (1.060)	.566	.664 (1.066)	.533	.560 (1.058)	.597	.562 (1.061)	.596	.6464 (1.066)	.544
State Incentive Policies										
Corporate Tax	.285 (.860)	.740	.356 (.853)	.676	.243 (.866)	.779	.231 (.863)	.788	.419 (.861)	.626
Personal Tax	-.120 (.927)	.897	-.135 (.918)	.883	-.095 (.935)	.918	-.110 (.937)	.906	-378 (.929)	.684
Sales Tax	2.117 (.822)	.010	2.096 (.819)	.011	2.001 (.812)	.014	2.015 (.812)	.013	2.143 (.816)	.009
Property Tax	-.124 (.378)	.742	-.120 (.374)	.747	-.023 (.361)	.948	-.028 (.364)	.937	.116 (.388)	.763
Production Incentive	.722 (.977)	.459	.638 (.984)	.516	.926 (.987)	.348	.842 (.975)	.388	.665 (.960)	.488
Production Rebate	1.246 (.774)	.107	1.197 (.775)	.123	1.336 (.772)	.084	1.33 (.786)	.090	1.215 (.737)	.100
Bond	-2.717 (2.669)	.309	-2.694 (2.608)	.302	-2.801 (2.878)	.331	-2.635 (2.802)	.347	-3.273 (3.002)	.276
Grant	-.594 (.440)	.177	-.607 (.434)	.162	-.705 (.498)	.157	-.697 (.501)	.165	-.538 (.446)	.228
Loan	.580 (.454)	.201	.625 (.462)	.176	.474 (.454)	.296	.492 (.452)	.277	.448 (.410)	.275
Excise Tax	-8.622 (2.981)	.004	-8.456 (2.92)	.004	-8.764 (3.096)	.005	-8.581 (3.065)	.005	-6.649 (2.834)	.019
Industry Support	.785 (.603)	.193	.764 (.599)	.203	.843 (.603)	.162	.834 (.609)	.171	.801 (.572)	.161

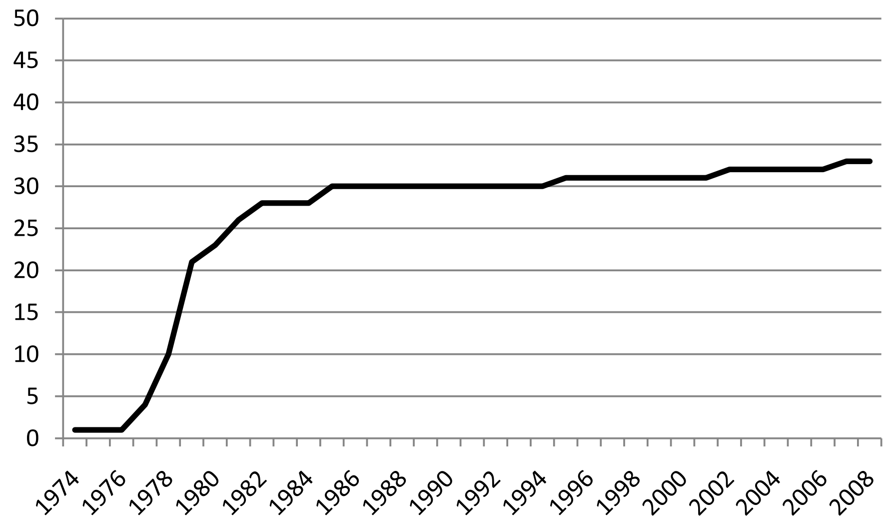
State Rules & Regulations										
Renewable Portfolio Standard	-.359 (.810)	.658	-.359 (.809)	.657	-.225 (.781)	.773	-.227 (.784)	.771	-.288 (.785)	.714
Green Power Purchasing	3.821 (1.057)	.000	3.722 (1.061)	.000	3.877 (1.102)	.000	3.868 (1.125)	.001	3.77 (1.014)	.000
Required Green Power	.935 (1.683)	.578	.911 (1.671)	.585	.845 (1.657)	.610	.775 (1.650)	.638	.910 (1.587)	.566
Public Benefits Fund	1.232 (1.052)	.242	1.232 (1.042)	.237	1.119 (1.037)	.280	1.071 (1.049)	.307	.713 (.975)	.464
Net Metering	-.380 (.861)	.659	-.337 (.849)	.691	-.354 (.876)	.686	-.283 (.858)	.741	-.124 (.822)	.880
Diffusion Variable	1.273 (1.329)	.338	1.181 (1.054)	.262	1.051 (1.748)	.547	.605 (1.450)	.676	.001 (.0008)	.072
Trend	-.861 (.490)	.079	-.860 (.489)	.079	-.854 (.497)	.086	-.890 (.491)	.070	-.886 (.489)	.070
Constant	-12.740 (4.209)	.002	-12.700 (4.187)	.002	-12.966 (4.356)	.003	-12.676 (4.304)	.003	-15.258 (4.676)	.001
Number of Cases	1585		1585		1585		1585		1585	
Wald Chi^2	85.25	.000	85.57	.000	83.39	.000	83.39	.000	79.54	.000
Log Likelihood	-74.442		-74.283		-74.719		-74.814		-73.297	
rho	.020		.020		.020		.020		.019	

Davidson-MacKinnon Test

	EPA	EPA Hybrid	Neighbor	Neighbor Hybrid	Leader-Laggard
EPA	-	.692	.449	.375	.263
EPA Hybrid	.499	-	.342	.273	.229
Neighbor	.953	.975	-	.576	.385
Neighbor Hybrid	.871	.764	.731	-	.535
Leader-Laggard	.059	.064	.057	.064	-

Standard errors are in parentheses. Two-tailed test. Davidson-MacKinnon Test results are the reported p-values.

Figure 5.7: State Adoption of Access Laws, 1974-2008



Source: Compiled by the author based upon state adoption of its first access laws

that states that had adopted production rebates were more likely to adopt construction and design regulations, but this measure was unable to achieve statistical significance in the other models.

Access Laws

In addition to policies concerning construction and design requirements, many states have adopted access laws. These policies are an effort to overcome city, county, and neighborhood covenants that may restrict or prohibit the installation of a renewable system. Usually they concern the construction of a solar array, but in some situations they address small wind turbines. State adoption of access laws is illustrated in Figure 5.7.

Table 5.13 presents the analyses of state access law adoption. The DMT reveals that the leader-laggard measure of diffusion provides the model with the best specification. This model is also significantly better specified than the others. The analysis doesn't reveal a great deal of insight into what influences the likelihood of adoption. The model only finds that states with more conservative citizens and states that are environmental leaders are more likely to adopt.

Table 5.13: State Adoption of Access Laws (Traditional Model)

	EPA		EPA Hybrid		Neighbor		Neighbor Hybrid		Leader-Laggard	
	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.
Internal Determinants										
Tax Revenue per Capita	-.217 (.688)	.752	-.238 (.678)	.725	.181 (.592)	.760	.185 (.592)	.754	.629 (.594)	.289
Population Density	.0007 (.001)	.563	.0006 (.001)	.619	.0003 (.001)	.757	.0003 (.001)	.772	-.0005 (.001)	.668
College Graduates	.101 (.075)	.183	.106 (.076)	.166	.095 (.075)	.202	.096 (.075)	.199	.112 (.078)	.154
Government Ideology	.018 (.016)	.250	.018 (.016)	.250	.015 (.016)	.345	.016 (.016)	.319	.014 (.016)	.384
Citizen Ideology	-.036 (.025)	.149	-.035 (.025)	.161	-.031 (.025)	.212	-.032 (.025)	.195	-.044 (.026)	.091
Legislative Professionalism	-1.218 (2.544)	.632	-1.729 (2.595)	.505	-.887 (2.576)	.730	-.976 (2.556)	.702	-1.899 (2.669)	.477
Energy Specific Conditions										
Wind Potential	.003 (.015)	.801	.007 (.015)	.641	.004 (.016)	.788	.005 (.016)	.753	.013 (.016)	.422
Percent Sunshine	-.011 (.021)	.582	-.011 (.020)	.584	-.005 (.020)	.789	-.004 (.020)	.810	.015 (.023)	.526
Nuclear Power Plants	-.131 (.147)	.372	-.137 (.150)	.358	-.106 (.144)	.463	-.107 (.144)	.460	-.187 (.158)	.236
Electric Energy Consumption	.004 (.006)	.465	.003 (.006)	.520	.004 (.006)	.454	.004 (.006)	.444	.0009 (.006)	.889
PUC Employees	.002 (.001)	.053	.002 (.001)	.058	.001 (.001)	.077	.001 (.001)	.077	.001 (.001)	.133
Green Conditions	.0005 (.0005)	.325	.0003 (.0005)	.442	.0005 (.0005)	.309	.0005 (.0005)	.314	-.00001 (.0005)	.973
Renewable Portfolio Standard	1.915 (1.447)	.186	1.910 (1.457)	.190	1.728 (1.440)	.230	1.678 (1.444)	.245	.900 (1.484)	.544
Diffusion Variable	1.064 (.800)	.184	1.033 (.685)	.132	.351 (.609)	.564	.370 (.594)	.534	.001 (.0005)	.012
Trend	-1.122 (.216)	.000	-1.136 (.212)	.000	-1.204 (.205)	.000	-1.210 (.205)	.000	-1.224 (.209)	.000
Constant	-2.403 (1.723)	.163	-2.103 (1.762)	.233	-2.685 (1.742)	.123	-2.657 (1.744)	.128	-3.496 (1.908)	.067
Number of Cases	869		869		869		869		869	
Wald Chi^2	56.63	.0000	56.48	.0000	54.15	.0000	53.82	.0000	55.77	.0000
Log Likelihood	-106.701		-106.480		-107.412		-107.387		-104.221	
rho	.022		.022		.023		.023		.023	

Davidson-MacKinnon Test

	EPA	EPA Hybrid	Neighbor	Neighbor Hybrid	Leader-Laggard
EPA	-	.943	.226	.237	.131
EPA Hybrid	.504	-	.162	.167	.097
Neighbor	.902	.984	-	.978	.676
Neighbor Hybrid	.931	.928	.818	-	.775
Leader-Laggard	.009	.009	.012	.013	-

Standard errors are in parentheses. Two-tailed test. Davidson-MacKinnon Test results are the reported p-values.

An expanded set of analyses can be found in Table 5.14. Again, the DMT reveals that the leader-laggard measure provides the best specified model, and this model is significantly better specified than the others. The model fit statistics indicate that the model performs well. The results of the expanded analysis clearly reveal that this approach allows for better coefficient estimations of the independent variables.

The results indicate that states with more college graduates, more conservative citizens, fewer nuclear power plants, more public utility commission employees, and states that were leaders in environmental matters were more likely to adopt. This stands in contrast to the traditional model, which only found that citizen ideology had a significant influence. Indeed, while none of the additional variables measuring previous adoption of related policies were found to have a significant influence, their inclusion clearly allowed the statistical model to better analyze the relationship between the existing variables and the likelihood of adoption.

While our understanding of access law adoption may not be as complete as we may like, it is clear that the choice of the control for diffusion was important. The leader-laggard model was the only model where the results indicate that college graduates, citizen ideology, and nuclear power plants play a significant role in the likelihood of adoption. Likewise, the leader-laggard model was the only that did not identify sales tax incentive policies as a significant influence.

Interconnection

While states have established that they have an interest in ensuring that individuals are able to install a renewable system, and to do it safely, they also have an interest in guaranteeing that these systems are properly integrated with the electrical grid. If a system is not properly connected to the electrical grid, it could potentially cause grid-wide problems, not to mention the

Table 5.14: State Adoption of Access Laws (Expanded Model)

	EPA		EPA Hybrid		Neighbor		Neighbor Hybrid		Leader-Laggard	
	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.
Internal Determinants										
Tax Revenue per Capita	-.122 (.774)	.874	-.332 (.796)	.676	.184 (.649)	.776	.176 (.654)	.788	.976 (.669)	.145
Population Density	.001 (.001)	.393	.001 (.001)	.340	.001 (.001)	.487	.001 (.001)	.479	-.0006 (.001)	.714
College Graduates	.127 (.088)	.150	.1175 (.088)	.187	.134 (.086)	.121	.130 (.086)	.132	.157 (.090)	.080
Government Ideology	.017 (.017)	.331	.017 (.017)	.321	.015 (.017)	.384	.016 (.017)	.343	.016 (.018)	.375
Citizen Ideology	-.044 (.028)	.114	-.045 (.027)	.102	-.039 (.027)	.141	-.042 (.027)	.119	-.066 (.030)	.029
Legislative Professionalism	-2.644 (3.004)	.379	-3.184 (3.031)	.293	-2.367 (3.082)	.442	-2.378 (3.067)	.438	-4.021 (3.282)	.220
Energy Specific Conditions										
Wind Potential	.010 (.016)	.540	.015 (.017)	.373	.008 (.017)	.618	.009 (.017)	.568	.019 (.017)	.253
Percent Sunshine	-.014 (.022)	.517	-.016 (.022)	.462	-.011 (.022)	.599	-.011 (.022)	.601	.012 (.026)	.631
Nuclear Power Plants	-.193 (.173)	.625	-.202 (.174)	.246	-.202 (.177)	.254	-.212 (.179)	.236	-.332 (.197)	.093
Electric Energy Consumption	.008 (.007)	.268	.007 (.007)	.310	.007 (.007)	.285	.007 (.007)	.281	-.0004 (.007)	.957
PUC Employees	.003 (.001)	.022	.003 (.001)	.018	.003 (.001)	.029	.003 (.001)	.029	.002 (.001)	.085
Green Conditions	.0006 (.0006)	.301	.0005 (.0005)	.320	.0005 (.0005)	.340	.0005 (.0005)	.328	-.0003 (.0006)	.634
National Policies										
Production Incentive	.734 (1.449)	.612	-.016 (.022)	.462	.591 (1.444)	.682	.584 (1.438)	.684	.082 (1.537)	.957
Business Energy Tax Credit	.509 (1.792)	.776	.648 (1.821)	.722	.319 (1.814)	.860	.343 (1.814)	.850	.336 (1.940)	.862
USDA Rural Energy Program	2.038 (1.752)	.245	2.262 (1.790)	.206	1.995 (1.747)	.253	2.087 (1.759)	.235	2.869 (1.850)	.121
State Incentive Policies										
Corporate Tax	-2.504 (2.395)	.296	-2.365 (2.415)	.327	-2.395 (2.346)	.307	-2.278 (2.342)	.331	-2.068 (2.391)	.387
Personal Tax	2.254 (2.442)	.356	2.220 (2.450)	.365	2.104 (2.414)	.383	1.983 (2.404)	.409	1.070 (2.428)	.659
Sales Tax	4.053 (2.369)	.087	4.090 (2.392)	.087	3.85 (2.304)	.094	3.835 (2.291)	.094	3.879 (2.378)	.103
Property Tax	-.180 (.585)	.758	-.386 (.638)	.545	-.041 (.529)	.937	-.095 (.536)	.858	2.201 (2.190)	.315
Production Incentive	2.314 (2.140)	.280	2.286 (2.126)	.282	2.477 (2.166)	.253	2.545 (2.175)	.242	2.201 (2.190)	.315
Production Rebate	-18.996 (11076.62)	.999	-18.956 (11451.78)	.999	-19.628 (13294.97)	.999	-19.237 (10818.76)	.999	-21.849 (19695.61)	.999
Grant	.210 (1.180)	.859	.037 (1.239)	.976	.423 (1.152)	.713	.490 (1.149)	.669	.887 (1.282)	.489
Loan	-.575 (1.375)	.676	-.539 (1.398)	.700	-.658 (1.383)	.634	-.664 (1.382)	.631	-.593 (1.460)	.684
Excise Tax	-2.793 (3.182)	.380	-2.449 (3.211)	.446	-2.816 (3.158)	.373	-2.677 (3.163)	.397	-1.971 (3.269)	.546
Industry Support	-.445 (1.098)	.685	-.542 (1.101)	.622	-.429 (1.104)	.697	-.464 (1.103)	.674	-.096 (1.103)	.930

