The Power of Choice: How Certain Policies Encourage Renewable Energy Development

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Abstract

Despite a great deal of attention paid to state renewable energy potential, there has been relatively little research on specific energy policies and their effect on the generation of renewable energy. This study seeks greater understanding of the state energy policies and how they individually affect the generation of wind, solar and biomass energy. Using a quantitative analysis of data from the United States, the results show that, despite geographic, economic, and political factors playing a significant role in renewable energy, Rebates had the most significant positive relationship to generating renewable energy. Required Green Power and Generation Disclosure policies were also significant and had a positive relationship for certain energy sources. These adopted policies which encourage individual consumer choice are the strongest policy predictors for net renewable energy generation form the aforementioned renewable energy sources.

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CL	=	Contractor Licensing
GD	=	Generation Disclosure
GR	=	Grants
ICS	=	Interconnection Standards
REAL	=	Renewable Energy Access Laws
NM	=	Net Metering
PBF	=	Public Benefit Funds
IS	=	Industry Support
GPP	=	Green Power Purchasing
RGP	=	Required Green Power
CTI	=	Corporate Tax Incentives
LN	=	Loans
PTI	=	Personal Tax Incentives
RTI	=	Property Tax Incentives
LEA	=	Line Extension Analysis
RB	=	Rebates
REPI	=	Renewable Energy Production Incentives
STI	=	Sales Tax Incentives
INCOME	=	Average Gross Household Income Per Capita by State
ED	=	Educational Attainment by State
DHOUSE	=	Democratic Control of State House
DSENATE	=	Democratic Control of State Senate
DGOV	=	Democratic Control of State Governor’s Office
WIND	=	Wind Energy Potential in State
SUN	=	Average Percentage Days of Sun by state
WGA	=	Western Governors Association
RGSPPC	=	Real Gross State Product Per Capita
GSCORE	=	Green Score

1. Introduction

The age of finite energy sources is coming to a close. It is a striking irony that most of the road of human civilization has been paved by the prosperity derived from agriculture and simple technologies such as aqueducts and windmills. The power of the sun was first harnessed to grow grain and as a result, mankind could settle permanently and end their nomadic lifestyle. In short, renewable energy was what lifted the *Homo Sapien* from its humble beginnings to become the dominant species on Earth. When looking through this timescale, non-renewable resources are a popular trend; a limited resource that was found, refined, and used up all in a matter of a few centuries.

While it cannot be disputed that the emergence of the modern industrial age would not have occurred without coal, oil and natural gas, it is uncertain what lies ahead. This study explores the growth of renewable energy in the United States. Specifically, this study compares the energy policies adopted by state governments to stimulate renewable energy in their respective states.

This is the primary question of this study. How do state energy policies have an effect on the development of specific renewable energy technologies? To understand the full scope of the question, it is important to note subordinate questions that will be answered by the study. First, if certain polices are found to affect renewable energy development in either a positive or negative manner, do those policies affect one energy source more than others? Is solar energy affected by policy “A” more than policy “A” affects wind energy development? Not all energy sources are equally distributed, and some energy sources may require different policy regimes to foster the best renewable technology growth.

The second subordinate question: how do politics, geography, culture, education and other control variables play a role in renewable development? Renewable energy is often tied to the environmental movement, which brings with it certain political and cultural stigmas and those that advocate environmental issues are often seen as more progressive or liberal. While policy may be a key factor in the generation of renewable energy, it is also important to recognize other variables which affect renewable energy outcomes. This study will analyze the states in the union and their individual renewable development to see if this assumption holds water.

2. Literature Review

The literature reviewed offered not only vital background information on the growth of renewable in the United States, but also insight into the variables and controls necessary for a robust model. In order to create a viable quantitative analysis to best describe the primary question of this study, literature was examined which could describe various energy policies adopted in the states, factors critical to the discussion of renewable energy, theoretical frameworks which could describe necessary controls in the model and cultural issues that occur in environmental policy.

In *State of the States 2009: Renewable Energy Development and the Role of Policy* by Doris, McLaren, Healy and Hockett of the National renewable Energy Laboratory provided the largest contribution to this study in terms of succinctly explaining the menu of policies states had selected. It also provided information on renewable energy trends for 2008. Although this is not used in this study, it is important for background and context. *State of the States* at its core is an evaluation of the policies adopted by the states and attempts to provide a metric for evaluating the best practices of these policies. While the current study focused on general state energy policy, this piece of literature analyzed policy subsets and combinations of energy policy portfolios.

Doris et al. reached several conclusions. First, that Required Green Power, Renewable Portfolio Standards and Generation Disclosure had the highest number of positive and significant relationships to the development of certain renewable energy sources including hydroelectric and wind.[1] This study also had the luxury of taking into account time lag or the difference in time between a policy adoption and a resulting effect. The paper went further to analyze the importance of state contextual factors of energy development. This arose out of discussion of state outlier omission; the fact that some state produced much higher quantities of renewable energy could have affected the quantitative results. As a note, none of the states in this study were marked as outliers.

State of the States ended with a call for more research, which would include social, political, economic and geographic variables in a study of renewable energy generation.[2] The inclusion of such variables in the present study stems from this point made by the

[1] Doris, E., McLaren, J., Healey, V., & Hockett, S. U.S. Department of Energy, National Renewable Energy Labs. (2009). *State of the states 2009: renewable energy development and the role of public policy*. Washington, DC: Government Printing Office.

[2] Ibid. pg. 137.

authors. The study also concludes with a statement acknowledging the significance of social acceptance of renewable energy as the most important factor to be further studied.

Alternative Energy: Political Economic and Social Feasibility by Christopher A. Simon investigated many of the questions raised by Doris et al. about the social elements of renewable energy development. The author made a statement that echoed other literature: that politics is key to the discussion of energy policy and that the social paradigm in which we all live in is an indicator of how the politics will play out.[3] From this book, many of the political and cultural variables are derived. Simon's book is also important to understanding some of the renewable energy technologies studied in this essay, including wind power and photovoltaic solar.

In the author's discussion of the rise of green politics and environmental interest groups, he explained the New Environmental Paradigm (NEP). This paradigm is in sharp contrast to the typical view on the environment, the Human Exemptionist Paradigm, which considers mankind as exempt from the environmental consequences. NEP considers humans as merely a part of the world's environment, not the primary force for resource consumption.[4] In addition, NEP supporters believe that the environment is a system of interconnected ecosystems which are all affected by happenings in every other.[5] Simon brings this up as a primary motivator for the growth of environmentalism in the 1970's and the reemergence of the movement today.

[3] Simon, C. (2007). *Alternative energy*. Rowman & Littlefield Pub Inc.
[4] Dunlap, R., & Van Liere, K. (2008). The "New Environmental Paradigm". *Journal of Environmental Education*. 40(1), 19-28.

[5] Ibid.

Simon also addresses a number of political elements in the development of renewable energy. These include the creation of the federal Department of Energy in the late 1970's and the subsequent legislative action taken at the national level, including PURPA in 1978 and the EPActs of 1992 and 2005, which were key milestones for federal regulation of national energy markets.[6] This led to the discussion of national policy as a sort of variable or variables in the model. Such variables would take into account bureaucratic interaction between states and the federal government. For this study, this notion was rejected because federal policy was not in the scope of the question. Moreover, federal energy policy and regulatory oversight is assumed to be relatively uniform throughout the United States and therefore held constant in the quantitative analysis.

Theories of the Policy Process by Paul A. Sabatier, which describes the various theories in public policy that have evolved over the last half century, is a useful explanation of the various frameworks used in policy analysis to explain policy action and motivation. The section on policy diffusion and innovation is written by Frances Stokes Berry and William D. Berry. Policy diffusion models seemed a logical place to begin research into a framework for this study since this theory is most used to explain and compare different governments and government agencies. Diffusion describes the world of policy as a game of adaptation of preexisting ideas and motivations, and that only a given few states and entities are innovators in a policy field.[7]

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[6] Simon, C. *Alternative Energy*. Pg.15.
[7] Sabatier, P. (2007). *Theories of the policy process*. Westview Press.

States emulate each other for three reasons. First, they learn from innovative states the most effective means for producing given policy results. Second, states compete with each other for end game economic or political advantage. Third and finally, that states are coerced into adopting certain policies because of pressure from either the federal government or from a large majority of other states.[8] Such considerations are difficult to assess in a quantitative study, especially ambiguities about whether a state is or is not an innovator. Does this mean that the state adopted the policy first or simply created the most original approach? While there seems to be a scarcity of diffusion as it is applied to energy policy, there is different literature in the environmental policy field to be discussed later.

Another consideration mentioned in the section by Berry and Berry and not used in this study is time lag. There appears to be a time lag between adoption of a policy by an innovator state and the application of that policy in a number of other states. As this study employs static data, time lag will be impossible to ascertain quantitatively. With all these exceptions to the framework, this does not mean that Innovation and Diffusion is not applicable to the study.

While Berry and Berry discuss several types of model and sub-theories in innovation and diffusion, the one which appears most applicable to the current study was Internal Determinants Model. This model assumes that political, social and cultural elements are key to the adoption of certain state policies over others.[9] In so doing it reinforces the inclusion of political and cultural variables such as legislative and gubernatorial political control and

[8] Dolowitz, D., & Marsh, D. (1996). Who learns what from whom: a review of the policy transfer literature. *Political Studies*, *44*(1), 343-357.

[9] Sabatier, P. (2007). *Theories of the policy process*. Westview Press. Pg. 232.

the existence of a strong environmental culture through an NEP variable. The other consideration of the internal determinants model is that, despite effects of policy transfer throughout different governments in the United States, with little way to determine this factor, policy transfer is held constant. Additionally, all national considerations, such as federal regulation, are also held constant.

Adoption of State Climate Change and Renewable Portfolio Standards: Regional Diffusion or Internal Determinants by Daniel Matisoff analyzes the theoretical question of whether Renewable Portfolio Standards are adopted as a regional diffusion or internal determinants. Although this piece of literature lumps much of renewable energy policy into the broad category of climate change policy, the model Matisoff describes provides insight into options to be considered for variables in the model. This author supports the inclusion of a variety, if not all, the climate change policies in his model.[10] This inclusion method is used to demonstrate the regulatory activity of the state with respect to climate change. Matisoff does admit that this approach does not test the effectiveness of any adopted policy, which is something to be addressed in this study. [11]

Among the independent variables Matisoff employs include an explanatory variable for air quality. He assumes that a reason for adopting climate change policies is a desire for higher air and water quality.[12] While air and water quality may not be as directly related to the realm of energy policy, this environmental factor does give support for the inclusion of a

[10] Matisoff, D. (2008). "The adoption of state climate change policy and renewable portfolio standards: regional diffusion or internal determinants." *Review of Policy Research*. 25(6), 527-546.

[11] Ibid. pg. 537.
[12] Ibid. pg. 534.

variable that reflects environmental concern in states. Matisoff also includes state income levels and political government control as variables arguing that more affluent populace will be more in favor of renewable energy development. The author further assumes that depending on the political control of the state government, renewable and climate change policy will either be on the agenda or shelved away. Matisoff includes Gross State Product Per Capita, which demonstrates not only the individual wealth of the state, but also the overall prosperity of the economy at an individual level.[13] The belief of Matisoff is that the more prosperous the economy, the more likely the state will favor renewable energy.

Matisoff's model showed that a state's ideology and the existence of poor air quality were significantly related to the development of renewable energy and other climate change policies. In fact, political ideology had a significance level of 0.01, showing the strength of popular ideology in the development of renewable technology. For these reasons, such variables are to be included in the present study.[14]

2.1 Recent Journal Articles

In addition to the abovementioned literature, several journal articles have been recently published regarding renewable energy policy with implications to the United States. The three presented articles were important to provide a context for the past recommendations that may have been conveyed to state and federal policymakers.

[13] Ibid.

[14] Matisoff, D. (2008). "The adoption of state climate change policy and renewable portfolio standards: regional diffusion or internal determinants." *Review of Policy Research*. 25(6), 527-546. Pg. 538.

Fostering a Renewable Energy Technology Industry: An Industrial Comparison of Wind Industry Policy Support Mechanisms by Lewis and Wiser investigates the benefit derived from not only national policies, but also state level ones. It is this sub-national aspect which will receive the most focus. The paper makes a comparative analysis of wind energy programs in twelve countries including the United States. This comparison is accomplished through a cross-sectional study format examining the support mechanisms provided for the development of wind energy.

The article concluded several results. First, in order for wind turbine manufacturers to be internationally competitive, they must initially be competitive and stable at the domestic level. Further, the authors found data to support incentives to alleviate technology barriers to the local manufacturing of wind energy systems. Once these industries are at a suitable size as to no longer require government incentives, the subsidies would be scaled back if not completely removed.

