TAILORING RENEWABLE PORTFOLIO STANDARDS TO ACHIEVE DISPARATE ECONOMIC AND ENVIRONMENTAL GOALS

by

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ABSTRACT

Within the United States, Renewable Portfolio Standard (RPS) programs have become a popular public policy initiative for states to enact in order to encourage the use of renewable resources for meeting state energy demand. As more states have adopted RPS programs, the design of these programs have grown more varied and complex as states seek to increase the benefits and decrease the costs of RPS programs by tailoring program design to suit the interests and characteristics of a state.

The purpose of this Masters Project is to create a primer for policymakers, interested in designing new, or amending existing, RPS programs, to better understand the policy design options available when developing an RPS program, the potential impacts of structuring an RPS program in a particular manner, and the current best practices and national trends in designing RPS programs. My report uses best practice RPS design principles, created by Wiser et al. in 2003, to evaluate the positive and negative impacts RPS component options have on each principle.

The use of an energy-based compliance requirement, unbundled renewable energy certificates (RECs), REC banking, true-up periods, and clearly defined financial penalties for non-compliance are necessary components for the optimal performance of any state RPS program. The goals emphasized by different RPS programs and state-specific characteristics dictate the additional RPS components needed to complete the optimal RPS design for a state. Of the RPS design options analyzed, most have positive impacts on some best practice principles while having negative impacts on others. As a result, it is important for policymakers to clearly define the relative importance of different policy goals that an RPS program aims to achieve in order to select the appropriate RPS component options.

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1. EXECUTIVE SUMMARY

1.1 Introduction

The purpose of a Renewable Portfolio Standard (RPS) is to increase the development and utilization of renewable resources for electricity generation. In the US, RPS programs are typically enacted at the state level, requiring utilities within the state to meet a percentage of their total retail sales of electricity with renewable energy (RE) generation. In total, 26 states have created RPS programs to date as well as the District of Columbia. The majority of these programs have been enacted in just the last five years.

As RPS legislation has been adopted by more states, RPS programs have grown more complex. The objective of this paper is to evaluate the various RPS component options (i.e. cost containment, eligibility restrictions, or specific technology incentives) of state RPS programs to better understand why different components might be included in an RPS program and to evaluate when it may or may not make sense to include specific components within an RPS. This paper can serve as a primer or roadmap for anyone seeking to create a new RPS program in those states that have yet to enact an RPS, or for anyone considering ways of improving an existing RPS program through a revision of its structure.

1.2 Methods

In support of my analysis, I reviewed the program designs of all 26 state RPS programs, creating a database of state RPS design characteristics. I supplemented this information with several reports that provide status updates on the current state of RPS programs across the country

(Rabe, 2006; Sedano & Murray, 2005; Wiser et al., 2007; Wiser & Barbose, 2008). Using the information collected and database created, I discuss the most common components present within current RPS programs and recent program design trends.

For evaluating the best practices of RPS program design, I use six best practice principles created in 2003 by Wiser et al. who critiqued each state RPS enacted at that time, pointing out the strengths and weaknesses of each RPS design. According to these principles, a well-structured RPS program is:

1. Socially Beneficial
2. Cost-Effective and Flexible
3. Predictable
4. Nondiscriminatory
5. Enforceable
6. Consistent with Market Structures

Rather than recreate Wiser et al.'s 2003 analysis for the new and modified RPS programs present in 2008, I evaluate each individual component option available in designing an RPS in order to determine the likely impacts that the inclusion of a component option will have on the overall performance of an RPS program.

1.3 RPS Goals

The intent of state RPS programs is to provide three types of benefits to a state. First, the renewable energy development generated by an RPS is intended to benefit the environment by reducing the state and region's reliance on conventional fossil fuel power plants, reducing the amount of pollution emitted to meet the state's electricity demand. The second goal of RPS programs is for them to be beneficial to the state economy by creating new green jobs and industries. The third goal of RPS programs is that they benefit the electricity industry by diversifying the energy resources utilities utilize to meet electricity demand and help stabilize electricity prices by increasing the use of energy resources that have stable variable fuel costs.

1.4 Evaluating RPS Design Options

I organized my evaluation of RPS design options into seven categories of components that describe all the major design considerations and policies that must be considered when constructing an RPS program. One category, eligibility, has three subsections to account for the wide array of eligibility decisions that must be made when designing an RPS program.

1.4.1 Compliance Metric and Tracking

The requirements of an RPS program can be set in terms of power capacity (megawatts) or energy generation (megawatt-hours). While a power capacity standard is easy to understand, it is inconsistent with the primary purpose of the electricity industry which is to generate and supply energy for consumption. As a result, the national consensus is to design RPS programs with energy generation requirements.

Tracking RPS compliance can be done through monitoring renewable energy purchases, bundled renewable energy certificates (RECs), or unbundled RECs. The national trend towards the use of unbundled RECs has been driven by the greater cost-effectiveness and flexibility that this method of tracking provides to RPS programs. While there are concerns about the negative social benefit impacts of unbundled REC use, these impacts can be partially mitigated through constraints on the eligibility of out-of-state RECs (discussed in the location eligibility section).

1.4.2 Eligibility

1.4.2.1 Resource Eligibility

'Renewable energy' does not mean the same thing to all people and groups. Consequently, eligible RE resources must be defined by any RPS program. The resources that state RPS programs define as eligible for use in RPS compliance covers a wide spectrum from narrowly defining eligible resources to core RE resources like wind, solar, geothermal, etc., to a much broader interpretation that allows resources like municipal solid waste and large hydropower to be eligible. Many RPS programs use tiers within their RE requirements for different types of RE resources. Alternative, non-renewable energy resources such as clean coal technology and energy efficiency can also be included within eligible resources as a separate class.

Within this category, the chief design challenge is addressing the tension between the social benefits an RPS delivers and the cost-effectiveness of the program. Narrowly defined resource eligibility may improve the environmental benefits of an RPS but at the expense of energy diversity and higher overall compliance costs. Conversely, a broad definition of eligible resources creates more competition between eligible resources, driving down costs, and may help increase the resource diversity used to achieve compliance. One exception to the tension between social benefits and cost-effectiveness is the eligibility of energy efficiency which has both a positive social benefit and cost-effectiveness impact on an RPS. Consequently, states that do not already have aggressive energy efficiency programs ought to strongly consider incorporating energy efficiency into their portfolio standards to improve its overall performance.

The appropriate resource eligibility definition for a state is heavily dependent upon the particular characteristics of the state. States with ample RE resources have a lot more flexibility in how they define eligible resources than states where RE resources are limited. In the latter states, a tiered resource standard that includes low-cost, less socially preferable energy resources in a secondary tier makes sense as a means of balancing the social benefits and cost-effectiveness of an RPS program.

1.4.2.2 Facility Eligibility

Whether existing RE facilities are eligible to generate RECs for use in complying with a state's RPS is another important RPS design consideration. Fifteen states do not make any eligibility distinctions between new and existing RE facilities. Many of these states have set more aggressive initial and ultimate RE standards to take into account existing RE generation already being used to meet state electricity demand.

Among the remaining states, the eligibility of existing facilities is treated in one of three ways. First, all existing facilities can be ruled ineligible. Second, all facilities built before a certain year that pre-dates the enactment of the RPS can be ruled ineligible. Third, the electricity generated from existing RE facilities may be used to achieve compliance with a portion of a state's RPS.

It is important for states that meet a significant portion of their electricity demand with generation from existing RE facilities to account for existing facilities when defining facility eligibility in order to avoid having new renewable energy development crowded out by existing RE facilities. States can address this issue either by adjusting the RE standard upwards to account for existing RE generation or by creating separate tiers of new and existing RE facilities. Once again, states concerned with compliance costs ought to considering using a tiered standard with existing RE facilities included in a secondary tier as a means of balancing non-discrimination interests against program cost-effectiveness.

1.4.2.3 Location Eligibility

The manner in which existing state RPS programs handle the eligibility of RECs generated out-of-state covers a wide spectrum with some states only allowing RECs that are generated in-state to be used for RPS compliance while others have few or no restrictions on where the RECs can originate. In between these extremes lie most state eligibility requirements for RECs. The most common geographic limitations require that the RE be delivered to the state or region in order for the associated RECs to be eligible for use in the state. Others states limit out-of-state RECs by allowing them to fulfill only a percentage of the total RPS compliance requirements.

Overall, the value of geographic REC limitations is largely dependent upon the circumstance of the state. States with large amounts of RE resources risk little but also gain little by implementing restrictions on the use of out-of-state RECs since most RECs used for compliance will be generated in-state either way. States will limited in-state RE resources risk much more by limiting the eligibility of out-of-state RECs and so should be much more carefully to weigh the social benefit gains of such limitations against the potential increases in RPS compliance costs.

Another important consideration is whether a state is surrounded by other RPS states. Allowing for the regional trade of RECs with other RPS states may encourage or discourage RE development within the state depending upon the competitiveness of the state's RE facilities and resources, but it will have the opposite impact on RPS compliance costs. This tradeoff provides some level of balance between the social benefit and cost-effectiveness objectives of an RPS program. The larger REC market created by regional trading further stabilizes REC prices, benefitting both RE developers and electricity consumers.

In the absence of a regional REC market, states that are not neighbored by other RPS states should strongly consider allowing eligibility of out-of-state RECs for compliance with a percentage of the state's overall RPS requirements. Such a limit would provide some useful compliance flexibility for utility's if in-state RE resources are not developed on schedule, are insufficient, or prove to be expensive while still ensuring the a significant amount of RE and its ensuing social benefits will be developed within the state.

1.4.3 Coverage

Nineteen RPS states make some form of exemption from the main RPS standard for smaller or publicly-owned electric utilities. Typical exemptions included less aggressive RE standards, fewer restrictions on how compliance is achieved, requirements that exempted utilities develop their own RE procurement policies, or complete exemptions from RPS requirements.

Providing exemptions from an RPS program's requirements violates the best practice principle of nondiscrimination and ought not to be provided without sound justification. The claim that smaller utilities bear higher proportional costs for complying with RPS programs is a somewhat weak argument that lacks substantiation, especially when RPS compliance is achieved through the use of unbundled RECs. Unfortunately, energy politics is a contentious field and providing exemptions from the requirements of an RPS can be a useful political tool for removing the opposition of critical stakeholders that might threaten RPS program ratification.

1.4.4 Renewable Energy Technology Preference

Three options exist for how an RPS can be designed to address the public and private interests of giving preference to certain types of RE technologies. First, a state can provide no preferential treatment to RE technologies. Second, additional RECs can be issued for each MWh of electricity generated from specific RE technologies, increasing the competitiveness of the technology. Third, a state can utilize a set-aside requirement, or mini-tier, to require a certain portion of the overall RPS standard, typically a small percentage, be met using a specific RE technology.