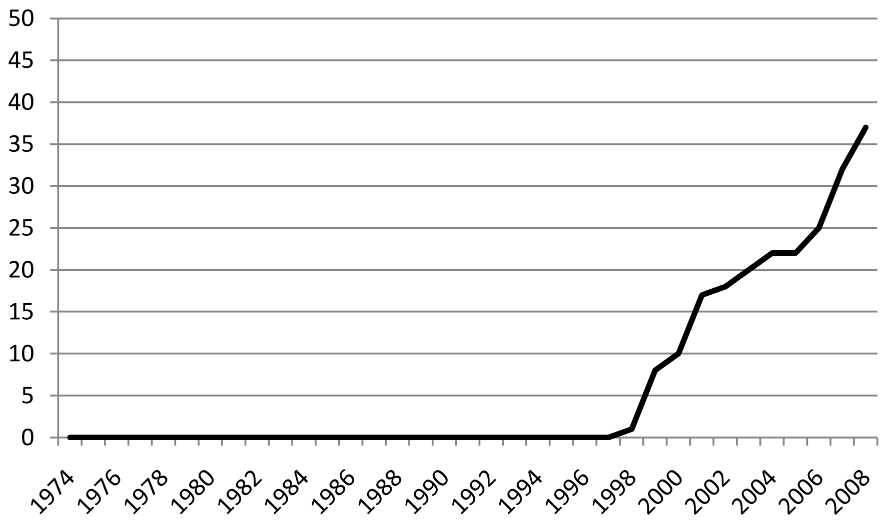
State Rules & Regulations										
Renewable Portfolio Standard	2.738 (2.292)	.232	3.078 (2.355)	.191	2.734 (2.292)	.233	2.838 (2.302)	.218	3.071 (2.533)	.225
Public Benefits Fund	-16.977 (11347.31)	.999	-17.172 (11744.22)	.999	-17.575 (13726.15)	.999	-17.310 (11253.4)	.999	-20.092 (19931.42)	.999
Net Metering	-3.011 (2.085)	.149	-3.172 (2.113)	.133	-3.020 (2.059)	.142	-3.080 (2.063)	.136	-3.636 (2.208)	.100
Diffusion Variable	.849 (.998)	.395	1.271 (.976)	.193	.439 (.655)	.503	.589 (.650)	.365	.002 (.0006)	.001
Trend	-1.209 (.247)	.000	-1.209 (.241)	.000	-1.254 (.237)	.000	-1.260 (.235)	.000	-1.290 (.245)	.000
Constant	-2.230 (2.151)	.300	-1.616 (2.239)	.470	-2.568 (2.156)	.234	-2.442 (2.183)	.263	-3.197 (2.451)	.192
Number of Cases	869		869		869		869		869	
Wald Chi^2	61.66	.0009	62.27	.0007	60.31	.001	59.86	.001	57.54	.002
Log Likelihood	-99.567		-99.031		-99.717		-99.536		-94.474	
rho	.021		.021		.021		.022		.020	

Davidson-MacKinnon Test

	EPA	EPA Hybrid	Neighbor	Neighbor Hybrid	Leader-Laggard
EPA	-	.451	.552	.634	.206
EPA Hybrid	.205	-	.254	.306	.123
Neighbor	.804	.923	-	.569	.330
Neighbor Hybrid	.588	.762	.397	-	.364
Leader-Laggard	.001	.001	.001	.001	-

Standard errors are in parentheses. Two-tailed test. Davidson-MacKinnon Test results are the reported p-values.

Figure 5.8: State Adoption of Corporate Tax Interconnection Regulations, 1974-2008



Source: Compiled by the author based upon state adoption of its first interconnection regulation

risk of electrification or fire. As a result, almost every state has adopted policies to regulating this interconnection. Figure 5.8 shows the adoption of state interconnection regulations over time.

The analyses of adoption of interconnection policies using a traditional approach are presented in Table 5.15. The DMT suggests that the EPA hybrid measure of diffusion provides the best specified model. This model is significantly better specified than all but the EPA model, where it is comparatively better specified. The model fit statistics indicate that the model performs well.

The results indicate that states with higher per capita tax revenue, lower population density, more college graduates, less wind potential, and higher electrical energy consumption are more likely to adopt an interconnection policy. The results also suggest that states that have already adopted renewable portfolio standards are more likely to adopt.

Table 5.15: State Adoption of Interconnection Policies (Traditional Model)

	EPA		EPA Hybrid		Neighbor		Neighbor Hybrid		Leader-Laggard	
	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.
Internal Determinants										
Tax Revenue per Capita	1.202 (.452)	.008	1.218 (.464)	.009	1.368 (.420)	.001	1.400 (.431)	.001	1.399 (.370)	.000
Population Density	-.003 (.001)	.010	-.004 (.001)	.004	-.004 (.001)	.005	-.004 (.001)	.002	-.004 (.001)	.002
College Graduates	.081 (.043)	.064	.096 (.043)	.025	.098 (.042)	.022	.103 (.042)	.015	.114 (.041)	.005
Government Ideology	-.008 (.009)	.382	-.009 (.009)	.320	-.011 (.008)	.192	-.011 (.008)	.188	-.013 (.008)	.129
Citizen Ideology	.004 (.021)	.848	.010 (.021)	.630	.011 (.021)	.594	.011 (.020)	.564	.029 (.021)	.158
Legislative Professionalism	.400 (2.100)	.849	-.276 (2.179)	.899	.545 (2.101)	.795	.293 (2.120)	.890	.177 (2.164)	.935
Energy Specific Conditions										
Wind Potential	-.048 (.020)	.015	-.050 (.020)	.012	-.049 (.202)	.013	-.053 (.020)	.008	-.058 (.019)	.003
Percent Sunshine	-.004 (.022)	.855	.0007 (.021)	.972	.010 (.023)	.633	.015 (.022)	.493	.004 (.024)	.841
Nuclear Power Plants	-.022 (.089)	.798	-.043 (.088)	.624	-.021 (.092)	.815	-.027 (.091)	.767	-.006 (.091)	.946
Electric Energy Consumption	.010 (.004)	.012	.011 (.004)	.010	.009 (.004)	.033	.009 (.004)	.026	.009 (.004)	.018
PUC Employees	-.0004 (.0009)	.587	-.00009 (.0008)	.918	-.0002 (.0008)	.786	-.0002 (.0009)	.817	.00005 (.00008)	.951
Green Conditions	-.0002 (.0004)	.608	-.0003 (.0004)	.394	-.0004 (.0004)	.340	-.0004 (.0004)	.263	-.0004 (.0004)	.367
Renewable Portfolio Standard	1.859 (.490)	.000	1.914 (.488)	.000	1.940 (4.94)	.000	1.912 (.492)	.000	2.275 (.504)	.000
Diffusion Variable	2.402 (.756)	.002	2.166 (.607)	.000	1.448 (.697)	.038	1.667 (.681)	.014	-.0003 (.0004)	.488
Trend	-.713 (.199)	.000	-.658 (.190)	.001	-.643 (.199)	.001	-.630 (.191)	.001	-.494 (.176)	.005
Constant	-7.997 (2.077)	.000	-8.665 (1.980)	.000	-9.332 (2.077)	.000	-9.789 (2.044)	.000	-10.130 (2.000)	.000
Number of Cases	1573		1573		1573		1573		1573	
Wald Chi^2	71.90	.0000	73.11	.0000	67.81	.0000	66.97	.0000	73.47	.0000
Log Likelihood	-109.141		-108.345		-111.872		-111.046		-113.675	
rho	.019		.019		.019		.019		.019	

Davidson-MacKinnon Test

	EPA	EPA Hybrid	Neighbor	Neighbor Hybrid	Leader-Laggard
EPA	-	.984	.017	.038	.002
EPA Hybrid	.213	-	.005	.013	.000
Neighbor	.997	.973	-	.486	.036
Neighbor Hybrid	.545	.806	.141	-	.014
Leader-Laggard	.804	.649	.459	.477	-

Standard errors are in parentheses. Two-tailed test. Davidson-MacKinnon Test results are the reported p-values.

Table 5.16 presents the results of the expanded set of analyses attempting to explain the likelihood that a state would adopt an interconnection regulation. The DMT finds that the EPA hybrid measure of diffusion provides the best specified model of adoption. This model is significantly better specified than the others. The model fit statistics indicate that the model performs well.

The results indicate that states with less population density, more college graduates, more conservative governments, less wind potential, and worse green conditions were more likely to adopt interconnection regulations. As seen when comparing most traditional models to their expanded models, there are significant estimation differences uncovered. Tax revenue and electric energy consumption are not longer statistically significant. The differences also find that government ideology and green conditions are now significantly influencing the likelihood of adoption.

The data also indicates that none of the federal policies had a significant influence on adoption. However, the existence of previously adopted renewable energy policies seems to play an important role in influencing the likelihood of adoption. Specifically, states that have already adopted sales tax incentives and net metering policies are more likely to adopt interconnection regulations. Additionally, states that have adopted state-backed loan programs and excise tax incentives are less likely to adopt. The findings also suggest that renewable portfolio standards no longer provide a significant influence on the likelihood of adoption, which indicates that it was inaccurately representing the influence of something else.

In addition to the significant differences between the traditional and expanded model of adoption, there are also differences in our estimations based on the measure of diffusion. The models indicate that if we were to only use the leader-laggard measure, we would be unable to

Table 5.16: State Adoption of Interconnection Regulations (Expanded Model)

	EPA		EPA Hybrid		Neighbor		Neighbor Hybrid		Leader-Laggard	
	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.
Internal Determinants										
Tax Revenue per Capita	.833 (910)	.360	.827 (.911)	.364	.984 (.930)	.290	.988 (.932)	.289	.696 (.935)	.456
Population Density	-.007 (.002)	.001	-.008 (.002)	.000	-.008 (.002)	.000	-.008 (.002)	.001	-.007 (.002)	.001
College Graduates	.275 (.090)	.002	.294 (.091)	.001	.296 (.092)	.001	.289 (.092)	.002	.275 (.089)	.002
Government Ideology	-.033 (.017)	.065	-.033 (.018)	.066	-.033 (.018)	.064	-.034 (.018)	.059	-.029 (.018)	.113
Citizen Ideology	-.012 (.033)	.704	-.015 (.032)	.642	-.003 (.032)	.924	-.006 (.032)	.837	-.003 (.032)	.919
Legislative Professionalism	1.49 (3.69)	.686	1.734 (3.785)	.647	.357 (3.762)	.924	.606 (3.787)	.873	3.592 (4.267)	.400
Energy Specific Conditions										
Wind Potential	-.129 (.036)	.000	-.128 (.035)	.000	-.138 (.037)	.000	-.133 (.037)	.000	-.133 (.037)	.000
Percent Sunshine	.050 (.038)	.196	.053 (.038)	.162	.047 (.040)	.237	.047 (.040)	.239	.026 (.045)	.552
Nuclear Power Plants	.172 (.181)	.341	.159 (.178)	.372	.291 (.197)	.139	.260 (.197)	.185	.169 (.180)	.348
Electric Energy Consumption	-.004 (.008)	.634	-.003 (.008)	.640	-.008 (.008)	.322	-.007 (.008)	.382	-.003 (.008)	.718
PUC Employees	-.001 (.001)	.426	-.001 (.001)	.359	-.0005 (.001)	.721	-.0007 (.001)	.640	-.001 (.001)	.366
Green Conditions	-.001 (.0007)	.036	-.001 (.0007)	.026	-.001 (.0008)	.022	-.001 (.0008)	.029	-.001 (.0008)	.089
National Policies										
Business Energy Tax Credit	.522 (.861)	.544	.510 (.849)	.548	.588 (.871)	.499	.544 (.874)	.533	.656 (.893)	.462
USDA Rural Energy Program	-1.34 (.925)	.147	-1.430 (.890)	.108	-.838 (.970)	.388	-1.035 (.934)	.268	-.1.147 (.884)	.194
State Incentive Policies										
Corporate Tax	.983 (1.082)	.363	1.249 (1.109)	.260	1.132 (1.078)	.294	1.056 (1.073)	.325	.764 (1.075)	.477
Personal Tax	-.008 (1.117)	.994	-.129 (1.132)	.909	-.094 (1.089)	.931	-.073 (1.094)	.946	.221 (1.112)	.842
Sales Tax	3.182 (1.067)	.003	3.009 (1.053)	.004	3.449 (1.095)	.002	3.392 (1.080)	.002	3.527 (1.130)	.002
Property Tax	.441 (.454)	.331	.337 (.465)	.468	.627 (.457)	.170	.619 (.466)	.185	.263 (.494)	.594
Production Incentive	-.154 (1.022)	.880	-.189 (1.016)	.852	-.238 (1.040)	.819	-.206 (1.029)	.841	-.618 (1.118)	.580
Production Rebate	.191 (.960)	.842	.178 (.980)	.855	.246 (.959)	.798	.206 (.952)	.828	.311 (.977)	.750
Bond	-5.717 (3.429)	.095	-5.132 (3.391)	.130	-6.142 (3.442)	.074	-6.266 (3.469)	.071	-6.720 (3.651)	.066
Grant	.112 (.479)	.814	.124 (.478)	.795	.029 (.466)	.950	.074 (.464)	.873	.089 (.487)	.854
Loan	-1.196 (.501)	.017	-1.142 (.498)	.022	-1.426 (.533)	.008	-1.34 (.534)	.009	-1.044 (.530)	.049
Excise Tax	-3.718 (2.199)	.091	-3.699 (2.133)	.083	-4.276 (2.234)	.056	-4.131 (2.196)	.060	-4.385 (2.207)	.047
Industry Support	-.581 (.523)	.267	-.683 (.534)	.201	-.470 (.527)	.372	-.515 (.524)	.326	-.459 (.535)	.391

State Rules & Regulations										
Renewable Portfolio Standard	.983 (.646)	.149	.914 (.646)	.157	.974 (.655)	.137	.952 (.649)	.143	1.020 (.678)	.132
Green Power Purchasing	-.785 (1.267)	.535	-.923 (1.275)	.469	-.682 (1.298)	.599	-.711 (1.296)	.583	-.898 (1.258)	.475
Required Green Power	1.388 (1.563)	.375	1.33 (1.531)	.385	1.310 (1.727)	.448	1.499 (1.699)	.377	1.253 (1.597)	.433
Public Benefits Fund	1.156 (.907)	.202	1.241 (914)	.175	1.334 (.949)	.160	1.280 (.938)	.172	1.271 (.921)	.167
Net Metering	7.785 (1.624)	.000	7.752 (1.621)	.000	8.105 (1.592)	.000	7.992 (1.600)	.000	7.956 (1.647)	.000
Diffusion Variable	.825 (1.245)	.508	1.510 (1.007)	.134	-1.397 (1.319)	.289	-.830 (1.156)	.473	-.0008 (.0008)	.292
Trend	-.207 (.411)	.614	-.226 (.412)	.583	-.122 (.414)	.767	-.142 (.413)	.731	-.169 (.399)	.672
Constant	-18.651 (4.733)	.000	-19.138 (4.750)	.000	-19.383 (4.787)	.000	-19.083 (4.784)	.000	-17.586 (4.871)	.000
Number of Cases	1573		1573		1573		1573		1573	
Wald Chi^2	50.33	.020	49.80	.023	49.64	.024	49.36	.025	51.47	.016
Log Likelihood	-67.282		-66.398		-66.922		-67.237		-66.931	
rho	.019		.019		.019		.019		.019	

Davidson-MacKinnon Test

	EPA	EPA Hybrid	Neighbor	Neighbor Hybrid	Leader-Laggard
EPA	-	.044	.087	.160	.584
EPA Hybrid	.017	-	.014	.016	.098
Neighbor	.062	.030	-	.224	.292
Neighbor Hybrid	.156	.050	.344	-	.423
Leader-Laggard	.324	.310	.291	.266	-

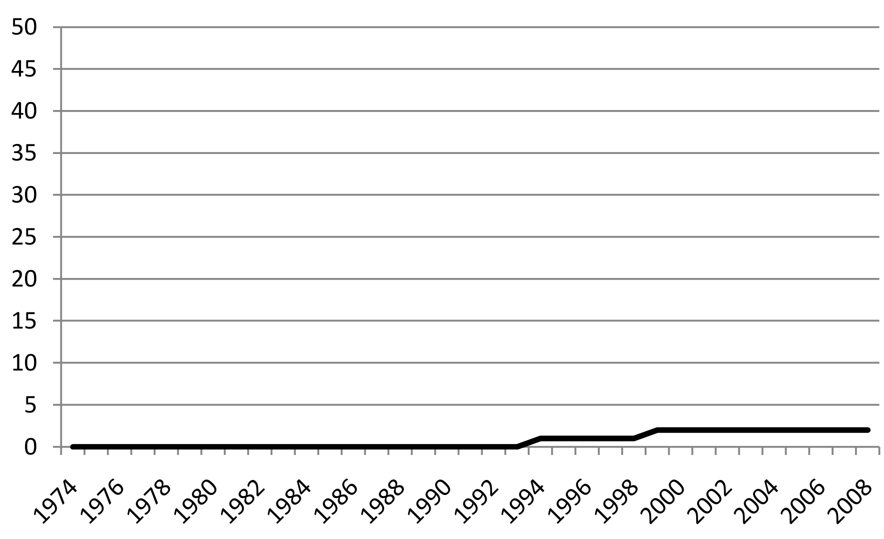
Standard errors are in parentheses. Two-tailed test. Davidson-MacKinnon Test results are the reported p-values.

identify the significant relationship between government ideology and adoption. An additional difference can be seen in the EPA hybrid model being the only one that doesn't identify state-backed bonds as having a significant impact on the likelihood of adoption.

