Improving the Likelihood of Effective Policy Outcomes:

A Theory of Policy Diffusion Program Evaluation

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We present an individual-level theory which explains how decision-making during the policy adoption process allows policy scholars to understand the likelihood of effective policy outcomes. Unlike other theories of the policy process, we contend that when policy diffusion occurs it is possible to identify the likelihood of effectiveness by examining the causal reasoning that resulted in the diffusion of the policy. We expand upon Oxley and Stoutenborough's (2012) analogy heuristic to identify ways in which policy actors may mistakenly use invalid causal reasoning during situations of policy diffusion, and how this will influence policy effectiveness. We follow the theoretical development with an empirical test of the effectiveness of state renewable energy policies on the construction of wind energy. The results indicate that several of the policies that were diffused relied upon a valid causal structure, while others may not have been as fortunate.

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 substantial progress. In our quest to create more sophisticated theories, policy studies focused on the adoption process and, to a lesser extent, the implementation process. These recent theories, though, rarely help us to understand why one policy would be more effective than another.

Understanding if the policies we analyze are effective has the potential to provide an important contribution 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 link between policy adoption and program evaluation is not always clear. The policy theories offer some insight into the implementation process, but ultimately offer little to help scholars understand why a policy could be effective or ineffective, regardless of the ease in which it was implemented. Indeed, a policy could sail through a legislature with overwhelming bi-partisan support, which could result in a quick, smooth implementation of the policy, but the policy could still be ineffective because the causal reasoning that underpins it inaccurately portrayed the conditions in the state. Our policy theories do not necessarily help us to understand why, when, or how legislative bodies may decide to adopt an ineffective policy.

Recently, Oxley and Stoutenborough (2012) outlined a more precise model of the individual for the theory of policy diffusion. This model goes beyond the traditional reliance on bounded rationality, and outlines a specific way in which humans utilize causal reasoning when engaging in policy diffusion. They argue that policy actors use analogies when copying a policy idea from

another state. They outline a very specific behavioral process, and identify ways in which policy diffusion may occur.

We extend this argument beyond the policy adoption process, and seek to determine how well it informs the examination of policy effectiveness. In other words, does the analogical reasoning that led to diffusion explain the distinction between less effective policies and more effective policies? To examine this question, we explore the influence of the adoption of state renewable energy policies on the construction of wind turbines in their respective states. Did the diffusion of policies that encourage the construction of wind energy facilities rely upon valid causal reasoning?

Program Evaluation

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 the implementation of environmental policies (e.g. Landy, Roberts and Thomas 1994; Marcus 1980).

The extant literature identifies three potential reasons that a renewable energy policy could be ineffective in achieving 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 (i.e. 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 (i.e. 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 many points could potentially derail the implementation of a policy. If these factors are not carefully considered during adoption and implementation, then a policy may not be effective at achieving its 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). Sometimes, a policy was never intended to have a material impact because it is limited to a small proportion of the population. 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). 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 are typically ineffective. 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.

While these explanations certainly help to explain why a policy may be effective, they do not necessarily help us to understand how the adoption process influences the likelihood of effectiveness. For instance, the advocacy coalition framework would certainly be helpful for explaining how the process may lead to a successful implementation of a policy, but it does not provide a theoretical explanation for why some policies are more effective than others. Again, a policy could be implemented in the most ideal manner possibly conceived, but if the causal theory is misapplied, then it will likely be ineffective.

Similarly, the policy theories do not explain why or when a legislature would adopt a symbolic policy. Symbolic policies are inherently difficult to identify, and often require post-hoc observation. While Edelman's observations may be helpful to understand why a policy was ineffective after the fact, it does not help us to identify situations of symbolic policymaking before or when it is occurring.

Finally, the argument that environmental incentive policies simply do not work is compelling. However, can we simply write off an entirely reasonable approach for achieving environmental goals because of a few negative results? Certainly, it would be easy to declare environmental financial incentive policies a money pit, but, again, there is no theoretical explanation within the existing policy theories for why these policies have a higher likelihood of failure.

Policy Diffusion & Analogical Reasoning

Sometimes, legislative bodies adopt a policy with a low likelihood of success to address a particular problem. Conventional wisdom would suggest that by the time a policy works its way through the legislative process, someone would have noticed if the policy was unlikely to succeed at meeting its goals. However, history is filled with legislative bodies adopting policies that, given the conditions within their jurisdiction, were unlikely to be effective. This phenomenon is one of the reasons U.S. states are referred to as "laboratories of democracy." In these situations, the implementation, level of symbolism, and/or characterization as yet another failed incentive policy are red herrings that often mask the adoption of a policy that was unlikely to achieve its goals because the policy was inherently unlikely to address its problem from the beginning.

Recently, Oxley and Stoutenborough (2012) developed a model of individual behavior for policy diffusion based on analogical reasoning, which we believe offers insight into policy effectiveness. Analogical reasoning is a form of causal reasoning rooted in the psychological literature on problem solving that explains how individuals use analogies as a cognitive shortcut (see Bassok 2003). Because the policy process is ultimately a problem solving process, their reliance on analogical reasoning is intuitive, and consistent with the long line of policy diffusion literature.

Oxley and Stoutenborough (2012) suggest that analogies are being used by individuals to provide the causal theory utilized in policy adoption. They argue that policy actors use analogies as a heuristic to save on the cognitive costs involved in innovation. Recent psychological literature on analogy use in decision-making indicates that there are four types of mental tasks when an individual reasons using analogy (Holyoak, Lee and Lu 2010). While these four tasks can be categorized separately, it is likely that an individual would engage in these mental calculations nearly simultaneously and may not recognize them as being separate. Oxley and Stoutenborough argue that because analogies are used in policy adoption, these tasks are occurring at the individual level during the process of policy adoption. Similarly, we will suggest that all four are also essential for explaining how policy actors come to believe that a policy will be effective in cases of policy diffusion.

To provide an example, we will explain the analogy heuristic in terms of renewable energy policies that specifically promote the construction of wind energy, such as a property tax incentive. First, a policy actor must identify a source that has attempted to address a problem and build a causal theory for why the policy might cause the problem to be solved in the source state. The problem, in this scenario, could be that there is not enough energy produced by wind turbines. The source is a state that has already adopted a policy to encourage wind energy, such as the property tax incentive. In this first step, a mental model of why the policy was effective in the source state is developed by the individual making the analogy. This mental representation of the causal theory driving the policy success (or expected success) in the source state provides a basis for comparison to the target state. The target is the state that is trying to solve the problem.