Recent trends have shown states favoring the use of set-asides over REC multipliers, including Arizona and New Mexico who switched from using REC multipliers to set-asides because REC multipliers were not providing the level of demand certainty necessary to encourage the actual development of technologies given preference by the RPS. While set-aside requirements have the potential to increase RPS program compliance costs, the resource diversity and innovation benefits generated by the use of small set-asides are sufficient to justify their inclusion for many states.

1.4.5 Compliance Flexibility

There are several ways to combat price volatility by making utility compliance with an RPS more flexible. One of the simplest methods of increasing compliance is to create a true-up period for several months after the compliance period has ended in order to provide utilities with more time to acquire the RECs needed for compliance. In many cases, RECs created during this true-up period can also be used to comply with the previous year's REC requirements. A second option is to allow a utility to borrow RECs that must be repaid at a later date. Conversely, the third option is to allow utilities to save, or 'bank', RECs generated during one year to be used in later years. One last compliance flexibility measure is the use of an alternative compliance payment (ACP), which allows utilities to buy an unlimited number of alternative RECs from the state at a given price.

Compliance flexibility is an essential aspect of an RPS program if it is to successfully and cost-effectively promote RE development. The popularity of banking as a flexibility measure is understandable because it provides an incentive to utilities to encourage a more rapid development of RE resources than necessary for RPS compliance in order to accumulate excess RECs and stabilize REC prices over time. The borrowing of RECs can be equally useful to a utility but suffers from the perception that it enables laggard utilities to avoid non-compliance and punishment. Both banking and borrowing provide compliance flexibility while ensuring that, ultimately, all the RE required by an RPS is generated.

An ACP is a less preferable form of compliance flexibility (although it has other purposes to be discussed below) because it only guarantees that a certain amount of money will be devoted to the development of renewable energy, not that the required amounts of RE will actually be generated. Were an RPS program were to utilize both REC banking and borrowing, then the use of an ACP would be largely unnecessary for providing compliance flexibility since the ability to bank and borrow would provide compliance flexibility for most any situation.

1.4.6 Enforcement

The first RPS programs enacted tended to rely on undefined penalties for non-compliance that would be determined by the state's PUC. Such penalties may be financial but also might take the form of requirements on the actions that a utility must make to achieve future compliance with RPS requirements. Recently implemented RPS programs have more commonly enforced compliance by requiring utilities to pay a set amount for each REC that a utility is short of their required amount. This method of enforcement breaks down into a spectrum with some states considering these payments in lieu of RECs to be an ACP while other states consider the payments to be financial penalties for non-compliance. The main distinction between an ACP and a MWh-based penalty is whether the utility is allowed to recover the cost of the payments by passing the costs on to ratepayers in electricity bills or whether the cost of the payments must come out of the utility's profits. Five states allow for automatic recovery of ACP costs while another four states leave the decision of whether ACP costs for a utility can be recovered up to the determination of the state PUC. Another seven states utilize MWh-based financial penalties, typically not allowing the costs from these penalties to be recovered through a utility's ratebase.

Key to the efficacy of enforcement is the certainty that non-compliance will be penalized. But as is noted by Wiser et al., 2003, the appropriate enforcement method can vary between regulated and deregulated states. In regulated states where the state utility commission is typically more involved in the resource planning and cost recovery decisions of utilities, strong oversight and action to develop a plan for achieving compliance, or keeping a utility in compliance, may be all that is necessary to enforce an RPS so long as the clear threat of financial penalties exists as a last resort. In deregulated states, where state utility commissions have much less oversight over utilities, a well-defined ACP system that utilities must use to cover any REC shortfalls is likely to provide the necessary motivation for utilities to aggressively pursue RE procurement.

1.4.7 Cost Containment

The simplest and most common cost containment measure used by states is a limit on the percentage retail rate impact caused by the RPS. Rate impacts in excess of the limit result in suspension of any further RE acquisition until the rate impact falls below the limit once again. A slightly more complicated cost containment measure is to limit the rate impact to specific types of electricity consumers. Under such a policy, the rate impact to the average residential customer may be limited to $5 per month while the average industrial customer's energy bill impact may be limited to $50,000 per month. A third form of cost containment is for utilities to define the maximum price that utilities can pay for renewable energy. This method of cost containment is more common to states that do not use RECs for compliance and/or are regulated utility states where the utility commission is aggressively involved in the resource procurement activities of the utilities it regulates. In addition to the formal cost containment measures that states use to control RPS costs, many states utilize ACPs which act as cost cap by providing a ceiling on the price of RECs. The use of an ACP as the sole method of cost containment typically results in a maximum rate impact several times larger than if another method of cost containment is used.

The use of cost containment measures is a clear example of the tension and need for balance between the social benefits of an RPS and the potential costs of compliance. For states that have ample low-cost RE resources, the concern that an RPS program's costs will be excessively high are small and consequently the need for a cost cap is small as well. For smaller states or states with limited RE resources, the value of a cost containment measure can be significantly greater since the potential for high or volatile compliance costs is greater. For most states, the retail rate impact cap is the most straightforward and fair method of containing RPS costs.

But cost containment measures should not be intended as a means of limiting an RPS program's costs to the projections of an initial RPS cost study. Cost containment measures are a very blunt instrument best suited to controlling runaway compliance costs that would otherwise damage a state's economy. As a result, cost containment measures should be set at several multiples of the projected costs of an RPS program and used as a cost control mechanism of last resort. Less blunt methods of controlling compliance costs, such having a broader definition of resource eligibility, allowing out-of-state RECs to be used for compliance, and increasing compliance flexibility, are available and should be used to increase the likelihood that an RPS program will be cost-effective.

1.5 Optimal RPS Design Case Examples

In order to demonstrate the conclusions drawn in my evaluation of design options, I provide hypothetical RPS program designs for two states, Idaho and Georgia, that do not current have

RPS programs. The optimal RPS design for these two states have some similarities, both because of national RPS design trends and because the two states have some similar characteristics, but also have a number of differences. In both states, I recommend their RPS design follow national trends by using energy generation-based RE requirements, unbundled RECs, true-up periods, allowances for REC banking, and an ACP to enforce the program's requirements. Because both states are middle-income states, I recommend that both use a retail rate impact cap to ensure RPS compliance costs do not get excessively expensive and structure their programs to have separate tiers for existing and new RE development.

Despite these similarities in recommended RPS designs, there are a number of differences to my recommendations as well. Because Idaho is a small population state with ample RE resources, it can afford to set a more aggressive RE standard and have a renewable resource definition that is only moderate in breadth. In comparison, Georgia is a state with relatively few low-cost RE resources in comparison to its population and ought to consider a more moderate RE standard and a broader definition of eligible RE resources.

A second difference between the optimal RPS designs for Idaho and Georgia exists in the way the two programs ought to address the eligibility out-of-state RE generation. Because the western region of the US has a large number of RPS states, including Idaho neighbors Oregon, Washington, Nevada, and Montana, Idaho ought to join the regional REC trading market that is developing and allow for regional RECs to be used for compliance. In contrast, the southern region of the US has only one state with an RPS program currently, North Carolina, and as a result Georgia should limit the amount of out-of-state RECs that can be used for RPS compliance in order to encourage in-state RE development until a southern RE market develops more fully.

One final difference in optimal program designs between the two states is in how RPS regulatory coverage should be defined. While universal coverage is preferable in both states, Idaho's retail electricity sales are dominated by three utilities while almost half of Georgia's retail electricity sales are from smaller utilities. As a result, Idaho can provide partial or complete exemptions from its RPS requirements for small utilities without significantly reducing the RE development that will result from its RPS. Georgia does not enjoy this flexibility and needs to provide few if any exemptions from its RPS requirements in order to deliver the renewable energy development expected from whatever percentage standard Georgia chooses.

1.6 Conclusions

The use of an energy-based compliance requirement, unbundled renewable energy certificates (RECs), REC banking, true-up periods, and clearly defined financial penalties for non-compliance are necessary components for the optimal performance of any state RPS program. The goals emphasized by different RPS programs and state-specific characteristics dictate the additional RPS components needed to complete the optimal RPS design for a state. Of the RPS design options analyzed, most have positive impacts on some best practice principles while having negative impacts on others.

In order to create an RPS program that not only balances the different goals that the program is intended to achieve but also balances these benefits against the program's costs, the optimal RPS components for many of the categories evaluated are going to the component designs that are a compromise between the extreme options available. While this increases the apparent complexity of RPS programs in most cases, it also tends to provide greater flexibility to RE developers, utilities, and public utility commissions in their efforts to make an RPS program successful.

2. INTRODUCTION

A Renewable Portfolio Standard (RPS) is a government policy initiative intended to require greater generation in order to meet a larger amount of customer electricity demand. In the U.S., RPS legislation has typically been applied at the state level through legislation to require more RE (RE) generation be used by all, or certain categories of, electricity service providers (here forward referred to as "utilities") to meet their customers' electricity demand and sets the quantity of RE required as a percentage of total electricity sold within the state each year.

Beginning in 1994 with the first successful initiative to create a state RPS in Minnesota,[1] the U.S. has seen a rapidly strengthening trend towards the implementation of mandatory RPS legislation at the state level. Today, 26 states and the District of Columbia have enacted mandatory RPS legislation while six additional states have enacted voluntary Renewable Portfolio Goal (RPG) programs. In addition, most of the early RPS adopter states have revised their RPS commitments upwards.

As RPS legislation has been adopted by more states, RPS programs have grown more complex. RPS programs enacted in recent years have included many provisions intended to address specific stakeholder interests, such as alternative compliance payments, specific RE set-asides, and the eligibility of energy efficiency. While the evolution of RPS program design has been rapid, the transmission of information about successful and flawed design elements has been fragmentary between states.