The article creates the implication that technology access is one of the major problems with wind energy development. Lewis and Wiser's conclusions seem to be a plausible explanation for lack of vast wind energy development: lack of technological understanding and manufacturing infrastructure. While the authors only focus on this renewable technology, the conclusions will be taken into account in this study and in the model to be discussed later.[15]

[15] Lewis, J. & Wiser, R. (2007). "Fostering a renewable energy technology industry: an industrial comparison of wind industry policy support mechanisms." *Energy policy*. 35., 1844-1857. Print.

Stability, Participation and Transparency in renewable Energy policy: Lessons from Denmark and the United States by Mendonça at al. addresses a more narrowly focused discussion, the usefulness of energy policies in two nations. This is similar to the current study because of the primary question of the article: What policies are beneficial and which are not? The paper assumes that the best ways to promote renewable energy is through public support and diverse ownership. Diverse ownership is defined by the authors to mean private and public ownership of energy technology to ensure rapid growth of renewable energy development.

The article uses Denmark and the United States as case studies to support their conclusions. For the United States, renewable energy has been incentivized at both state and federal levels through the application of tax credits, which the paper places significant emphasis. While tax credits (according to the authors of the article) have led to rapid growth in American wind and solar, the growth has been in the form of large projects and has provided little to the growth of small-scale energy companies. The article looks at this as a negative and not only encourages more small scale energy generation but also policies which would allow the economic benefits to remain in the local economies.

Mendonça at al. recommend renewable energy policies which encourage transparency and community participation in the process of energy generation. These are the same recommendations made for the state of Denmark. These conclusions are important and lend support to the later results and conclusions of this study.[16]

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[16] Mendonca, M., Lacey, S. & Hvelplund, F. (2009). "Stability, participation and transparency in renewable energy policy: lessons from Denmark and the United States." *Policy and Society*. 27.

Francisco X. Aguilar and Adam Saunders examine biomass energy in *Policy Instruments Promoting Wood-to-Energy Uses in the Continental United States*. This article, published late in the summer of 2009, examines state level energy policy and its implications in the development of wood biomass energy. The author's research into policy shows that tax incentives and other financial instruments are the most likely to be adapted to aid woody biomass development.

There appear to be significant pros and cons to the commonly adopted biomass policies. First, it is important to understand that the paper concludes that most states address biomass as a whole and not based on specific feedstocks, such as wood or cellulosic fiber. Biomass policies are often easily adopted and result in what the authors believe to be limited cost to producers and consumers. The negative effects relate to the inflexibility of these policies which leads to waste or underfunding. An inability to evaluate the amount of cost burden for a given circumstance can result in either too much financial support or too little. This inability of government programs to adjust to individual situations is the major concern of Aguilar and Saunders.[17]

This piece of literature differs from the aforementioned due to its scope of study. It covers a nearly identical range of investigation as this essay. For this reason, the conclusions by the authors are to be taken seriously. Unfortunately, the paper examines much of the detailed components of state biomass policies, something which will not be done in this present study, which should be addressed through further research to corroborate the findings to be discussed later.

[17] Aguilar, F. & Saunders, A. (2010). "Policy Instruments Promoting Wood-to-Energy Uses in the Continental United States." *Journal of Forestry*, 132-140.

3. Types of Renewable Energy

It is important to better understand the variety of renewable energy technologies available to the United States and the rest of the world. Before proceeding, one important semantic distinction should be addressed. There is a tendency to use the terms renewable energy, green energy and alternative energy synonymously. However, to this point these terms have no clearly accepted universal definitions. So, for the purposes of this study, alternative energy is defined as all energy sources, finite and renewable, that do not qualify as traditional (fossil energy) sources. An energy technology such as nuclear energy is finite in nature, but not a fossil fuel.

A renewable energy source is defined herein as one that is both sustainable and non-traditional. The following section lists a selection of the renewable energy sources and provides explanation on how the technology harnesses the forces of nature. The energy types were selected chiefly because of the growing public discussion of these renewables. Additional reasons include the availability of production data and availability of supplementary control variable data.

3.1 Wind Energy

Wind energy was first exploited thousands of years ago. By the industrial revolution, this system of energy production was seen as backward, and society slowly began to favor hydrocarbon energy. Indeed, with the Rural Electrification Act of 1936, which led to much of the Western United States receiving cheap energy from hydroelectric dams, windmill technology fell into disuse.[18] Slowly, and as a result of oil shocks and growing volatility of global energy security, wind power has emerged as the one of most developed renewable energies, second only to hydroelectric power.

Wind energy operates as many other energy systems, as an answer to the classic energy generation question: how to spin a magnetic coil to generate and store electricity. Wind energy harnesses the natural gale forces of the earth to produce such power. Every wind turbine system has three essential parts: the propeller, the rotor and the support assembly. The propeller is the driving force of wind technology, catching the wind which forces the propeller to spin. This spinning action from the propeller sends kinetic energy to the rotor.[19]

The rotor serves two functions. First, it acts as the unit where the wind energy is converted to electricity and houses the electrical generator, called the nacelle. Second, the rotor adjusts the pitch of the propeller blades, which can reduce or increase the speed of the propeller's motion. In the event of high wind conditions, the rotor will adjust accordingly (often automatically and without any external monitoring) to avoid damage to the turbine system.[20]

Finally, the support structure allows for varied heights of wind turbines. Wind energy is harnessed high above the ground, at heights averaging 80 meters. For this reason, a solid structure is required not only to capture the greatest amount of energy, but also to

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[18] Nersesian, R. (2007). *Energy for the 21st century*. M E Sharpe Inc.
[19] Simon, C. (2007). *Alternative energy*. Rowman & Littlefield Pub Inc. pg. 104-106.

[20] Ibid.

ensure longevity of the turbine system. Depending on the height of the structure, wind turbine may also employ cable tethers to buttress the support structure.[21]

Issues abound from wind energy, as well as opportunity. Wind energy is potentially one of the largest renewable resources in the United States, especially for states along the Pacific, Atlantic and in the Great Plains. In fact, states such as Oklahoma have wind potential measured as 123,243.6 km^2 of land suitable for wind energy generation, representing a large and virtually untapped energy resource in that state.[22] However, public support is not uniform throughout the nation. Issues surrounding danger to avian migration are a major factor. Another more challenging hurdle seems to be the aesthetic impact of large wind turbines on the horizon.[23] These issues of public support and other political considerations may be linked to high growth rates of wind energy in certain states.

3.2 Solar Energy

The power of the sun has been a critical element for civilization since the first agricultural society emerged. While still of primary importance to the generation of food, solar energy has expanded through technology to be important to the generation of electricity. There are currently two methods of electricity generation through solar energy. The first, and certainly the older of the two, involves producing steam to push a turbine and

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[21] Simon, C. *Alternative energy*. Pg. 106.

[22] US Department of Energy. (2010). *Estimates of windy land area and wind energy potential for states >=30% capacity factor at 80 Meters*. Washington, DC. Government Press Office.

[23] Sovacool, Benjamin K. "Contextualizing avian mortality: A preliminary appraisal of bird and bat fatalities from wind, fossil-fuel, and nuclear electricity ." *Energy Policy*. 37.6 (2009): 2241-2248. Print.

generate electricity, much the same mechanical principle employed in coal and geothermal power generation.[24] The second involves an electrochemical reaction.

Alexandre Bequerel pioneered electrochemical solar applications in the late nineteenth century. While it was understood that solar energy could illuminate certain substances, it was not until the twentieth century that the principles of photovoltaics would be readily understood and feasible for energy generation.[25] Photovoltaic or “PV” cells, made from crystalline silicon, absorbs the photons within light, which hold a large amount of energy for their size, allowing for rapid collection of massive amount of energy. Silicon is uniquely suited to act as a solar energy medium for its high level of material purity. However, this purity is not absolute. Imperfections are necessary in the silicon film in order for a charge to collect as charges collect around these microscopic anomalies.[26]

PV cells act as essentially a giant battery, and use two types of silicon film are used in the process. The first, called the N-type, is negatively charged during manufacturing. The other silicon film, the P-type, is positively charged. The two are connected by an electrical circuit allowing electrical flow between these two parts of the cell. This circuit is also connected to some sort of device to direct the electricity generated through transmission lines for consumption.[27]

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[24] Libraries, Association, and Roy Nersesian. *Energy for the 21st century*. M E Sharpe Inc, 2007. Print. pg. 315.

[25] Lenardic, Denis. "A walk trough time ." *PV Resources.com*. N.p., n.d. Web. 29 Apr 2010. <http://www.pvresources.com/en/history.php>.

[26] Simon, C. *Alternative energy*. Pg. 89.

[27] Green, M. (2000). "Silicon solar cells: at the crossroads." *Progress in Photovoltaics: Research and Applications*. 8(5), 443 - 450.

Solar energy has developed for use at both the household level, and simultaneously into major industrial solar energy facilities. Much of the individual solar development has been due to local knowledge of the technology as well as state energy incentives to be discussed later. Politics and simple geography also seem to have an effect on this solar development.

3.3 Geothermal Energy

Today, geothermal technology comes in two varieties: closed and open system. A closed system uses water or "brine" from underground to generate electricity. The brine is funneled through pipes into a cistern where the depressurized brine solution results in massive amounts of steam.[28] This in turn pushes a turbine and generates electricity.

Up to this point, the open and closed systems are identical. A closed system from here would pump the brine through an injector well which would put the water back into the underground, super-heated aquifer where it can be reheated by the natural forces of geothermal science.[29] An open system forces the brine solution into either a lake or river. Despite the fact that the solution is mostly water, it does contain some elements considered harmful to humans.

Although some states, especially those in the Western United States have enormous potential for the development of geothermal energy, this renewable resource was excluded for a number of reasons. First, the energy as stated before, is regional specific and therefore

[28] "Basics of Geothermal Energy." *Geothermal Energy Association*. Geothermal Energy Association, Accessed 15 Feb 2010. Retrieved from http://www.geo-energy.org/basics.aspx.

[29] Ibid.

could confound the model. Second, only a few states (mostly in the Southwest) have a significant amount of geothermal energy in its energy generation portfolio. This could further distort the model to be later discussed.

3.4 Biomass Energy

Biomass is the generation of energy from a number of organic materials or organic derivatives. There are five types of biomass fuels: garbage, wood, waste, landfill gas and alcohol fuels such as ethanol.[30] Large commercial electricity generation, which is the subject of this study, comes primarily from miscanthus, switchgrass, hemp, corn, sugarcane, sorghum, and a variety of trees.[31] Poplar is the most common tree exploited for the sole purpose of biomass power generation due to its rapid rate of growth and slow rate of burning. However, in certain regions (especially warmer climates) palm tree and eucalyptus are also used. Biomass material fuel is not always produced for the sole purpose of energy generation as in the case of organic garbage, landfill gas, and the collection of forest residues such as tree stumps and branches, which are secondary-use biomass fuels.

Use of biomass comes in many forms. Some are as simple as burning for the generation of heat. Others involve an initial chemical process of to break down the material to produce a synthetic liquid or gas. The area this study concentrates on primarily is the generation of electricity which occurs either through direct incineration to produce steam,

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[30] *Biomass Energy Centre*. UK Forestry Commission. "Sources of biomass." Accessed 29 Apr 2010. Retrieved From http://www.biomassenergycentre.org.uk/portal/page?_pageid=75,15174&_dad=portal&_schema=PORTAL.

[31] Volk, T., Abrahamson, L., White, E., Neuhauser, E., Gray, E., Demeter, C., & Lindsey, J. (October 15–19, 2000). "Developing a Willow Biomass Crop Enterprise for Bioenergy and Bioproducts in the United States". *Proceedings of Bioenergy 2000*.

or through the indirect process of refining a gas or alcohol to be used in electricity plants, though this last option is less prevalent in the United States.

While biomass is a renewable energy source, it is considered one of the least environmentally friendly as it produces large amounts of carbon dioxide. In fact, the amount of carbon stored in a piece of dry wood is 50 percent of it's weight.[32] This carbon footprint is often offset through the planting of new trees and plants. Biomass crops, which are crops specifically bred for use in generating biomass electricity and biofuels, may sequester or trap carbon from the atmosphere during their growth period, especially in perennial switch grasses and corn according to recent study.

3.5 Hydro and Nuclear, and Other Energy Sources

There are many other sources of electricity generation that are (depending on who you speak to) renewable. Hydroelectric seems to be the most obvious energy technology excluded in this study. Indeed, as much as 75 percent of the total renewable energy produced in the United States by 2007 was from hydroelectric power. However, hydroelectric energy is not a technology one would classify as rapidly expanding. In fact, hydroelectric generation decreased 14.4 percent in 2007. [33] Hydroelectric has undergone extensive study since major construction of hydroelectric dams in the US in 1930. For this reason, it was not included in the current study.