Second, the policy actor builds a map between the characteristics of the source state and the characteristics of the target state. Some characteristics of the policy domain in the source state may either generate or prevent the policy from having its desired effect. For instance, California adopted a property tax incentive to encourage the construction of wind farms and other renewable energy systems. A policy actor in Arizona would like to maximize their state's ability to create wind energy,

and realizes that California has adopted this property tax incentive. The policy actor in Arizona will compare the characteristics of California to those of Arizona in this step. Third, if the characteristics between California and Arizona are believed to be similar, the causal structure is transferred from the source, California, to the target, Arizona. Finally, when the characteristics match adequately, an inference is available to be drawn for the target, Arizona, based on the causal model that came from the source, California.

Does the policy actor believe that the similar characteristics between the source and target would allow the property tax incentive policy to work in Arizona? If yes, then they are likely to advocate for the diffusion of the policy. Importantly, the policy actor in Arizona does not know for certain that the policy will be successful in their state. The analogy that allows the actor to believe that it would be successful is simply a projection that what worked in the source will also work in the target given the similarities between the characteristics and causal relationships.

Oxley and Stoutenborough (2012) argue that this analogy heuristic is what we witness in situations of policy diffusion. In short, they suggest that use of analogies, (1) resembles the expectations of policy diffusion, (2) is consistent with bounded rationality, and (3) allows diffusion scholars to understand the process that results in regional/neighbor, leader-laggard, national interaction, isomorphic, and bottom-up diffusion. Though their argument is far more detailed than what we have thus far reviewed, it appears as though this understanding of policy diffusion offers a theoretical foundation that would allow us to explain the likelihood of policy effectiveness when policies are diffused.

Program Evaluation in Situations of Policy Diffusion

From an adoption perspective, the development of the analogy between a source and target is crucial for explaining how policies spread from state to state. It is cognitively more efficient to copy a policy from another state than it is to innovate. Analogical reasoning appears to provide a reasonable explanation for how individuals behave when engaging in diffusion activities. However, the use of this cognitive shortcut also carries some risk.

If Oxley and Stoutenborough (2012) are correct, then the development of the analogy is also important for understanding policy effectiveness. There are many potential ways in which policy effectiveness can be compromised when using the analogy heuristic. If the causal theory explaining policy effectiveness in the source state is not fully understood, it is possible that the policy will be ineffective in the target state because of this misunderstanding. The problem is that individuals are not always aware that they misunderstand the causal theory in either state. As Confucius is often credited as observing, "To know that we know what we know, and that we do not know what we do not know, that is true knowledge."

There are several ways in which the use of the analogy heuristic can lead to adoption of a policy with a low likelihood of effectiveness. For example, a policy actor can overstate the similarities between the source and the target. When adopted, such a policy would be expected to be effective in theory, but would be ineffective in practice. A similar circumstance could occur when unanticipated effects are the result of the application of a causal theory from a source state in the target state.

Returning to the four mental tasks associated with analogical reasoning, we will explore how it is possible for policy actors to misapply an analogy, and discuss how this could result in ineffective policies. Recall, the second mental task requires the policy actor to map the characteristics that may generate or prevent the policy effect between the source and the target. The actor builds an analogical map of the causal theory that allows the policy to be effective within the source. The more complex the issue domain or the policy, the more difficult it will be to fully comprehend the inference made between the causal theory as it works in the source as it applies in the target. Using the analogy heuristic to adopt a policy in a complex issue domain carries with it a risk of policy ineffectiveness.

It is possible that individuals using the analogy heuristic will focus on characteristics of the policy domain that are unrelated to what actually causes the policy to be effective in the source. Further, some characteristics may lead to unanticipated effects when applied in the policy domain

that are different from those which occurred in the source. An example from the policy diffusion literature illustrates these situations well. Karch observes that "Democratic officials and decisionmakers in liberal states might look to the policies enacted by liberal Democrats in other states as models from which to draw policy lessons" (2007, 64). However, if the liberalness of a state has nothing to do with whether or not a policy is actually effective in the source, such a relationship could lead to an inaccurate inference being made to the target. Perhaps what allows a policy to be effective in the example described by Karch has less to do with their relative liberalness and more to do with the existence of a powerful environmental protection agency within the state.

When important components are left out of the mapping of the causal structure in a source, it is possible that diffusion could lead to an ineffective implementation because that important component does not exist, or cannot exist, in the target. For instance, property taxes may be prohibitive to the development of wind energy in California, but they may not be nearly as high in Arizona. If the property taxes in Arizona were not high enough to cause a wind farm developer to avoid developing in Arizona, as they might in California, it is unlikely that a property tax incentive would be particularly effective as they were not a major concern prior to adoption. In this scenario, one of the primary reasons the property tax incentive was successful in California was the property tax rates in California. If these conditions do not exist in Arizona, and this characteristic was not mapped, the causal structure would be incomplete. Therefore, the analogy would be misapplied when used in Arizona.

To assure that a policy is effective at meeting its goals, policy actors must have a strong understanding of and reliable information about these characteristics. If there is inaccurate information or an incomplete understanding of identified components to the causal theory of the source, it may result in an improperly applied analogy between the source and the target. Remember, analogy use only provides a useful and efficient cognitive shortcut if the actual conditions which cause the policy's effectiveness in the source are also present in the target. The use of a misapplied analogy may be effective at causing someone to be convinced to adopt a policy, but that does not

mean that the policy will be effective. A solid causal theory is required to improve the likelihood of policy effectiveness. The analogy heuristic has substantial potential to mislead policy actors into believing in the effectiveness of a policy when that may not be warranted.

Imitation, Emulation and Competition

These comparison and mapping processes are influenced by the three traditional modes of diffusion: imitation, emulation, and competition (e.g. Karch 2007; Meseguer 2005; 2006a; 2006b; Volden 2006). Imitation refers to the process where a policy is quickly copied from the source to the target without regard for its effectiveness. Emulation refers to when a policy is diffused because it was effective, or at least believed to be effective. According to Oxley and Stoutenborough (2012) competition is a motivation to engage in either imitation or emulation. These three modes are likely to influence the ability of policy actors to use analogies in ways that will lead to effective outcomes.

Use of the analogy heuristic where the source is imitated by the target likely creates a situation where policy effectiveness would be left to chance. Policies that are diffused quickly, particularly before the policy would have had a chance to achieve its goals in the source state, are likely to be imitated (Bache and Olsson 2001). If a policy has not had enough time to demonstrate its effectiveness, how is a policy actor to adequately develop its causal theory? In situations of imitation, it is likely that the causal theory will be based on the expectations in the source state, which may or may not be correct. Thompson (1967) suggest that when the cause/effect relationships are uncertain, an individual will resort to some sort of judgmental strategy, which may be no better than a gut-feeling (Khatri and Ng 2000). If it is impossible to infer the causal theory from source to target because the policy has yet to produce any effects, or consistent effects, how can a target adequately evaluate the likelihood of the policy resulting in similar outcomes, when no outcomes have yet occurred? The simple answer is that it can't. Therefore, when a policy is imitated shortly after the innovator adopts their policy, the analogical reasoning must rely upon assumptions that may, or may not, be accurate or practical.