Extension Analysis

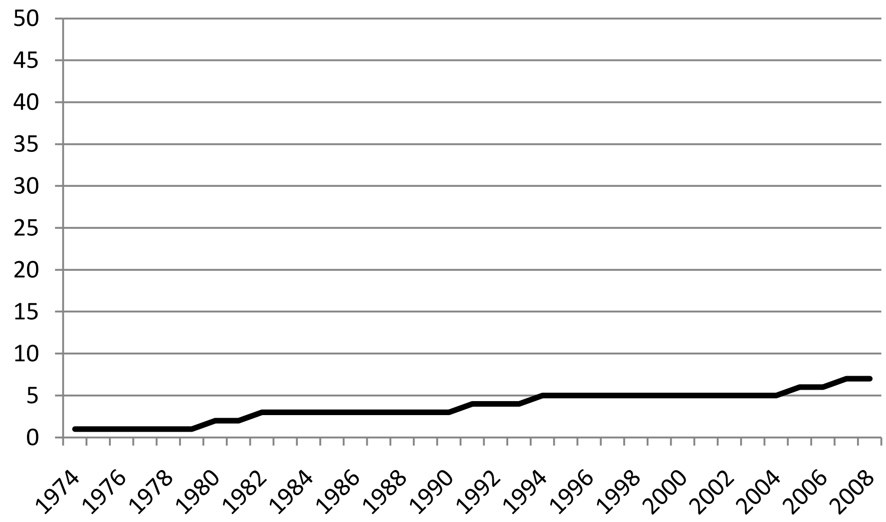
To guarantee that the public is safe, states have adopted extension analysis policies. These policies require that the electrical lines going to and from the electrical grid meet code requirements. This is particularly important when retrofitting a renewable system to an electrical grid that was installed long ago. Mostly, this is to ensure that electrical fires and electrocutions do not occur. Figure 5.9 depicts state adoption of extension analysis regulations over time. Thus far, only Arizona, Colorado, and Texas have adopted extension analysis regulations. With only three states having adopted this policy, there is not sufficient variation within the dependent variable to allow for a proper statistical analysis. If more states adopt this policy researchers will then be able to effectively model policy adoption.

Figure 5.9: State Adoption of Extension Analysis Regulations, 1974-2008



Source: Compiled by the author based upon state adoption of its first extension analysis regulation

Figure 5.10: State Adoption of Contractor Licensing Regulations, 1974-2008



Source: Compiled by the author based upon state adoption of its first contractor licensing regulation

Contractor Licensing

To protect citizens from unscrupulous renewable energy systems contractors, states have begun to adopt licensing programs. These are designed to try to prevent contractors from charging a large fee to install a system, but not doing it properly. Typically, states require at least four years of experience working with renewable systems, usually solar, before they can become certified. Some states even require a year experience in a supervisory role to obtain certification. Figure 5.10 illustrates the adoption of state contractor licensing regulations.

State adoptions of contractor licensing regulations using the traditional analyses are found in Table 5.17. The DMT suggests that the neighbor measure of diffusion provides the best specified model. Model fit statistics suggest that the model performs well. The findings indicate that states with less wind potential, more sunshine, more electric energy consumption, fewer public utility commission employees, and greater green conditions were more likely to

Table 5.17: State Adoption of Contractor Licensing Regulations (Traditional Model)

	EPA		EPA Hybrid		Neighbor		Neighbor Hybrid		Leader-Laggard	
	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.
Internal Determinants										
Tax Revenue per Capita	-1.880 (1.815)	.300	-1.644 (1.764)	.351	-2.677 (1.718)	.119	-2.465 (1.663)	.138	-1.778 (1.536)	.247
Population Density	-.003 (.002)	.263	-.003 (.002)	.248	-.003 (.002)	.195	-.003 (.003)	.201	-.003 (.003)	.231
College Graduates	-.162 (.114)	.156	-.172 (.113)	.128	-.119 (.122)	.329	-.120 (.125)	.335	-.155 (.105)	.140
Government Ideology	-.005 (.027)	.837	-.007 (.028)	.802	-.001 (.027)	.944	-.003 (.026)	.908	-.008 (.028)	.758
Citizen Ideology	.027 (.057)	.633	.024 (.056)	.660	.038 (.059)	.516	.038 (.061)	.532	.027 (.057)	.635
Legislative Professionalism	6.866 (6.584)	.297	6.605 (6.513)	.331	7.603 (7.040)	.280	7.280 (6.965)	.296	6.164 (6.666)	.355
Energy Specific Conditions										
Wind Potential	-.144 (.061)	.020	-.146 (.061)	.018	-.149 (.065)	.023	-.146 (.064)	.023	-.143 (.063)	.024
Percent Sunshine	.124 (.065)	.058	.131 (.063)	.039	.111 (.055)	.043	.118 (.055)	.033	.151 (.090)	.093
Nuclear Power Plants	-.257 (.399)	.518	-.280 (.404)	.487	-.183 (.408)	.654	-.191 (.401)	.633	-.274 (.416)	.509
Electric Energy Consumption	.053 (.015)	.001	.054 (.015)	.000	.052 (.015)	.001	.051 (.015)	.001	.053 (.015)	.001
PUC Employees	-.006 (.003)	.081	-.006 (.003)	.084	-.006 (.003)	.056	-.006 (.003)	.069	-.007 (.004)	.090
Green Conditions	.004 (.001)	.016	.004 (.001)	.013	.003 (.001)	.033	.003 (.001)	.033	.003 (.001)	.021
Renewable Portfolio Standard	2.775 (1.661)	.095	2.832 (1.680)	.092	2.882 (1.684)	.087	2.768 (1.661)	.096	2.684 (1.658)	.105
Diffusion Variable	-.215 (2.146)	.920	-.745 (2.171)	.732	3.548 (3.800)	.351	2.451 (3.340)	.463	.0007 (.001)	.644
Trend	-.846 (.727)	.245	-.795 (.716)	.267	-.853 (.730)	.242	-.843 (.720)	.242	-.813 (.694)	.241
Constant	-18.352 (7.741)	.018	-18.951 (7.627)	.013	-17.810 (7.688)	.021	-18.298 (7.600)	.016	-20.163 (8.812)	.022
Number of Cases	1618		1618		1618		1618		1618	
Wald Chi^2	29.29	.0148	29.01	.0160	29.84	.0125	29.68	.0131	28.52	.0185
Log Likelihood	-29.833		-29.779		-29.370		-29.566		-29.733	
rho	.023		.023		.023		.023		.023	

Davidson-MacKinnon Test

	EPA	EPA Hybrid	Neighbor	Neighbor Hybrid	Leader-Laggard
EPA	-	.293	.414	.511	.864
EPA Hybrid	.267	-	.320	.330	.896
Neighbor	.216	.196	-	.468	.208
Neighbor Hybrid	.320	.240	.671	-	.285
Leader-Laggard	.637	.742	.334	.370	-

Standard errors are in parentheses. Two-tailed test. Davidson-MacKinnon Test results are the reported p-values.

adopt. The results also indicate that states that have already adopted renewable portfolio standards are more likely to adopt.

Table 5.18 provides the results of an expanded set of analyses of the adoption of contractor licensing regulations. The DMT reveals that the leader-laggard measure of diffusion provides the model that is best specified. The expanded model approach allows the analysis to better measure the impact of the variables, which has led to the neighbor measure no longer providing the best specified model. The model fit statistics indicate that the model performs well.

The results suggest that states with fewer college graduates, less wind potential, more sunshine, more electric energy consumption, and fewer public utility commission employees are more likely to adopt contractor licensing regulations. In contrast, these results are similar to those found in the traditional model, except for the addition of college graduates and the loss of green conditions. The results also indicate that states that have already adopted a production rebate and required green power policies are more likely to adopt. On the other hand, states that have already adopted a personal income tax incentive are less likely to adopt.

Comparisons between the five expanded models reveal, yet again, that the choice of diffusion measure impacts our ability to understand adoption. College graduates are only found to have a significant impact on adoption in the leader-laggard model. Public utility commission employees are only found to not have a significant influence in the EPA model. Additionally, personal tax incentives only have a significant influence in the leader-laggard and neighbor hybrid models.

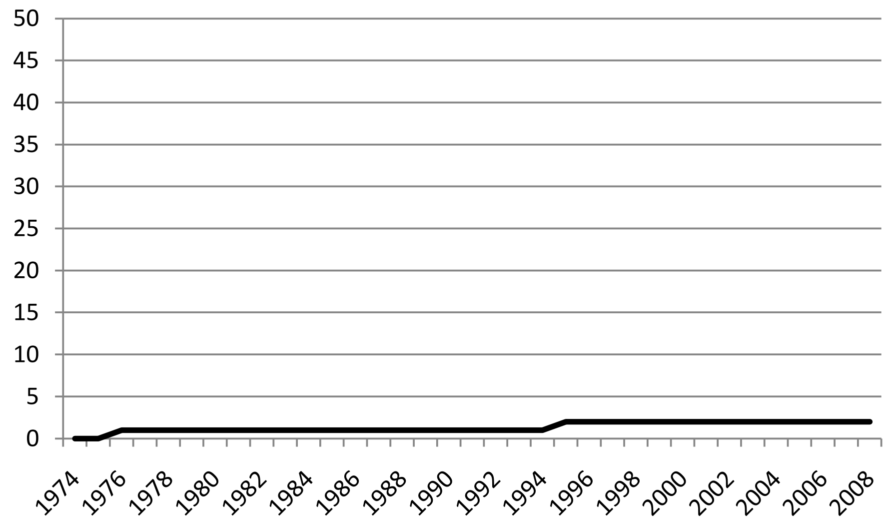
Table 5.18: State Adoption of Contractor Licensing Regulations (Expanded Model)

	EPA		EPA Hybrid		Neighbor		Neighbor Hybrid		Leader-Laggard	
	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.
Internal Determinants										
College Graduates	-.243 (.174)	.162	-.244 (.174)	.162	-.256 (.162)	.115	-.256 (.162)	.115	-.322 (.163)	.049
Citizen Ideology	.095 (.066)	.150	.095 (.066)	.151	.092 (.065)	.157	.092 (.065)	.158	.090 (.067)	.179
Legislative Professionalism	6.183 (11.872)	.602	6.233 (11.807)	.598	6.074 (11.855)	.608	6.164 (11.840)	.603	4.215 (12.077)	.727
Energy Specific Conditions										
Wind Potential	-.149 (.061)	.015	-.148 (.059)	.013	-.147 (.059)	.013	-.146 (.058)	.012	-.133 (.057)	.021
Percent Sunshine	.358 (.115)	.002	.359 (.114)	.002	.364 (.115)	.002	.365 (.115)	.002	.430 (.174)	.014
Electric Energy Consumption	.060 (.015)	.000	.060 (.015)	.000	.058 (.014)	.000	.059 (.014)	.000	.058 (.014)	.000
PUC Employees	-.010 (.006)	.104	-.010 (.006)	.097	-.009 (.005)	.093	-.009 (.005)	.089	-.011 (.006)	.084
Green Conditions	.001 (.001)	.219	.001 (.001)	.214	.001 (.001)	.208	.002 (.001)	.194	.001 (.001)	.337
State Incentive Policies										
Personal Tax	-4.945 (3.084)	.109	-4.953 (3.078)	.108	-5.027 (3.058)	.100	-5.039 (3.055)	.099	-5.14 (3.001)	.086
Property Tax	1.512 (1.390)	.277	1.523 (1.379)	.270	1.605 (.318)	.223	1.610 (1.315)	.221	1.882 (1.377)	.172
Production Rebate	7.326 (3.153)	.020	7.357 (3.156)	.020	7.310 (3.15)	.020	7.324 (3.149)	.020	7.294 (3.123)	.020
Grant	-4.746 (4.304)	.270	-4.809 (4.234)	.256	-5.002 (4.131)	.226	-5.049 (4.113)	.220	-5.088 (3.857)	.187
State Rules & Regulations										
Renewable Portfolio Standards	3.370 (2.549)	.186	3.360 (2.541)	.186	3.364 (2.519)	.182	3.349 (2.508)	.182	3.194 (2.425)	.188
Required Green Power	8.670 (4.016)	.031	8.709 (4.015)	.030	8.539 (3.881)	.028	8.592 (3.874)	.027	8.628 (3.587)	.016
Net Metering	-4.360 (3.145)	.166	-4.402 (3.171)	.165	-4.284 (3.069)	.163	-4.320 (3.099)	.163	-4.435 (3.013)	.141
Diffusion Variable	.770 (2.934)	.793	.759 (3.058)	.804	.661 (4.016)	.869	.614 (3.736)	.869	.001 (.002)	.570
Trend	-.291 (.873)	.739	-.298 (.869)	.732	-.332 (.843)	.693	-.343 (.821)	.676	-.618 (.867)	.476
Constant	-37.733 (11.704)	.001	-37.739 (11.759)	.001	-37.482 (11.775)	.001	-37.485 (11.782)	.001	-39.071 (12.354)	.002
Number of Cases	1618		1618		1618		1618		1618	
Wald Chi^2	26.47	.066	26.44	.066	26.54	.065	26.48	.066	25.45	.085
Log Likelihood	-23.001		-23.005		-23.022		-23.023		-22.871	
rho	.023		.023		.023		.023		.023	

	Davidson-MacKinnon Test				
	EPA	EPA Hybrid	Neighbor	Neighbor Hybrid	Leader-Laggard
EPA	-	.920	.830	.834	.544
EPA Hybrid	.974	-	.850	.850	.564
Neighbor	.945	.969	-	.973	.756
Neighbor Hybrid	.973	.970	.984	-	.785
Leader-Laggard	.439	.457	.535	.547	-

Standard errors are in parentheses. Two-tailed test. Davidson-MacKinnon Test results are the reported p-values.

Figure 5.11: State Adoption of Equipment Certification Regulations, 1974-2008



Source: Compiled by the author based upon state adoption of its first equipment certification regulation

<u>Equipment Certification</u>

Also in an effort to protect the public, four states have adopted equipment certification policies. These are designed to ensure that the renewable system meets the standards set by the state. Mostly, it is to try to prevent charlatans from installing a renewable system, usually solar power, which either does not work properly or break because it was constructed with cheap products. Figure 5.11 illustrates state adoption of equipment certification regulations. Unfortunately, through 2008, only two states, Arizona and Florida, had adopted this policy, which doesn't allow for sufficient variation in the dependent variable for estimations. Since 2008, Oregon and Minnesota, have adopted their own certification program. If more states adopt this policy researchers will then be able to effectively model policy adoption.