Smith, J., Heath, L., & Jenkins, J. United States. (2009). *Forest Volume-to-Biomass Models and Estimates of Mass for Live and Standing Dead Trees of U.S. Forests*. Washington, DC: Government Press Office.

[33] Doris, E., McLaren, J., Healey, V., & Hockett, S. U.S. Department of Energy, National Renewable Energy Labs. (2009). *State of the states 2009: renewable energy development and the role of public policy*. pg. 11.

Nuclear energy some define as a renewable energy source. This is often the product of its difficulty to categorize. It is certainly an alternative to fossil fuel-based energy technology. However, the process by which nuclear fission produces steam to generate electricity relies on nuclear isotopes which are a finite resource.[34] In addition, the nuclear waste generated by power generation is difficult to store and decays at a rate measured in decades. Nuclear energy is not defined in this study as a renewable and is therefore excluded.

Finally, there are other energy sources, such as hydrogen and wave energy, which may yield enormous future potential in realm of renewable energy. However, these technologies are far from being widely available and used on a national basis in a way similar to wind and solar power. In fact, as much of this study accounts for state renewable energy generation in megawatt hours, some of the state production of, say solar energy, will register as a fraction of a megawatt hour. So, even the more popular renewable energy sources are but a fraction of a state's power production in some cases. This is indicative of the long road renewable energy must traverse to be as highly used as the conventional energy sources. Because other energy technologies are still in the infant stages of development, they were excluded from the study.

[34] France, Nuclear Energy Agency. (2008). *Uranium resources sufficient to meet projected nuclear energy requirements long into the future* Paris, France: Retrieved from http://www.nea.fr/press/2008/2008-02.html

4. Adopted State Energy Policy

States have the option to adopt a number of policies are intended to develop state-level renewable energy. Some policies are more direct (the policies are coercive and effect the energy market with little time lag) while others are implemented to prepare the market for the next wave of renewable technology. The National Renewable Energy Laboratory categorizes these polices into four types: Consumption Access, Education and Information Barriers, Market Barriers and Technology Access.[35] The first category, Consumption Access, is defined as those policies which are fundamental to increasing consumption of renewable energy in the state. These policies allow nearly everyone in the adopting state to enjoy renewable energy either as a choice or in some case, as a mandate. The second policy category covers education and information barriers. This is defined as any policy which is adopted to specifically address either lack of renewable energy knowledge in the given state, or to inform the public about their own energy consumption. The third category is Market Barriers, which is defined as any policy which seeks to assuage market failures inherent in common pool resources, as energy is often defined. The fourth and final category addresses the accessibility of the technology within the state and its main focus is the financial roadblocks to renewable development. These incentive-based policies vary from state to state.

[35] Doris, E. *State of the States 2009.* Pg. 95-96.

4.1 Consumption Access

- Consumption Access is defined as those policies which are fundamental to increasing consumption of renewable energy in the state.

4.1.1 Interconnection Standards

Interconnection Standards is the most popular energy policy adopted in the US. The policy involves regulation at the local utility level of the procedural, contractual and rate rules which govern the areas electricity grid. All this is to ensure equal access to the electricity grid by all consumers. While Interconnection Standards can differ depending on state politics and environment, the policy plays a significant part in removing market barriers and protecting consumers against distribution discrimination. Interconnection Standards also allows homes and businesses to connect their own private energy generating technologies to the grid in a fair and effective manner.[36]

Interconnection rules often include regulation on technologies eligible to connect, grid system capacity and the demand limit on said system, insurance requirements, and a number of charges for connection, engineering certification and other technical support. Because of the high level of Interconnection adoption and regulation, both at the local state level and at the national level from the Federal Energy Regulatory Commission, over 39 states have some form of this policy in place.[37]

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[36] Doris, E. *State of the States 2009..* Pg. 57.
[37] Doris, E. *State of the States 2009..* Pg. 56.

4.1.2 Renewable Energy Access Laws

Land access laws in the case of renewable energy apply usually to businesses and homeowners who choose to install wind and solar power systems. This policy supersedes any city or county ordinances which may seek to eliminate one's ability to install renewable technology as well as any homeowner association or neighborhood's collective rules. Another common form of access law is easement, which allows for the transfer of rights to certain renewable resources from one owner to another. Renewable access has proven difficult to enforce at the state and federal level and often can fall to local communities for enforcement in a pseudo-voluntary manner. A total of 35 states and the US Virgin Islands have adopted Energy Access Laws. In 2008, Vermont became the newest state to enact access laws for renewable energy.[38]

4.1.3 Line Extension Analysis

Line Extension Analysis is a policy used in states where a portion of the population is not serviced by the electrical grid. In these cases, power customers often pay a fee to have the line extended to their home or business. Line Extension Analysis requires power companies to provide information on the benefits and costs of renewable energy to these type of consumers.

Renewable energy has been found to be more cost effective in some cases for rural homeowners compared to paying for line extension services. There are only three states

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[38] *DSIRE. Database of State Incentives for Renewables and Efficiency. DSIRE: Glossary online. Accessed July 9, 2009.*

(Texas, Arizona, and Colorado) that have adopted line extension. These three are states which are either sparsely populated, or possess vast tracts of uninhabited land.[39]

4.1.4 Required Green Power Option

A Mandatory Green Power option has been adopted in several states including Oregon and Washington. Customers may desire to purchase green power, but if their electricity utility doesn't have a green option, this becomes impossible. Required Green Power Options allow for individuals and businesses to purchase power from green sources through their electricity grid. This policy is different from RPS because utilities are not necessarily required to have a fixed amount of renewable power, just that consumers can choose to purchase green energy for consumption, allowing consumer demand to guide renewable energy production.[40] A study by the DOE found that green power choice programs significantly and effectively improved growth of renewable energy. Additionally, the option of green power could reduce cost of renewable development and operation in the long-term.[41]

[39] Doris, E. *State of the States 2009.* Pg. 59.
[40] Ibid.
[41] Ibid.

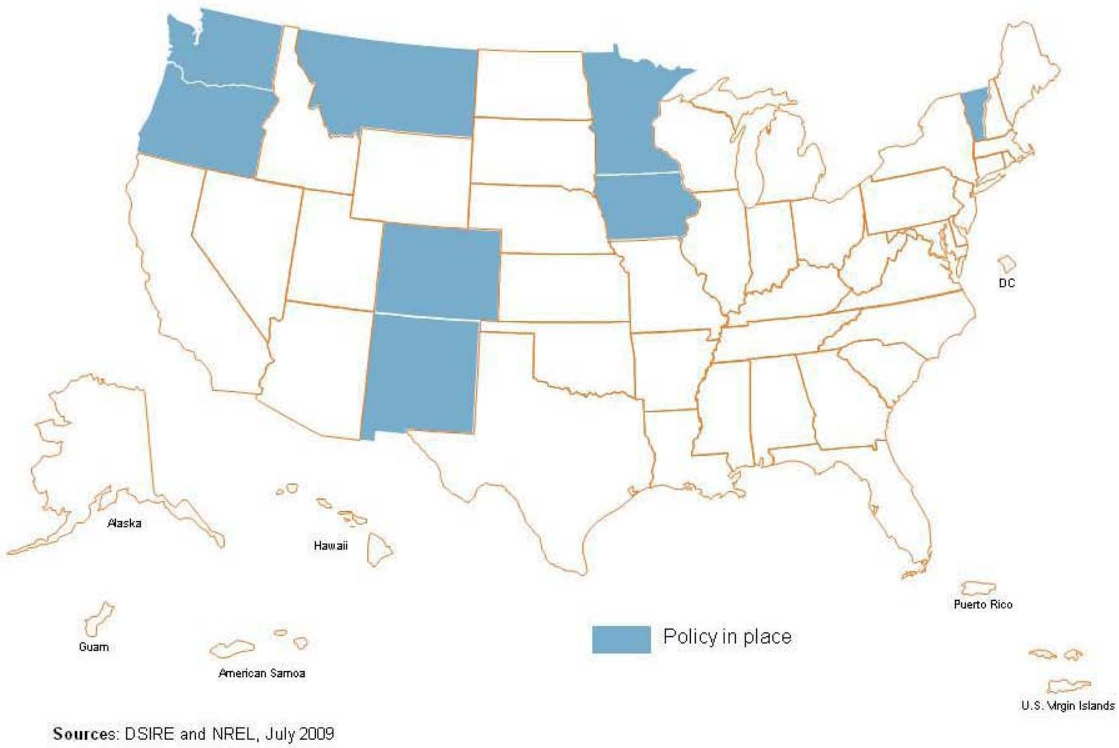

Figure 4.1.4: Required Green Power Option Adoption by State (Courtesy of NREL)

4.1.5 Green Power Purchasing

Green power purchasing is one of the more collectivist options in state energy policy. In this policy, state and local governments commit to purchase a certain amount of green power as opposed to providing renewable energy as an option. Certain states even allow for several local communities to aggregate and purchase power, thereby creating a larger purchaser of green energy which has greater bargaining power in the electricity market. The municipalities in membership are essentially creating an electricity cooperative.[42]

[42] *DSIRE. Database of State Incentives for Renewables and Efficiency.*

Green power purchasing is a direct government method to meet environmental or renewable energy goals by simply purchasing at the level required. This not only provides more business for green energy providers, but can reduce the costs to transform a market from a totally non-renewable energy system to a balanced portfolio of energy technology. Community involvement in the purchase of green power seems to be a factor in growth of renewable energy in certain regions.[43]

4.2 Education and Information Barriers

- Education and Information Barriers are defined as policies adopted to address lack of renewable energy knowledge in the given stat, or to inform the public about state and individual energy consumption.

4.2.1 Contractor Licensing

Contractor Licensing is a mandate which requires all contractors who want to install renewable energy systems to complete certification to ensure not only safety concerns are addressed, but that all technology is properly installed and maintained. In most states, this involves minimal experience in renewable technology and an examination on installation and upkeep. Contractor Licensing decreased risk of shoddy installation and neglected maintenance, resulting in greater returns on investments and more efficient energy generation. In addition, certification increases the amount of skilled individuals in the state

[43] Bird, L. A.; Cory, K.S.; Swezey, B.G. (2008a). *Renewable Energy Price-Stability Benefits in Utility Green Power Programs.* NREL/TP-670-43532. Golden, CO: National Renewable Energy Laboratory.

and helps resolve the education barrier which is a constant issue in many are looking to develop renewables.[44]

As of 2009, there are 8 states which have adopted this policy. Oregon in particular stands out in contractor licensing as it requires licensing for nearly all alternative energy including solar, wind, fuel cells and small-level hydroelectric. Puerto Rico, which was the first US territory to adopt this policy only last year and its effects on that territory are not yet known.[45]

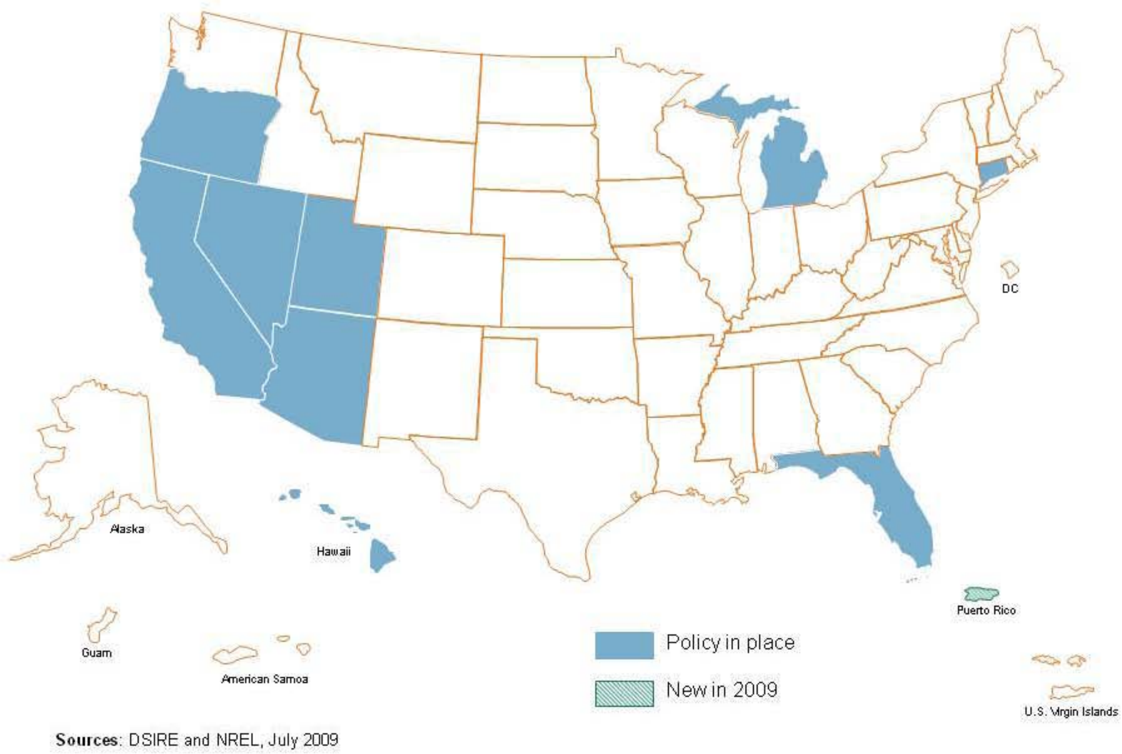

Figure 4.2.1: States Which Adopted Contractor Licensing Policy as of January 2009 (Courtesy of NREL)

[44] Beck, F.; Martinot, E. (2004). "Renewable energy policies and barriers." *Encyclopedia of Energy*. Ed C. J. Cleveland. Academic Press/Elsevier Science.