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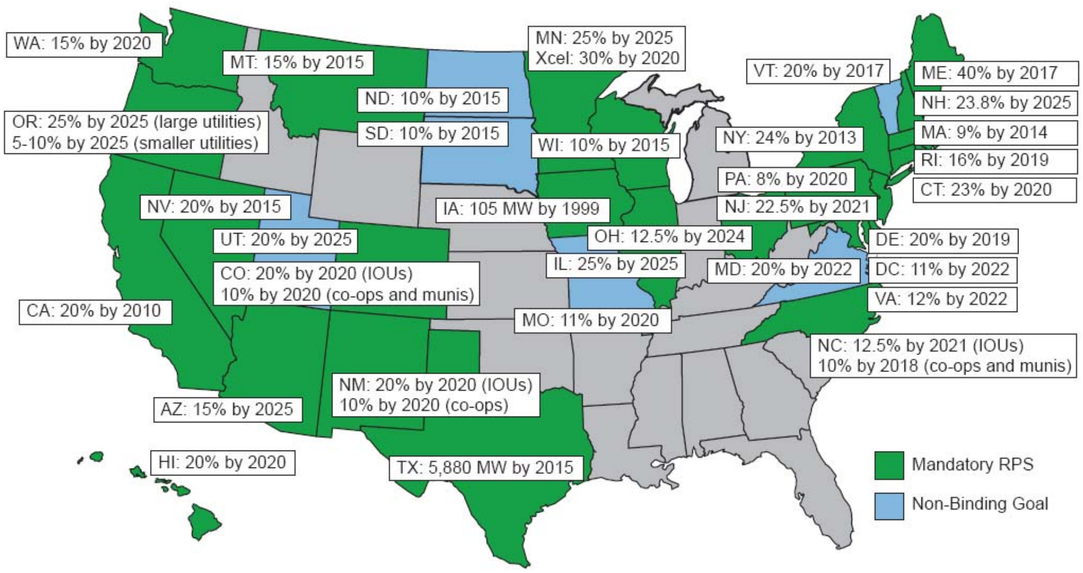
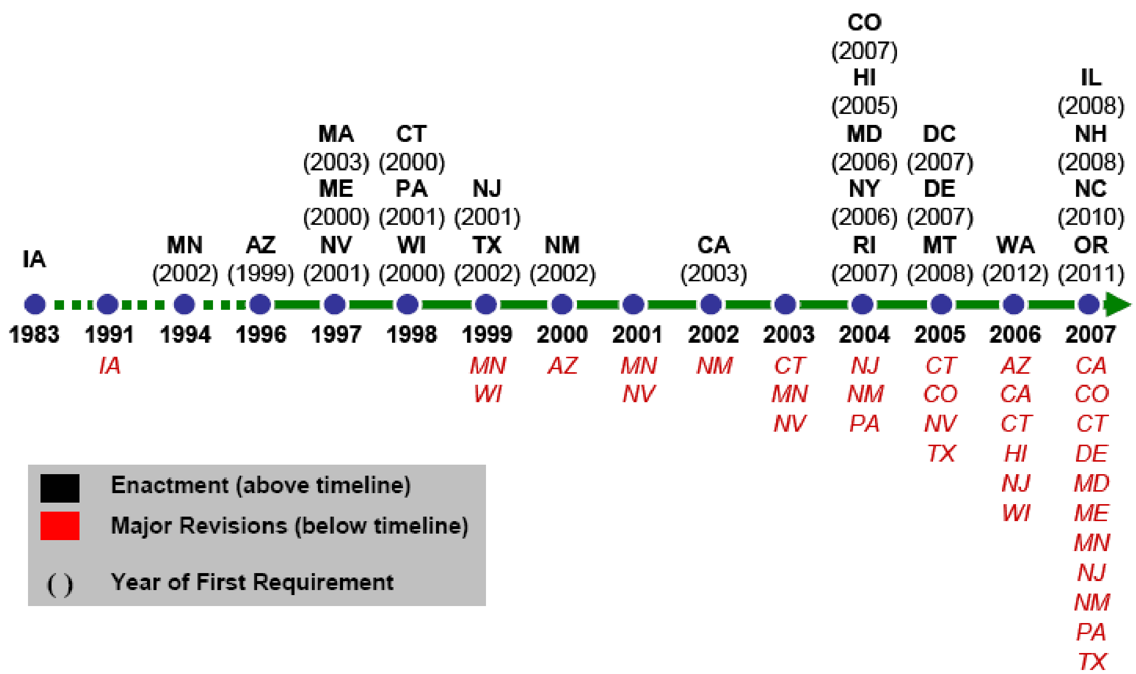
[1] While Iowa's 1983 Alternative Energy Law is commonly considered to be an RPS, including in this paper, the law's requirement that the state's two major electricity utilities invest in 105 MW of renewable power capacity bears only some of the traits of modern RPS programs and failed to capture the attention of policymakers outside the state.

Figure 1 – Current states with mandatory RPS and voluntary RPG programs



Source: EERE, 2008

Figure 2 – The Adoption and Revision of State RPS Programs



Source: Wiser, 2008

The objective of this paper is to evaluate the various RPS component options (i.e. cost containment, eligibility restrictions, or specific technology incentives) of state RPS programs to better understand why different components might be included in an RPS program and to evaluate when it may or may not make sense to include specific components within an RPS program. This paper can serve as a primer or roadmap for anyone seeking to create a new RPS program in those states that have yet to enact an RPS program, or for anyone considering ways of improving an existing RPS program through a revision of its structure.

Section 3 of this paper details the methods used to evaluate the RPS design options available to states looking to enact or amend an RPS program. Section 4 outlines the chief goals that an RPS is intended to deliver. Section 5 separates each component I evaluate into seven different categories corresponding to the main purpose of each type of component. It should be noted that not all components fit neatly into one category but are placed in the category they fit best into while also being discussed at lesser length in other pertinent categories.

I have organized Section 5 so that each category of RPS design components is considered separately. Within each category, I evaluate the various component design options available to policymakers when deciding how to structure an RPS program. I also evaluate the main stakeholders groups that are likely to influence which components are included within an RPS. For each category of RPS components, I next evaluate how each RPS design component interacts with the best practices for RPS design. In order to evaluate these components, I use the best practice principles developed by Wiser et al. in 2003. Finally, I finish each category subsection with conclusions about which policy options are most likely to lead to a well-performing RPS program and what other factors might affect the success of different component options and an RPS program's overall performance.

Section 6 applies the conclusions drawn in Section 5 to two states, Idaho and Georgia, that have not yet enacted RPS programs to see what similarities and differences might exist between the optimal RPS design structures for the two states. Finally, Section 7 includes my conclusions about how to best structure an RPS program to ensure that it will deliver, as best as possible, all the environmental, economic, and energy benefits attributed to the implementation of an RPS program while also moderating the potential costs of such a program.

3. METHODS

In order to accumulate the necessary information about all 26 state RPS programs enacted in the U.S., I created a comprehensive database of state RPS design characteristics using the DSIRE database which catalogs and summarizes each state's RPS program and has links to each state's RPS language. I supplemented this information with several reports that provide status reports on the current state of RPS programs across the country (Rabe, 2006; Sedano & Murray, 2005; Wiser et al., 2007; Wiser & Barbose, 2008). Using the information collected and database created, I discuss in Section 5 the most common components present within current RPS programs and determine trends based on how RPS programs have changed over time and how more recently enacted RPS programs have been structured.

Through cataloguing the purposes listed by each state when enacting their RPS, I summarize below the six goals RPS programs intend to achieve with varying degrees of emphasis. These goals are to:

1. Encourage RE development
2. Improve the environmental quality of the state and region
3. Strengthen the state economy
4. Promote the creation of new, in-state jobs
5. Encourage stable electricity prices in both the near and long-term
6. Encourage innovation in RE technologies

My own analysis of state RPS programs builds off the work done in 2003 by Wiser et al. who critiqued each state RPS enacted at that time, pointing out the strengths and weaknesses of each RPS design. As part of the analysis, Wiser et al. developed a set of seven best practice principles that describe an optimal RPS program as:

1. Socially Beneficial – Increasing RE generation, creating new, high quality jobs, improving environmental quality, increasing the diversity of energy supply, decreasing electricity price volatility, and other politically chosen objectives.

2. Cost-Effective and Flexible – Implemented and administered in a straightforward, flexible, and not unduly burdensome manner that allows program compliance to be achieved at a low $/MWh cost ratio.

3. Predictable – A stable program that provides market stability for all participants, reducing regulatory risk for generators and utilities and improving the ability of RE developers to obtain long-term financing.

4. Nondiscriminatory – The application of fair, consistent, and proportional program and regulatory requirements to all market participants and customers.

5. Enforceable – Incorporating appropriate regulatory oversight or penalties to ensure that a policy's RE targets and broader goals are achieved.

6. Consistent with Market Structures – Consistent with and complementary to the structure of a state's electricity market, whether regulated or deregulated.

7. Compatible with Other Policies – Compatible with other applicable policies and regulations in the state and region.

Rather than recreate Wiser et al.'s 2003 analysis for the new and modified RPS programs present in 2008, I evaluate each individual component option available in designing an RPS using the first six best practice principles above[2] and their underlying criteria[3] in order to determine the likely impacts that the inclusion of a component option will have on the overall performance of an RPS program. Having evaluated each RPS component option, I discuss which RPS components are likely to work better together and create a more optimal RPS program design and how various components will be affected by state-specific variables such as renewable resource availability, transmission capacity, and median state income.

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[2] The applicability of the seventh principle, Compatible with Other Policies, falls somewhat outside the scope of my project since it is less focused on policy design or market outcomes and more focused on the interaction that an RPS might have with other state initiatives which I have not catalogued or evaluated.
[3] The underlying criteria that led to Wiser et al.'s development of the seven best practice principles for a successful RPS are shown in Appendix 1.

4. RPS GOALS

At the beginning of most every state RPS enacted is a section that details the reasons for why the RPS is a desirable piece of policymaking. Common reasons used to justify the enactment of an RPS include claims that an RPS will provide economic, environmental, and electricity price benefits.

Table 1 – Common Goals Used for Justifying RPS Enactment and Implementation

Benefit Categories	Intended RPS Goals	Legitimacy of Goals
Economic	Increase in-state RE development	Legitimacy is unclear but likely correct. The percentage of total RE development occurring in RPS states is rising rapidly, reaching 72% in 2007 (Wiser et al., 2008).
	Job creation	Initial results demonstrate goal's legitimacy. Both in terms of jobs per million dollars of investment and jobs per MWh of electricity generated, RE facilities generate more jobs than conventional power plants (Kammen et al., 2004).
	Increase innovation in RE industry	Innovation is hard to attribute to specific market forces but the creation and development of advanced solar and geothermal facilities in the US Southwest is an example of how RPS programs likely encourage renewable technology innovation.
Environmental	Reduce greenhouse gas emissions from the electricity sector	Most all RE technologies have been found to have no or low greenhouse gas emissions when compared with conventional energy technologies.
	Improve state air quality	With few exceptions, replacing natural gas and coal-fired electricity generation with RE generation results in a net reduction in harmful air pollutant emissions.

Benefit Categories	Intended RPS Goals	Legitimacy of Goals
	Improve state water quality	The most prevalently used RE technologies use minimal water for energy generation. Reductions in the electricity generation from large conventional power plants reduces the overall water consumption from the electricity industry and reduces the thermal pollution created when cooling water is returned to lakes and rivers.
Electricity	Price stabilization through greater energy resource diversity	Legitimacy of goal is likely since RE cost fluctuations are unlikely to directly mirror the cost fluctuations of conventional energy generation.
	Increase future electricity price certainty through use of energy resources with no or few variable fuel costs	RE prices have fluctuated wildly in some states but all non-solar price fluctuations have typically stayed below $0.005/kWh whereas electricity cost fluctuations for natural gas power plants have been several times larger in recent years (Wiser et al., 2008). Future price changes are uncertain but likely to be less volatile with further RE market expansion and maturation.

Understanding the intended goals of an RPS is key to understanding the logic behind the design structure of an RPS program because pursuing any one goal to its furthest extent will likely diminish the capability of an RPS to deliver on its many other goals. For instance, an emphasis on promoting the development of new and advanced RE technologies may result in higher short-term electricity prices than if an RPS were designed to focus RE development on mature energy technologies such as large-scale wind energy projects.