Discussion and Conclusions

In this chapter I explored the adoption of state renewable energy rules and regulations. Again, I employed a universal modeling approach to allow a comparison between the adoptions of state renewable energy incentive policies. Unfortunately, it was not possible to analyze every policy due to too few states having adopted equipment certification and extension analysis policies. However, taken as a whole, these analyses offer several important observations.

The analyses of each policy reveal that the traditional style of modeling adoption results in models that may be underspecified. All of the expanded models provide a more nuanced analysis of adoption by more accurately measuring the feedback of existing state policies and national policies on adoption. In many instances, the expanded models reveal that the traditional models have misestimated the relationship between the traditional independent variables and the dependent variable. Estimation inaccuracies should certainly suggest that expanded models ought to be emphasized because they offer a more nuanced understanding of adoption and they better reflect the inherent complexity of the policy adoption process.

To illustrate these differences, Table 5.19 presents a summary of the statistically significant independent variables that were found in the models that were best specified. This summary reveals that the internal determinants and energy specific conditions were consistently misestimated in the traditional models, whereas the expanded models were better able to identify how these variables and the dependent variable were related. A comparison clearly illustrates that the expanded models were better able to estimate both positive and negative relationships, particularly with government ideology and legislative professionalism.

The results presented above also provide an interesting view into the dynamics of federalism. Recall, Gormley (1986) would suggest that renewable energy policy is an area that

Table 5.19: Summary of Statistically Significant Independent Variables

	Traditional			Expanded		
	Positive	Negative	Total	Positive	Negative	Total
Internal Determinants						
Tax Revenue per Capita	33.3%	11.1%	44.4%	11.1%	33.3%	44.4%
Population Density	0%	11.1%	11.1%	0%	11.1%	11.1%
College Graduates	22.2%	11.1%	33.3%	22.2%	11.1%	33.3%
Government Ideology	0%	0%	0%	22.2%	11.1%	33.3%
Citizen Ideology	22.2%	11.1%	33.3%	11.1%	11.1%	22.2%
Legislative Professionalism	0%	0%	0%	11.1%	11.1%	22.2%
Energy Specific Conditions						
Wind Potential	22.2%	22.2%	44.4%	22.2%	33.3%	55.5%
Percent Sunshine	22.2%	11.1%	33.3%	33.3%	11.1%	44.4%
Nuclear Power Plants	11.1%	0%	11.1%	11.1%	22.2%	33.3%
Electric Energy Consumption	55.5%	0%	55.5%	33.3%	11.1%	44.4%
PUC Employees	11.1%	22.2%	33.3%	33.3%	22.2%	55.5%
Green Conditions	22.2%	0%	22.2%	11.1%	11.1%	22.2%
National Policies						
Production Incentive	-	-	-	0%	0%	0%
Modified Accelerated Cost-Recovery System	-	-	-	0%	0%	0%
Business Energy Tax Credit	-	-	-	22.2%	22.2%	44.4%
USDA Rural Energy Program	-	-	-	0%	0%	0%
State Incentive Policies						
Corporate Tax	-	-	-	0%	0%	0%
Personal Tax	-	-	-	0%	22.2%	22.2%
Sales Tax	-	-	-	33.3%	0%	33.3%
Property Tax	-	-	-	11.1%	0%	11.1%
Production Incentive	-	-	-	22.2%	11.1%	33.3%
Production Rebate	-	-	-	22.2%	11.1%	33.3%
Bond	-	-	-	0%	0%	0%
Grant	-	-	-	22.2%	0%	22.2%
Loan	-	-	-	22.2%	11.1%	33.3%
Excise Tax	-	-	-	0%	22.2%	22.2%
Industry Support	-	-	-	0%	0%	0%
State Rules & Regulations						
Renewable Portfolio Standard	44.4%	0%	44.4%	12.5%	0%	12.5%
Green Power Purchasing	-	-	-	37.5%	0%	37.5%
Required Green Power	-	-	-	25%	0%	25%
Public Benefits Fund	-	-	-	12.5%	0%	12.5%
Net Metering	-	-	-	25%	0%	25%

Note: All percentages represent the number of statistically significant results for each variable that identified in the best specified model for each of the nine policies, except for the variables representing the policies that were examined in this chapter, which were only modeled in eight analyses because they all had to be removed from their own analysis.

the national government ought to dominate. However, the states have been heavily involved in adopting policies creating financial incentives to encourage the construction of these resources. An important issue was to determine if states were motivated by national action. As Table 5.19 illustrates, the analyses indicate that the states were acting primarily independent of national action. Only a few policies were influenced by national policy adoption, and this only applied to the adoption of the Business Energy Tax Credit. Regardless, these results suggest that it would be beneficial to control for the influence of the national government on state policy adoption.

These analyses should also illustrate the importance of controlling for previously adopted policies within the policy arena. The basic idea underlying the feedback loops that are inherent to every theory of policymaking is that previously adopted behaviors are going to influence future behavior. However, existing research rarely examines these relationships. I attempt to fully test the influence of pre-existing policies on the adoption of a new policy. As Table 4.19 reveals, not every previously adopted policy has a significant influence on the adoption of a different policy (i.e. corporate tax incentives, state-backed bonds, and industry support), but the cumulative results clearly suggest that existing policies can provide both positive and negative feedbacks. These feedbacks tended to be overwhelmingly positive, which was to be expected. However, there were clearly situations where the existence of a specific policy decreased the likelihood of adoption. Certainly these results should encourage policy adoption scholars to model the effects of other policies in the policy arena.

Another goal of these analyses was to determine if our conceptualization of diffusion influenced the analyses. Rarely is it clear prior to analyzing adoption how states learn from one another. It was expected that there were many equally plausible explanations, and that the only way to know for certain which best represents policy learning was to model each in a competing analysis. Using a Davidson-MacKinnon test, I was able to fit each model into the others to determine which measure of diffusion created the best specified model. Table 5.20 presents the breakdown of best measure of diffusion for each policy and type of model.

Similar to what was found when examining the incentive policies, policy learning about renewable energy rules and regulations follow several paths. Unlike the incentive policies, the

Table 5.20: Summary of Diffusion Measures and Model Specification

	Traditional Models				Expanded Models			
	Best Model[a]	DMT Significant[b]	Estimate Significant[c]	Estimate Negative[d]	Best Model[a]	DMT Significant[b]	Estimate Significant[c]	Estimate Negative[d]
EPA	1	.75	1	1	1	.75	1	1
EPA Hybrid	1	.75	1	0	1	1	0	n/a
Neighbor	2	1	1	0	1	1	1	0
Neighbor Hybrid	1	1	1	0	1	1	1	0
Leader-Laggard	4	3	3	0	5	4	4	0

Notes:
a: The number of times each measure of diffusion was identified as the measure that provided the best specified model
b: The number of times the Davidson-MacKinnon Test identified the measure as being statistically significantly better that the other measures. If a measure was not significantly better than all four measures, a decimal was added to represent the percent of that it was significantly better.
c: The number of times the best specified measure resulted in a statistically significant coefficient estimate.
d: The number of times a significant result was negative.

diffusion variable was statistically significant in fourteen of the eighteen models, which indicates that diffusion is far more important to understanding the adoption of rules and regulations concerning renewable energy. The examination of state rules and regulations more accurately reflects our expectation that diffusion is occurring on most, but not all, state policy adoptions (Mooney 2001). These results also provide additional support that this relationship can be negative as well as positive (e.g. Hays and Glick 1997), as two of the fourteen were a negative relationship.

Table 5.20 also reveals another interesting relationship amongst the data. In both models where the EPA regional diffusion variable is statistically significant, the direction of this relationship is negative. This is consistent with what was found when examining state incentive policies. Again, these results indicate that every time the EPA regional diffusion measure was identified as the best specified model and had a statistically significant coefficient estimate, that estimate was negative. Is this more than a coincidence? Given data limitations this is simply an open question that awaits future analysis.

When conceptualizing diffusion in several different manners, it is expected that not all of the policies will spread in the same manner. It is possible that certain policies are more likely to follow a leader-laggard approach, while others may be spread through the assistance of the EPA.

Despite all of the policies examined in this chapter generally falling under the category of rules and regulations, the method of learning within the states varied greatly. As Table 5.20 illustrates, clearly diffusion is not consistent within a policy arena. This suggests that policy scholars should not rely solely on the results of previous policy research in a policy arena to determine what type of diffusion should be modeled. Indeed, the analysis of net metering policies confirms the need to reexamine the possibility that a different measure of diffusion may provide a better understanding of policy adoption than one that was previously identified as important. Moreover, of the eight policies examined, the measure of diffusion that presented the best specified model changed once, suggesting that better models can alter estimations. Together, these results suggest that this approach to identifying the best measure ought to be used by policy scholars.

Finally, while it was not always the case, several models revealed that one form of measuring diffusion created models that were statistically significantly better specified than the others. When this occurred, there can be no doubt that that particular measure was the best. In twelve of the eighteen models, the DMT reveals that one measure of diffusion created a model that was significantly better specified than the four others. Three measures were significantly better than three of the four alternatives, with the exception being the hybrid or regular version of the measure. This is important to note because more than eighty percent of the eighteen models resulted in a measure that created a model that significantly better specified than the others. If any of the other options were used, it would have resulted in inaccurate estimations.

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Section 2:
Policy Evaluation

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Chapter 6:
Promoting Wind Energy:
Evaluating the Effects of State Renewable Energy Incentives

Policy scholarship has grown increasingly sophisticated in the last three decades. As policy studies moved from the general approaches of Lasswell (1956) and Cohen, March and Olson (1972) to the more sophisticated theories of Mazmanian and Sabatier (1981, 1983), Baumgartner and Jones (1993), and Sabatier and Jenkins-Smith (1988) our understanding of the policy process has made giant strides. However, in our quest to create more sophisticated theories, we began to limit the focus of our studies primarily to the adoption process, and to a lesser extent the implementation process.

Understanding if the policies we analyze succeed ought to be an important aspect of policy research. Indeed, Meier (1994, xlv) argues that "policy implementation and policy outcomes are integral parts of the policymaking process and must be studied to obtain an accurate view of a policy." He goes on to say, "Only by determining the impact that public policies have on the public can we get an accurate portrayal of the politics of public policy" (Meier 1994, xlv).

The study of policy impacts is particularly important seeing as the literature seems to suggest that there are a lot of opportunities for a policy to fail. Edelman (1964) was perhaps the biggest proponent that some policies are not intended to have a material impact because they were meant to be symbolic. An examination of the implementation literature reveals several reasons that a policy could fail to achieve its goals. For instance, Mazmanian and Sabatier's (1981; 1983) top-down approach clearly identifies pitfalls that could cause a policy to fail. Furthermore, the literature finds that policies that provide a financial incentive to achieve a policy goal often fail, principally in environmental areas (e.g. Caldwell 1970; Sagoff 1988). In a time of budget crunching and economic hardship, state legislatures and the federal government should be increasingly interested in the outcome of policy analyses.

As the federal and state governments continue to allocate billions of dollars in renewable energy incentives, it is imperative to evaluate whether these policies achieve their goals. With all of the potential pitfalls that could prevent a policy from achieving its goal(s), and the failures of previous environmental incentive policies (e.g. Sagoff 1988), have renewable energy incentive policies provided an incentive for developers to build renewable energy systems?

To answer this question, I evaluate the influence of state and federal renewable energy incentives on the installed wind energy capacity in each state. I will proceed in three parts. First, I discuss renewable energy policy and pertinent policy literature. Second, I analyze the impact of state financial incentives and rules and regulations of renewable energy on the construction of wind turbines. Finally, there will be a discussion of the implications of this project. The results of this examination will identify several renewable energy policies that appear to achieve their goals, and other policies that actually have a negative impact.

Renewable Energy and Policy Analysis

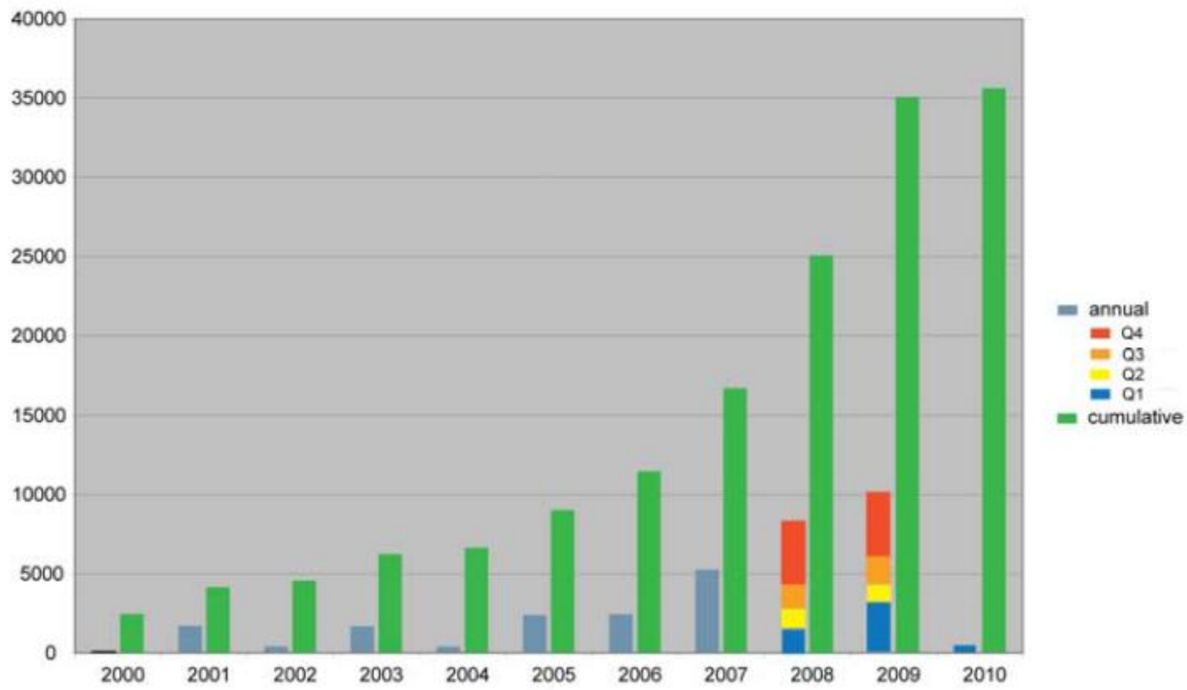
Since the 1970s, public concern about the environment has grown significantly (Kraft and Vig 2005). Previous scholarly attempts to examine the effectiveness of environmental policies have resulted in mixed findings. Scholars have found that these policies do not always meet expectations (e.g. Downing and Kimball 1982; Freeman and Havemen 1972). Moreover, personnel and budgetary shortages, technical and scientific obstacles and uncertainties, and the need for consultation with various levels of government complicate implementation (e.g. Landy, Roberts and Thomas 1994; Marcus 1980).

There are three potential reasons that a renewable energy policy could fail to achieve its goals. First, there could be a problem with the implementation process. Mazmanian and Sabatier (1981; 1983) identify several policy mechanisms that must be in place for a policy to be properly implemented. They suggest that material variables (e.g. technical difficulties, target group behavior, amount of behavior change required), structural variables (i.e. clear and consistent objectives, incorporation of adequate causal theory, hierarchical integration within and among implanting institutions, decisions rules of implementing agencies, recruitment of implementing officials, initial allocation of financial resources, and formal access by outsiders), and contextual variables (e.g. public support, socioeconomic variables, support from legislators, and commitment from implementing official) are important conditions that need to be established (Mazmanian and Sabatier 1983). They argue that a problem at any of these different points could potentially derail the implementation of a policy. If a policy is not correctly implemented, it may not be able to achieve its policy goals.

Second, it is possible that a policy may be a symbolic attempt to appease certain segments of the populace (Edelman 1964). When this occurs, there is a distinct possibility that a policy will end up not having a material impact. Often, there is a problem at the implementation process because interested groups no longer pay attention (Edelman 1964). However, this is not always the case. Sometimes, a policy was never intended to have a material impact because they are limited to a small proportion of the population. This could be the case for several renewable energy policies. For instance, personal tax incentives are unlikely to have a large impact on the construction of renewable energy systems simply because those renewable systems are often too expensive for the typical individual to make the investment, even with the incentive. These policies tend to make specific interests happy, but could ultimately have little impact.