One of the characteristics of policy emulation is that there is an expectation that a diffused policy was effective in a different state (Karch 2007; Volden 2006). While policy actors in the target may still copy a policy from a source, it is likely that they do so because they believe the policy worked. Accordingly, emulation typically occurs after the initial adopters have had a chance to evaluate the policy (e.g. Leichter 1983, 231-232). This waiting period is beneficial for the effectiveness of the policy because it allows the policy actor in the target to be better able to develop the causal theory. The more time that passes and the more states that adopt a policy, the easier it is for the non-adopter to develop a causal model specifically adapted to the conditions and characteristics of the target state. Indeed, we would expect that as the number of states that adopt a policy increases, the non-adopters will be more efficient at building a complete causal structure that does not contain irrelevant characteristics.

Oxley and Stoutenborough (2012) also suggest that the states are more likely to make slight modifications to a policy when engaging in emulation. They argue that time spent developing a causal theory will likely lead to the identification of important differences between the source and target when the causal model is transferred to the target. Policy actors in the target may recognize that there are some differences between the causal structures, which may require some modifications to the policy. Any modifications to the policy that result from the comparison ought to increase the likelihood that the policy will be effective because the policy actors will have corrected the incongruent aspects of the source policy that would have made it less effective in the target.[1]

Finally, competition has the potential to be an important factor in the likelihood of a target to adopt an effective policy. It has long been accepted that individuals are more likely to engage in risky behavior when faced with competition. If a state is in competition with another state, they may be more likely to risk policy ineffectiveness by rushing the analogical reasoning to justify the diffusion of a policy that was adopted by a competitor. For instance, perhaps a wind farm developer is trying

[1] It is still possible that policy actors in the target overlook important differences. However, we believe that recognition that there are important differences increases the likelihood of effectiveness.

to determine whether their next three projects will be constructed in California or Arizona. California may adopt their property tax incentive as a means to convince the company to come to California. Arizona, not wanting to miss out on the potential benefits associated with the construction of three wind farms in its state may rush to copy California's policy to negate the competitive advantage that California may have gained. However, without understanding the causal theory for California, Arizona policy actors may not realize that their property tax incentive does not provide the same level of incentive as the California policy because California's base rates are substantially higher. The potential for a mistaken inference increases when competition becomes a motivational factor because it could cause a legislative body to rush.

Hypotheses

The preceding discussion provides a theoretical foundation for how Oxley and Stoutenborough's (2012) explanation for individual behavior in situations of policy diffusion informs our understanding of policy effectiveness in situations of diffusion. We believe this conceptualization of individual behavior provides a reasonable basis for how a theory of the policy process contributes to our understanding of policy effectiveness. We ought to be able to predict policy effectiveness by using the causal reasoning that resulted in policy adoption. If the inference made from use of the analogy heuristic is invalid, then there ought to be an increased likelihood that the policy adopted using that reasoning would be less effective, irrespective of the implementation, post-hoc accusations of symbolic politics, and the absolutist declaration that incentive policies will fail. Based on the previous discussion, we offer the several specific hypotheses regarding the relationship between policy effectiveness and analogical reasoning in situations of policy diffusion.

Hypothesis 1: Mistakes in the mapping of the causal structure in a source state will decrease the likelihood of a diffused policy being effective in addressing the problem.

Hypothesis 2: Mistakes in the comparison of the conditions of the source and target relevant to the causal structure will decrease the likelihood of a diffused policy being effective in addressing the problem.

Hypothesis 3A: Policies diffused through imitation will be less likely to be effective in addressing the problem.

Hypothesis 3B: Policies diffused through imitation will be more likely to contain mistakes in the analogical reasoning.

Hypothesis 4A: Policies diffused through emulation will be more likely to be effective in addressing the problem.

Hypothesis 4B: Policies diffused through emulation will be less likely to contain mistakes in the analogical reasoning.

Hypothesis 5A: Policies diffused as a result of competition will be less likely to be effective in addressing the problem.

Hypothesis 5B: Policies diffused as a result of competition will more likely to contain mistakes in the analogical reasoning.

Unfortunately, testing these specific hypotheses is a difficult proposition given data limitations. To ascertain the information necessary to test these specific hypotheses one must conduct interviews with policy actors at the time that the causal structure is being mapped and compared. While the analogies used to advocate for the policy provide insight into a policy's imitation, emulation, or competition status, they are simplifications of the underlying reasoning that drives this process. One concern is that it is difficult to know *a priori* that policy diffusion is occurring. Accordingly, we offer a more general hypothesis that better conforms to the types of data that policy scholars are likely to have available to them with the expectation that future examinations will examine the more specific hypotheses.

Hypothesis 6: Use of the analogy heuristic where the inferences are based on valid causal theory will increase the likelihood of a diffused policy being effective in meeting an expected policy goal.

Analytical Strategy

An examination of renewable energy policy allows for a unique opportunity to examine the link between policy adoption and program effectiveness at the aggregate level. Renewable energy policies ought to be fairly easy to implement as they typically do not necessitate the creation of a large bureaucratic administration or the development of complex regulatory guidelines. Incentive policies ought to be particularly easy to implement, and the types of rules and regulation policies that are relevant to large-scale renewable systems are also relatively simple to implement. Therefore, implementation concerns should not be a large factor in the effectiveness of a renewable energy

policy.[2] Further, this ease of implementation should also make adoption through diffusion more likely.

It is possible that these policies could be symbolic. However, because we are presenting a cross-sectional analysis over time, symbolic policies should not be a concern unless several states adopted the same policy as a symbolic gesture to organized interests. We could presume that the incentive policies are failures as Sagoff (1988) and others might suggest, but as Figure 2 illustrates, there has been a great deal of wind energy installed since 2000. Therefore, the conditions seem ideal to examine the relationship between policy diffusion and policy effectiveness because the three reasons that are usually identified to explain policy ineffectiveness do not appear to a debilitating concern. At the very least, any impact these may have should be minimized.