5. EVALUATING RPS DESIGN OPTIONS

5.1 Overview

In this section I discuss and evaluate the different RPS component options for seven different categories of policy components that are commonly included within state RPS programs. Within each category, I will first discuss the possible policy options that are or can be used to structure an RPS to meet different goals. Second, I discuss the potential stakeholder groups that are most interested in influencing an RPS program's structure within each category. Third, I evaluate how the Wiser et al. best practice principles are affected by each of the RPS component options. Finally, I finish each category subsection with conclusions about which policy options are most likely to lead to a well-performing RPS program and what other factors might affect the success of different component options.

At the beginning of each component evaluation subsection is a table that provides a quick overview of the subsection's analysis with the best practice principles of the section running across the columns and the potential component options running down the rows. Within the body of the tables, a "+" means that the component has a positive impact on an RPS's performance in that particular principle while a "– " means that the component has a negative impact on that principle. Components within the tables that have a "+ +" or "– –" have strongly positive or negative impacts on the particular best practice principle in question. Components within the tables that have a "±" have an uncertain or minimal impact on the particular principle being analyzed.

5.2 Compliance Metric and Tracking

One of the key questions to address when designing an RPS is how compliance with the standard is going to be measured and tracked. An RPS is only as good as the metric that is used to gauge progress and compliance with the program's chief goal of promoting RE development. Likewise, without a consistent and transparent method of tracking compliance, an RPS will be expensive to administer and difficult to enforce.

5.2.1 Metric and Tracking Options

Two of the first states to enact an RPS, Iowa and Texas, defined their required RE standards in terms of MWs of capacity which presented a challenge for implementation since the energy output of a 100MW wind energy facility is likely to be very different from the output of a 100MW biomass facility. As a result, both states converted their initial standards into requirements that credited facilities for their annual average power output rather than their nameplate power capacity. The other 24 state RPS programs that have been enacted have defined the requirements of the standard not in terms of power capacity but in terms of energy generated, requiring that a certain percentage of each utility's total retail sales be met through the generation of RE.

Defining compliance with an RPS in terms of energy rather than power capacity results in a number of potential options for how compliance can be tracked and achieved. The first method of tracking compliance is for the state PUC to require each utility in the state to enter into long-term contracts with RE facilities to purchase the electricity generated. This method only occurs in states that closely regulate their electric utilities and typically requires that the state's utilities acquire a large percentage of their electricity and RE generated electricity through long-term contracts. A second method of compliance is to allow utilities to purchase RE by whatever means is preferable so long as the amount of electricity purchased from eligible RE facilities is sufficient to meet the utility's RPS compliance requirements. This second method only occurs in states that have deregulated electric utility industries where short-term power procurement markets are better developed.

The third and most common method of tracking compliance is to make a distinction between the generic electrons and RE attributes of each MWh of electricity generated from renewable resources. The RE attributes, commonly called RE Certificates (RECs), are then used as the basis for evaluating a utility's RPS compliance. Each REC is equal to a MWh of electricity generated from renewable resources. This distinction between the electricity being generated and RECs allows state PUCs to provide utilities with greater flexibility in achieving compliance with an RPS. While some states track compliance through RECs while requiring all RECs to be sold, or 'bundled', along with the electricity that generated the RECs, it is more common for state PUCs to allow eligible RECs to be traded separately, or 'unbundled', from their associated electricity.

Only four states do not currently allow RECs to be used for RPS compliance and two of these states, California and New York, are in the process of transitioning to the use of RECs for compliance tracking. Only Iowa and Hawaii do not have plans to allow the use of RECs.[4]

5.2.2 Interested Stakeholders

[4] For all subsequent sections of this report, I will discuss RPS compliance in terms of RECs since this is the predominant method of tracking and enforcing utility compliance.

Utilities: Favor allowing the use of unbundled RECs because it provides greater flexibility to achieve compliance and reduces the costs of acquiring, tracking, and reporting compliance.

RE facility owners and developers: Favor the use of unbundled RECs because it maximizes the potential value of generating RE by ensuring that transmission constraints don't diminish the value of the RE attributes being generated.

Environmental groups: Often have some reservations about the use of RECs because they allow the environmental and economic benefits of RE development to be concentrated in specific areas while other areas of a state or region continue to suffer from the negative environmental impacts of conventional power plants. Typically, environmental groups do not try to stop the use of RECs for RPS compliance but instead try and place additional constraints on the eligibility of RECs.

5.2.3 Component Evaluation

Cost-Effectiveness & Flexibility: Consensus has developed around the use of unbundled RECs for three reasons related to cost and flexibility. First, the use of RECs simplifies the tracking, monitoring, and compliance processes as each REC generated is given a specific identification number or code that can be tracked electronically. When RECs are generated, they are reported to a central database the retains all the important information about a particular REC, including information about which facility the REC was generated from, what resources were used, and when. With the use of RECs, utilities no longer have to prove that they purchased and sold the appropriate amount of eligible RE. Instead, RECs are purchased and sold electronically between registered users through the transmission of REC information through a central REC tracking

Table 2 – Evaluation of Metric and Tracking Component Options

Component Options	Best Practice Principles					
	Social Benefits	Cost-Effectiveness & Flexibility	Predictability	Non-discrimination	Enforcement	Consistent with Market Structure
Capacity	– –	+		– –	+	– –
Delivered Energy	+ +	–		–	–	–
Bundled RECs	+ +	–		–	+	–
Unbundled RECs	±	+ +		+	+	+

database. RPS compliance is achieved through the submission and retirement of RECs electronically to the state utility commission or RPS tracking organization.

Second, the use of unbundled RECs is advantageous because physical limitations to the transmission of electricity exist that can make it prohibitively expensive for RE to be delivered to specific utilities or regions. RE facilities are especially sensitive to this challenge because they are typically located in rural areas away from major electricity loads, are frequently located in areas with few major transmission lines, and in many cases electricity generation occurs on nature’s schedule rather than when the electricity might be most needed or easiest to transmit to utilities needing additional RE. As a result, options for how to transmit the electricity generated from a RE facility, and who to sell the electricity to, are limited unless the RE facility or an electric utility takes on the large expense of building additional transmission lines to better connect the RE facility into the regional grid. By separating the RECs from the underlying electricity, it frees up the electricity generated from a RE facility to be sold as a commodity and delivered wherever it is most cost-effective for it to go while allowing the RECs to be sold separately to whichever utility values them the highest.

Third, the use of unbundled RECs allows for REC trading to continue beyond the instant when electricity is generated and consumed. Since foresight is imperfect and the generation of electricity from many RE facilities is uncertain, without post-generation trading utilities would be forced to horde or over-purchase RE in order to ensure compliance in the event that later RE generation were unexpectedly low or electricity demand was unexpectedly high. Such behavior is inefficient and raises the overall cost of compliance with an RPS program.

In contrast to the usage of unbundled RECs for RPS compliance, requiring utilities to acquire RE directly in order to achieve compliance presents a number of physical challenges which are likely to drive compliance costs up. By requiring utilities to directly acquire RE for compliance, the utilities cannot, in all cases, contract with the least cost RE generators. Instead, they must plan around transmission restrictions and losses to figure out which facilities are the least-cost facilities amongst the pool of facilities that they can reliably receive electricity from. Not only does this process mean that many utilities will sign contracts with more expensive RE facilities, costs will be increased further because of the more rigorous and labor-intensive process involved in identifying and contracting with these facilities.

Requiring RECs to be bundled with their associated electricity simplifies the tracking and reporting of RPS compliance for utilities but fails to provide the flexibility associated with unbundled RECs. Requiring eligible RECs to be bundled with their associated electricity does not change the fundamental challenge of acquiring the necessary RE to achieve compliance.

Measuring RPS compliance through power capacity is inherently low-cost because it only requires that utilities own, or be contracted with, sufficient renewable power capacity. Because this metric is largely unrelated to energy output, utilities are free to invest in inexpensive RE technologies without having to consider how much electricity the facilities will actually generate. Augmenting this system, as Texas has done, to consider the energy output of eligible facilities changes the compliance method to either of the two other options, delivered RE or RECs.[5]

Social Benefits: The use of power capacity as a measure of compliance, while simple to understand, is difficult to implement since all energy technologies produce different amounts of energy for a given amount of capacity. The capacity factor is low for technologies like solar and wind and generally much higher for biomass or geothermal power plants. If an RPS uses the power capacity of an eligible facility without taking into account the actual energy generated from the facility, then low capacity factor technologies will be treated equally with high capacity factor technologies despite providing significantly less electricity to the state or region. Since the production of energy is what provides the environmental benefits, and many of the economic

[5] Texas utilizes RECs for tracking compliance.

benefits as well, of an RPS, measuring compliance through energy generation is a more accurate gauge of the benefits a RE facility is providing.

While the use of unbundled RECs for RPS compliance creates greater compliance flexibility and lower compliance costs, this flexibility also has the potential to shift the costs and benefits of an RPS so that areas of a state or region that have the greatest RE resources, in particular wind energy resources, will receive the bulk of the economic benefits, and to a lesser degree the environmental benefits, of an RPS. At the same time, areas of a state that lack low-cost RE resources will see less RE development and the creation of fewer jobs locally as a result of RPS implementation. At the extreme, a state could rely completely on RE generation that occurs out-of-state and that is not delivered into the state in order to achieve RPS compliance. In this extreme case, RPS compliance has been achieved without delivering the local economic and environmental benefits that are important RPS goals. The challenge of controlling where the benefits and costs of an RPS occur when unbundled REC are used for compliance will be discussed further in section 5.3.3.

Requiring utilities to acquire their own RE sacrifices the cost-efficiency of an RPS in favor of ensuring that RE development occurs within reasonable proximity of a utility's service territory in order for the resulting electricity to be able to be delivered to the utility. This limitation helps spread the economic and environmental benefits of an RPS out over a state and region.

Consistency with Market Structure: An RPS's consistency with the electricity market structure in a state can also be affected by the compliance method required by an RPS. The primary objective of electric utilities is to provide reliable electricity at the least cost to meet customer's electricity demand. Defining RPS compliance based on the nameplate power capacity of eligible facilities does not address this core objective since it doesn't measure the actual impact of an eligible facility on meeting a customers' electricity demand. Likewise, requiring utilities to achieve RPS compliance through directly acquiring RE limits a utility's ability to contract with least-cost energy generators and instead gives preference to RE generators that are located in or near a utility's service territory. The use of unbundled RECs for compliance allows utilities to achieve compliance without disrupting their least-cost energy contracting for electricity purchases.

Enforceability: While enforcement is feasible regardless of whether compliance is measured using RECs or actual RE purchases by utilities, the transparency and ease of tracking RECs makes enforcement easier for REC-based RPS programs. By comparison, demonstrating that a utility purchased sufficient RE can be a more complicated process, especially if a utility purchased RE on spot markets rather than receiving all of their RE from long-term contracts.