Finally, some scholars would go as far as to say that any attempt to address environmental problems through economic incentives is doomed to failure (i.e. Caldwell 1970; Dryzek 1987; Heilbroner 1974; Ophuls 1977; Sagoff 1988). This isn't to say that environmental

Figure 6.1: Cumulative and Annual Wind Energy Installations in the United States, 2000-2010



Source: AWEA (2010)

policy has all been a failure. Certainly, many environmental policies have achieved their goals (e.g. Magat and Viscusi 1990; White 1982). However, most environmental policies are associated with regulatory changes, and not with financial incentives. The literature indicates that it is these incentives that typically fail (e.g. Sagoff 1988). This line of literature is particularly important since renewable energy is often thought of as an environmental issue, and the national and state governments provide a number of financial incentives to encourage the construction of renewable systems.

An examination of renewable energy policy allows for a unique opportunity to analyze public policy. As Figure 6.1 illustrates, there has been a great deal of wind energy installed since 2000. Have state and national renewable energy policies helped to encourage this growth? With such a large number of competing incentive policies, all of which are intended to increase the likelihood of using renewable energy systems, it is important to evaluate which policies appear to provide a material benefit.

Renewable Energy Policies

The states and national government have adopted several policies that are designed to provide financial incentives for developers to build renewable energy systems. However, states have been more aggressive in their attempts to promote renewable energy. Indeed, several states adopted incentive policies in the late 1970s, while the national government created its first incentive in 1986. Despite several states offering incentives in the early 1980s, the majority of the renewable energy incentive policies have been adopted since 2000.

The national government has been a bit slower to create renewable energy incentive policies. In 1986, they adopted the Modified Accelerated Cost-Recovery System, which modifies the way depreciation is calculated for renewable energy systems (26 USC § 168). In 1992, the national government adopted its Renewable Electricity Production Tax Credit. The production tax credit creates a per-kilowatt-hour tax credit for electricity generated and sold. For wind energy, the developer of a wind farm can deduct 2.2¢ / kWh for up to ten years after a phase has been placed in service (26 USC § 45). In 2002, the national government adopted the USDA Rural Energy for America Program, which provides loan and grant guarantees for the construction of renewable energy systems (7 USC § 8106). Finally, in 2006, they adopted the Business Energy Investment Tax Credit. This tax credit allows for a deduction of up to thirty percent of expenditures (26 USC § 48).

State governments have enacted a wide range of incentive policies in an attempt to encourage renewable energy. As depicted in Tables 2.1 and 2.2, states have adopted several hundred financial incentive policies and rules and regulations. While not all of these apply to wind energy, it is clear that states have been very active in promoting renewable energy development within their borders.

Generally, state tax incentives are treated as deductions on state income taxes. State sales tax incentives allow an individual/developer to deduct any sales tax paid for renewable energy, so long as the sales tax was paid within the state. This deduction can be a bit deceiving since most sales tax is not paid in the state where the renewable energy system is installed because most require purchases directly from the manufacturer. For wind energy, this limits the applicability of these policies since wind turbines are built in only a few states. Property tax incentives vary, while some tend to only apply to the plot of land that the renewable energy system actually occupies, others apply to the value of the system. An excise tax is a tax on goods produced within the state. They are usually associated with the production of goods that can somehow hurt people whether physically (e.g. tobacco, alcohol, etc.) or indirectly through pollution during the production process (e.g. coal or oil-based electricity, steel, etc.). Some states have provisions in their excise tax regulations that apply to all electricity producers, which have caused two states to create tax credits for renewable energy systems since they don't fall into the same category as traditional, pollution creating energy sources.

State production incentives are very similar to the national governments production tax credit, in that they allow those that produce renewable energy to deduct a set amount of money for each kilowatt-hour of energy created. Production rebates, on the other hand, provide a one-time, lump-sum rebate once a renewable energy source is producing energy. Recognizing that supply needed to be increased to meet the demand for renewable systems, many states have adopted industry support policies that help to ease the burden associated with starting a new manufacturing plant that builds these renewable systems. States also provide grants, loans and bonds in an effort to help fund the construction of renewable energy systems.

However, these only tell a part of the renewable energy story. It is important to also focus on the influence of peripheral policies on an outcome. Within renewable energy policy there is a large group of policies that are generally described as rules and regulations. While typically ignored in many analyses, rules and regulations often lay the groundwork for achieving a stated policy goal.

For an inherently complex issue (Gormley 1986), there ought to be a number of rules or regulations that might be needed to encourage the construction of wind turbines. Indeed, through 2009, states have adopted several hundred of these types of policies. Again, not all of these policies include wind energy as a qualifying technology, but it does demonstrate the need for these policies.

Renewable portfolio standards are often considered to be the most important policies to promote the construction of renewable energy systems (Wiser, Porter and Grace 2005) because they mandate that a predetermined percentage of the electricity consumed within a state must be generated by renewable systems, and they are typically politically safe policies to support (Rabe 2007). However, renewable portfolio standards typically do not specify how these goals are to be obtained, or what would happen in the event the stated goals are not met. Green power purchasing policies require that state agencies purchase a certain percentage of their electricity from renewable systems. States that have adopted required green power laws mandate that utility companies provide electricity produced by renewable systems. To help utilities transition to renewable systems several states have adopted public benefits funds, which result in utilities charging a special fee to their customers. This revenue is then used to provide several of the financial incentives previously discussed.

Many states have also created construction and design policies. Some of these require the "greening" of existing state buildings, while others create new building codes pertaining to the retrofitting of renewable systems to an existing structure or adding them to a new structure. Access laws were typically created to benefit the construction of solar arrays and overturn existing county, city, and neighborhood covenant policies that may otherwise prevent the construction of a renewable energy system. Interconnection laws concern the technology and regulations that actually connect a renewable source to the electrical grid.

States have also adopted rules and regulations that have been designed to protect the interests of the public. Net metering policies require that utility companies pay the same rate they charge for extra renewable energy that is put onto the electric grid, often referred to as the deferred costs. A few states require contractors to be licensed in an effort to ensure that renewable systems are installed by reputable and qualified experts. Finally, equipment certification policies are designed to guarantee that the renewable systems installed meet the state's safety and quality criteria.

Each of these rules and regulations are intended to have a positive impact on the construction of renewable energy. While financial incentives tend to generate the most attention, many of these rules and regulations ought to also have a significant impact on construction. To what extent do these policies provide the groundwork to encourage construction? To truly understand impact of renewable energy policies it is essential that these peripheral policies are also modeled along with financial incentives.

Strategy of Analysis

With all of the possible road blocks in their way, have renewable energy policies achieved their intended goals of providing an incentive for the construction of renewable energy systems? There are two possible ways to examine installed wind energy capacity, which is measured in megawatt-hours. First, one could examine the total installed wind power capacity in each state. This approach would result in a dependent variable that would be a cumulative count of capacity in each year, which would model the long-term influence of a policy on capacity. Second, one could examine the total yearly change in wind capacity for each state.[27] Here, the dependent variable would only measure change. This approach would allow for an examination of short-term influence on capacity. Each of these approaches has their advantages and disadvantages for explaining the influence of incentive policies. However, taken together, they would allow for generalizations to be drawn as to the relative effectiveness of each policy. Accordingly, this project will model both measures to provide a more complete analysis.

To determine the influence of renewable energy policies on the construction of wind turbines, data was collected for each state for each year between 1984 and 2008.[28] Both dependent variables are count data, which suggests that either a poisson distribution or a negative binomial distribution would be the best statistical approaches to use in this examination. Because there was overdispersion in both of these measures, a negative binomial cross-sectional

[27] The yearly change in installed wind capacity model is for each state between 1985 and 2008. The year 1984 was dropped from this particular analysis because there was no way to determine how much wind energy was added in California during 1984.
[28] At present time, data is unavailable for installed wind capacity prior to 1984. This limitation only applies to California, who held capacity fairly stable between 1980 and 1985.

time-series model is used to estimate the influence of policies on the construction of wind energy.[29]

Traditionally, policy analyses examine the influence of one policy on whatever phenomenon a policy was designed to impact. This presumes that the influence of public policies operate within a vacuum, and doesn't represent the reality that there might be several policies that concurrently work together to achieve a policy goal. This project seeks to understand the simultaneous impact of all of the incentive policies and rules and regulations on the construction of wind turbines. It is possible the many of the problems that previous incentive policy examinations (e.g. Sagoff 1988) experienced was due to underspecified statistical modeling and this approach ought to best allow for a proper examination of the influence of a policy.

Information on state and federal policies was collected. The data was coded as a cumulative count of the number of policies adopted in a particular policy type (i.e. corporate tax

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[29] A random-effects overdispersion model is used. Therefore, it is assumed that $1/(1 + \delta) \sim \text{Beta}(r,s)$, which allows δ, the dispersion parameter, to vary randomly across groups. The joint probability of the counts for the *i*th group is

$$\Pr\left(Y_{it} = y_{i1}, \ldots, Y_{in_i} = y_{in_i} \middle| X_i\right) = \int \prod_{t=1}^{n_i} \Pr\left(Y_{it} = y_{it} \middle| x_{it}, \delta_i\right) f(\delta_i) d\delta_i$$
$$= \frac{\Gamma(r+s)\Gamma\left(r + \sum_{t=1}^{n_i} \lambda_{it}\right)\Gamma\left(s + \sum_{t=1}^{n_i} y_{it}\right)}{\Gamma(r)\Gamma(s)\Gamma\left(r + s + \sum_{t=1}^{n_i} \lambda_{it} + \sum_{t=1}^{n_i} y_{it}\right)} \prod_{t=1}^{n_i} \frac{\Gamma(\lambda_{it} + y_{it})}{\Gamma(\lambda_{it})\Gamma(y_{it} + 1)}$$

for $X_i = (x_{i1}, \ldots, x_{in_i})$. Where y_{it} is the count for the *t*th observation in the *i*th group, and $\lambda_{it} = \exp(x_{it}\beta + \text{offset}_{it})$. The log likelihood is

$$\ln L = \sum_{i=1}^{n} w_i \left[\ln\Gamma(r+s) + \ln\Gamma\left(r + \sum_{k=1}^{n_i} \lambda_{ik}\right) + \ln\Gamma\left(s + \sum_{k=1}^{n_i} y_{ik}\right) - \ln\Gamma(r) - \ln\Gamma(s) - \ln\Gamma\left(r + s + \sum_{k=1}^{n_i} \lambda_{ik} + \sum_{k=1}^{n_i} y_{ik}\right) + \sum_{t=1}^{n_i} \left\{\ln\Gamma(\lambda_{it} + y_{it}) - \ln\Gamma(\lambda_{it}) - \ln\Gamma(y_{it} + 1)\right\} \right]$$

where w_i is the weight for the *i*th group.

incentives, state-backed loans, production incentives, etc.).[30] A number of states have adopted multiple, similar incentive policies. For instance, in 2001 California adopted its second production rebate, and in 2005 Connecticut adopted its fourth state-backed grant. This process was used to determine the availability of incentives for every state in each policy incentive.[31]

I expect that when compared to corporate incentives, personal level incentives will be less likely to provide a significant influence on installed wind energy. For instance, a personal tax credit is likely to be used to build a relatively small wind turbine, as opposed to a corporate tax incentive that is used to build an entire wind farm. As such, for personal level incentives to have a significant influence on capacity, it would require a massive investment in small turbines every year, whereas one modestly sized wind farm could result in a substantial increase in capacity. Therefore, I expect that personal tax incentives and sales tax incentives are less likely to provide a large impact on wind energy.

Because there are many things that can slow the impact of a policy, it is important to lag the influence of each policy. Indeed, few policies become instantly available. This is particularly the case for state and federal incentives which usually require an administrative arm of the bureaucracy to oversee applications. The implementation of a policy alone suggests that it would take at least one year for a policy to have an impact on wind capacity. As such, it is unreasonable to expect that a production incentive adopted in 2000 would have an impact on the installed wind capacity of 2000, particularly if the incentive couldn't be accessed until 2001.

[30] An attempt was made to code based on the amount each incentive offers. However, several policies do not stipulate maximum values. Instead, these policies allow for a predetermined percentage of costs to be the limit. Additionally, several of these policies do not appear to contain limits for the total amount of money that can be allocated/deducted in a given year, making it impossible to know how to code these policies. As a result, a simple count is the best option available at this time.

[31] Policies that did not include wind energy as an eligible renewable system were not included in this analysis.

Unfortunately, there are several other factors that can slow the impact of a policy. Construction time tables, access to experienced crews, and the availability of wind turbines can also slow the process, thus further pushing the measureable impact of a policy back. Recently, demand for large wind turbines have resulted in back orders that prevent a phase from going online for two years (e.g. Kanellos 2008; Redell 2008).[32] This means that if a policy provides sufficient incentive for a developer to build a wind farm, it could take two years before the additional capacity would be installed, and counted toward the total.

This suggests that each policy needs to be lagged two years before it is reasonable for that policy to produce any additional capacity. Accordingly, each policy is lagged two years. For instance, Kansas adopted a property tax incentive in 2001. Under the two-year lag, it would be coded as a policy from 2003 to 2008. This process was applied to every policy adopted, which meant that any policy adopted in 2007 or 2008 were unable to be modeled.

It is also important to consider several state characteristics because states are expected to be in the best position to respond to local concerns and conditions (Pressman and Wildavsky 1984). I consider the influence of state wind potential, the number of nuclear power plants, electric energy consumption, the number of public utility commission employees, population density, legislative professionalism (Squire 2007) the percent of the state that are college graduates, government and citizen ideology (Berry et al. 1998), the state green policy score (Hall and Kerr 1991), and state green conditions (Hall and Kerr 1991).

[32] Since 2007, the demand for large wind turbines has created sufficient incentives for the construction of additional manufacturing plants across the country. Indeed, when the national government adopted the American Recovery and Reinvestment Act of 2009, they included the Qualified Advanced Energy Manufacturing Investment Tax Credit which would allow the Department of Energy and the Department of Treasury to fund up to thirty percent of a qualified manufacturing plants initial capital investment. Additionally, many states have begun to offer industry support programs to try to lure manufacturing to their states. An increase in manufacturing should reduce the amount of time between ordering a turbine and the delivery of that turbine.

It is anticipated that states with greater wind potential would be more likely to install wind energy.[33] I model the number of nuclear power plants because nuclear power was the original clean power (Ramey 1973). Moreover, nuclear power plants are typically nowhere near production capacity, which suggests that demand for new sources of electrical energy may not be particularly high. Accordingly, I expect that states with more nuclear power plants would be less likely to install wind power. Meanwhile, to help meet demand, states that consume more electric energy ought to be more likely to install wind power. I expect that states with larger numbers of public utility commission employees will be more able to facilitate the coordination between governmental entities and those investing in wind turbines. Likewise, states with more professional legislatures ought to be betters suited to oversee the bureaucracy, which should make it easier for them to ensure that the agencies are properly implementing policies.

Because wind farms currently require large, undeveloped, plots of land, I anticipate that states with lower levels of population density would be more likely to develop wind energy. Generally speaking, I expect that those with more education are better able to process information. Furthermore, those with more education are generally more predisposed to be environmentalists (e.g. Buttel and Flinn 1974). Accordingly, I anticipate that states with a higher percentage of college graduates are more likely to install wind power. Likewise, liberals are generally more predisposed to be environmentalists (e.g. Ellis and Thompson 1997). As such, states with more liberal citizens ought to be more likely to install wind turbines. Similarly, state legislatures that are more liberal should be more accommodating to developers of wind farms. States that generally adopt more environmentally green policies ought to be more likely to see an investment in wind turbines because these states should already have strong base of support for

[33] Wind potential is determined by a variety of characteristics, but is primarily a reflection of the consistent speed of wind across large swaths of land.

these systems. Finally, the environmental conditions within states vary greatly depending upon a whole host of factors such as water and air pollution, community health, agriculture pollution, toxic waste, and even life quality, which includes indicators like recreational waters, visitors to state parks, and conservation members (see Hall and Kerr 1991). I anticipate that states that generally have greener conditions will be more likely to install wind energy.