[Insert Figure 2 about here]

Specifically, we will examine the influence of renewable energy policies that identify wind energy as an eligible technology. Accordingly, the dependent variable will be the total installed large-scale, wind energy capacity measured in megawatt-hours.[3] Data was collected for each state for each year between 1984 and 2008.[4] The dependent variable represents a count of the installed capacity, which requires either a poisson or a negative binomial distribution in the statistical analysis. Because there was overdispersion, a negative binomial cross-sectional time-series model is used to estimate the influence of diffused policies on the construction of wind energy.[5]

[2] Another way to think about this is that Oxley and Stoutenborough (2012) suggest that if analogical reasoning is occurring when diffusion is found, then the transfer and development of the causal structure would at the very least satisfy Mazmanian and Sabatier's (1981; 1983) concerns about the incorporation of an adequate causal theory. Though not discussed by Oxley and Stoutenborough (2012), we would expect that if a policy is diffused, then the target should be aware of any implementation troubles that occurred in the source(s), and may be able to avoid those troubles. Additional research is needed to explore the possibility that the implementation of a policy that was diffused could also be diffused.

[3] There are no reliable estimations for the amount of small-scale wind energy being produced.

[4] Data is unavailable for installed wind capacity prior to 1984. This limitation only applies to California.

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

$$\Pr\left(Y_{it} = y_{i1}, \ldots, Y_{in_i} = y_{in_i} | X_i\right) = \int \prod_{t=1}^{n_i} \Pr(Y_{it} = y_{it} | x_{it}, \delta_i) \, f(\delta_i) d\delta_i$$

Traditionally, policy analyses examine the influence of one policy on a problem. 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 to achieve a policy goal. This project seeks to understand the simultaneous impact of all of the applicable incentive policies and rules and regulations on the construction of wind turbines.[6] This includes both federal and state policies. It is possible that many of the problems that previous incentive policy examinations (e.g. Sagoff 1988) experienced was due to underspecified modeling and this approach ought to allow for a proper examination of policy influence.

Data was collected on the following state renewable energy policies that include wind energy as an applicable technology: corporate tax incentives, property tax incentives, excise tax incentives, production incentives, production rebates, state-backed bonds, state-backed grants, state-backed loans, renewable portfolio standards, green power purchasing, and required green power policies.[7] The following federal programs are included: federal production incentive, business tax credit, and the USDA energy program. The data was coded as a dichotomous variable representing the year in which a policy was adopted, and all subsequent years. Data was even collected for relevant state policies that were not diffused. This is to ensure that our analytical strategy accounts for alternative explanations.

$$= \frac{\Gamma(r+s)\Gamma\left(r+\Sigma_{\mathrm{t=1}}^{\mathrm{n_i}}\lambda_{it}\right)\Gamma\left(s+\Sigma_{\mathrm{t=1}}^{\mathrm{n_i}}y_{it}\right)}{\Gamma(\mathrm{r})\Gamma(\mathrm{s})\Gamma\left(r+s+\Sigma_{\mathrm{t=1}}^{\mathrm{n_i}}\lambda_{it}+\Sigma_{\mathrm{t=1}}^{\mathrm{n_i}}y_{it}\right)}\prod_{t=1}^{n_i}\frac{\Gamma(\lambda_{it}+y_{it})}{\Gamma(\lambda_{it})\Gamma(y_{it}+1)}$$

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

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

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

[6] Several renewable energy policies are designed to apply to small-scale energy production, such as a solar panel on someone's roof. These policies should have no influence on the construction of large-scale wind farms, and will not be included in the analyses.

[7] A brief description of each state renewable energy policy can be found in Appendix A.

Of these eleven state policies; Stoutenborough (2010) identified six as having been diffused: property tax incentives, production rebates, state-backed grants, renewable portfolio standards, green power purchasing, and required green power policies. These six policies are the focus of our examination. In short, did the use of a heuristic lead to policy ineffectiveness?

There are two ways to begin to answer this question. The first would require careful analysis of the legislative records and conducting interviews with policy actors to determine the causal model utilized in the analogical reasoning for all fifty states for more than one hundred actual policies. For obvious reasons, this approach would represent a Herculean task given the lack of availability of state legislative hearing records, communications, speeches, and the likelihood that many sponsors have passed since some of these policies were adopted in the 1980s. Even if we were able to talk to a particular bill's sponsor, it is unlikely that they will still remember the exact causal reasoning that triggered them to draft a bill twenty years ago.

A second option for determining if a valid causal theory was utilized is to examine the characteristics that would be essential to the valid causal theory. In a study of wind energy the obvious characteristic that should influence the effectiveness of a renewable energy policy promoting wind energy is the potential to generate wind energy within that state. Essentially, if the wind does not blow consistently or strong enough to allow for the reliable generation of electricity, it is very unlikely that a wind energy policy will be effective at meeting the goal of actually generating wind energy. If a policy actor does not realize that you need at least moderate levels of wind to generate wind energy, then there is an obvious flaw in their causal reasoning.

Although there are a number of aspects that may be important to ensuring that a policy is effective in a source state, no characteristic should be more fundamental to wind energy than wind itself. Wind is a deceptive characteristic, too. While a policy actor may be able to walk outside and feel the wind blowing, it does not mean that there is sufficient wind to be able to predictably rely upon it for energy generation. The intent of a wind farm, besides turning a profit, is to provide clean energy that will offset the production of energy from a fossil fuel-based plant. If the energy

generation from wind is inconsistent, the fossil fuel-based plant cannot risk decreasing their energy production without chancing black-outs or brown-outs for their customers. Therefore, the potential for large-scale wind generation is essential for a wind energy policy to be effective. If policy actors overlooked, or misunderstood the nature of this relationship, it is possible that they would have misapplied the analogy by adopting a policy that will likely be ineffective. When using an analogy heuristic to imitate policies from other states, this type of oversight is entirely reasonable to expect.

We measure a state's wind potential using estimates provided by the Department of Energy's National Renewable Energy Laboratory that utilize the mapping technology of AWS Truewind, LLC. These estimates are based on wind speeds at a height of 80 meters above ground. The estimates exclude areas that are unlikely to be developed into a wind farm, such as parks, wilderness, urban areas, and bodies of water. By taking these into consideration, we can obtain a more accurate estimation of potential given a maximization of non-excluded land. Additionally, the estimation takes into consideration industry standards for capacity losses of thirty percent or greater due to fluctuations in wind speed. Interestingly, one state, Mississippi, is estimated to have zero potential for wind energy at 80 meters, and they have wisely avoided adopting any policies that encourage the construction of wind turbines.