Nondiscrimination: The use of capacity targets as a metric for compliance with an RPS fails to be nondiscriminatory since a facility that generates 100 MW of power continuously would be considered equally valuable to a facility that delivers 100 MW of power for only one hour out of the year. Because many of the benefits of RE facilities are measured in the reduction of energy generation that occurs at conventional power plants, the maximum power output of a RE facility is of secondary or tertiary importance.

By comparison, an energy generation-based metric for RPS compliance is nondiscriminatory because it focuses on the productivity of the facility rather than its potential, providing an accurate depiction of the contributions of RE facilities towards meeting a utility's or state's electricity demand.

5.2.4 Conclusions

More so than in later sections, there is strong consensus among states that currently have an RPS about the optimal metric and compliance tracking method. In most all cases, states have enacted energy generation-based portfolio standards that utilize unbundled RECs for the tracking of compliance. The use of RECs for measuring RPS compliance ensures that an RPS is unbiased by the power capacity of RE facilities and instead focuses on the amount of electricity generated from eligible RE facilities since it is through electricity generation that an RPS creates environmental benefits, reduces the demands on other electricity generation sources, diversifies a state's energy supply, and helps stabilizes its electricity rates.

Likewise, most all state RPS programs utilize RECs in one form or another because of their ease of tracking. The flexibility created by allowing RECs to be unbundled from the underlying RE has positive impacts on the overall cost to utilities of achieving RPS compliance. While the social benefits of an RPS are jeopardized by the unregulated use of RECs, simple RPS components can be added to help guarantee that an RPS will deliver social benefits to a particular state. Many of these components will be discussed in section 5.3.

5.3 Eligible Resources & Facilities

One of the most important components of an RPS is the section that defines what resources and types and locations of facilities are eligible to be used for compliance with the requirements of an RPS. Because ‘RE’ is a somewhat vague term that means different things to different people, every state RPS must explicitly define which energy resources, technologies, and facilities, as well as where these facilities may be located, are eligible to be used for RPS compliance.

5.3.1 Eligible Resources

5.3.1.1 Eligibility Options

Energy generated from wind, solar photovoltaics, and biomass technologies are considered eligible RE resources in every state RPS passed so far while solar thermal, geothermal, landfill gas, ocean tidal and wave energy generation are commonly defined as eligible resources as well. Also included in many state RPS programs as an eligible resource is fuel cell technology that uses other RE resources as its fuel source. In a few states, solar thermal hot water and heating installations are eligible for RPS compliance as well, even though they do not generate electricity and may offset energy consumption other than electricity.

Large hydro-electric dams are almost exclusively not considered an eligible RE facility but much less consensus exists over how small hydropower facilities, typically defined as being smaller than 10-30 MW in power capacity, should be treated with many states defining them as an eligible resource. Some states have also included additional resources, such as electricity generation from energy that would otherwise be wasted (Colorado), coal mine methane combustion (Pennsylvania) or municipal solid waste incineration (Minnesota), within their definition of a RE resource.

Both Pennsylvania and Ohio have recently expanded their portfolio standards beyond the definition of an RPS by including a second tier of eligible resources that are not RE resources but are other unconventional, advanced energy technologies for which each state wishes to encourage further development. In Pennsylvania, eligible advanced energy resources include waste coal, integrated gasification combined cycle coal technology, large-scale hydropower, and demand side management. In Ohio, eligible advanced energy resources include advanced nuclear power, coal power that includes carbon sequestration, combined heat and power (cogeneration), and energy efficiency. Outside of Ohio, which requires that its eligible energy resources be carbon neutral, no states have included an environmental performance clause in their RPS (i.e. a limit on the rate of sulfur dioxide or particulate matter emissions per kWh of electricity generation) but it is feasible that such a clause could be used to create an incentive to decrease the environmental impacts of marginal alternative energy resources.

The inclusion of energy efficiency among eligible energy resources is a more recent trend that has grown out of the desire to combine into one market-based policy two initiatives that are commonly public policy-driven endeavors, increasing the use of RE and energy efficiency to meet a state's energy demand. Five states, Hawaii, Nevada, North Carolina, Pennsylvania, and Ohio allow 'white tags', the equivalent of RE certificates (RECs)[6] but for energy efficiency projects, to be used to meet a portion of the states' overall portfolio standards. In the first three states listed, white tags generated from energy efficiency projects can only be used for a percentage of the overall RPS requirements while in the latter two states white tags can only be

[6] Discussed in further detail below in section 5.2.

used to meet compliance with the alternative energy tier of the state AEPS. In addition to the five states mentioned above, a number of other states have enacted separate energy efficiency programs or goals in conjunction with their RPS programs. The inclusion of energy efficiency into a portfolio standard has led some to make their own name for this type of standard, a Renewables and Efficiency Portfolio Standard (REPS).

5.3.1.2 Interested Stakeholders

Utilities: Tend to be primarily interested in reducing the risk of significant RPS compliance costs. As a result, utilities are likely to be interested in having as broadly defined a resource eligibility standard as possible in order to increase the potential stocks of resources that can be used to meet compliance. The inclusion of alternative energy technologies is also beneficial to utilities that are more likely to directly develop or implement these resources than RE resources which many utilities rely on smaller, independent companies to develop.

RE resources developers: Have a clear self-interest in defining eligibility as narrowly as possible while ensuring that their own renewable resource of choice is included within the eligible resource and technology definitions.

Potential alternative energy resource developers and owners: Have an interest in expanding a portfolio standard to include their own alternative energy resource so that they can increase the value of the electricity generated from their facility.

Contractors and other energy efficiency technology implementers: Are interested in having energy efficiency included as an eligible resource in order to create a stronger market incentive for the implementation of energy efficiency and to reduce a utility's resistance to meeting electricity demand through demand reductions.

Environmental groups: Are interested in protecting the environmental benefits associated with an RPS. As such, they typically push for a narrower definition of eligible RE resources and facilities that includes only the resources that will deliver the greatest environmental benefits.

Ratepayers groups and large commercial and industrial electricity consumers: Are interested in ensuring that compliance costs are kept as low as possible in order to minimize electricity bill increases. While ratepayers may support the inclusions of energy efficiency as an eligible resource because of its potential to reduce the overall costs of an RPS as well as their own electricity bills through reduced electricity consumption, many larger industrial and commercial electricity consumers may oppose having the costs of energy efficiency programs included in their electricity bills since they are more likely to have already implemented their own energy efficiency programs.

5.3.1.3 Component Evaluation

Social Benefits: The most important impact resource eligibility has on the performance of an RPS is on the program's social benefits. First, defining eligible RE resources narrowly emphasizes the environmental benefits of an RPS by allowing only the cleanest RE technologies to be eligible for use complying with an RPS. For a given RE standard level, limiting eligible resources to only those that are low or free of CO2 emissions and without other negative environmental impacts ensures that an RPS helps a state address critical environmental challenges such as improving air quality and addressing global warming.

Table 3 – Evaluation of Eligible Resource Definition Options

Component Options	Best Practice Principles					
	Social Benefits	Cost-Effectiveness & Flexibility	Predictability	Non-discrimination	Enforcement	Consistent with Market Structure
Narrow Eligibility	+	– –	–	–		
Broad Eligibility	–	+	±	+ +		
Separate Resource Tiers	±	+ +	±	+		
AEPS	±	+ +	±	–		
REPS	+	+	–	±		

At the same time, a narrow definition is likely to reduce the diversity of resources and technologies used to achieve RPS compliance to one or two primary resources with more limited contributions from other eligible resources. Consequently, the resource diversity benefits from an RPS that defines eligible resources narrowly are not as great as for an RPS that defines resource eligibility more broadly. The use of resource tiers or limitations on the amount of low-cost, less-environmentally friendly resources that can be used for compliance are simple methods of trying to balance the different forms of social benefit generated by an RPS.

Technological innovation may also be impacted by how the eligibility of energy resources is defined. One of the benefits of an RPS is that it creates a market incentive for the investment in research and development of new technologies to reduce the costs and increase the potential generation of energy from eligible resources. But at the same time, an RPS can discourage investment in energy resources that are ineligible for RPS compliance. Reducing the investment in less-environmentally beneficial technologies may slow the development of technologies that could benefit the energy industry either by making the energy resource more cost competitive with conventional energy resources or environmentally competitive with eligible RE technologies.

The interaction between the eligibility of various energy resources and a state's energy resource potential is also crucial. States with large amounts of core RE resources like wind, solar, and geothermal have a greater ability to define an RPS program's eligible resources more narrowly without risking a significant influx of out-of-state RE to achieve RPS compliance. Conversely, smaller, more urban states with fewer RE resources risk seeing much of the RE development created to comply with a state RPS occur outside the state unless eligible resources are defined more broadly or restrictions are placed on the use of out-of-state energy resources (addressed in section 5.4).

There may be important energy resource development and economic benefits associated with a state tailoring its RPS eligible resources to take advantage of a state's own abundant energy resources. A landlocked state is not going to see any in-state development associated with allowing wave energy to be an eligible resource but the same land-locked state may benefit greatly from making the recycling of waste heat for electricity generation an eligible resource if the state has a large industrial sector. Such resource eligibility tailoring allows for a state to keep more of the energy development and job creation benefits associated with an RPS in-state by limiting the eligible energy resources to those available in the state and region.

A clear exception to the conclusion that environmental benefits are sacrificed by the inclusion of non-RE resources is the inclusion of energy efficiency among a state's eligible resources for compliance with a portfolio standard. The social benefits of including energy efficiency within eligible resources, with restrictions, are likely to be strongly positive. Increased use of energy efficiency to meet a state's energy demands will help create in-state jobs, deliver many environmental benefits from the reduction in emissions from conventional power plants operating fewer hours, and reduce consumers' electricity bills which can help counteract the negative economic impact from RPS compliance driven electricity rate increases (Roland-Holst, 2008). While the use of energy efficiency to achieve partial compliance with an RPS does reduce the development of RE resources, energy efficiency delivers most of the same social benefits that makes RE beneficial for a state to promote. In addition, reducing electricity demand through developing a state's energy efficiency potential diminishes the need to utilize natural resources at all, which can have environmental benefits equal to the cleanest RE technologies in most cases.

Cost-Effectiveness & Flexibility: The second principle that applies to how eligible resources are defined is how eligibility affects an RPS program's cost-effectiveness and flexibility. Narrowly defining resource eligibility is, for a given portfolio standard, going to increase the cost to each utility of achieving RPS compliance. Restricting the supply of RE to only the most environmentally beneficial technologies will exclude many other energy resources that may not have the same environmental benefits but will be able to generate electricity at a lower cost. Allowing a greater array of energy resources, such as large hydropower or municipal solid waste incineration, to be used to achieve RPS compliance increases the competition between energy resources and makes RPS compliance more flexible to potential RE development constraints as have been faced in a number of states.