Finally, a trend variable was added to ensure that duration dependence was not a factor. In particular, this should a problem with the cumulative wind capacity model because there has never been an instance of a decrease in installed capacity. Accordingly, the dependent variable is either always increasing or staying constant. To take this into consideration, a trend variable similar to those created in the policy adoption chapters was created for both dependent variables. For the total installed capacity model, the trend variable was created by taking the square root of the number of years before 2008, which is the year when the most cumulative wind energy capacity existed. For the yearly change in capacity model, I used a trend with a base year of 2007 because that represented the year when the most wind capacity was added. This trend was created by taking the square root of the number of years before and after 2007.

Estimation Concerns

As found when estimating models for Chapters 4 and 5, there was an estimation concern that necessitated the removal of two variables from the statistical model. The statistical software was unable to fit the comparison model because the log-likelihood was "not concave." This meant that the software was unable to even begin to estimate coefficients, even after several thousand iterations. To overcome this problem, variables were added one at a time to the analysis. If a variable caused the log-likelihood to become "not concave," previously added variables would be removed to determine if the problem variable was the new variable, or a combination of variables. In every circumstance where this occurred, the variable that was added when the problem occurred was the culprit, and it was removed from the analysis. For reasons that are unknown, the state-backed bonds and equipment certification variables resulted in the log-likelihood problem in every model they were included, which is why they will not be found in any of the models.[34]

Results

The results indicate that this analytical approach provides a good understanding of how states and the national government can influence the construction of wind turbines. The results of the negative binomial cross-sectional time-series are presented below. The model fit statistics indicate that both models perform well. To simplify the discussion of the statistical findings, the total wind capacity model will be presented first.

Analysis of Total Wind Capacity

The results of the total wind capacity model suggest that there are number of ways that states and the national government influences the construction of wind turbines. Table 6.1 provides the results of the statistical analysis. The estimate for the trend variable indicates that it was important to control for duration dependence.

Beginning with the influence of state characteristics, the results reveal that states with more nuclear power plants, energy consumption, fewer public utility commission employees, more conservative government ideology, greater green conditions, and more professional legislatures are more likely to install wind turbines. The most striking of these results is that the state's wind potential ranking does not appear to have a significant influence on the construction of wind turbines. It is likely that this is being influenced by the lack of development in Kansas,

[34] Both of these policies have only been adopted by two states, which may account for the problem.

Table 6.1: Impact of State and National Incentive Policies and State Rules and Regulations on Installed Wind Energy Capacity

	Total Installed Capacity		Yearly Change in Capacity	
	Coefficient	Probability	Coefficient	Probability
State Incentive Policies				
Corporate Tax	1.324 (.462)	.004	-.101 (.568)	.859
Personal Tax	-1.146 (.393)	.004	.047 (.260)	.917
Sales Tax	.035 (.248)	.885	-.507 (.370)	.171
Property Tax	.459 (.061)	.000	-.135 (.160)	.398
Production Incentives	-.407 (.339)	.230	.118 (.429)	.782
Production Rebates	-.818 (.197)	.000	-.794 (.336)	.018
Grants	-.225 (.134)	.094	.130 (.269)	.629
Loans	.740 (.138)	.000	.356 (.171)	.038
Excise Tax	-.446 (.631)	.479	.434 (.721)	.547
Industry Support	.240 (.178)	.177	-.222 (.245)	.365
State Rules & Regulations				
Renewable Portfolio Standard	-.692 (.156)	.000	-.084 (.261)	.746
Green Power Purchasing	.390 (.248)	.116	-.334 (.525)	.524
Required Green Power	.942 (.371)	.011	.723 (.384)	.060
Public Benefits Fund	.022 (.224)	.919	-.015 (.326)	.963
Construction & Design	-.411 (.162)	.012	-.123 (.331)	.711
Access Laws	-.524 (.304)	.084	-.312 (.288)	.278
Interconnection	.369 (.206)	.074	.444 (.293)	.130
Net Metering	.713 (.126)	.000	.470 (.260)	.071
Contractor Licensing	1.877 (.446)	.000	-.579 (.656)	.378
National Policies				
Production Tax Credit	.993 (.338)	.003	1.130 (.586)	.054
Modified Accelerated Cost-Recovery System	-.730 (.475)	.124	-.643 (.872)	.461
Business Energy Tax Credit	-.270 (.158)	.088	-.141 (.281)	.616
USDA Rural Energy Grant	.249 (.151)	.098	-.237 (.299)	.426
State Characteristics				
State Wind Potential	-.003 (.012)	.764	.087 (.013)	.000
Nuclear Power Plants	.091 (.054)	.093	-.079 (.075)	.291
Energy Consumption	.007 (.002)	.008	.007 (.003)	.048
PUC Employees	-.002 (.0003)	.000	-.00007 (.0004)	.872
Population Density	.0001 (.0007)	.805	-.001 (.0009)	.077
College Graduates	.022 (.015)	.134	.018 (.020)	.357
Government Ideology	-.010 (.005)	.048	-.003 (.006)	.624
Citizen Ideology	.006 (.008)	.437	.013 (.009)	.177
Green Policy	-.0003 (.0002)	.113	.001 (.0002)	.000
Green Conditions	.001 (.0002)	.000	.0001 (.0003)	.583
Legislative Professionalism	5.416 (1.030)	.000	.509 (1.252)	.684
Trend	-1.108 (.100)	.000	-.968 (.186)	.000
Constant	-2.729 (.856)	.001	-6.928 (1.375)	.000
Number of Cases	1250		1200	
Log Likelihood	-1924.565		-1186.445	
Wald Chi^2	2567.76	.0000	462.81	.0000

Standard errors in parentheses. Two-Tailed Tests.

North and South Dakota, Montana and Nebraska, which are five of the top six states in potential. Additionally, states like Oregon and Washington, who are twenty-fourth and twenty-fifth respectively, have a combined total of installed wind capacity greater than the combined total of those five top-ranked states.

Looking at national policies, it is not surprising to find that wind turbines were more likely to be installed after the passage of the federal Production Tax Credit, which interest groups have long advocated was an essential incentive policy (e.g. Krauss 2007). The results also suggest that wind turbines are more likely to be installed after the adoption of the USDA Rural Energy Grant, but less likely following the Business Energy Tax Credit.

The results also indicate that state policies can have an important influence on the construction of wind turbines. Specifically, the findings suggest that states that have adopted corporate tax incentives, property tax incentives, state-backed loans, required green power, interconnection regulations, net metering, and contract licensing rules were more likely to install wind turbines. Additionally, I find that states with personal tax incentives, production rebates, state-backed grants, renewable portfolio standards, construction and design regulations, and access laws were less likely to install capacity. Perhaps the most unexpected of these results is that the renewable portfolio standards appear to have a negative relationship with wind energy. Everything would suggest that a policy that sets goals for renewable energy production would have a positive impact on capacity (Wiser, Porter and Grace 2005). Perhaps this is a reflection of the relatively recent nature of these adoptions, and a little more time would reveal the anticipated relationship. The results also indicate that public benefits funds do not have a significant influence on capacity, which is unexpected since these policies are used to raise the money used to fund other financial incentives.

Analysis of Yearly Change in Capacity

The analysis of yearly change reveal several important influences on capacity, and suggest that it is important to consider analyzing policy impacts in several manners. These results can also be found in Table 6.1. Again, the analysis indicates that duration dependence was a concern, and that a trend variable was needed.

The findings suggest that only the federal Production Tax Credit has a significant influence on yearly change in wind capacity. This suggests that both the Business Energy Tax Credit and USDA Rural Energy Grant may have a cumulative impact, but not a short term influence.

The analysis also identifies several state characteristics that have an important influence on wind capacity. Specifically, states with greater wind potential, greater energy consumption, less population density, and more green policies are more likely to install wind capacity. While wind potential doesn't appear to have a cumulative influence, it certainly has a short term impact that is consistent with what was anticipated.

State policies also play an important short term influence on wind turbine construction. The results indicate that states with state-backed loans, required green power, and net metering are more likely to have higher levels of capacity. However, state production rebates still have a negative impact on capacity. Again, there is no support for the argument that renewable portfolio standards have a significant influence on capacity. The same is true for public benefits funds.

Discussion

The results of these models reveal several important findings. It is clear that it is important to examine the impact of policies in more than one way, if it is an option. While one set of models examined the cumulative effect of policies on installed wind capacity, the other set explored the influence of the same policies on yearly change. At face value, one may not think that there would be much of a difference between these models. However, the data indicates that both approaches are of merit.

The two-model approach allows for a more complete analysis of the impact of policies. If this project had only examined the impact of the policies on one of these two measures, the results would have been incomplete, as would our understanding of how these policies actually influence wind energy construction. Depending upon the dependent variable explored, the results could have overlooked the positive impact of corporate tax incentives or state wind potential. Likewise, and potentially more important for policymakers, the results could have been unaware of the negative impact of state-backed grants. Moreover, this analytical approach reveals that some policies may not have measureable short-term impact, but may actually reveal their importance over time.

Interestingly, the results provide mixed support for the use of financial incentive policies. Incongruent with the findings of Sagoff (1988), Caldwell (1970), and others, the results of the analyses generally find support for some of the incentive-based approaches used by many states. It is possible that these models benefit from the inclusion of all of the policies concerning renewable energy, as opposed to one or two policies. It is also probable that the analytical approach using the cross-sectional negative binomial time-series allowed for more precise coefficient estimates.

Regardless, the data indicate that the positive influence of incentive policies and rules and regulations tend to have more of a cumulative effect than a short-term impact. On the other hand, the results reveal that three incentive policies are consistent with previous research.

Indeed, state personal tax incentives, production rebates, and state-backed grants have a negative impact in the cumulative analysis, while production rebates also has a negative impact in the yearly analysis. The results also indicate that three of the rules and regulations also had a negative impact - renewable portfolio standards, construction and design regulations, and access laws. It was anticipated that personal tax incentives were more likely to be symbolic in nature, so it may not necessarily be that these policies failed to achieve their goals. Nevertheless, the rest of these policies had unanticipated results, and appear to fall under the category of policies that fail to achieve their goals.

By combining the influence of national policies and state policies, this paper also reveals that states can play an important role towards achieving a particular goal even when the national government is actively involved. Importantly, this suggests that states and the national government can work together to achieve these goals. Often, the national government dominates a policy arena when it decides to get involved, while the states play a cursory role. This is particularly true when the issue area is highly complex and salient (Gormley 1986), as with renewable energy. Here, the results clearly suggest that states play an important role in encouraging the development of wind power in their state, while the influence of the national government is also prominent. Indeed, these results find support for Pressman and Wildavsky's (1984) assertion that states are in the best position to adopt policies that impact their environment.

Conclusion

Traditionally, policy scholars tend to focus their examinations on the adoption phase of the policy process. Accordingly, scholars fail to take their examinations to the next level to determine if the policies that are studied actually achieve their goal. With this in mind, I build on the results of Chapters 4 and 5 by conducting a comparative exploration of the impact of state and national policies on installed wind energy capacity.

This project deviates from previous attempts to measure policy impacts in two ways. First, the impact of a given policy is measured against the impact of all of the other policies that seek to achieve the same goal. Typically, policy analysis explores the impact of a single policy on a phenomenon. My approach allows for the analysis of a given policy while controlling for the influence of all of the other policies in a policy arena. This prevents the statistical model from incorrectly measuring policy impact due to an underspecified model. This statistical approach also allows for a more complete understanding of the policy impacts.

Second, this project differentiates itself from previous policy analysis research by examining the impact of policies in more than one way. Usually, policy analysis projects will study the cumulative change in the issue, while others may examine yearly change, but these two approaches are seldom combined. As discussed, this approach allows for a more nuanced examination of the impact of a given policy.

Existing policy analysis literature suggests that achieving goals through incentives typically fails (e.g. Cantwell 1970; Sagoff 1988). While this project doesn't necessarily contradict these findings, it does suggest that this isn't always the case, and that incentive policies can achieve policy goals. The results of this analysis indicate that some policies have a strong positive effect on installed wind energy. Consequently, unlike previous research, this project suggests that legislatures should continue to experiment with incentive policies because some of them may actually work.

Finally, this project demonstrates the necessity of policy scholars to evaluate whether a policy achieves its goals, or if it fails to do so. Research, such as this, could be used by state and federal legislators to determine what type of incentive policies ought to be offered. This research reveals that several state incentive policies may actually be money pits, and this could be very useful information to policymakers. However, it is critical to note that the results presented here only apply to installed wind capacity. It is possible that these policies would have a different impact on the installation of solar power or any of the other eligible renewable systems.

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Chapter 7:
Renewable Energy Policy:
Concluding Observations

Renewable energy has become a multi-billion dollar industry in the United States. Yet, the national government and states have dedicated billions of dollars to helping to support this relatively fledgling industry. I attempt to determine what influences states to adopt policies that encourage the development of renewable energy systems, and I examined if these policies have actually obtain a measurable impact on the construction of wind turbines. Throughout this project, I address several analytical concerns that are commonly found within the policy adoption literature, and attempt to identify a more appropriate way to examine these relationships. In the end, several important conclusions can be drawn from this analysis.

Following the analysis of eighteen state renewable energy policies, it is clear that comparative state policy adoption scholars need to revisit the many theories of public policy. As outlined in Chapter 2, there are three clearly universal themes that can be identified in all of the public policy theories – internal determinants, feedback loops, and the importance of time. Nearly all comparative state policy adoption studies focus on the internal determinants and time, but only a few have included the feedback loop (e.g. Balla 2001; Soule and Earl 2001; Stoutenborough and Beverlin 2008). As illustrated in Chapters 4 and 5, these feedback loops can play an important role in influencing the adoption of a policy. Specifically, the analyses clearly illustrated that the inclusion of previously adopted policies concerning renewable energy influenced the adoption of other policies, and that they provided better specified models of adoption. A comparison of the traditional analyses – those without previously adopted policies – and the expanded analyses – those with previously adopted policies – reveal that there are several significant estimation differences between these types of analyses, which illustrates the importance of controlling for the influence of previously adopted policies. Moreover, this indicates that there may be sequencing in the adoption of policies, such that certain policies are often adopted before others. However, additional research is needed before any process tracing elements to the adoption process can be ascertained.

Additionally, I began to outline a possible relationship between policy diffusion and these feedback loops in Chapter 2. While this relationship still needs to be further developed, there appears to be a connection between the feedback loop and policy diffusion that may suggest that policy diffusion provides the mechanism by which to evaluate the policies that a state currently has. If this relationship is true, then this will help us to better explain how this feedback loop works, and it will securely place the model of policy diffusion (Schlager 2007) within existing policy theories, which should be beneficial for our understanding of policy adoption.

We know that states are constantly learning whether through experience or the sharing of information between states and that states will often compete against one another, which are all characteristics typically associated with driving policy diffusion (Berry and Berry 2007). I begin to explore the possibility that the learning or competitive process that allow states to find out what other states are doing will likely provide the mechanism to evaluate the policies that the state has already adopted to determine if the state needed to adopt a new policy. In short, if a state compares their current policies to those adopted by another state, and determine that their current policies are insufficient, then they are more likely to adopt a policy that is similar to what others have adopted. However, if the state evaluates the policy, and determines that their current policies are sufficient, then they are less likely to adopt. This evaluation process may explain why a state may have several of the same type of policy. For instance, New Mexico has four personal tax incentive policies. This connection between policy diffusion and the feedback loop would explain that as New Mexico learned what other states were doing, they determined that their current personal tax incentives were insufficient, which caused them to adopt additional policies that replicated what other states had adopted.

In addition to illustrating the importance of modeling previously adopted policies, I challenge the way we traditionally model policy diffusion. As argued in Chapter 3, policy adoption scholars typically use the power of fiat to determine which form of diffusion a policy follows. These studies rarely attempt to justify why a particular form was chosen. Moreover, I confront the assumption that regional, or neighbor, diffusion and leader-laggard diffusion are mutually exclusive. I anticipate that there may be leaders and laggards in regional, or neighbor, diffusion, and that states are more likely to turn to their neighbors that are leaders than those that are traditionally laggards for policy solutions. If this presumption is true, then it would be extremely difficult to identify which form of diffusion best explains the spread of policies across the country.