To fully understand the relationship between renewable energy policies that promote wind energy and the construction of wind turbines, we will present four models. The first set of models will present straightforward analyses that evaluate the influence of any given policy. To illustrate the concerns for proper model specification, we will estimate two versions of this analysis. The first version will only include diffused policies, and the second will include the rest of the applicable state policies. The second set of analyses will interact our measure of wind potential with the adoption of each policy. This interaction should provide insight into the application of the analogies used to diffuse the policies. Like before, we will include two versions of this analysis, one with only the diffused policies, and another with all of the policies. We will continue to interact non-diffused policies to determine if their adoption took into consideration wind. Although this project was

initially informed by Oxley and Stoutenborough's (2012) work on policy diffusion, this should not affect the fundamental need for wind for non-diffused policies to be effective. Additionally, these interactions may provide a useful comparison.

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 wind farm phase from going online for two years (e.g. Kanellos 2008; Redell 2008).[8] 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.[9]

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.

In addition to the state and federal policies and measure of wind potential, we will control for the influence of other characteristics that ought to influence the construction of wind energy in a state. Specifically, we will control for the influence of each state's electrical energy consumption, the number of public utility commission employees, college graduates, citizen ideology (Berry et al. 2010), government ideology (Berry et al. 2010), and legislative professionalism (Squire 2007). These

[8] 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.

[9] Our analysis relies on the assumption that renewable energy policies that promote the construction of large-scale wind farms are actually intended to increase the amount of electricity generated within the state from wind turbines.

characteristics have the potential to influence activities within a state, and their influences must be controlled to ensure the analyses do not suffer from an obvious omitted variable bias.

Finally, we will include a trend variable to ensure that duration dependence is not a factor influencing our analyses. This could be a concern because there has never been a decrease in installed capacity. To take this into consideration, a trend variable was calculated 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 a similar approach to calculating a trend, see Chamberlain and Haider-Markel 2005; Haider-Markel 2001; Mooney and Lee 1995).

Results

We will separate the discussion of the results into two sections. The first will provide the results of our analyses of the effectiveness of renewable energy policies on the construction of wind energy. The second section will present our examination of Hypothesis 6.

Results: Policy Effectiveness Analysis

Given the competing influences of various state and federal policies, are the renewable energy policies that states adopt effective? We presume that these policies were intended to increase the amount of wind energy produced in each state. Therefore, if these policies are effective, we would expect to find a statistically significant positive coefficient estimate for each policy. The results of our analyses are provided in Table 1.

[Insert Table 1 about here]

We have divided this analysis into two models. The first model will present only the influence of state policies that Stoutenborough (2010) identified as having a statistically significant coefficient estimate for policy diffusion. The results indicate that of the six diffused policies, states that adopted property tax incentives and required green power policies were more likely to have higher installed capacity. Conversely, states that adopted a production rebate or state-backed grant policy were likely to have less installed capacity. The results also suggest that renewable portfolio standards and green power purchasing policies had little effect on capacity.

Similarly, the results suggest that the national government's production incentive and USDA Energy Program had a positive influence on wind capacity. However, the Business Energy Tax Credit had a negative influence on capacity. The data also indicate that states with greater wind potential, less energy consumption, more college graduates, more liberal governments, and more professional governments were more likely to have more capacity.

The full model presents a different understanding of the relationship between policies and wind capacity. This model suggests that states that have adopted corporate tax incentives, state-backed loans, and required green power policies were more likely to have higher capacity. The model also reveals that states that adopt production incentives and excise tax incentive policies were less likely to have high levels of capacity. The remaining state policies failed to exert a statistically significant influence on capacity. The analysis indicates that all of the other variables perform the same as they did in the diffusion-only model.

The inclusion of the diffusion-only model illustrates our concerns that policy scholars should have when conducting program evaluations. These analyses usually only examine the influence of the one policy that the project is studying. As these results suggest, these models can yield significantly different results when we include the influence of other policies that could also affect the issue. In short, not including alternative influences could lead to significant specification errors.

This analysis also indicates that environmental incentive policies do not always result in ineffective policies. Although it is not an overwhelming repudiation, the results clearly suggest that state-backed loans and corporate tax incentive policies can yield desirable results. However, the remaining incentive policies performed as this literature would suggest.

Results: Causal Reasoning Analysis

We turn our attention to examining Hypothesis 6, which is a test of whether the inferences made when using an analogy heuristic based on valid causal theory lead to a higher likelihood of effectiveness at meeting a policy goal. We estimate this by interacting wind potential with the adoption of each policy. We expect that a statistically significant positive coefficient estimate for this

interaction with the six diffused policies will indicate that the policy was diffused using an adequately mapped causal structure and sufficient comparison between the source and target. A statistically insignificant or negative coefficient estimate would indicate that states that adopted the diffused policy may have misapplied the analogy. We consider any state which does not have much potential for wind energy to be fundamentally flawed in their expectation that the policy would lead to the policy goal of wind energy production. In this circumstance, we would expect an insignificant or non-positive coefficient. The full model will allow comparisons to be made between diffused policies and non-diffused policies. The results of these analyses are presented in Table 2.

[Insert Table 2 about here]

We are most concerned with the estimates for the interaction variables in the diffusion-only model. The results indicate that states with higher wind potential that also adopted a property tax incentive, a production rebate, and/or a renewable portfolio standard were all more likely to have higher levels of wind energy capacity. This would suggest that states without a lot of potential did not adopt these diffused policies. In other words, these results suggest that these diffused policies were effective in states with a greater potential for wind energy. Conversely, the results indicate that states that adopted green power purchasing policies may have done so without regard for wind potential in their state. Additionally, the data suggests that required green power and state-backed grant policies may have been adopted as a result of the use of invalid causal theory when using an analogy heuristic. The controls for national policies and state characteristics resulted in estimates that were consistent with the results presented in both models of Table 1.

The full model tells a slightly different story. The results still indicate that states that diffused property tax incentives, production rebates, and renewable portfolio standards properly applied the analogies, which has resulted in the policies being effective in these states. As an apparent consequence of the omitted variable bias, green power purchasing policies no longer have a significant negative influence, but, like required green power and state-backed grants, the results indicate that these policies may have diffused to states where the policies will not be as effective

because they do not have much potential for wind energy. The results also indicate that states with low wind potential who adopted corporate tax incentives appeared to be more likely to have wind energy. Finally, none of the other non-diffused policies resulted in a statistically significant relationship between policy adoption and wind potential on wind energy capacity in a state.

Interestingly, this fully specified model is the first to reveal that the federal business energy tax credit may not have a significant influence on the construction of wind farms. Previous models indicated that there was a significant negative relationship, but when the model was further clarified with the interaction, the negative relationship was not as strong as before. Additionally, the influence of electric energy consumption is no longer significant. This was a rather significant change the in the estimation of this coefficient from the diffusion-only model to the full model.