[45] Doris, E. *State of the States 2009.* Pg. 47.

4.2.2 Generation Disclosure

Generation Disclosure addresses a lack of knowledge by the public as to the source of their electricity. This policy requires that electricity providers publish information on their power supply and often the information is attached to consumer's monthly bill. This disclosure gives the public a chance to better understand the composition of their power supply and often has led to other policies including Renewable Portfolio Standards and Renewable Energy Access Laws. Some studies indicate that this policy alters consumer choice. The hope of renewable energy advocates is that by understanding how much energy comes from non-renewable sources, the public would demand more green options.[46]

In 2009, 22 states had adopted this policy in one form or another. The specifics of the policy vary across the United States (disclosure is defined differently, differences in report publication intervals, etc.). However, Generation Disclosure is one of the more heavily adopted policies.[47]

[46] Darby, S. (2006). *The Effectiveness of Feedback on Energy Consumption: A Review for DEFRA of the Literature on Metering, Billing and Direct Displays*. Environmental Change Institute at the University of Oxford. Oxford, England.

[47] Doris, E. *State of the States 2000.* Pg. 50.

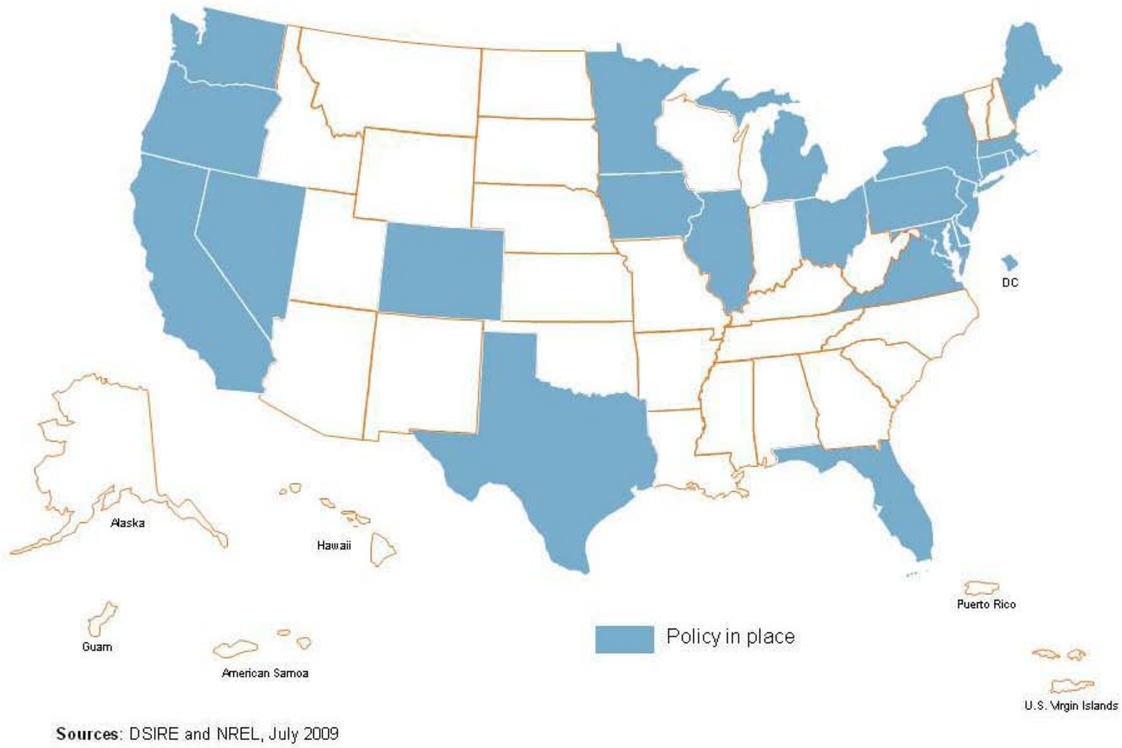

Figure 4.2.2: States Which Adopted Generation Disclosure as of January 2009 (Courtesy of NREL)

4.2.3 Public Benefit Funds

Public Benefit Funds for Renewable Energy, also called the System Benefit Charge is a surcharge on energy consumption enforced at the state level. These funds go towards rebates, loans, research and development and public education about renewable energy. According to the EPA, there are three methods that the funding is allocated. First, investment through loans and state equity provides start-up capital for infant renewable industries. The second method provides project development incentives through rebates, production incentives and specified grants. The final method of allocation is more industry based, and relies on consumer education, demonstration projects and marketing support programs to increase development.[48]

Public benefit Funds are intimately linked to many of the other policies in effect, for this reason, it seems prudent to include PBF in the model in question. Today, 17 states, including California, Oregon, New York and Maine have adopted this system as a way to pool fund for allocation to various other renewable energy programs.[49]

4.3 Market Barriers

- Market Barriers are defined as any policy which seeks to solve market failures inherent in common pool resources such as renewable energy.

4.3.1 Net-Metering

Net metering involves the use of bidirectional meters installed on virtually all building in the state. A bidirectional meter allows for the home or business to feed power back into the power system, allowing for reduced electric bills at the end of the month. During times when the consumer is using less power than their renewable energy system produces, net metering allows for a reduction in their energy cost and can even lead to a profit.[50] This is a strong incentive to install renewable technology or to expand an older infrastructure. The one major downside to net metering is the possibility that the power utility could suffer revenue loss if enough residence and businesses are feeing surplus

[48] EPA. (2007). *State Clean Energy Funds: An Effective Mechanism to Encourage Clean Energy Supply.* Washington, D.C: Environmental Protection Agency.

[49] Doris, E. *State of the States 2009.* Pg. 65.

[50] *DSIRE. Database of State Incentives for Renewables and Efficiency.*

energy into the system. As of 2009, 42 states had adopted such a program and several US territories.

4.3.2 Renewable Portfolio Standards

Renewable Portfolio Standards or RPS is a requirement placed on utilities to purchase a certain percentage of their demanded power from renewable energy sources. This can either be done as a percentage of electrical capacity or of a nominal wattage within a specific time period. Often, state policies go further and use RPS to “carve-out” certain percentages of purchase for specific generation sources such as Solar and Wind Energy. RPS is regarded as one of the most effective state energy polices for its inherent benefit to the state’s traditional energy portfolio. Requiring more portfolio diversity allows for greater flexibility in the generation of electricity and can mitigate risk in emergency circumstances such as disaster or oil price shock.[51]

4.4 Technology Accessibility Policies

- Technology Accessibility Policies are defined as those policies which seek to solve the financial roadblocks to renewable development. The goal of these policies is to reduce the initial costs of introducing new technology or to bolster infant energy technology markets.

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[51] Ibid.

4.4.1 Grants

Grants are simply allotments of funding dispersed to groups and businesses to encourage greater development of renewable energy in a given state. In many regions of the US, renewable technology suffers from high cost for both installation and materials. Grants are one of the policies intended to mitigate technology accessibility issues by reducing the cost of renewable development. While some states allow for homeowner grants, most are only applicable to industry, utility and government sectors of the energy economy. As of may 2009, 22 states had adopted a policy of distributing at least some form of renewable energy grants.[52]

4.4.2 Loans

A policy very similar to the grant, renewable loans are used to reduce the high start-up cost of renewable energy development but requires reparation to the state-level provider, with interest. As many as 27 states have implemented a loan program to alleviate the cost of renewable development and generation growth. [53]

4.4.3 Rebates

Depending on the administrating government, rebate amounts can vary. Rebates distribute a fixed amount of returned funding after the installation of new renewable energy systems. Such policies are adopted at state-level as well as at community and utility levels. Unlike Production Incentives, to be discussed later, rebates are free from long-term

[52] Doris, Elizabeth D. *State of the States 2000.* Pg. 52.
[53] Ibid. pg. 53.

considerations inherent in incentivizing certain renewable projects over long periods of time. Currently, 18 states have adopted this program as a way to reduce the high cost of developing renewable technology.[54]

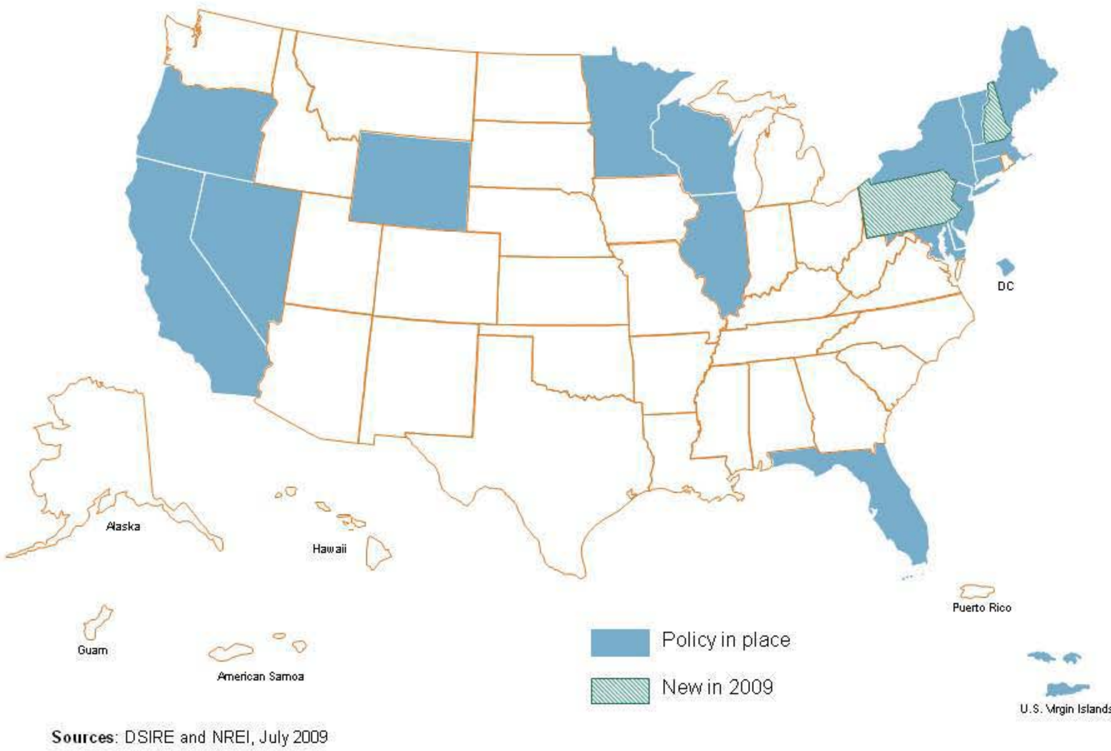

Figure 4.4.3: States Which Adopted RE Rebate Policy as of January 2009 (Courtesy of NREL)

4.4.4 Renewable Energy Production Incentives

Production incentives are project specific. The state provides cash based on the kilowatt hours generated by a renewable energy system. Production incentives are also referred to as performance-based incentives. The higher performances produce higher rates of rewarded funding from the state. With Vermont adopting the policy in May 2009, 6

[54] Doris, Elizabeth D. *State of the States 2000.* Pg. 68.

states had adopted production incentives. Production incentives are potentially effective in growing state energy portfolios.[55]

4.4.5 Tax Incentives

Tax incentives for energy development address one or more corporate tax, personal tax, property tax, sales tax, and industry support policies. Corporate tax incentives are credits, deductions and exemptions and often are attached to a condition. In the event that the corporation is able to achieve a certain level of renewable energy generation, only then can the business receive the tax breaks. This forces corporations to meet certain standards and not exploit renewable energy tax incentives for minimal effort. Closely tied to the corporate tax incentive are the industry recruitment and support credits, which are distributed to companies as an incentive to develop large renewable projects in the state. These types of support incentives are often a result of a state effort to bring jobs to the local and regional economy.[56] These incentives are also not meant to be long-term, and are adopted only to aid in the development of infant power markets.