To combat this problem, I proposed that we should model all five forms of diffusion – regional, neighbor, leader-laggard, and a hybrid of both regional and neighbor with leader-laggard. While this is clearly a cumbersome process, Chapters 4 and 5 clearly indicate that this approach will best allow us to explain policy adoption. The results presented in those chapters find that all five forms of diffusion provide the best specified model of policy adoption depending upon the policy examined. In addition to illustrating the importance of modeling multiple forms of diffusion, these results suggest that policy scholars cannot rely on the results of previous diffusion studies to identify what form of diffusion they should model. It is important to correctly measure the influence of policy diffusion because, as Chapters 4 and 5 consistently indicated, relying on an incorrect, or worse specified, measure could result in incorrect coefficient estimates for the independent variables. Beyond estimation concerns, we ought to make sure that we estimate the correct form of diffusion on theoretical grounds as well. If, as argued, each of these five forms of diffusion provide a different theoretical explanation of how learning occurs, it is essential that we get this right.

I also felt it was important to analyze all of the policies using the same statistical approach to allow for comparisons after all of the policies were analyzed. Comparisons across policies within an issue area are rarely, if ever, attempted, and the results of these analyses suggest that this can be an incredibly informative approach to understanding policy adoption. As Tables 4.19 and 5.19 illustrate, internal determinants and previously adopted policies can provide a vastly different influence on policy adoption depending upon the specific policy adoption. While beyond the scope of this current project, future analyses will attempt to better understand why the same variable will have a positive influence on some policies, but a negative influence on others. For instance, as Table 4.19 indicates, why do nuclear power plants provide a positive influence in a third of the models, and a negative influence in another third? This approach to analyzing adoption using the same models can set the stage for analyses that will better allow us to understand exactly how our independent variables interact with our dependent variables.

Through these additions to the policy adoption literature, I am able to provide a strong understanding of what may have influenced a state to adopt a renewable energy policy. Generally, the results indicate that virtually all of the variables can provide either a positive or negative impact, depending upon the actual policy. However, four policies – green power purchasing, required green power, public benefits funds, and net metering – only appear to have a positive impact on the adoption of other policies. Interestingly, three of these policies, green power purchasing, required green power, and public benefits funds, were expected to only have a positive influence on the adoption of another policy. These three, and renewable portfolio standards (which only had a significant negative influence once), were the only four previously adopted policies where it was reasonable to have a preconceived notion of directionality prior to the analyses.

After the analyses of the adoption of all of these policies, I wanted to determine if they were achieving their legislative goals by providing a measurable impact on the construction of renewable systems. Rarely are the policies that are important enough to analyze the adoption process taken to the next logical level – analyzing their impact. Typically, this disconnect is related to the difficulty of gathering data that will allow for such an analysis. Fortunately, there has been a strong effort to track the construction of wind turbines in the United States, which allowed for the analysis of influence of these policies on the installed wind energy capacity in each state.

Traditionally, these types of analyses only examine the impact of policies in one manner. I estimated this relationship in two manners which allow for different interpretations of the impact of the same policies. The first was an analysis of the impact of these policies on the total, cumulative installed capacity in each state. This allows for an analysis of the long-term influence of these policies. The second was an analysis of the yearly installed capacity in each state. In this model, the existence of previously build wind turbines has no influence on the construction of new turbines. This allowed for an analysis of the short-term impact of the policies. The results indicate that this approach is quite useful, as only analyzing this using one approach instead of the other would only tell part of the story, and it may allow for a misinterpretation of the influence of a policy on the construction of wind turbines.

These analyses also differed from previous attempts to measure policy impact by modeling all of the policies at the same time. Policy impact studies have traditionally modeled this process as if they were working in a vacuum where the influence of one policy has absolutely no influence on the influence of another. Instead, it should be clear that all of the policies within the issue area ought to be influencing the dependent variable at the same time. The results of these analyses clearly indicate that this all inclusive approach provides a strong explanation of the influence of any given policy on the construction of wind turbines.

Additionally, previous research into the use of financial incentives to achieve an environmental goal has consistently found that that these policies fail (e.g. Sagoff 1988). By implementing these simple methodological changes, the results indicate that this may not always be true. Indeed, the results find that some policies do provide a negative impact, which is consistent with this research, but other policies clearly have a positive impact. Perhaps these previous studies would benefit from the statistical approach operationalized in Chapter 6.

Finally, this project has uncovered several future avenues of research. As mentioned, I would like to work to better understand the sequencing of policy adoption through a process tracing analysis. I would also like to further explore the relationship between policy diffusion and the feedback loop. I would also like to examine the influence of interest groups on the adoption of renewable energy policies. At this point, it has been difficult to identify all of the interest groups active in renewable energy going back to the 1970s, but I'm hoping that groups that have already been identified will be able to fill in this missing information. In short, there is a lot more research that needs to be done to truly understand renewable energy policymaking.

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References

Adam, Silke, and Hanspeter Kriesi. 2007. "The Network Approach." In Paul A. Sabatier, ed., *Theories of the Policy Process*, 2nd Edition. Boulder, CO: Westview Press.

Agresti, Alan. 1990. *Categorical Data Analysis*. New York: Wiley.

Agresti, Alan. 1996. *An Introduction to Categorical Data Analysis*. New York: Wiley InterScience.

Allen, Mahalley D. 2005. "Laying Down the Law? Interest Group Influence on State Adoption of Animal Cruelty Felony Laws." *Policy Studies Journal* 32(3): 521-544.

Allen, Mahalley D., Carrie Pettus, and Donald P. Haider-Markel. 2004. "Making the National Local: Specifying the Conditions for National Government Influence on State Policymaking." *State Politics and Policy Quarterly* 4(3): 318-344.

Allison, Paul D. 1984. *Event History Analysis*. Sage University Paper series on Quantitative Applications in the Social Sciences, 07-46. Newbury Park, CA: Sage.

American Wind Energy Association (AWEA). May 2010. *Market Watch: Record 2009 Leads to Slow Start in 2010*. Washington D.C.: American Wind Energy Association.

Balla, Steven J. 2001. "Interstate Professional Associations and the Diffusion of Policy Innovations." *American Politics Research* 29(3): 221-245.

Barry, John, Geraint Ellis, and Clive Robinson. 2008. "Cool Rationalities and Hot Air: A Rhetorical Approach to Understanding Debates on Renewable Energy." *Global Environmental Politics* 8(2): 67-98.

Baumgartner, Frank R. 1989. "Independent and Politicized Policy Communities: Education and Nuclear Energy in France and in the United States." *Governance* 2(1): 42-66.

Baumgartner, Frank R., and Bryan D. Jones. 1991. "Agenda Dynamics and Policy Subsystems." *Journal of Politics* 53(4): 1044-1074.

Baumgartner, Frank R., and Bryan D. Jones. 1993. *Agendas and Instability in American Politics*. Chicago: University of Chicago Press.

Baumgartner, Frank R., and Bryan D. Jones. 2002. "Positive and Negative Feedback in Politics." In *Policy Dynamics*, ed. Frank R. Baumgartner and Bryan D. Jones. Chicago: University of Chicago Press.

Beck, Nathaniel, and Jonathan N. Katz. 2001. "Throwing the Baby out with the Bathwater: A Comment on Green, Kim, and Yoon." *International Organization* 55(2): 487-495.

Beck, Nathaniel, Jonathan N. Katz, and Richard Tucker. 1998. "Taking Time Seriously: Time-Series–Cross-Section Analysis with a Binary Dependent Variable." *American Journal of Political Science* 42(4): 1260-1288.

Beck, Nathaniel. 2001. "Time-Series-Cross-Section Data: What Have We Learned in the Past Few Years?" *Annual Review of Political Science* 4: 271-293.

Bell, Derek, Tim Gray, and Claire Haggett. 2005. "The 'Social Gap' in Wind Farm Siting Decisions: Explanations and Policy Responses." *Environmental Politics* 14(4): 460-477.

Berry, Frances Stokes, and William D. Berry. 1990. "State Lottery Adoptions as Policy Innovations: An Event History Analysis." *American Political Science Review* 84(3): 822-840.

Berry, Frances Stokes, and William D. Berry. 2007. "Innovation and Diffusion Models in Policy Research." In Paul A. Sabatier, ed., *Theories of the Policy Process*, 2nd Edition. Boulder, CO: Westview Press.

Berry, William D., and Brady Baybeck. "Using Geographic Information Systems to Study Interstate Competition." *American Political Science Review* 99(4): 505-519.

Berry, William D., Evan J. Ringquist, Richard C. Fording, and Russell L. Hanson. 1998. "Measuring Citizen and Government Ideology in the American States, 1960-93." *American Journal of Political Science* 42(1): 327-348.

Blomquist, William. 2007. "The Policy Process and Large-N Comparative Studies." In *Theories of the Policy Process*, 2nd Edition, ed. Paul A. Sabatier. Boulder, CO: Westview Press.

Box-Steffensmeier, Janet M., and Bradford S. Jones. 2004. *Event History Modeling: A Guide for Social Scientists*. New York: Cambridge University Press.

Brown, Jerry B., Rinaldo S. Brutoco, and James A. Cusumano. 2007. *Freedom From Mid-East Oil*. Ojai, CA: World Business Academy.

Buckley, Jack, and Chad Westerland. 2004. "Duration Dependence, Functional Form, and Corrected Standard Errors: Improving EHA Models of State Policy Diffusion." *State Politics and Policy Quarterly* 4(1): 94-113.

Buttel, F. H., and W. L. Flinn. 1974. "The Structure of Support for the Environmental Movement, 1968-1970." *Rural Sociology* 39(1): 56-69.

Caldwell, Lynton. 1970. *Environment: A Challenge for Modern Society*. Garden City, NJ: The Natural History Press.

Carleyolsen, Sanya. 2006. "Tangled in the Wires: An Assessment of the Existing U.S. Renewable Energy Legal Framework." *National Resources Journal* 46(3): 759-792.

Christensen, Per, and Henrik Lund. 1998. "Conflicting Views of Sustainability: The Case of Wind Power and Nature Conservation in Denmark." *European Environment* 8(1): 1-6.

Cohen, Michael D., James G. March, and Johan P. Olsen. 1972. "A Garbage Can Model of Organizational Choice." *Administrative Science Quarterly* 17(1): 1-25.

Coleman, William. 1991. "Fencing Off: Central Banks and Networks in Canada and the United States." In Policy Networks: Empirical Evidence and Theoretical Consequences, eds Bernd Marin and Renate Mayntz. Frankfurt/Boulder, CO: Campus/Westview Press.

Crotty, Patricia McGee. 1987. "The New Federalism Game: Primacy Implementation of Environmental Policy." *Publius* 17(2): 53-67.

Daley, Dorothy M., and James C. Garand. 2005. "Horizontal Diffusion, Vertical Diffusion, and Internal Pressure in State Environmental Policymaking, 1989-1998." *American Politics Research* 33(5): 615-644.

Davidson, Russell, and James G. MacKinnon. 1993. *Estimation and Inference in Econometrics*. New York: Oxford University Press.

Dawson, Richard E., and James A. Robinson. 1963. "Inter-party Competition, Economic Variables, and Welfare Politics in American States." *Journal of Politics* 25(2):265-289.

Devine-Wright, Patrick. 2005. "Beyond NIMBYISM: Towards an Integrated Framework for Understanding Public Perceptions of Wind Energy." *Wind Energy* 8(2): 125-139.

Downing, Paul, and James Kimball. 1982. "Enforcing Pollution Control Laws in the U.S." *Policy Studies Journal* 11(1): 55-65.

Downs, Anthony. 1957. *An Economic Theory of Democracy*. New York: Harper and Row.

Dryzek, John. 1987. *Rational Ecology: Environment and Political Economy*. New York: Basil Blackwell.

Duffy, Robert J. 1997. *Nuclear Politics in America: A History and Theory of Government Regulation*. Lawrence, KS: University Press of Kansas.

Dye, Thomas R. 1966. *Politics, Economics, and the Public: Policy Outcomes in the American States*. Chicago: Rand McNally.

Easton, David. 1953. The Political System: *An Inquiry into the State of Political Science*. New York: Alfred A. Knopf.

Easton, David. 1965a. *A Systems Analysis of Political Life*. New York: Wiley.

Easton, David. 1965b. *A Framework for Political Analysis*. Englewood Cliffs, NJ: Prentice-Hall.

Edelman, Murray. 1964. *The Symbolic Uses of Politics*. Urbana, IL: University of Illinois Press.

Ellis, Richard J., and Fred Thompson. 1997. "Culture and the Environment in the Pacific Northwest." *American Political Science Review* 91(4): 885-897.

Firestone, Jeremy, and Willett Kempton. 2007. "Public Opinion about Large Offshore Wind Power: Underlying Factors." *Energy Policy* 35(3): 1584-1598.

Freeman, A. Myrick, and Robert Haveman. 1972. "Clean Rhetoric and Dirty Water." *The Public Interest* 28(1): 51-65.

Gamson, William A. 1989. "Media Discourse and Public Opinion on Nuclear Power: A Constructionist Approach." *American Journal of Sociology* 95(1): 1-37.

Gormley, William T. Jr. 1986. "Regulatory Issue Networks in a Federal System." *Polity* 18(4): 595-620.

Gray, Virginia, and David Lowery. 1988. "Interest Group Politics and Economic Growth in the U.S. States." *American Political Science Review* 82(1): 109-132.

Gray, Virginia, and Russell L. Hanson. 2008. "Preface." In *Politics in the American States: A Comparative Analysis*, Ninth Edition, eds. Virginia Gray and Russell L. Hanson. Washington, D.C.: CQ Press.

Gray, Virginia. 1994. "Competition, Emulation, and Policy Innovation." In *New Perspectives on American Politics,* eds. Lawrence C. Dodd and Calvin Jillson. Washington, D.C.: CQ Press.

Greene, William H. 2000. *Econometric Analysis,* 4th Edition. Upper Saddle River, NJ: Prentice Hall.

Greene, William H. 2008. Econometric Analysis, 6th Edition. Upper Saddle River, NJ: Pearson Prentice Hall.

Grogan, Collen M. 1999. "The Influence of Federal Mandates on State Medicaid and AFDC Decision-Making." *Publius* 29(1): 1-30.

Grossback, Lawrence J., Sean Nicholson-Crotty, and David A. M. Peterson. 2004. "Ideology and Learning in Policy Diffusion." *American Politics Research* 32(5): 521-545.

Haider-Markel, Donald P. 2001. "Policy Diffusion as a Geographical Expansion of the Scope of Political Conflict: Same-Sex Marriage Bans in the 1990's." *State Politics and Policy Quarterly* 1(1): 5-26.

Hall, Bob, and Mary Lee Kerr. 1991. *1991-1992 Green Index: A State-By-State Guide to the Nation's Environmental Health*. Washington, D.C.: Island Press.

Hays, Scott P., and Henry R. Glick. 1997. "The Role of Agenda Setting in Policy Innovation: An Event History Analysis of Living-Will Laws." *American Politics Quarterly* 25(4): 497-516.

Heilbroner, Robert. 1974. *An Inquiry into the Human Prospect*. New York: W.W. Norton.

Hofferbert, Richard I. 1974. *The Study of Public Policy*. Indianapolis: Bobbs-Merrill.

Houck, Jason, and Wilson Rickerson. 2009. "The Sustainable Energy Utility (SEU) Model for Energy Service Delivery." *Bulletin of Science, Technology & Society* 29(2): 95-107.

Hsiao, Cheng. 2003. *Analysis of Panel Data*, Second Edition. Cambridge, UK: Cambridge University Press.

Ingram, Helen, and Anne L. Schneider. 1990. "Improving Implementation through Framing Smarter Statutes." *Journal of Public Policy* 10(1): 66-87.

Ingram, Helen, and Anne L. Schneider. 1993. "Constructing Citizenship." In *Public Policy and Democracy*, eds. Helen Ingram and Steven Smith. Washington D.C.: Brookings Institution.