Discussion

The intent of this project was to determine if Oxley and Stoutenborough's (2012) model of the individual for policy diffusion informed our understanding of program evaluation. To empirically test this relationship, we examined the influence of state renewable energy policies on the construction of wind energy in each state. We believe that this project has yielded several important implications for understanding the relationship between policy diffusion and policy effectiveness.

First, we believe the four mental tasks that psychologists have identified during situations of analogical reasoning (e.g. Holyoak, Lee and Lu 2010), and that Oxley and Stoutenborough (2012) suggest is occurring in policy diffusion, should also influence the likelihood of a policy being an effective solution to a problem. We identified several ways in which a policy actor may use invalid causal theory when applying an analogy heuristic. We believe that the absence of a valid causal theory increases the likelihood that any policy adopted using the flawed reasoning to be ineffective at solving the problem.

Second, we believe the results of our analyses provide insight into the analogical reasoning of policy actors in states that diffused property tax incentives, production rebates, state-backed grants, renewable portfolio standards, green power purchasing, and required green power policies. The

results indicate that states that diffused property tax incentives, production rebates, and renewable portfolio standards may have adopted the policies consistent with the use of a valid causal theory. Certainly, for these three policies, the results suggest that the states that should be adopting policies promoting wind energy did actually adopt those policies. However, the results also suggest that many states that should not be adopting wind energy policies because they are unlikely to be particularly effective due to a limited potential for wind energy in the state, still adopted state-backed grants, green power purchasing, and required green power policies.

Also encouraging is that the only policies to have a significant positive relationship with installed wind capacity, when factoring their potential, were the three diffused policies. The only other policy to have a positive influence on wind energy was state production incentives, but they failed to achieve statistical significance. All of the other policies examined had a negative influence on the construction of wind farms. Additional research is needed to determine if this relationship exists in other policy domains.

Third, because there is a clear relationship between valid causal theory and the likelihood of policy effectiveness, we believe this project provides additional support for Oxley and Stoutenborough's (2012) contention that policy diffusion is a product of policy actors engaging in analogical reasoning. Indeed, if this very specific behavior was unable to provide a reasonable explanation for policy ineffectiveness, then it is unlikely that analogical reasoning would represent the model of the individual for the theory of policy diffusion. However, we believe that this provides an excellent explanation for why a policy might be ineffective, even if it was properly implemented.

We encourage policy scholars to understand how the activities of policy actors during the agenda setting and adoption phase will influence the likelihood of policy effectiveness. There is no reason to believe that these should be mutually exclusive topics of study. While there are many reasons that a policy may fail to be effective, we need to understand why a policy that may not suffer from implementation problems would still be ineffective. Theories of the policy process, by and

large, do not offer an explanation for why policy actors may simply adopt a policy using invalid causal theory. We believe that we have filled that gap for policy diffusion.

Fourth, a comparison of the two full models reveals that there is a difference in our evaluations of effectiveness and the application of analogies that may seem counterintuitive. First, the full model examining the relationship between the policies and wind construction indicates that corporate tax incentives, state-backed loans, and required green power policies all have a significant positive impact on the construction of wind energy. Second, the full model examining the relationship between policy adoption and wind potential indicates that there is a significant negative influence for the interaction of corporate tax incentives and insignificant influences for both required green power and state-backed loan policies.

While initially appearing counterintuitive, we believe that these represent a perfect example of states with minimal wind potential maximizing that potential with the assistance of these policies. All three have negative coefficient estimates, which suggest that states with less potential were equally likely to adopt these policies. Because the estimates for required green power and state-backed loans are statistically insignificant, this suggests that these policies have resulted in roughly similar rates of construction in the states that have adopted them, but that there is a slightly greater impact in the states with little potential.

Similarly, the significant negative coefficient for corporate tax incentives indicates that these policies are significantly more effective in the states that have little potential. This may help to explain why corporate tax incentive policies were adopted in the first place. Because policy diffusion could not explain corporate tax incentive policy adoption (Stoutenborough 2010), it is possible that these policies were adopted to benefit particular wind farm developers in states that have little potential. If these policies were adopted with prior knowledge that they would be used in short order to develop a wind farm, it should not be surprising that we find the results that we do. Were state legislators adopting these policies in states with little potential because of campaign donations from the companies that later benefited from the policy? Were these companies serving the

role of policy entrepreneur? Regardless, these results suggest that this should be a topic for further investigation.

Of these three policies, only required green power policies were found to be diffused. The interesting thing about these policies is that we should expect to find that they would have a positive influence on wind energy regardless of wind potential because they mandate the construction of renewable systems. Likewise, we should expect that they would not have a statistically significant impact when interacted with potential. These policies require that utilities provide a predetermined percentage of their electricity from renewable systems. At present time, wind energy is the most efficient of the renewable energy alternatives. Therefore, these should be the systems that utilities would be most likely to turn to if they were required to provide renewable energy. By forcing utilities to invest in renewables, it forces states with relatively little potential to begin to maximize what is available.

In the long-term, these three policies will be fairly ineffective in these states, but in the short-term, these policies appear to be helping these states utilize what little potential they may have. This may provide a useful opportunity to determine how quickly a policy can move from being effective to ineffective. If we were to revisit these analyses in five years, will we find the same relationships? How will improvements to the technologies influence construction of wind turbines?

Fifth, though not discussed earlier, these results provide an explanation for a phenomenon that Stoutenborough (2010) uncovered in his analyses of the adoption of these policies. Specifically, Stoutenborough (2010) found that three of the diffused policies – property tax incentives, production rebates, and required green power – had a negative coefficient estimate in his analyses. Essentially, as more states adopted these policies, non-adopters were less likely to adopt. In each case, he found that the best explanation of policy diffusion was using an EPA regional diffusion model using a technique for determining the best explanation for adoption that was used by Stoutenborough and Beverlin (2008). At the time, Stoutenborough (2010) was unable to provide a reasonable explanation for why EPA regional offices may have actively sought to prevent the diffusion of these policies.

With these results, we begin to have a better understanding of why EPA regional offices may have prevented further diffusion. Two of these policies, property tax incentives and production rebates, were two of the three diffused policies that appear to suggest that states were using valid causal theory when making the decision to adopt these policies. Clearly, states that probably shouldn't adopt these policies did not, and states that should have adopted these policies found that they were effective in promoting the construction of wind farms. Perhaps these EPA regional offices were trying to prevent states with little wind potential from adopting these policies. Similarly, the EPA offices may have been trying to prevent states that did not have much wind potential from mandating the use of renewable sources for their utility companies because the state would not have the wind potential to allow this policy to be effective in the long term.