Property tax incentives are similar to personal taxes in their incentive for individual development of renewable energy. While property tax is often collected at the local level, many states have delegated taxing authority to counties and municipalities for the purpose of renewable energy incentives. Personal taxes provide a limited credit or deduction for the

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[55] Ibid. pg. 72.
[56] *DSIRE. Database of State Incentives for Renewables and Efficiency.*

installation of home renewable energy kits, such as small solar panels or geothermal water heating systems, while property taxes can apply to homeowners and businesses alike.[57]

Some states have used sales tax incentives effectively to develop renewable energy at the individual level. These incentives exempt the consumer from the sales tax if the person had installed and operated renewable energy technology. Some states provide the incentive in the form of an end-of-the-year deduction while others use a "sales tax holiday" in which people can purchase commodities for a period of usually two days free of state sales taxes.[58]

The advantage of tax incentives is that they provide policymakers with a means to manipulate renewable energy demand and supply. By adopting several of the tax measures (as states have done on a number of occasions) the state government receives flexible mechanisms to promote renewable energy technology. Tax incentives are highly popular and used as compliments to a number of other policies. Consequences are often associated with a large number of incentives which can lead to budget deficits in the states. See Appendix A for a map of the tax incentives throughout the United States.

5. Methods and Approach

5.1 The Analysis

The findings in this study are derived from a dataset compiled from a number of government databases for the year 2008. The model compiled was created to not only involve the dependent variable of net renewable energy generation in the given state per

[57] Ibid.
[58] Ibid.

capita, and to include a number of controls to compliment the independent variables for state energy policies. The control variables selected provide for a more robust explanation of the data and also account for a number of issues within state energy policy discussed previously in the literature. In order to maintain sufficient statistical degrees of freedom and to produce the most significant data that could be applied to the whole United States, all fifty states were included in this study. As another tactic to preserve statistical degrees of freedom, dummy variables for individual states were not employed.

Due to the large number of dummy variables (or variables testing the existence of a given condition) in the model, there was no possibility to include data over an extended period of time. Instead, all data is from a static point in time. Moreover, as the states were chosen for aforementioned reasons, there was of course no possibility of random sample. To avoid issues of statistical bias in the data, the Aike Informational Criterion (AIC) was used to find the best fit model for the given variables. For all findings in the study, the Statistical Analysis Software (SAS) was used.

The model shall be evaluated in several stages. First an OLS was run to analyze the model of all independent variables to the dependent variable corresponding to all renewable energy technologies chosen for the study. Then, regressions were estimated for the energy sources of Solar, Wind and Biomass individually.

5.2 The Data

The data was compiled from a list of sources including the National Renewable Energy Laboratory (state policies), Energy Information Agency (energy generation by state and energy source), Bureau of Economic Analysis (Gross State Product) Census Bureau (Education and Average Income), National Oceanic and Atmospheric Administration (Days of Sun) and the Department of Energy for the state wind capacity. This data was collected from most recent year of record, usually 2008. All the information was taken as either averages, in the case of days of sun, or as a figure at a fixed point, as is the case for GSP and average income, which were both taken as of December of the given year. The policies studied are those in place in the chosen states in 2008.

The data came with a very interesting complications, a personal debate arose of whether to use information in nominal or inflation-adjusted dollars. The decision was ultimately to use inflation-indexed information because of a need to use data in year 2000 dollars as several variables were already using this form of monetary figure. The question of multicollinearity inflation-adjusted data was not seen as an issue with static data analysis.

6. The Model

The chosen model, based on theory and literature, was as follows:

$$f(Solar_i, Wind_i, Biomass_{i,})_i = \beta_1 + \beta_{10}CL_i + \beta_{11}GD_i + \beta_{12}GR_i + \beta_{13}ICS_i + \beta_{14}REAL_i + \beta_{15}NM_i + \beta_{16}PBF_i + \beta_{17}IS_i + \beta_{18}GPP_i + \beta_{19}RGP_i + \beta_{20}CTI_i + \beta_{21}LN_i + \beta_{22}PTI_i + \beta_{23}RTI_i + \beta_{24}LEA_i + \beta_{25}RB_i + \beta_{26}REPI_i + \beta_{27}STI_i + \beta_{28}INCOME_i + \beta_{29}ED_i + \beta_{30}DHOUSE_i + \beta_{31}DSENATE_i + \beta_{32}DGOVi + \beta_{33}WIND_i + \beta_{34}SUN_i + \beta_{35}WGA_i + \beta_{36}RGSPPC_i + \beta_{37}GSCORE_i + e_i$$

Where e_t is the constant, f(Solar, Wind, Biomass) is a function of solar, wind and biomass renewable energy net generation in megawatt hours in 2008 per capita, For independent policy variables CL is Contractor Licensing adopted in state, GD is Generation Disclosure adopted in state, GR is Grants adopted in state, ICS is Interconnection Standards adopted in state, REAL is RE Access Laws adopted in state, NM is Net Metering, PBF is Public Benefit Funds, IS is Industry Support adopted in state, GPP is Green Power Purchasing, RGP is Required Green Power adopted in state, CTI is Corporate Tax Incentive adopted in state, LN is Loans adopted in state, PTI is Personal Tax Incentive, RTI is Property Tax Incentive, RB is Rebate adopted in state, REPI is RE Production Incentives, and STI is Sales Tax Incentive. Other control variables included: INCOME which corresponds to Average Household Income in given state in 2000 dollars, ED is Attainment of Bachelors degree or higher as percentage of state population in 2008. DHOUSE corresponds to the Political Control of lower house of state legislature in 2008, either Democrat or Republican. DSENATE is a similar control for the upper house of respective state legislatures in. DGOV is the Political Control of office of the Governor in given state in 2008. Other indicators include WIND, which is the Area of state suitable for wind energy generation at 30%+ turbine capacity in KM^2; SUN, which is the Amount of days of sun in largest metropolitan area as percentage in state; And RGSPPC, which represents Real Gross State Product per Capita in 2000 dollars. WGA is the State's membership in the Western Governors Association, which includes all states west of the Mississippi River. GSCORE corresponds to the Green Score of the state, which is an index of multiple environmental and political indicators as measured by *Forbes*.

Independent Variables
(Table 1)

Variable	Description	Means (Standard Deviation)
Income (INCOME)	Average Household Income in given state in 2000 dollars	51,977.96 (8,592.00)
Education (ED)	Attainment of Bachelors degree or higher as percentage of state population in 2008	26.74 % (4.687 %)
Average Sun (SUN)	Amount of days of sun in largest metropolitan area as percentage in state	59.38 (8.887)
Wind Capacity (WIND)	Area of state suitable for wind energy generation at 30%+ turbine capacity in KM^2	51,423.60 (87,357.93)
Gross State Product Per Capita (RGSPPC)	Real Gross State Product per Capita in 2000 dollars	35,474.58 (6,375.25)
Contractor Licensing (CL)	Contractor Licensing adopted in state (1=yes 0=No)	0.160 (0.3703280)
Generation Disclosure (GD)	Generation Disclosure adopted in state (1=yes 0=No)	0.440 (0.5014265)
Grants (GR)	Grants adopted in state (1=yes 0=No)	0.440 (0.5014265)
Interconnection Standards (ICS)	Interconnection Standards adopted in state (1=yes 0=No)	0.760 (0.4314191)
RE Access Laws (REAL)	RE Access Laws adopted in state (1=yes 0=No)	0.720 (0.4535574)
Net Metering (NM)	Net Metering adopted in state (1=yes 0=No)	0.820 (0.3880879)
Public Benefit Funds (PBF)	Public Benefit Funds adopted in state (1=yes 0=No)	0.340 (0.4785181)
Industry Support (IS)	Industry Support adopted in state (1=yes 0=No)	0.30 (0.4629100)
Green Power Purchasing (GPP)	Green Power Purchasing adopted in state (1=yes 0=No)	0.180 (0.3880879)

Variable	Description	Means (Standard Deviation)
Required Green Power (RGP)	Required Green Power adopted in state (1=yes 0=No)	0.160 (0.3703280)
Corporate Tax Incentive (CTI)	Corporate Tax Incentive adopted in state (1=yes 0=No)	0.480 (0.5046720)
Loans (LN)	Loans adopted in state (1=yes 0=No)	0.540 (0.5034574)
Personal Tax Incentive (PTI)	Personal Tax Incentive adopted in state (1=yes 0=No)	0.420 (0.4985694)
Property Tax Incentive (RTI)	Property Tax Incentive adopted in state (1=yes 0=No)	0.660 (0.4785181)
Rebate (RB)	Rebate adopted in state (1=yes 0=No)	0.360 (0.4848732)
RE Production Incentives (REPI)	RE Production Incentives adopted in state (1=yes 0=No)	0.120 (0.3282607)
Renewable Portfolio Standards (RPS)	RPS adopted in state (1=yes 0=No)	0.680 (0.4712121)
Sales Tax Incentive (STI)	Sales tax Incentive adopted in state (1=yes 0=No)	0.520 (0.5046720)
WGA Membership (WGA)	Membership of the state in the Western Governors Association (1 = Yes, 0 = No)	0.380 (0.4903144)
Green Score (GSCORE)	State's Green Score (0-50)	30.1140 (7.9783383)
Democratic House (DHOUSE)	Democratic Control of lower house of state legislature in 2008 (1 = Yes, 0 = No)	0.660 (0.4785181)
Democratic Senate (DSENATE)	Democratic Control of Upper house of state legislature in 2008 (1 = Yes, 0 = No)	0.560 (0.5014265)
Democratic Governor (DGOV)	Democratic Control of office of the Governor in given state in 2008 (1 = Yes, 0 = No)	0.520 (0.5046720)

The model's descriptive statistics are interesting in themselves. As shown in the figure above, certain policies are very popular in the states, while others are far less prevalent. Policies adopted such as Interconnection Standards and Renewable Energy Access laws have more than 70% adoption rate in the United States, showing popularity for policies which alleviate consumer access issues. The most popular policy is Net Metering (87.5%) indicating a similarly strong desire to solve state issues of market barriers to renewable energy. Other policies are less adopted by the chosen states. Contractor Licensing, Required Green Power and Production Incentives numbered some of the very lowers adopted policies at >20% adoption rate. Interestingly, while subsidies such as loans, grants and project rebates are more popular in the studied states, tax incentives of all kinds are usually less adopted; the outlier in this case being property tax incentive.

In terms of the control variables, political control of the lower houses in 2008 seems to be handedly in the purview of the Democratic Party. In the state Senates, there seems to be an almost even split between Democratic and Republican control. The same pattern was seen in the gubernatorial indicator. The State's Green Score, which acts as a stand-in for the presence of an environmentally friendly state culture, averages 30.1. The scale of the Green Score is from 0 to 50. With a score above the possible Green Score median, this seems to indicate a growing influence from the New *Environmental Paradigm*.

Wind capacity only highlights the enormous potential of wind energy in the United States. The mean land area of the selected states suitable for wind energy generation in the defined amounts was 51,423.60 km^2. This is no doubt correlated to land mass of the states. However, states like Oklahoma and South Dakota outperformed many other states in terms of wind energy capacity. This fact is clearly not lost on these state governments as most of their recent renewable energy development has been in the wind energy sector.

7. Model Results

The analysis of total net renewable energy generation in Table 2 (below) indicates that several independent variables play a role in the production of renewable energy. In terms of the state policies, rebates showed the strongest positive relationship to generation of renewable energy per capita. This was an interesting find as the more popular energy policies, such as RPS and Required Green Power, were only significant at a 0.1 level. It should be noted, however that RPS and Required Green power both showed a positive effect. Generation disclosure was the only other partially significant relationship among the policy variable.

Among the controls for demographics, ideology, geography and culture, none of the variables were significant in this model passed the 0.05 significance level, which is the standard significance threshold. While it is unclear why this is the case, more in-depth analysis of the individual energy sources researched yielded significant relationships in this area. This model explained roughly a third of the variation in the data, with a adjusted R-squared of 0.321.

Regression Estimates for Full Model
(Table 2)

Variable	Coefficient (SE)
Income	-0.00004140 (0.00004131)
Education	0.12523* (0.06231)
Avg. Days of Sun	-0.00964 (0.02087)
Democratic Governor	-0.60787* (0.34725)
Contractor Licensing	-0.72268 (0.50014)
Corporate Tax Incentives	0.31074 (0.31460)
Generation Disclosure	-0.76968* (0.38949)
Grants	0.81469 (0.49921)
Green Power Purchasing	-0.56939 (0.55667)
Industry Support	-0.02518 (0.40846)
Interconnection Standards	-0.33226 (0.39672)
Loans	-0.29642 (0.32302)
Net Metering	-1.16162 (1.14542)
Public Benefit Funds	-0.49128 (0.50868)
RE Production Incentives	0.32425 (0.53078)
Rebates	1.44473*** (0.47806)
Required Green Power	0.96778* (0.53925)
Renewable Portfolio Standards	0.83679* (0.45503)
Real GSP (Per Capita)	-0.00006546 (0.00004431)
F-Test	2.11**
Adjusted R^2	0.321
N	50

**=P>0.10, **=P>0.05, ***=P>0.01*

The second regression analysis (See Table 3 below) examines the independent variables against net wind energy generation per capita. While rebate policy remains important to the generation of wind energy, other policies are statistically significant as well. Required green power is positively related to wind energy generation at the 0.01 level. This strong relationship indicates the importance of choice-based policy by state government to alleviate issues of energy accessibility. Personal tax incentives were significant at the 0.1 level. As a challenge to my original political assumptions, the presence of a political dominance in a state seems to have no significant relationship.