Ingram, Helen, Anne L. Schneider, and Peter deLeon. 2007. "Social Construction and Policy Design." In *Theories of the Policy Process,* 2nd Edition, ed. Paul A. Sabatier. Boulder, CO: Westview Press.

Jensen, Jason L. 2003. "Policy Diffusion through Institutional Legitimation: State Lotteries." *Journal of Public Administration Research and Theory* 13(4): 521-541.

Jones, Bradford S., and Regina P. Branton. 2005. "Beyond Logit and Probit: Cox Duration Models of Single, Repeating and Competing Events for State Policy Adoption." *State Politics and Policy Quarterly* 5(4): 420-443.

Kanellos, Michael. April 4, 2008. "Wind Turbines in Short Supply." CNET News – Green Tech. Found at < http://news.cnet.com/8301-11128_3-9910667-54.html>. Last accessed March 1, 2009.

Kasperson, Roger E., Gerald Berk, David Pijawka, Alan B. Sharaf, and James Wood. 1980. "Public Opposition to Nuclear Energy: Retrospect and Prospect." *Science, Technology, & Human Values* 5(2): 11-23)

Kennedy, Peter. 2003. *A Guide to Econometrics*, 5th Edition. Cambridge, MA: MIT Press.

Kingdon, John W. 1995. *Agendas, Alternatives and Public Policies,* 2nd Edition. New York: Harper Collins.

Kirst, Michael, and Richard Jung. 1982. "The Utility of a Longitudinal Approach in Assessing Implementation." In *Studying Implementation*, ed. Walter Williams. Chatham, N.J.: Chatham House.

Kiser, Larry L., and Elinor Ostrom. 1982. "The Three Worlds of Action: A Metatheoretical Synthesis of Institutional Approaches." In *Strategies of Political Inquiry*, ed. Elinor Ostrom. Beverly Hills, CA: Sage.

Kitschelt, Herbert B. 1986. "Political Opportunity Structures and Political Protest: Anti-Nuclear Movements in Four Democracies." *British Journal of Political Science* 16(1): 57-85.

Kluklinski, James, Daniel S. Metlay, and W.D. Kay. 1982. "Citizen Knowledge and Choices on the Complex Issue of Nuclear Energy." *American Journal of Political Science* 26(4): 615-642.

Koopmans, Ruud, and Jan Willem Duyvendak. 1995. "The Political Construction of the Nuclear Energy Issue and Its Impact on the Mobilization of Anti-Nuclear Movements in Western Europe." *Social Problems* 42(2): 235-251.

Koroneos, Christopher, Thomas Spachos, and Nikolaos Moussiopoulos. 2003. "Exergy Analysis of Renewable Energy Sources." *Renewable Energy* 28(2): 295-310.

Kraft, Michael E., and Norman J. Vig. 2005. "Environmental Policy from the 1970s to the Twenty-First Century." In *Environmental Policy: New Directions for the Twenty-First Century*, 6th Edition, eds Norman J. Vig and Michael E. Kraft. Washington, D.C.: CQ Press.

Krauss, Clifford. June 1, 2007. "A Promising Energy Source Turns On the Ebb and Flow of Tax Credits." *New York Times,* Section C, Column 2, pg. 1.

Laird, Frank N. 2001. *Solar Energy, Technology Policy, and Institutional Values*. New York: Cambridge University Press.

Landy, Marc K., Marc J. Roberts, and Stephen R. Thomas. 1994. *The Environmental Protection Agency: Asking the Wrong Questions*, 2nd Edition. New York: Oxford University Press.

Langer, Laura, and Paul Brace. 2005. "The Preemptive Power of State Supreme Courts: Adoption of Abortion and Death Penalty Legislation." *Policy Studies Journal* 33(3): 317-340.

League of Conservation Voters (LCV). 2008. *National Environmental Scorecard*. Washington, D.C. [Online]. http://www.lcv.org/scorecard. Accessed August 4, 2009.

Magat, Wesley, and W. Kip Viscusi. 1990. "Effectiveness of the EPA's Regulatory Enforcement: The Case of Industrial Effluent Standards." *Journal of Law and Economics* 33(2):331-360.

Mannheim, Karl. 1936. *Ideology and Utopia*. New York: Routledge.

Marcus, Alfred A. 1980. *Promise and Performance: Choosing and Implementing Environmental Policy*. Westport, CT: Greenwood Press.

Mastrull, Diane. August 23, 2010. "Gubernatorial Candidates Weigh in on Alternative-Energy Portfolio Standards." *Philadelphia Inquirer,* City Edition: C03.

Mazmanian, Daniel A., and Paul A. Sabatier. 1981. *Effective Policy Implementation*. Lexington, MA: Lexington Books.

Mazmanian, Daniel A., and Paul A. Sabatier. 1983. *Implementation and Public Policy*. Glenview, IL: Scott, Foresmen.

McKay, Jim. October 24, 2005. "What's the Alternative? Even as Fossil Fuel Prices Sour, Renewable Energy Sources Still May be Too Expensive." *Pittsburg Post-Gazette*, Business: K-1.

Meier, Kenneth J. 1994. *The Politics of Sin: Drugs, Alcohol, and Public Policy*. Armonk, NY: M. E. Sharpe.

Miller, Alan S. 1995. "Energy Policy from Nixon to Clinton: From Grand Provider to Market Facilitator." *Environmental Law* 25(3): 715-732.

Mintrom, Michael, and Sandra Vergari. 1998. "Policy Networks and Innovation Diffusion: The Case of State Education Reforms." *Journal of Politics* 60(1): 126-148.

Mintrom, Michael. 1997. "Policy Entrepreneurs and the Diffusion of Innovation." American Journal of Political Science 41(3): 738-70.

Mooney, Christopher Z. 2001. "Modeling Regional Effects on State Policy Diffusion." *Political Research Quarterly* 54(1): 103-124.

Mooney, Christopher Z., and Mei-Hsien Lee. 1995. "Legislating Morality in the American States: The Case of Pre-*Roe* Abortion Regulation Reform." *American Journal of Political Science* 39(3): 599-627.

Mooney, Christopher Z., and Mei-Hsien Lee. 2000. "The Influence of Values on Consensus and Contentious Morality Policy: U.S. Death Penalty Reform, 1956-82." *Journal of Politics* 62(1): 223-239.

Morone, J.G., and E.T. Woodhouse. 1989. *The Demise of Nuclear Energy: Lessons for Democratic Control of Technology*. New Haven, CT: Yale University Press.

O'Leary, Rosemary, and Susan Summers Raines. 2001. "Lessons Learned from Two Decades of Alternative Dispute Resolution Programs and Processes at the U.S. Environmental Protection Agency." *Public Administration Review* 61(6): 682-692.

Ophuls, William. 1977. *Ecology and the Politics of Scarcity*. San Francisco: W.H. Freeman.

Ostrom, Elinor. 2005. *Understanding Institutional Diversity*. Princeton, NJ: Princeton University Press.

Ostrom, Elinor. 2007. "Institutional Rational Choice: An Assessment of the Institutional Analysis and Development Framework." In *Theories of the Policy Process*, 2nd Edition, ed. Paul A. Sabatier. Boulder, CO: Westview Press.

Pressman, Jeffrey L., and Aaron Wildavsky. 1984. *Implementation*. Berkely, CA: University of California Press.

Rabe, Barry. 2007. "Race to the Top: The Expanding Role of U.S. State Renewable Portfolio Standards." *Sustainable Development Law & Policy* 7(3): 10-16.

Ramey, James T. 1973. "The Promise of Nuclear Energy." *Annals of the American Academy of Political and Social Science* 410(Nov): 11-23.

Redell, Charles. May 15, 2008. "Avista Buys Wind Near Spokane." Sustainable Industries. Found at <http://www.sustainableindustries.com/energy/18950904.html>. Last accessed October 1, 2008.

Ringquist, Evan J. 1993. *Environmental Protection at the State Level: Politics and Progress in Controlling Pollution*. Armonk, NY: M.E. Sharpe.

Rogers, Everett M. 1995. *Diffusion of Innovations*, 4th Edition. New York: Free Press.

Rothman, Stanley, and S. Robert Lichter. 1987. "Elite Ideology and Risk Perception in Nuclear Energy Policy." *American Political Science Review* 81(2): 383-404.

Sabatier, Paul A. 2007. "The Need for Better Theories." In *Theories of the Policy Process*, 2nd Edition, ed. Paul A. Sabatier. Boulder, CO: Westview Press.

Sabatier, Paul A., and Christopher M. Weible. 2007. "The Advocacy Coalition Framework: Innovations and Clarifications." In *Theories of the Policy Process*, 2nd Edition, ed. Paul A. Sabatier. Boulder, CO: Westview Press.

Sabatier, Paul A., and Hank Jenkins-Smith. 1988. "An Advocacy Coalition Model of Policy Change and the Role of Policy Oriented Learning Therein." *Policy Sciences* 21(2): 129-168.

Sabatier, Paul A., and Hank Jenkins-Smith. 1993. *Policy change and Learning: An Advocacy Coalition Approach*. Boulder, CO: Westview Press.

Sagoff, Mark. 1988. *The Economy of the Earth: Philosophy, Law, and the Environment*. Cambridge: Cambridge University Press.

Schlager, Edella. 2007. "A Comparison of Frameworks, Theories, and Models of Policy Processes." In *Theories of the Policy Process*, 2nd Edition, ed. Paul A. Sabatier. Boulder, CO: Westview Press.

Schneider, Anne, and Helen Ingram. 1988. "Systematically Pinching Ideas: A Comparative Approach to Policy Design." *Journal of Public Policy* 8(1): 61-80.

Schneider, Anne, and Helen Ingram. 1993. "The Social Construction of Target Populations." *American Political Science Review* 87(2): 334-346.

Sharkansky, Ira. 1970. "Environment, Policy, Output, and Impact: Problems of Theory and Method in the Analysis of Public Policy." In *Policy Analysis in Political Science*, ed. Ira Sharkansky. Chicago: Markham Publishing Co.

Shipan, Charles R., and Craig Volden. 2006. "Bottom-Up Federalism: The Diffusion of Anti-Smoking Policies from U.S. Cities to States." *American Journal of Political Science* 50(4): 825-843.

Shipan, Charles R., and Craig Volden. 2008. "The Mechanisms of Policy Diffusion." *American Journal of Political Science* 52(4): 840-857.

Simon, Christopher A. 2007. *Alternative Energy: Political, Economic, and Social Feasibility*. Lantham, MD: Rowman & Littlefield Publishers.

Soss, Joe, Sanford F. Schram, Thomas P. Vartanian, and Erin O'Brien. 2001. "Setting the Terms of Relief: Explaining State Policy Choices in the Devolution Revolution." *American Journal of Political Science* 45(2): 378-395.

Soule, Sarah A., and Jennifer Earl. 2001. "The Enactment of State-Level Hate Crime Law in the United States: Intrastate and Interstate Factors." *Sociological Perspectives* 44(3): 281-305.

Squire, Peverill. 2007. "Measuring State Legislative Professionalism: The Squire Index Revisited." *State Politics & Policy Quarterly* 7(2): 211-227.

Stoutenborough, James W. 2009. "Rethinking State Policy Diffusion: Examining the Role of Leaders and Laggards within Regional Diffusion." Presented at the annual meeting of the Midwest Political Science Association, Chicago.

Stoutenborough, James W., and Matthew Beverlin. 2008. "Encouraging Pollution-Free Energy: The Diffusion of State Net Metering Policies." *Social Science Quarterly* 89(5): 1230-1251.

Strachan, Peter A., and David Lal. 2004. "Wind Energy Policy, Planning and Management Practice in the UK: Hot Air or a Gathering Storm?" *Regional Studies* 38(5): 551-571.

Szarka, Joseph. 2004. "Wind Power, Discourse Coalitions and Climate Change: Breaking the Stalemate?" *Environmental Policy and Governance* 14(6): 317-330.

Thomas, Kerry, Elisabeth Swaton, Martin Fishbein, and Harry J. Otway. 1980. "Nuclear Energy: The Accuracy of Policy Makers' Perceptions of Public Beliefs." *Behavioral Science* 25(5): 332-344.

Toke, David, and Vokmar Lauber. 2007. "Anglo-Saxon and German Approaches to Neoliberalism and Environmental Policy: The Case of Financing Renewable Energy." *Geoforum* 38(4): 677-687.

Toke, David. 2005. "Are Green Electricity Certificates the Way Forward for Renewable Energy? An Evaluation of the United Kingdom's Renewables Obligation in the Context of International Comparisons." *Environment and Planning C: Government and Policy* 23(3): 361-374.

True, James L., Bryan D. Jones, and Frank R. Baumgartner. 2007. "Punctuated-Equilibrium Theory: Explaining Stability and Change in Public Policymaking." In *Theories of the Policy Process*, 2nd Edition, ed. Paul A. Sabatier. Boulder, CO: Westview Press.

United States Code. 1986. 26 USC § 168.

United States Code. 1992. 26 USC § 45.

United States Code. 2002. 7 USC § 8106.

United States Code. 2006. 26 USC § 48.

Van der Pligt, Joop, J. Richard Eiser, Russell Spears. 1981. “Attitudes toward Nuclear Energy: Familiarity and Salience.” *Environment and Behavior* 18(1): 75-93.

Voivontas, D., D. Assimacopoulos, A. Mourenlatos, and J. Corominas. 1998. “Evaluation of Renewable Energy Potential Using a GIS Decision Support System.” *Renewable Energy* 13(3): 333-344.

Volden, Craig. 2006. “States as Laboratories: Emulating Success in the Children’s Health Insurance Program.” *American Journal of Political Science* 50(2): 294-312.

Wald, Matthew L. March 29, 2009. “Cost Works Against Alternative and Renewable Energy Sources in Time of Recession.” *The New York Times*, New York Edition: A18.

Walker, Jack L. 1969. “The Diffusion of Innovations among the American States.” *American Political Science Review* 63(3): 880-899.

Wasserman, Stanley, and Katherine Faust. 1999. *Social Network Analysis: Methods and Applications*. Cambridge, UK: Cambridge University Press.

Welch, Susan, and Kay Thompson. 1980. “The Impact of Federal Incentives on State Policy Innovations.” *American Journal of Political Science* 24(3): 715-729.

White, Lawrence. 1982. “U.S. Mobile Source Emissions Regulation: The Problems of Implementation.” *Policy Studies Journal* 11(1): 77-87.

Wiener, Joshua G., and Tomas M. Koontz. 2010. “Shifting Winds: Explaining Variation in State Policies to Promote Small-Scale Wind Energy.” *Policy Studies Journal* 38(4): 629-642.

Wiser, Ryan, Christopher Namovicz, Mark Gielecki, and Robert Smith. 2007. "The Experience with Renewable Portfolio Standards in the United States." *Electricity Journal* 20(4): 8-20.

Wiser, Ryan, Kevin Porter, and Robert Grace. 2005. "Evaluating Experience with Renewable Portfolio Standards in the United States." *Mitigation and Adaption Strategies for Global Change* 10(2): 237-263

Yamaguchi, Kazuo. 1992. *Event History Analysis*. Newbury Park: Sage.

Zahariadis, Nikolaos. 2007. "The Multiple Streams Framework: Structure, Limitations, Prospects." In *Theories of the Policy Process*, 2nd Edition, ed. Paul A. Sabatier. Boulder, CO: Westview Press.

Appendix A

EPA Regions:

EPA Region 1 – Connecticut, Massachusetts, Maine, New Hampshire, Rhode Island, Vermont
EPA Region 2 – New Jersey, New York
EPA Region 3 – Delaware, Maryland, Pennsylvania, Virginia, West Virginia
EPA Region 4 – Alabama, Georgia, Florida, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee
EPA Region 5 – Illinois, Indiana, Michigan, Minnesota, Ohio, Wisconsin
EPA Region 6 – Arkansas, Louisiana, New Mexico, Oklahoma, Texas
EPA Region 7 – Iowa, Kansas, Missouri, Nebraska
EPA Region 8 – Colorado, Montana, North Dakota, South Dakota, Utah, Wyoming
EPA Region 9 – Arizona, California, Hawaii, Nevada
EPA Region 10 – Alaska, Idaho, Oregon, Washington