Sixth, a comparison of the diffusion-only models to the full models reveals that policy evaluation studies may suffer from a significant omitted variable bias if they do not control for the influence of other policies that may impact the issue domain. No model illustrates this concern better than the diffusion-only model examining the effectiveness of diffused state policies. Three of the policies that were identified as having a significant influence on wind farm construction, both positive and negative, were no longer significant in the full model that integrated additional policies. Scholars that are attempting to determine the effectiveness of a policy need to be cognizant of this bias. If the model is underspecified, there may be significantly misestimated relationships. We found this omitted variable bias despite our analysis providing quite robust results and including a fairly large number of variables.

Finally, in the relatively short time that many of these policies have been in existence, it appears as though a few of them have been successful in encouraging the development of wind farms in the state. Importantly, these results suggest that the existing research examining policy effectiveness may have adopted an overly absolutist perspective on the ability of financial incentives to achieve environmental goals. Indeed, the results suggest that two of the incentive policies, corporate tax incentives and state-backed loans, have had a strong influence on the construction of

wind energy. While the absolutist position may be a bit too strong, the rest of the state incentive policies appear to have the observed influence that this literature has typically found. Additionally, we find that federal production incentives and the USDA energy program both provided positive incentives to build wind farms, while the business energy tax credit failed to provide the desired positive impact.

Conclusion

This project began with the intention of better understanding why a policy that has been adopted may, or may not, be effective. The connection between the theories of the policy process and program evaluation has been tenuous at best, and there has been too little effort amongst policy scholars to explain how the behavior that results in policy adoption may influence the effectiveness of a policy. Using Oxley and Stoutenborough's (2012) model of the individual for policy diffusion, we sought to determine if this behavior would inform an examination of policy effectiveness for policies that were diffused. As a result of this endeavor, we can draw the following conclusions.

First, the psychology of analogical reasoning identifies several ways in which a policy actor could be fooled by the use of an analogy heuristic while adopting a policy through policy diffusion. While these mistakes do not necessarily always result in an ineffective policy, they sometimes do. From a theoretical perspective, there is every reason to believe that the theory of policy diffusion will provide insight into studies of policy effectiveness.

Second, by interacting a state condition that is essential for policy effectiveness with the adoption of the policy, we can begin to get an understanding if the analogies that facilitated policy diffusion used valid causal theory. If states that have little potential for wind energy are adopting policies promoting wind energy, these policies will ultimately prove to be ineffective for providing wind energy in the state. While they may appear to be effective in the short term, their long-term effectiveness in enabling the majority, or even a large percent, of the state's energy to come from wind is not possible due to the limited amount of utility-grade wind available. Our analysis indicates that states used valid causal theory when diffusing property tax incentives, production rebates, and

renewable portfolio standard policies. They may not have used valid causal theory in the diffusion of state-backed grants, green power purchasing, and required green power policies.

Finally, evaluations of policy effectiveness need to be aware of the potential for an omitted variable bias in their analyses. As our analyses illustrated, coefficient estimates are easily misestimated if the model is underspecified. This is particularly a concern for program evaluation studies that fail to control for the influence of other policies within the issue domain that could influence the problem.

Appendix A

[Insert Table A1 about here]

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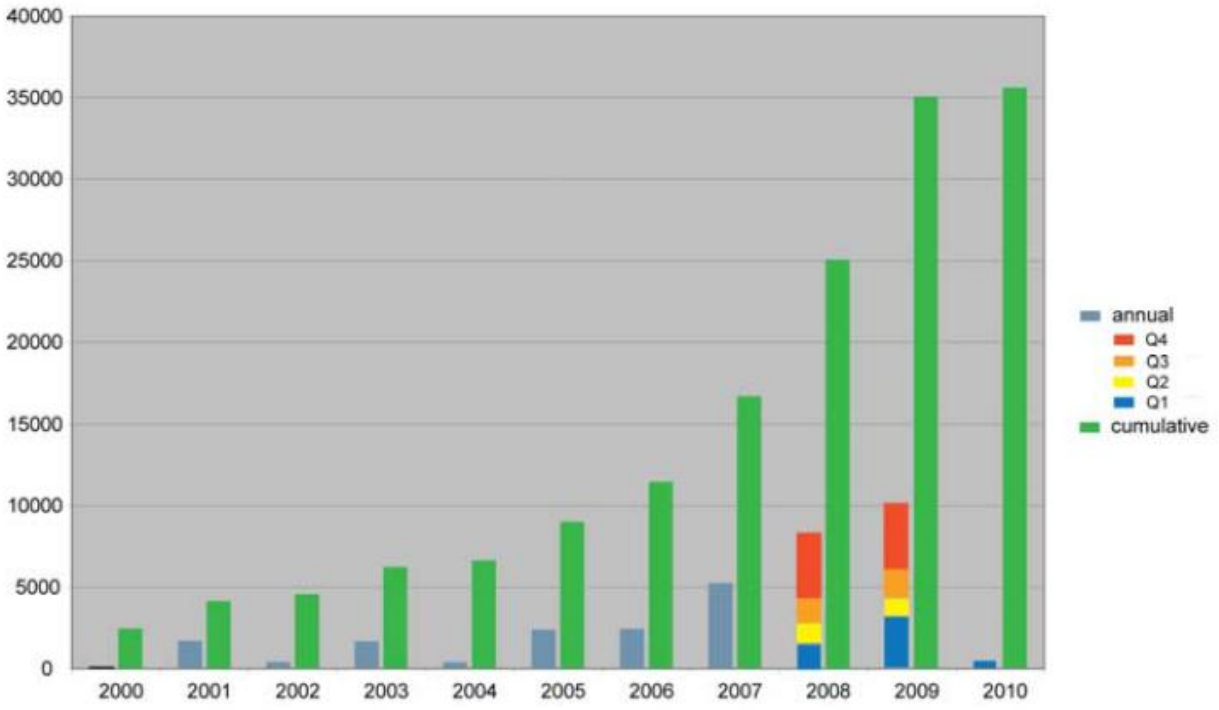
Figure 2: Cumulative and Annual Wind Energy Installations in the United States, 2000-2010



Source: American Wind Energy Association (2010)

Table 1: The Impact of State Renewable Energy Incentives on the Construction of Wind Turbines