Cultural and regional variables played an important role in this model. Membership in the Western Governors Association had a positive relationship at the 0.05 significance level, indicating that the states in the Western U.S. are more apt to develop wind energy resources. Green score, which acts as the substitute for a NEP variable, shows significant negative relationship at the 0.01 level. It is unclear how this variable is negatively related. The reasons could have to do with the negative consequences of wind power, including the aesthetic issues as well as the danger to avian migrations. These factors may outweigh wind energy considerations. Another explanation could be a political and cultural issue; the states with high potential wind energy are likely conservative states and are also more likely to have low green scores. In other words, the motivation to develop wind energy may not start with altruistic environmental ideology in certain circumstances, rather a drive for net political or economic benefit.

Model for Wind Power
(Table 3)

Variable	Coefficient (SE)
Education	0.01645 (0.01975)
Wind Power Potential	3.995822×10^{-8} (2.728164×10^{-8})
Democratic House	-0.22723 (0.15285)
Democratic Governor	0.08533 (0.11542)
Interconnection Standards	-0.24708 (0.14645)
Loans	-0.14766 (0.12382)
Personal Tax Incentives	0.21138* (0.11948)
Rebates	0.40943** (0.15126)
Required Green Power	0.61237*** (0.18229)
Renewable Portfolio Standards	0.25792 (0.16853)
Sales tax Incentives	0.09394 (0.13229)
Membership in Western Governors Association	0.38467** (0.15061)
Green Score	-0.04372*** (0.01317)
F-Test	3.72***
Adjusted R^2	0.42
N	50

**=P>0.10, **=P>0.05, ***=P>0.01*

The regression for solar power (See Table 4) provides contrast to previous results. With an adjusted R-Squared of 0.541 (explaining 54% of the data variance), this was the most explanatory model in this study. In terms of policy variables, rebates are far less significant to the generation of solar energy at a 0.1 significance level in this model. Renewable energy access laws showed some positive significance as well. The interesting developments come from Generation disclosure and Contractor Licensing. Generation Disclosure or the requirement placed on an electricity provider to explain the sources of their electricity generation to individual consumers, had a positive relationship at the 0.05 significance level. This reinforces the previous results that individual choice is necessary for renewable energy generation; a lack of generation knowledge would render individual choice far more difficult and less informed. Contractor Licensing showed a significant negative relationship to solar energy generation. As one of the more widely available energy sources for home and business installation, licensing has often been touted as a way to ensure quality in solar array construction and maintenance. These results seem to show that the opposite is the case. It should be noted that, despite a 0.05 significance level, Contractor Licensing has a small negative coefficient, indicating marginal negative effects on solar generation.

Education was an important demographic variable with a 0.05 significance level, however in this case the relationship was negative. While this variable is significant, with a marginal coefficient of -0.001, it is unclear if the negative relationship is truly noteworthy. The regional variable for membership in the Western Governors Association was positively significant at the 0.01 level. This result lends further support to a regional element associated with the generation of renewable energy. Finally, as no surprise, average days of sun seem to be positively related to the generation of solar energy at the 0.01 significance level.

Model for Solar Power
(Table 4)

Variable	Coefficient (SE)
Income	2.575675 x10^{-8} (1.885496 x10^{-7})
Education	-0.00159** (0.00034766)
Avg. Days of Sun	0.00034291*** (0.00011776)
Wind Power Potential	-8.4934 x10^{-10}* (4.75516 x10^{-10})
Democratic Senate	0.00427* (0.00212)
Democratic Governor	-0.00303 (0.00202)
Contractor Licensing	-0.00606** (0.00264)
Generation Disclosure	0.00569** (0.00256)
Interconnection Standards	0.00344 (0.00272)
Net Metering	-0.00993 (0.00709)
Public Benefit Funds	-0.00478 (0.00340)
Personal Tax Incentives	-0.00153 (0.00197)
Property Tax Incentives	0.00173 (0.00216)
RE Access laws	0.00412* (0.00217)
Rebates	0.00421* (0.00232)
Renewable Portfolio Standards	0.00388 (0.00298)
Membership in Western Governors Association	0.00888*** (0.00303)
F-Test	4.60***
Adjusted R^2	0.54
N	50

**=P>0.10, **=P>0.05, ***=P>0.01*

Unlike solar energy, which is more likely to be developed in the Western States, biomass energy was shown to be prevalent in all areas of America (See Table 5). The regression model had an Adjusted R-Squared of 0.31, indicating only 31% of the data variance was explained by this model. Once again, rebate policy had the most significant positive relationship to energy generation at the 0.05 significance level. Other policy variables were only significant to the 0.1 level. These included grants, which showed positive relationship, and property tax incentives and generation disclosure, which had negative relationships.

The control variable, education showed 0.1-level significance as well. Again, education showed a positive relationship, lending support to indications that higher levels of educational attainment influences development of renewable energies. This may be a regional issue as well, as the Western states may have a greater emphasis on environmental topics in higher education in relation to the Eastern United States which is more likely to remain reliant on traditional energy sources. This regression was the only one which featured any significant relationship with political variables. The dummy variable for the existence of a Democratic governor was significantly negative at a 0.05 level. This may be due to the environmental impact of biomass which is certainly one of the more environmentally damaging of the discussed renewables. In fact, there has been recent backlash from environmental groups against politicians advocating biomass as a solution to fossil fuels consumption. For this reason, democratic governors may choose to favor other types of renewable energy such as solar or wind.

Model for Biomass Power
(Table 5)

Variable	Coefficient (SE)
Income	-0.00005493 (0.00003883)
Education	0.12546* (0.06401)
Avg. Days of Sun	-0.01688 (0.01988)
Democratic House	0.19342 (0.39850)
Democratic Governor	-0.70443** (1.19471)
Contractor Licensing	-0.68076 (0.45312)
Generation Disclosure	-0.71309* (0.37180)
Grants	0.82391* (0.43296)
Green Power Purchasing	-0.79574 (0.53522)
Net Metering	-0.90865 (1.03211)
Public Benefit Funds	-0.39161 (0.49622)
Property Tax Incentives	-0.62226* (0.33134)
RE Access Laws	-0.38696 (0.38180)
RE Production Incentives	0.12704 (0.51612)
Rebates	1.07713** (0.44135)
Renewable Portfolio Standards	0.63221 (0.44558)
Real GSP (Per Capita)	-0.00006525 (0.00003941)
Membership in Western Governors Association	-0.29826 (0.36761)
Green Score	0.04420 (0.03508)
F-Test	2.18**
Adjusted R^2	0.31
N	50

**=P>0.10, **=P>0.05, ***=P>0.01*

8. Further Research

Further research must go towards analysis of hydroelectric energy and the other renewable energy sources not discussed in this study. While much study has been conducted to analyze hydroelectric policy, more can be done to study its effect on the development of other renewable such as wind solar and geothermal.

Research should also be done to further investigate the effect of the Western Governors Association and how its existence and conduct influences the development of renewable energy not only in the Western states but in the nation as a whole. The WGA is used in this study only as a stand-in for a regional variable. However, the behavior of the association itself, such as it's ability to disseminate policy information and ideas to the leaders of the Western states, should be explored further. It is possible that the Western Governors Association is producing a type of environmental regime specific to the western states.

Many of these policies explored in the study are more effective if adopted in tandem with others. One common example is the adoption of Renewable Portfolio Standards along with Net Metering. Individually, policies have some effect; combined with other energy policies, this effect could magnify. A careful study of some of the most popular policy combinations may yield insightful conclusions.

Study should also be put into the political variable mentioned in this study, such as control of the state legislature and office of the governor. The lack of significance in most of the model results for these variables was disappointing and should be confirmed with further researched. The literature shows overwhelming agreement that politics is an essential factor to renewable energy development, reason enough to conduct more research on this topic.

There is literature to support the claim that renewable energy may not be a traditional ideological issue; that support for renewable can originate from both sides of the political spectrum, for different reasons. The literature argues that a liberal ideology tends to favor renewable energy more than a conservative persuasion. However, the specific reasons for support may be the key. Economic development is often cited as a reason to develop renewable energy in states such as Texas and Oklahoma, which are traditionally conservative. Economic development versus environmental concern is closely related to the political variables. Any research in the future should include reasons for support of renewable energy.

Renewable energy should also be studied through a time series. Change in the intended area of the economy and society are not immediate upon adoption of a policy. Instead, the effects can take years to generate results. Effect over time should be analyzed through a time-series analysis of the data. This may be difficult given the level of dummy variables utilized in this study. However time lag and duration of policy adoption is a crucial factor in the understanding of net renewable energy generation.

For this study, the interaction of the federal government with the states was held as a constant; it was assumed that since regulations on renewable energy are uniform throughout the United States, the analysis should not take them into account. The problem underlying this assumption is the fact that each energy source is regulated and subsidized differently by the federal government. Biomass, as an example, received more subsidies in the last ten years than solar or wind energy systems.

Research should explore the interaction between the federal government and specific energy sources, especially wind, solar and biomass. The policies at the federal level could either magnify the effect of state energy policies, or blunt their effect. With the recent environmental damage from the oil plume in the Gulf of Mexico, now may be the best time to investigate the federal interaction in renewable energy. Such research could study the federal action in renewable energy before and after this historic oil spill.

Finally, it is important to research further into the details of the specific state policies. Many of the policies in this study, such as Renewable portfolio Standards are actually quite different in terms of their details. The model in this study limited the possibility of investigating specific differences in the policies, making it an important stone left unturned in the investigation of renewable energy policy.

9. Implications

9.1 General Implications and Recommendations

There are several implications of these results. While it must be understood that this study is by no means definitive, the model and data encompass a large portion of the available information on the state policies of renewable energy. With this data and the subsequent results, we can derive some important conclusions.

There is no significant effect from Market Barrier policies.

The data shows that the policies of Net Metering and Renewable Portfolio Standards are less effective than other policies such as Required Green Power. This could be due to the effect of those policies that were significant. Required Green Power Options and Rebates for installing renewable power at a business or home may create many of the same results as market barriers. For example, offering a rebate for installing solar panels on homes are useful only if the power grid has a protocol to feed the energy produced back into the larger grid. Directly adopting net metering in this case would be unnecessary.

The lack of significance from these market barrier policies could mean that other policies produce effects that are quite similar. In other words, it does not require a government policy or policies like net metering or Renewable Portfolio Standards to be enacted. An example of this could be the similarity between RPS and Require Green Power Option. RPS requires a fixed proportion of energy generation to come from renewable sources. Required Green Power does the same thing, but allows the electricity consumers to determine in aggregate the necessary amount of renewables. Additionally, the energy generation under RPS is often "carved out" for certain types of renewable energy. Under RGP, the renewable energy sources are determined by the power companies. These two policies are similar in that they may produce similar results; however the determination of these results in the case of Required Green Power rests not in the hands of the government, but the energy consumers and producers.

The Most Popular Policies are not the most effective for Renewable Energy Development.

Among the four most popularly adopted energy policies (Interconnection Standards, Renewable Energy Access, Net Metering and Renewable Portfolio Standards) none of these create a significant increase in renewable energy generation. Again, this fact could be a product of other polices creating the similar results. The four most widely adopted policies are aimed at creating a "level playing field" for homes and businesses to install renewable energy and have access to the grid, to be able to feed surplus into the transmission lines, and to receive benefit from the endeavor. The goal of creating a “level playing field” may be an impetus for adopting these policies. Regardless of the reasons for their popularity, Rebates, Required Green Power and Generation Disclosure may produce identical results.

Tax Incentives have no significant effect.

This conclusion may come as a relief to those states with ailing budgets. Of the tax incentives, all of which are categorized as technology access policies, none had an effect at the 0.05 significance level. Additionally, loans, grants and production incentives, which are technology access policies as well, had a similar lack of effect. Only rebates seem to have an effect. The lack of effect from tax incentives means not only that tax deductions and credits are ineffective, but may also imply that the average citizen is unaware of the incentives. However, with data from all fifty states, it seems less probable that very few citizens across the entire country knew about the incentives. It also is unlikely that businesses would be unaware of the tax incentives either.