The use of a tiered portfolio standard to differentiate between different groups of resources has a mixed effect on RPS compliance costs and flexibility. A 15% portfolio standard with separate tiers for different types of energy resources is likely to have lower compliance costs than the same standard but with a narrow definition of eligible resources while having a higher compliance costs than a standard that defines resource eligibility broadly.

Tiered standards also have the potential to reduce compliance flexibility if the tiers are kept completely separate. Rather than make completely separate tiers, several states have created a hierarchy to their tiers whereby resources that are eligible for the first tier of more socially preferable RE resources can be used for compliance with lower tiers. This method promotes both cost-effectiveness and flexibility by allowing for a broader definition of eligible resources without creating distinctly separate standards. A hierarchy to the tiers allows utilities to use potentially lower-cost, less socially preferable energy resources to meet a portion of the overall standard while also allowing for the possibility that, in the short or long-term, market changes might make it more cost-effective for most or the entire standard to be met with first-tier energy resources.

The use of energy efficiency as a method of partial compliance with an REPS or AEPS is intended to achieve the same economic and environmental objectives as a more conventional RPS but at a lower price tag since the per MWh cost of energy efficiency projects is commonly found to be a fraction of the cost of generating electricity with renewable resources or even conventional energy resources. Energy efficiency projects not only hold down the costs of a portfolio standard, they also save electricity customers money through lower electric bills and promote economic development because the implementation of energy efficiency projects is relatively labor intensive in comparison to energy generation (Roland-Holst, 2008). Allowing utilities to achieve partial compliance through the implementation of energy efficiency reduces the overall cost of the portfolio standard while creating a market and financial value for energy efficiency. *Predictability*: The overall predictability of an RPS is also affected by how resource eligibility is defined over time. It is quite common for states that have enacted RPS legislation to return to the standard's eligibility definitions and make revisions, typically to expand eligibility to additional resources or to clarify vague eligibility language. Errors can be made both by defining the eligibility requirements too narrowly or broadly. A very restrictive definition of eligible renewable resources has the potential to lead to higher than expected compliance costs that will necessitate a slackening in eligible resources. Eligibility requirements that allow for a broad array of resource to qualify for use to comply with a portfolio standard may degrade both the intended economic and environmental benefits of the standard, requiring the state to tighten eligibility requirements.

While such amendments may improve the overall integrity of an RPS going forward, they also impose costs on an RPS program. States like Connecticut, which has changed its resource eligibility definitions several times, have seen rapid and significant shifts in the market price of RE as a result of these eligibility changes. Major shifts in the market price received by RE in a state creates greater uncertainty about the profitability of potential RE developments. Financial markets will translate this greater uncertainty into higher financing costs that can sharply increase the cost of RE projects.

Non-discrimination: Whether an RPS program is nondiscriminatory is also affected by how resource eligibility is defined. While rare, a state's selection of eligible energy resource for compliance with its RPS may be arbitrary, resulting in the exclusion of some energy resources that offer the same economic, social, or environmental benefits as energy resources defined as eligible. In creating a state's eligibility definitions, it is crucial that states' have a coherent rationale for why certain resources are defined as eligible or included in a particular tier while others are not. Developing clear criteria for judging the value of different energy resources can be a key step in creating a coherent set of resource eligibility requirements. Without clear criteria, the drafting of a state's RPS may become prone to responding to the lobbying efforts of different stakeholders that do not necessarily reflect the larger interests of the public.

5.3.1.4 Conclusions

Many different state-specific factors come into play when evaluating how a state should structure the resource eligibility requirements of an RPS. The size of the state's available RE resources, availability of alternative energy resources, transmission capacity, average household income, commitment to environmental improvements, prior commitments to implementing energy efficiency, and the existing portfolio of energy resources used to meet a state's electricity demand all have the potential to affect the optimal structure of a state's RPS.

The greater a state's pool of RE resources, especially wind energy, the greater the potential for the state to pursue an aggressive RPS that narrowly defines eligible energy resources without triggering significantly higher compliance costs. States with fewer available renewable resources in-state face greater pressure to define eligible resources and facilities more broadly in order to avoid having portfolio standard compliance resulting in large electricity bill increases and greater associated economic costs.

States that do not already have a coherent policy for promoting energy efficiency implementation in the state ought to strongly consider utilizing an REPS instead of an RPS as a way to create a complementary portfolio standard that is better able to keep overall compliance costs low while maximizing the economic and environmental benefits of the standard.

The potential to include energy resources not commonly considered to be renewable resources into a portfolio standard, creating an AEPS is likely to prove controversial in most states. But states that rely heavily on coal for their electricity generation and/or have a large stock of in-state energy resources that can be used for the generation of electricity using advanced energy technologies do have economic and environmental justifications for pursuing the development of advanced energy technologies. These justifications can be especially compelling if the alternative energy development portion of an AEPS comes in addition to RE development rather than in place of it. Promoting advanced energy technologies will allow such states to transition away from older, dirtier conventional coal plants and encourage technological innovation that will make these advanced technologies less expensive and more beneficial to the environment in the long-run.

Structuring an RPS so that it has tiers or limitations on the usage of certain resources or facilities is advisable for many states, especially those with more limited stocks of RE resources, because it can increase the cost-effectiveness of an RPS while also guaranteeing meaningful environmental improvements and RE industry development.

When drafting an RPS, significant amounts of time ought to be put into creating the eligibility definitions for an RPS so that they are complete, detailed, and supported by an underlying logic because there are important market costs to changing eligibility requirements through later RPS amendments or changes in the interpretation of RPS language. These costs can make the market price that RE generation receives more uncertain, raising the overall costs of RE development and RPS compliance.

5.3.2 Eligible Facilities

5.3.2.1 Eligibility Options

A challenge faced in designing an RPS is how to address the eligibility of existing RE facilities to generate RECs for use in the state's RPS since a core purpose of an RPS is to promote new RE development. Fifteen states do not make any eligibility distinctions between new and existing RE facilities. Many of these states have set more aggressive initial and ultimate RE standards to take into account existing RE generation already being used to meet state electricity demand.

Among the remaining eleven states, the eligibility of existing facilities is treated in one of three ways. First, all existing facilities can be ruled ineligible. Second, all facilities built before a certain year that pre-dates the enactment of the RPS can be ruled ineligible (i.e. an RPS enacted in 2003 might define an eligible facility as any facility built post-1999). Third, the electricity generated from existing RE facilities may be used to achieve compliance with only a portion of a state's RPS requirements.

5.3.2.2 Interested Stakeholders

New RE developers: Prefer to limit an RPS to only new RE facilities, to create separate tiers for new and existing facilities, or to take existing RE facilities into account when setting an RPS program's RE requirements.

Existing RE owners: Want their facilities to be included within the definition of eligible facilities and typically prefer that they compete directly with new RE facilities because this maximizes the value of the RE they provide. Making existing facilities eligible under a separate tier than new facilities is less preferable but still of interest so long as the existing facility tier is set at a percentage roughly equal to the percentage of a state's retail electricity sales that are already met from existing RE facilities.

Utilities: Will likely support the inclusion of existing RE facilities in states where they represent a significant portion of retail electricity sales in conjunction with setting more moderate RE standards since this will decrease the cost of RPS compliance.

- *Ratepayers and large industrial and commercial electricity consumers*: Typically support the inclusion of existing RE facilities as a further method of keeping the impact of RPS compliance on electricity bills at a minimum.

5.3.2.3 Component Evaluation

Table 4 – Evaluation of Eligible Facility Definition Options

Component Options	Best Practice Principles					
	Social Benefits	Cost-Effectiveness & Flexibility	Predictability	Non-discrimination	Enforcement	Consistent with Market Structure
Only new facilities	+	–		– –		
Existing facilities eligible (unadjusted)	–	+ +		+		
Existing facilities eligible (adjusted)	+ +	– –		+		
Separate tiers	+	±		±		
Recently developed facilities eligible	+	±		–		

Social Benefits: The social benefits of an RPS program can be significantly affected by the interaction of facility eligibility with the overall RE standard. The concern in allowing existing RE facilities to be used for compliance with an RPS is that it has the potential to infringe on the primary goal of an RPS, to encourage the development of new RE generation. For instance, Maine saw very little RE development after its initial RPS was enacted because the RE standard did not surpass the amount of RE generation that already occurred annually.

For a given RE standard, excluding existing RE facilities from being eligible for use in RPS compliance ensures that the RPS encourages more new RE development. Greater RE development will in turn create more new jobs, both in the construction and operation of these energy generation facilities (Kammen, 2004). A greater emphasis on new RE development will also translate into larger environmental benefits as more of a state's electricity will be met with energy resources that result in little or no greenhouse gas and other important pollutant emissions.

But while the focus of an RPS is on encouraging new RE development, existing RE facilities do generate valuable, if pre-existing, social benefits in the form of high-quality jobs and low environmental impact electricity. Allowing existing RE facilities to be used for RPS compliance creates an incentive for these facilities to continue generating electricity and associated social benefits. Without the additional revenue created by an RPS, the likelihood that existing facilities will continue to operate diminishes over time, resulting in the state losing out on the jobs and the clean electricity generated by these facilities.

Balancing the social benefits of new and existing RE facilities can be achieved if existing RE generation is taken into account when setting the RE requirements of an RPS. If a state already meets 10% of its electricity demand with existing RE generation but wishes to have that percentage increase by a further by 2% in three years time and 15% in ten years, a state could set its initial RE standard at 12% and its ultimate standard at 25%. While this structure of RPS would likely generate more RE development than a 15% RPS that allowed existing RE facilities to be eligible, it is not certain to provide all the new RE development needed to meet 15% of state electricity demand because new RE development may still have to compete against existing, out-of-state RE facilities.

The simplest, yet unused, method of addressing the existing, out-of-state RE challenge is to specifically define existing, out-of-state RE facilities as ineligible for use in achieving RPS compliance. A different method that is used by several states to ensure a specific amount of new RE development is to create separate compliance tiers within an RPS for existing and new RE facilities. With this structure, the previously mentioned state's hypothetical RPS would require the state's utilities to meet at least 15% of its electricity demand with electricity generation from new RE facilities and the remainder of the RE requirement using existing facilities.

Cost-Effectiveness & Flexibility: How facility eligibility is defined also has a strong impact on the cost-effectiveness and flexibility of an RPS. An RPS that can be met entirely, or mostly, with existing RE resources is going to have the lowest compliance costs. At the other extreme, defining existing RE facilities as eligible for use in RPS compliance, setting an aggressive RE requirements that requires new RE development, and not creating separate tiers for new and existing facilities is likely to result in the highest RPS compliance costs for a given state. In this case, high compliance costs are created by the development of new RE facilities and the fact that the market clearing price of the marginal RE generator, which is likely to be a new facility, helps set the price that all RE generators receive for their electricity, including existing RE facilities. Separate tiers for new and existing facilities tends to result in lower costs because two markets prices are created with the one for existing RE generation typically being significantly less than the market for new RE generation. An RPS that only includes the new RE generation tier within its standard has even lower compliance costs since it does not create a market value for the RE attributes from existing facilities, forcing these facilities to continue to compete directly with conventional energy generation facilities.