	Diffusion-Only Model		Full Model	
	Coefficient	Prob.	Coefficient	Prob.
State Incentive Policies				
Corporate			.851 (.207)	.000
Property	.365 (.157)	.020	.181 (.154)	.238
Production Incentive			-.588 (.299)	.049
Production Rebate	-.433 (.247)	.080	-.344 (.249)	.166
Bond			-.232 (.405)	.568
Grant	-.358 (.171)	.037	-.217 (.181)	.231
Loan			.324 (.161)	.045
Excise Tax			-1.050 (.391)	.007
State Rules and Regulations				
RPS	-.039 (.161)	.808	.063 (.177)	.722
GPP	.432 (.300)	.150	.395 (.294)	.179
RGP	.951 (.324)	.003	.894 (.354)	.012
National Policies				
Production Incentive	1.490 (.289)	.000	1.358 (.288)	.000
Business Tax Credit	-.531 (.190)	.005	-.450 (.184)	.014
USDA Energy Program	.683 (.192)	.000	.692 (.186)	.000
State Characteristics				
Electrical Energy Consumption	-.003 (.001)	.033	-.003 (.001)	.082
PUC Employees	.0001 (.0003)	.659	-.0003 (.0003)	.381
College Graduates	.040 (.013)	.003	.056 (.014)	.000
Citizen Ideology	.006 (.005)	.267	.002 (.006)	.732
Government Ideology	.012 (.002)	.000	.009 (.003)	.002
Legislative Professionalism	3.563 (.752)	.000	4.455 (.768)	.000
Wind Potential	1.37×10^{-6} (2.46×10^{-7})	.000	1.10×10^{-6} (2.63×10^{-7})	.000
Trend	-.915 (.108)	.000	-.917 (.101)	.000
Constant	-3.465 (.717)	.000	-3.572 (.732)	.000
Number of Cases	1250		1250	
Wald Chi2	1417.10	.0000	1415.49	.0000
Log Likelihood	-1992.1604		-1975.2188	

Standard errors are in parentheses. Two-tailed test.

Table 2: The Impact of State Renewable Energy Incentives on the Construction of Wind Turbines: Interaction Model

	Diffusion-Only Model		Full Model	
	Coefficient	Prob.	Coefficient	Prob.
State Incentive Policies				
Corporate			1.418 (.329)	.000
Property	-.062 (.186)	.737	-.312 (.208)	.133
Production Incentive			-.290 (.397)	.465
Production Rebate	-.699 (.311)	.025	-.751 (.344)	.029
Bond			-.188 (.479)	.695
Grant	-.063 (.216)	.770	.041 (.247)	.867
Loan			.471 (.260)	.070
Excise Tax			.953 (1.933)	.622
State Rules and Regulations				
RPS	-.517 (.191)	.007	-.378 (.296)	.202
GPP	.931 (.386)	.016	.867 (.434)	.046
RGP	1.088 (.572)	.057	1.263 (.640)	.049
National Policies				
Production Incentive	1.498 (.289)	.000	1.400 (.293)	.000
Business Tax Credit	-.361 (.199)	.069	-.317 (.194)	.103
USDA Energy Program	.701 (.182)	.000	.682 (.177)	.000
State Characteristics				
Electrical Energy Consumption	-.005 (.002)	.010	-.001 (.002)	.471
PUC Employees	.0003 (.0003)	.380	-.0001 (.0004)	.675
College Graduates	.040 (.013)	.002	.037 (.015)	.016
Citizen Ideology	.001 (.006)	.754	-.005 (.007)	.479
Government Ideology	.012 (.002)	.000	.010 (.003)	.001
Legislative Professionalism	3.475 (.771)	.000	4.077 (.852)	.000
Interaction: State Policy and Wind Potential				
Corporate x Potential			-1.44×10^{-7} (4.92×10^{-7})	.017
Property x Potential	1.30×10^{-6} (4.56×10^{-7})	.004	1.50×10^{-6} (6.12×10^{-7})	.014
Production Incentive x Potential			1.66×10^{-6} (1.29×10^{-6})	.196
Production Rebate x Potential	1.44×10^{-5} (6.48×10^{-6})	.026	1.51×10^{-5} (6.92×10^{-6})	.029
Grant x Potential	-1.22×10^{-6} (7.86×10^{-7})	.122	-8.44×10^{-7} (1.06×10^{-6})	.428
Loan x Potential			-4.49×10^{-7} (6.58×10^{-7})	.495
Excise Tax x Potential			-2.96×10^{-6} (3.47×10^{-6})	.393
RPS x Potential	7.69×10^{-7} (3.41×10^{-7})	.024	6.67×10^{-7} (3.13×10^{-7})	.033
GPP x Potential	-1.00×10^{-5} (5.75×10^{-6})	.082	-7.92×10^{-6} (6.17×10^{-6})	.199
RGP x Potential	-2.60×10^{-7} (1.38×10^{-6})	.850	-2.46×10^{-7} (1.53×10^{-6})	.872
Wind Potential	4.01×10^{-7} (4.10×10^{-7})	.329	8.59×10^{-7} (4.92×10^{-7})	.081
Trend	-.903 (.103)	.000	-.901 (.100)	.000
Constant	-2.940 (.709)	.000	-2.918 (.810)	.000
Number of Cases	1250		1250	
Wald Chi2	1558.74	.0000	1586.02	.0000
Log Likelihood	-1980.3779		-1962.9201	

Standard errors are in parentheses. Two-tailed test.

Table A1: Description of the State Renewable Energy Policies Included in the Analyses

Diffused State Policies	
Property Tax Incentive	Policies that allow an energy producer to deduct all, or a portion, of the property taxes paid on a renewable system.
Production Rebate	Usually, this is a lump sum payment from the state to the energy producer after the renewable system is online.
State-Backed Grant	Policies that allow a state to invest in the development/construction of a renewable system.
Renewable Portfolio Standard	Renewable energy goals established by the legislature. For example, the policy may require that 15% of the state's electricity be generated by renewable systems by 2020.
Green Power Purchasing	Policies that require that state agencies purchase a predetermined percentage of their electricity from renewable systems.
Required Green Power	Policies that require that utilities provide a predetermined percentage of their electricity from renewable systems.
Other State Policies	
Corporate Tax Incentive	Policies that allow an energy producer to deduct a portion of their costs associated with the development/construction of a renewable system.
Production Incentive	Policies that allow an energy producer to deduct a predetermined amount of money for every megawatt of energy produced by a renewable system and fed onto the electric grid.
State-Backed Bond	Policies that allow the state to issue bonds to raise money on behalf of the energy producer at interest rates well below what the producer would have been able to get on their own.
State-Backed Loan	Policies that allow a state to issue loans to energy producers for the development/construction of a renewable system as interest rates that are typically below market rates.
Excise Tax Incentive	Policies that allow an energy producer to deduct all of the excise taxes that are paid on the production of electricity by a renewable system.

Note: There may be variation in the exact provisions of any of these policies from state to state.