Large projects are less effective than small ones for Renewable Energy Development.

Those policies that are most significant are not those aimed at encouraging large, long-term renewable energy projects. Rebates, one of the effective policies, are distributed by utilities or state government to homes and businesses for installing renewable energy on their property. Generation Disclosure is intended to provide information on their electricity sources, and Required Green Power is enacted to provide customers with an option to use green power. These significant policies encourage individual choice in energy options. Those policies which are adopted to provide large wind farms, as an example, funding in the form of a long-term contract, do not appear to be significantly effective in generating renewable energy. Instead, demand at the individual household or business level is more effective in increasing the development of renewables.

Required Green Power and Generation Disclosure only place regulations on existing power companies and do not directly push for local power generation. However, consumer demand and a growing market for renewables could create the necessary conditions for renewable “cottage industries” to grow in parts of the United States. These smaller renewable energy companies would contract to those major electricity distributors that are lacking in a green power option. A lack of pre-existing renewable energy would force companies to either create their own renewable infrastructure, or contract with smaller generation companies, generating jobs and revenue. This in turn allows people to decide on their power source and even for businesses to develop in the renewable energy sector.

States with the significant policies have high levels of renewables.

From examining those states which have not only implemented the three policies with positive significance, but also have abstained from Contractor Licensing (negatively significant in the model), we find interesting results. Among those states that have at least three of the four abovementioned policy choices (see figure 9.1 below), all of them have either high levels of renewable energy generation, or are rapidly growing. Among the ten states with the highest non-hydroelectric energy generation that are ranked by the NREL in 2009, six (Delaware, Illinois, New Hampshire, Washington, Colorado, Minnesota) have adopted three or more of the aforementioned policy choices. While this ranking does count geothermal energy, which was excluded from this study, the fact that the majority of the ranked states have adopted the significant policies adds support to the model results.

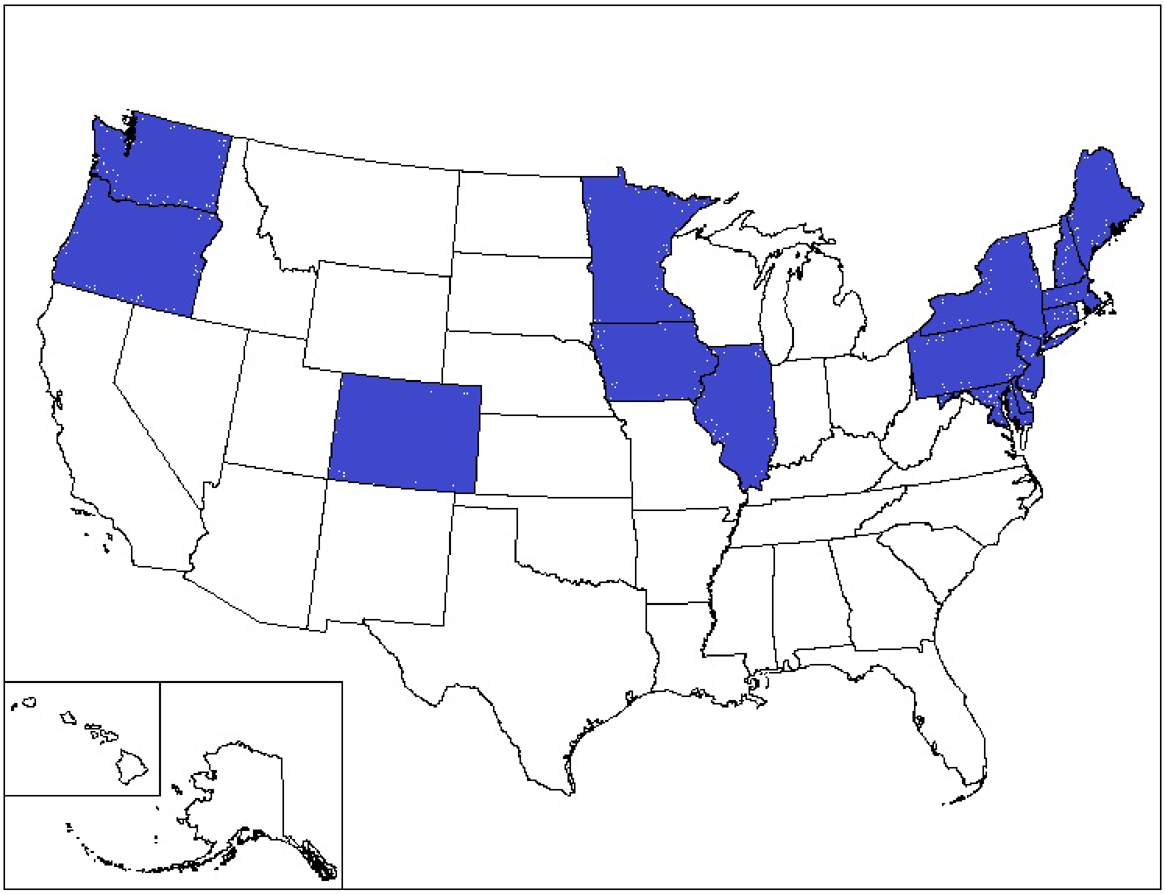

Figure 9.1: States which adopted three or more of the significant energy policies

9.2 Political Implications

The political implications of this study's findings are important to understand because they will be critical to many stakeholders in state governments. First, these findings discourage large government-funded projects. This will be a difficult result to acknowledge by both legislators and interests. Legislators will be reluctant to accept this finding because it will mean a potentially unproductive use of past taxpayer money. Many states have spent millions of dollars funding projects to improve the renewable energy market in their respective states. If it is concluded that a cheaper solution could have been adopted, one which encourages consumer choice and eases the burden on state budgets, voters may be displeased. Interest groups, especially those which advocate for large wind energy projects, whether representing traditional energy industry or environmental issues, will also resist these findings.

The second political implication is that these findings enforce the idea of transfer of choice from legislatures to businesses and households. This will eventually refocus the tactics of stakeholders. Power companies and environmental lobbies alike will turn to greater advertising and public support measures to convince citizens to choose certain power options. Municipal and utility level government may also be affected, with greater demand for rebates resulting in a push for larger rebates.

The final political implication is that renewable energy development is not dependent on one political ideology. It is possible that this particular issue transcends traditional political rhetoric. While this may seem to be an optimistic interpretation of the data results, the reasoning behind political acceptance may vary greatly. States such as Texas and Oklahoma are rich in potential wind energy. These states have greatly expanded renewable energy development in the last few years. Compared to others states, Texas and other “Middle-America” governments have little in the way of environmental programs, which would be an indicator of support for NEP or other progressive environmental concerns. This implies that the energy development in these states is the product of demand for economic development. The results of this study seem to indicate that motive is not an issue. Both sides of the political spectrum are developing renewable energy, or are at least open to the idea, but for different reasons.

9.3 Economic Implications

If a greater application of Rebate policy will result in more home and business renewable energy systems, it will also mean greater demand for these energy systems. This could result in more manufacturing of renewable energy kits and other small solar arrays and wind turbines. The potential for job growth from manufacture is complemented by a greater demand for installation experts.

The study shows a significant negative relationship between Contractor Licensing policy and renewable energy generation. However, this does not imply that there is no demand for installation professionals without licensing. In fact, absence of licensing may remove barriers for individuals to start businesses in the renewable energy installation business. Few policy experts would argue that growth in renewable energy will result in job growth, this study only proposes an alternative policy direction.

9.4 Social Implications

Greater consumer choice and the incentives produced from Rebate policy means more opportunity for citizens to learn about renewable energy and the growing need for alternatives to fossil fuels. Among those states which have high levels of renewable energy generation, most are ranked high in the Green Score. This score, which acts as a stand-in for the New Environmental Paradigm, shows that renewable energy generation and shifting paradigms may be closely related. More choice in renewables may result in an increase in NEP. More research should be conducted to investigate this claim.

Rebates for home and business installation of renewable energy also brings the issue of human impact on the earth literally to people's backyard. Greater education in renewable energy, while possibly intended to act as a way to save money and benefit from a utility rebate, could also highlight the anthropocentric effect of our own energy consumption.

10. Conclusions

The power of human choice has been apparent ever since the first nomads decided to settle and use the power of the sun to grow staple crops. Choice was also important in the decision to harness fossil fuel, to this day one of the densest forms of natural raw power known. However, this surplus energy source is slowly dwindling, and it will require yet more choices to retain the current standards of living. Renewable energy seems to be at least part of the solution. However, in order to successfully develop renewable energy, this will require alterations in our perception of not only the world, but our place in it.

How do politics, geography, economy, culture, education and other control variables play a role in renewable development? This was the secondary question in this study. The model results showed limited effect of political and cultural considerations, implying that their impact on renewable energy development is marginal. As an example, many of the states which had adopted the significant policies were known neither for their environmentally-amicable culture, nor for any equally friendly environmental political agenda. Examples include the former industrial hub of Illinois and the once textile-rich New York. Oregon and Washington *are* known for an environmentally-friendly culture. These states, while among the major producers of renewable energy, are not among the *highest* non-hydro renewable energy generating states. In fact, some of the states with lower Green Scores generated more renewable energy. This implies that cultural approval of renewable energy and a presence of the *New Environmental Paradigm* are not necessary for renewable energy development. This implication should be taken optimistically; it means that the development of renewable energy in the United States will not require a total transformation of the American culture.

The model presented and its results indicate that while policy is a key element in the development of renewable energy in the United States, not all policies are helpful. Statistical quantitative analysis of the data discussed shows that Rebates are the best policy to use in most renewable energy cases. Required Green Power Option as well as Generation Disclosure are also effective in some cases. These policies are focused on the individual consumer of energy to become informed, educated, and free to choose to use renewable energy.

Final Conclusions

Primary Question: *How do state energy policies have an effect on the development of specific renewable energy technologies?*

- Significant Positive relationship from following Policies:
  - **Rebates**
  - **Generation Disclosure**
  - **Required Green Power Option**
- Significant Negative Relationship from **Contractor Licensing**

Secondary Question: *How do politics, economics, geography, culture, education and other control variables play a role in renewable development?*

- Political varaibles has only marginal effect
- Green Score (New Environmental Paradigm) has little effect
- Economic variables for state have NO signifcant effect
- Education has little significant effect
- Geography has significant effect, states in the West more effective in developing renewable energy technology

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Appendix A: Diagrams of Tax Incentive Energy Policy Adoption by State