As with resource eligibility, tiered standards may reduce the overall flexibility of an RPS if the tiers are completely separate from each other. If the tiers are structured in a hierarchy, with the resources in the primary tier(s) being able to be used for compliance with a secondary tier(s), this reduction in overall flexibility is minimized. The most flexible structure is just to allow new and existing RE facilities to be eligible under the same standard but this presents the risk of utilities achieving compliance with existing out-of-state RE facilities. Consequently, an RPS that allows both new and existing RE facilities may have to reduce overall compliance flexibility through geographic limitations (discussed in section 5.3.3) in order to protect the in-state economic and environmental benefits of an RPS.

Nondiscrimination: Similar RE facilities that are treated differently solely because of when they were built appears to be a somewhat arbitrary method of discriminating between facilities. New RE development brings with it new economic benefits in the form of new jobs, investment, and infrastructure. By comparison, the economic benefits of existing RE facilities have either already passed through the economy or already part of the state's baseline economic performance. But the difference in economic benefits between new and existing RE facilities does not change the fact that existing facilities still deliver many or all of the environmental and electricity price benefits of new RE facilities.

One argument in favor of discriminating between new and existing RE facilities is that existing RE facilities have, through their successful development and operation, proven that they do not need the additional revenue generated from the sale of RE attributes to utilities. The persuasiveness of this argument is somewhat dubious for marginal facilities that were built immediately before or after the eligibility dividing line. This is one reason why some states allow recently developed RE facilities to be eligible for RPS compliance while defining older existing RE facilities as ineligible. For these states, the eligibility cutoff date is typically set just before any recent increase in RE development.

5.3.2.4 Conclusions

Because at its core, an RPS is intended to reward electricity generators for producing electricity through the use of RE resources, it is preferable where possible to define existing RE facilities as eligible for use in RPS compliance. But balancing the preference for a nondiscriminatory RPS against the other best practice principles of an RPS is not without challenges and the appropriate solution is heavily influenced, as with resource eligibility, by the particular characteristics of the state in question.

States and regions that generate relatively little electricity from eligible RE resources would likely benefit little from trying to develop a mechanism for including existing RE facilities other than to simply define them as eligible.

In contrast, states and regions that meet a significant percentage of electricity demand (> 1-2%) with existing facilities that use eligible RE resources will need to take existing RE generation into account when creating the timeline for RE requirements in order to ensure an appropriate and steady rate of new RE development. For states that are less concerned about the potential compliance costs of an RPS, either because they are a high-income state, have large amounts of low-cost RE resources, or are strongly committed to the environmental benefits of RE, existing and new RE facilities may be included within the same compliance tier so long as the standard takes into account existing RE generation. On the other hand, states that are concerned about RPS compliance costs ought to consider creating separate tiers for existing and new RE facilities in order to reduce the market price for RECs being generated from existing RE facilities.

5.3.3 Eligible Locations

5.3.3.1 Location Eligibility Options

The manner in which existing state RPS programs handle the eligibility of RECs generated out-of-state covers a wide spectrum with some states only allowing RECs that are generated in-state to be used for RPS compliance while others have few or no restrictions on where the RECs can originate. In between these extremes lie most state eligibility requirements for RECs. The most common geographic limitations require that the RE be delivered to the state or region in order for the associated RECs to be eligible for use in the state. Others states limit out-of-state RECs by allowing them to fulfill only a percentage of the total RPS compliance requirements.

5.3.3.2 Interested Stakeholders

Utilities: Typically are interested in having less restrictive barriers to the usage of out-of-state RECs since fewer barriers are likely to reduce REC prices through increased competition between in-state and out-of-state RE generators. This interest is especially strong for utilities with operations that cross state boundaries.

In-state renewable energy developers and generators: Are interested in insuring that they will not have to compete directly against out-of-state RE developers. As a result, they will seek to create restrictions on the eligibility of out-of-state RE generators. Concerns about competition from out-of-state RE generators diminish as more neighboring states have their own RPS programs since this reduces the likelihood that a vast reserve of low-cost, unused, out-of-state RECs exists that could flow into a state and jeopardize the profitability of in-state RE projects.

Out-of-state renewable energy developers and generators: Are interested in minimizing the barriers to the inter-state trade of RECs, especially when these developers and owners have RE projects in states that have not already passed an RPS. For these developers and operators, access to a mandatory RPS's REC market represents an opportunity to significant increase the revenue generated from the sale of RECs.

Environmental groups: Typically support increased restrictions on the usage of out-of-state RECs in order to promote in-state RE development that will translate into greater environmental benefits for the state.

5.3.3.3 Component Evaluation

Table 5 – Evaluation of Options for Defining Geographic Eligibility

Component Options	Best Practice Principles					
	Social Benefits	Cost-Effectiveness & Flexibility	Predictability	Non-discrimination	Enforcement	Consistent with Market Structure
Only in-state RE	+ +	– –	–	–		
Delivered to state	+	+	±	–		
Delivered to region	±	+ +	+	±		
Limits on out-of-state RECs	+	+	–	–		
No restrictions	–	+ +	±	+		

Social Benefits: The key justification for limiting the eligibility of out-of-state RECs for use in meeting a state's RPS is to try and keep the RE development that results from an RPS program in-state, along with its economic and, to a lesser degree, environmental benefits. Because RECs can be generated from RE generation that occurs anywhere, if a state allows unbundled RECs to be eligible without any restrictions on where the RECs originate, then utilities within the state can use RECs from anywhere in the country or beyond to achieve RPS compliance. For states that have large amounts of low-cost RE resources, such as wind energy, exposure to a national REC market might not result in a significant amount of out-of-state RECs flowing into the state because in-state RE resources are sufficiently competitive. But for RPS states with fewer RE resources, the market price for out-of-state RECs may be low enough that little or no in-state RE development occurs with the implementation of an RPS and instead utilities will opt to purchase inexpensive out-of-state RECs to achieve compliance.

Because much of the environmental benefits associated with RE generation involve improved air quality, the benefits from RE development tend to span a greater geographic area than economic benefits which tend to be more localized to the communities where renewable energy manufacturing, development, and operation jobs are created. As a result, a requirement that eligible RECs must come from electricity delivered to the state may allow for much of the economic benefits from an RPS to flow out of the state with the RE development. But such a requirement will likely result in the state achieving significant environmental benefits from the reduction in electricity generation, and resulting pollution emissions, from conventional coal or natural gas power plants located in or neighboring the state. Likewise, if REC eligibility is defined by whether the associated electricity is delivered into the interconnection region, then much of the economic benefits associated with RE development may occur several states away from an RPS state but the bulk of the environmental benefits will be received within the RPS state's interconnection region through the reduction in pollution emissions from coal and natural gas power plants that are used to meet the region's electricity demand.

While geographic REC limitations are an important component in determining the social benefits that a state receives from an RPS, the impact of these restrictions also depends greatly on the relative amounts of RE present in the state and neighboring states and whether neighboring states have their own RPS programs. States with a wealth of RE resources have less to worry about from inter-state RE competition than states with fewer resources because they are more likely to be low-cost generators of RE. Competition with out-of-state resources may actually benefit a resource rich state by allowing for increased exports of RE or RECs if neighboring states also choose to adopt more relaxed geographic REC limitations. For states with relatively few RE resources, the risk is much greater that, without limitations on out-of-state RECs, in-state RE projects will not be able to compete due to higher costs and the state will receive less of the economic and environmental benefits generated by its RPS program.

Cost-Effectiveness & Flexibility: More restrictions on the use of out-of-state RECs is going to decrease compliance flexibility and raise the potential compliance costs by limiting the eligible RE resources and facilities that can be used by a utility to achieve compliance with an RPS. As with social benefits, the impact of geographic REC limitations on the cost-effectiveness of an RPS depends strongly on the relative resources of a state compared to its neighbors. The compliance costs of states with ample RE resources, especially low-cost RE resources like wind energy, are unlikely to be affected by restrictions limiting the eligibility of out-of-state RECs since it is likely that in-state resources would be used to meet the majority of the state's RE requirements regardless of REC eligibility constraints. Conversely, utilities in RE resource poor states are far more likely to purchase out-of-state RECs in order to achieve RPS compliance at the lowest cost. For these states, geographic REC limitations are likely to increase the cost of RPS compliance significantly.

At the same time, having no eligibility limitations for RECs has the potential to increase the costs of administering an RPS as each program would have to certify the eligibility of RE facilities throughout the country or beyond. Limiting the eligibility to electricity delivered to the state's interconnection region or within the state is a simple way to decrease the certification costs of an RPS program.

The growing number of states that define REC eligibility based on whether the associated RE is delivered to the region is the direct result of recent growth in the development of regional REC tracking systems. As entire regions of the country such as the Northeast, Mid-Atlantic, and West become saturated with states that have enacted RPS programs, the economic costs associated with allowing RE to flow across state lines has diminished. Currently, five regional tracking systems are operating or under development spanning the Northeast, Mid-Atlantic/Central, Northern Midwest, West, and Texas regions of the country.[7]

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[7] The regional tracking systems are as follows:
Northeast – Northeast Power Pool Generation Information System (NEPOOL GIS)
Mid-Atlantic/Central – Pennsylvania Jersey Maryland Interconnection Environmental Information Services Generation Attributes Tracking System (PJM-EIS GATS)
Northern Midwest – Midwest Renewable Energy Tracking System (M-RETS)
West – Western Regional Electricity Generation Information System (WREGIS)
Texas – Electricity Reliability Council of Texas RE Credit Program (ERCOT RECP)
While a state, Texas should also be considered a region because of the state's size and because the bulk of the state has its own independent electricity grid.

The tracking and trading of RECs at the regional level is expected to present benefits to participating states by stabilizing REC prices through increased market liquidity. These states will also likely benefit from a reduction in RPS administrative costs associated with certifying REC eligibility and tracking REC trading because of the economies of scale associated with developing one regional tracking system instead of multiple state-specific systems. At the same time, a regional tracking system does impose an additional coordination cost as each state within a region will need to structure their RPS programs similarly in order for RECs to be efficiently traded across the region.

Nondiscrimination: While there are reasons for creating REC limitations, these limitations are a direct form of economic discrimination intended to favor in-state RE facilities over similar out-of-state facilities. State economic discrimination that takes the form of competitive barriers against interstate trade has been routinely interpreted as unconstitutional as a result of the US Constitution's Interstate Commerce Clause (ICC). While a lawsuit has yet to be filed alleging that geographic REC limitations violate the ICC, it is nearly guaranteed that many if not all of the geographic REC limitations utilized by state RPS programs would be found to be unconstitutional unless the federal court system were to determine that there was a compelling local purpose to the limitations that could not be achieved through some other nondiscriminatory method. Such exemptions from the ICC because of compelling local purposes are rare (Ferrey, 2005).