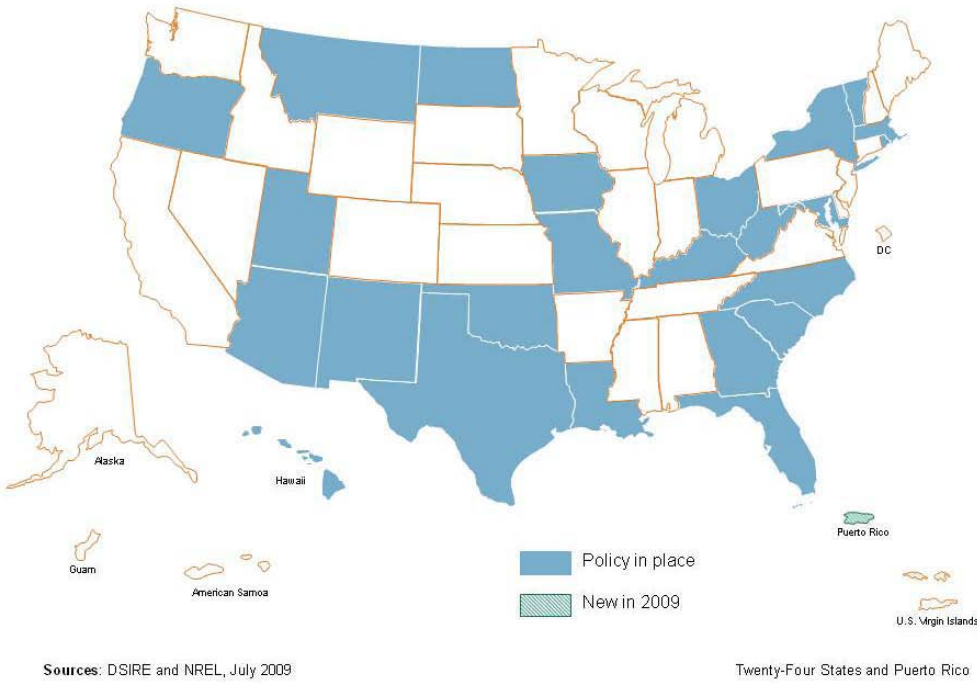

Figure A-1: Corporate Tax

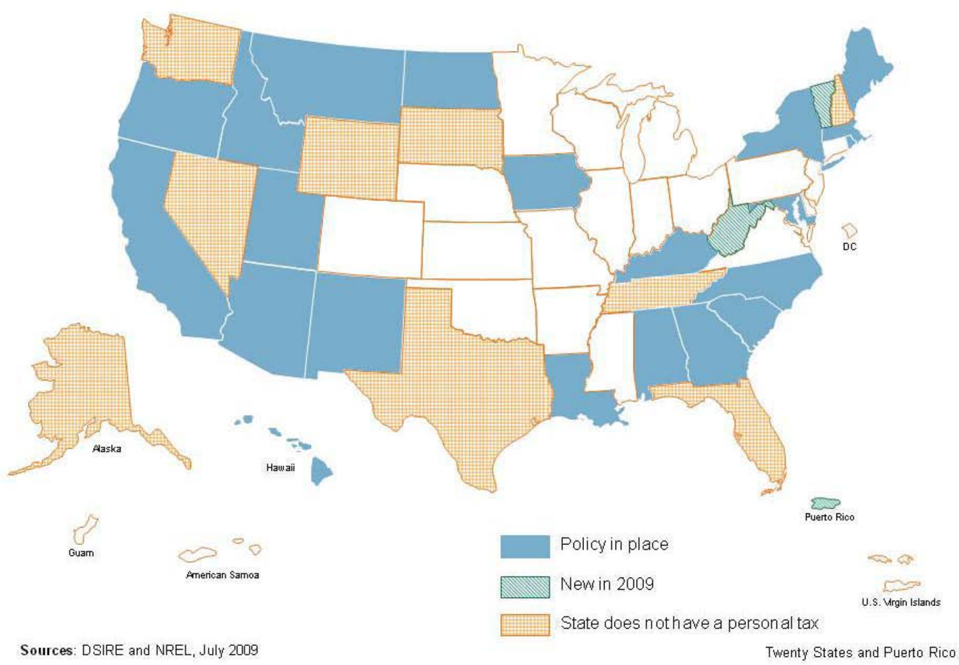

Figure A-2: Personal Tax

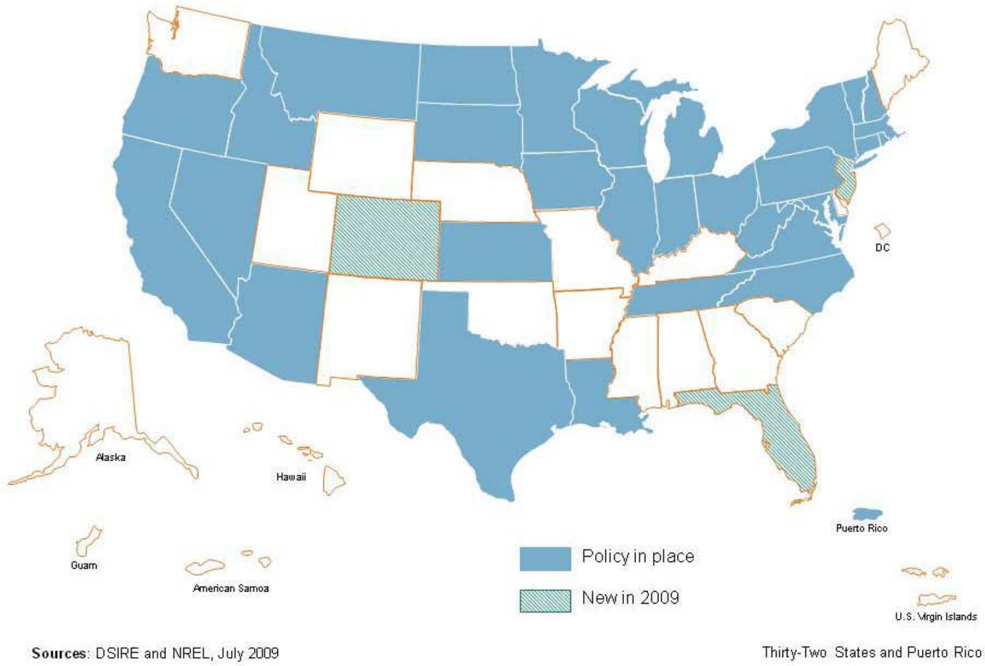

Figure A-3: Property Tax

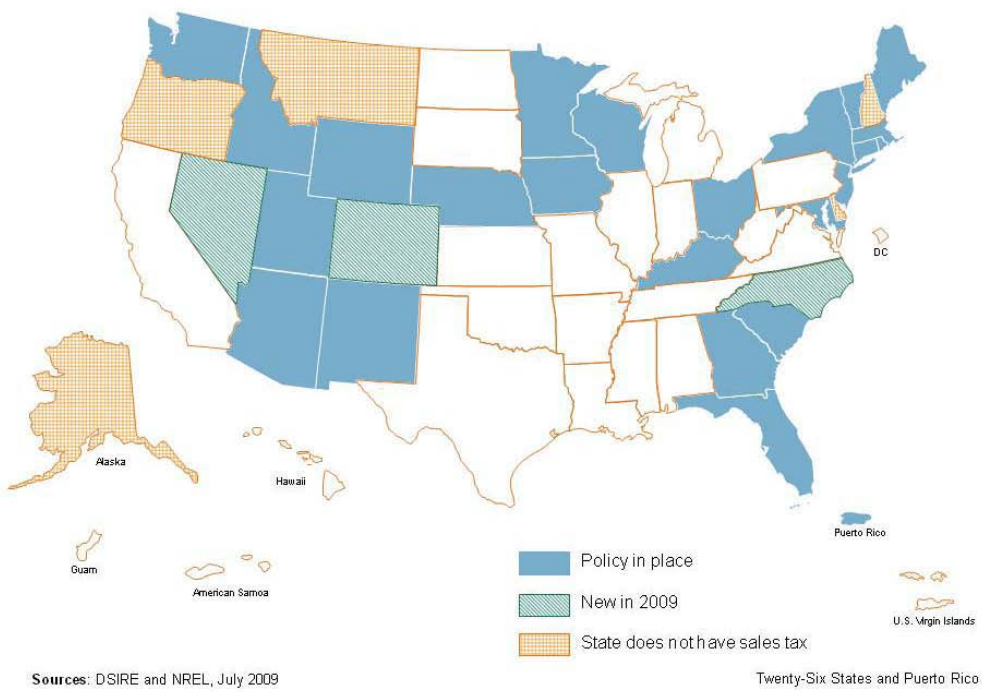

Figure A-4: Sales Tax

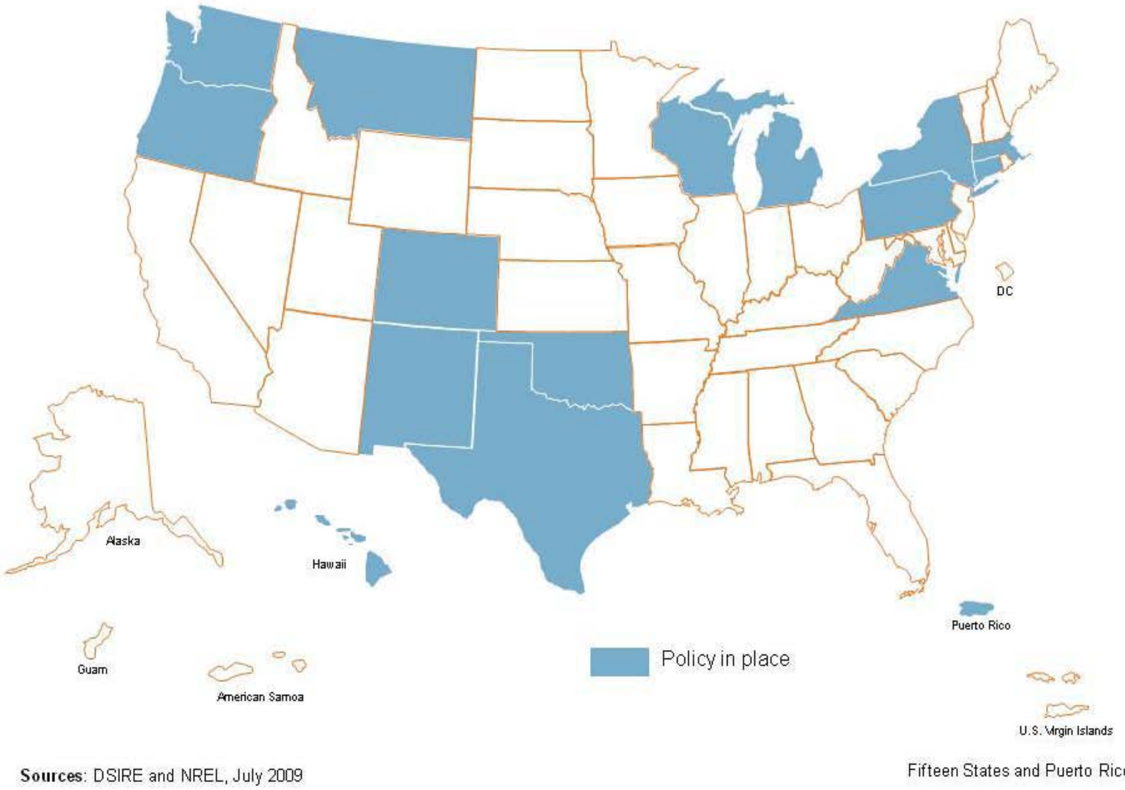

Figure A-5: Production Incentive

Appendix B: State Policy Adoption

Policy Type	Consumption Access					Information Barriers			Market Barriers		Technology Access							
Specific policy	ICS	REAL	LEA	RGP	GPP	CL	GD	PBF	NM	RPS	GR	LN	RB	REPI	PTI	RTI	STI	CTI
States																		
Albama											X	X			X			
Alaska		X									X	X						
Arizona	X	X	X			X			X	X					X	X	X	X
Arkansas	X								X									
California	X	X				X	X	X	X	X	X	X	X	X		X		
Colorado	X	X	X	X			X		X	X						X	X	
Connecticutt	X				X		X	X	X	X	X	X	X			X	X	
Deleware	X						X	X	X	X	X		X					
Florida	X	X					X		X	X	X		X			X	X	X
Georgia	X	X							X	X					X		X	X
Hawaii	X	X							X			X			X			X
Idaho		X								X					X	X	X	
Illinois	X				X		X	X	X		X		X			X		
Indiana	X	X			X				X		X					X		
Iowa	X	X		X			X		X	X	X	X			X	X	X	X
Kansas		X							X			X				X		
Kentucky	X	X							X	X					X		X	X
Louisiana	X								X			X			X	X		X
Maine		X			X		X	X	X	X	X	X	X				X	
Maryland	X	X			X		X		X	X		X	X		X	X	X	X
Masschusetts	X	X			X		X	X	X	X	X	X	X		X	X	X	X
Michigan	X						X	X	X		X					X		
Minnesota	X	X		X			X	X	X	X	X	X	X	X		X	X	
Mississippi												X						
Missouri	X	X							X			X						X
Montana	X	X		X				X	X			X			X	X		X

Appendix B: State Policy Adoption (Continued)

Policy Type	Consumption Access					Information Barriers			Market Barriers		Technology Access							
Specific policy	ICS	REAL	LEA	RGP	GPP	CL	GD	PBF	NM	RPS	GR	LN	RB	REPI	PTI	RTI	STI	CTI
States																		
Nebraska	X	X							X	X		X					X	
Nevada	X	X				X	X		X	X			X			X	X	
New Hampshire	X	X							X	X		X	X			X		
New Jersey	X	X					X	X	X	X		X	X	X		X	X	
New Mexico	X	X		X					X	X					X			X
New York	X	X			X		X	X	X	X	X	X	X	X	X	X	X	X
North Carolina	X	X							X	X	X	X			X	X	X	X
North Dakota		X							X	X					X	X	X	X
Ohio	X	X					X	X	X	X	X					X	X	X
Oklahoma									X			X						X
Oregon	X	X		X		X	X	X	X	X	X	X	X		X	X		X
Pennsylvania	X						X	X	X	X	X	X	X			X		
Rhode Island		X					X	X	X	X	X				X	X	X	X
South Carolina	X													X	X		X	X
South Dakota										X						X		
Tennessee		X									X	X				X		
Texas	X		X				X			X		X				X		X
Utah	X	X				X			X	X					X		X	X
Vermont	X	X		X				X	X	X	X	X	X	X	X	X	X	X
Virginia	X	X					X		X	X						X		
Washington	X	X		X			X		X	X				X			X	
West Virginia									X						X	X		X
Wisconsin	X	X			X			X	X	X	X		X			X	X	
Wyoming	X												X				X	
TOTALS	**38**	**36**	**3**	**8**	**8**	**5**	**22**	**18**	**41**	**34**	**22**	**26**	**18**	**7**	**21**	**33**	**28**	**24**