Predictability: Geographic REC limitations also have the potential to affect the predictability of an RPS program if they are subject to change over time. Changing the eligibility of out-of-state RECs, which typically take the form of a reduction in the limitations on out-of-state RECs, has the potential to threaten the profitability of RE facilities that are only marginally profitable and creates greater uncertainty about future REC prices since eligibility rules may be changed again. The penalty for changing the eligibility rules for RECs may be cancelled out or outweighed if the eligibility changes allow for utilities to draw from a larger and more liquid REC market.

5.3.3.4 Conclusions

Overall, the value of geographic REC limitations is largely dependent upon the circumstance of the state. States with large amounts of RE resources risk little by implementing restrictions on the use of out-of-state RECs and can create greater certainty that an RPS will create economic and environmental benefits for the state. Such guarantees can be particularly beneficial in gathering political support for an RPS. States will meager in-state RE resources risk much more by limiting the eligibility of out-of-state RECs and so should be much more carefully to weigh the social benefit gains of such limitations against the potential increases in RPS compliance costs. The experiences of state like California should give states considering stringent geographic REC limitations some hesitation as states with more restrictive limitations have found their impact on compliance costs and flexibility to me significant and have moved to weaken their REC limitations in most cases (Wiser et al., 2008).

States that neighbor other RPS states have little to gain from deterring the inter-state trade of RECs within an interconnection region. Allowing for the regional trade of RECs with other RPS states may encourage or discourage RE development within the state depending upon the competitiveness of the state’s RE facilities and resources, but it will have the opposite impact on RPS compliance costs. This inverse relationship means that if regional REC trading results in a loss in the social benefits generated by an RPS, it will be balanced by the state having a more cost-effective RPS program which translates into lower electricity rates for customers. At the same time, the creation of a regional REC market will create greater market liquidity and stable REC prices which, in turn, will help deliver on the RPS goal of reducing the overall risk of sharp electricity price increases. Stable REC prices will also reduce the financing costs faced by RE and further decrease the cost of RECs and RPS compliance across the regional REC market.

While this relationship is also true for states that are not surrounded by other RPS states, the flow of RECs is certain to flow into the one or few states that have an RPS program. In this instance, non-RPS states are “free-riding” on the RPS programs of neighboring states; enjoying some of the economic and environmental benefits that come from having RE facilities located in-state and the inexpensive and stable wholesale electricity they generate while not having to bear the expense of purchasing the RECs that allow for these RE facilities to be profitable. As a result of this free-riding, there is a more coherent argument for limiting the amount of out-of-state RECs that can be used by a utility to achieve RPS compliance until such time as neighboring states enact their own RPS programs and a regional REC market can be developed. A number of states have recently made rules that reflect this insight, limiting the eligibility of RECs to electricity delivered into the state while also noting that regional RECs would be eligible once a regional tracking system and REC market had been developed (Wiser et al., 2008).

In the absence of a regional REC market, states that are not neighbored by other RPS states should strongly consider allowing eligibility of out-of-state RECs for compliance with a percentage of the state’s overall RPS requirements. Such a limit would provide some useful compliance flexibility for utility’s if in-state RE resources are not developed on schedule, are insufficient, or prove to be expensive while still ensuring the a significant amount of RE and its ensuing social benefits will be developed within the state.[8]

5.4 Coverage

While RPS programs are typically reported as a simple percentage standard that electric utilities in a state must comply with, most state programs do not actually require all utilities in the state to comply with the main standard. Rather than a universal standard, exemptions for certain types of utilities are common. The reasons for the exemptions vary between states but common reasons include the lack of historical oversight of rural electric coops (Coops) and/or municipal utilities (Munis) by the state utility commission, the administrative burden that an RPS would place on smaller utilities, or the unaffordable rate increases that would be imposed on the rural poor.

5.4.1 Coverage Options

Nineteen of the twenty-six states that currently have an RPS make some form of exemption from the main RPS standard for smaller or publicly-owned electric utilities. Typical exemptions take one of four forms. First, certain types of utilities may be required to only meet a less aggressive standard that either has a lower ultimate RE requirement or a slower timeline for increasing the RE supply required. Second, certain types of utilities may be exempted from specific restrictions on how compliance is achieved. Third, certain types of utilities may be

[8] Delays in the development of RE facilities are a very common problem, especially in the initial years of an RPS when RE development companies are still establishing themselves.

exempted from an RPS program's main requirements in exchange for developing their own RE procurement plan or voluntary green energy program. And fourth, certain types of utilities may be completely exempted from an RPS.

5.4.2 Interested Stakeholders

Municipal utilities and electric coops: Have a strong incentive to advocate for some form of exemption from a state's RPS. Depending upon the state, these utilities might seek a complete exemption from the state's RPS program or a reduced standard or restrictions in order to allow them to participate in the RPS but with lower compliance costs.

Renewable energy developers and operators: Want to see the most aggressive RPS possible for a state in order to maximize their potential revenues. RE developers prefer for all electric utilities in a state to be covered but are largely ambivalent about how RE requirements are spread out between different types of electric utilities. Solar PV installers are one subset out of this group that has a stronger preference for a universal standard so that all utilities within the state have an incentive to encourage the installation of solar PV systems on homes and commercial buildings within their service territory.

Environmental groups: Typically oppose providing exemptions to different types of electric utilities on the grounds that it unfairly distributes the costs of an RPS.

Investor-owned utilities: Are interested in having an RPS standard apply to all electric utilities in order to distribute the costs of an RPS program evenly across all electric utilities and ratepayers.

Utilities have an especially strong incentive to seek universal coverage in deregulated markets where any exempted utilities might be provided with a competitive advantage.

5.4.3 Component Evaluation

Table 6 – Evaluation of Options for Defining RPS Coverage

Component Options	Best Practice Principles					
	Social Benefits	Cost-Effectiveness & Flexibility	Predictability	Non-discrimination	Enforcement	Consistent with Market Structure
Universal	+	+	+	+		+
Fewer restrictions on compliance for small utilities	±	±	–	–		–
Reduced standards for small utilities	±	±	–	–		–
Complete exemption for small utilities	–	–	–	–		–

Social Benefits: Including exemptions from RPS requirements for particular types of utilities within an RPS program reduces the social benefits of an RPS in two ways. First, these exemptions reduce the overall amount of RE that must be generated to comply with a given percentage standard which results in less RE development and its associated social benefits. Second, it undermines the overall rationale for the RPS by unevenly distributing the costs and benefits of an RPS program. For instance, the economic and environmental benefits of an RPS cannot be constrained to the areas of a state that must comply with an RPS. Because RE facilities tend to be located in rural areas where impediments to energy facility development are fewer, rural economies stand to gain the most from an increased focus on generating electricity from wind and biomass but these areas are also the most likely to be exempted from the costs associated with an RPS. Moreover, exempting some electricity providers from having to invest in RE may be counter-productive since one arguments for an RPS is to increase the diversity of resources used to generate electricity in order to insure greater electricity price stability in the future.

At the same time, the politics of policymaking are such that important stakeholders like Munis and Coops can wield disproportionate power in many states and threaten the implementation of an RPS without compromises. In these situations, the social benefits of an RPS may actually be maximized by providing exemptions to Munis and Coops so that an RPS can move forward with a more aggressive main RE standard.

Cost-Effectiveness & Flexibility: Smaller electric utilities are believed to have a lower capacity to operate and afford a compliance program for complying with a state RPS since they typically hold long-term contracts to acquire electricity from wholesale providers of electricity and consequently have less developed resource planning departments than large, investor owned utilities. The validity of this argument is unclear but is dubious for states that utilize unbundled

RECs for tracking and compliance since this method of RPS compliance requires minimal resource planning.

State policymakers frequently are willing to make concessions to small or publicly-owned electric utilities because these utilities make up a small percentage (<25%) of total electricity sales in most states. By appeasing these utility interests through an exemption to an RPS or a lower standard, state policymakers are able to remove a potential opposition group while still requiring the bulk of the state's electricity sales to comply with the main RPS requirements.

Nondiscrimination: The overall coverage of an RPS also has an impact on the degree to which an RPS is nondiscriminatory. Designating some utilities and their ratepayers as responsible for bearing the costs of increasing the amount of RE consumed in a state while exempting other utilities and ratepayers is a clear form of market discrimination. Moreover, this discrimination lacks a strong rationale in most all cases. The fewer exceptions that are made to the coverage of an RPS program, the more nondiscriminatory an RPS program will be. A truly nondiscriminatory RPS program requires all utilities in a state to participate in an RPS program equally.

Consistency with Market Structure: RPS coverage can also influence how consistent an RPS program is with a state's electricity market structure. In deregulated markets, making exemptions for certain types of utilities from the requirements of an RPS may provide exempted utilities with competitive advantages over utilities subject to an RPS's requirements. In regulated markets, the implications of providing some utilities with exemptions from RPS requirements while not others goes against the spirit of state regulation which is intended to provide low-cost, reliable electricity to all ratepayers in a state and not show favoritism for some types of utilities or ratepayers over others.

Predictability: The predictability of an RPS's regulations can also be affected by the coverage of an RPS if any exemptions from the requirements of an RPS are contingent upon the size of the utility or require specific actions. For instance, Oregon's RPS creates lower RE requirements for smaller utilities. If any of these utilities were to shift from one size tier of the standard to another, their RE requirements would change dramatically overnight, potentially creating expensive new RE commitments. Creating such clauses in the exemptions from an RPS can create perverse incentives within utilities or destabilize REC markets through sudden shifts in demand.

5.4.4 Conclusions

The justifications for why Munis, Coops, or any other type of utility ought to be exempt from some or all of an RPS's requirements is weak, especially when an RPS is supposed to, on the whole, provide all electricity consumers with net benefits. For the most part, those who seek an exemption from some or all of the requirements from an RPS are simply seeking to enjoy the benefits of the RPS without having to bear the costs. On the other hand, exemptions from the requirements of an RPS can be useful political tools for removing the opposition of critical stakeholders that might threaten the ratification and implementation of an RPS. To the extent possible, RPS programs should not provide exemptions, but as can be seen from the 19 RPS states that currently have exemptions of one form or another, such exemptions are hard to avoid.

5.5 Renewable Energy Technology Preference

One of the reasons that RPS policies have become a favored form of encouraging development in RE is that an RPS relies on markets to determine what is the most efficient and cost-effective manner of increasing RE generation. The basic format for an RPS is to require that a certain percentage of total retail electricity sales be met from the generation of electricity derived from eligible renewable resources. In this simple RPS format, the RE market is allowed to determine which renewable resources are used and to what degree in order to comply with the RPS.

In practice, this has resulted in wind energy dominating the RE market, supplying 92% of the RECs being used for compliance with RPS requirements (Wiser et al., 2008). Wind energy has dominated the RE market because the technology has achieved a significantly greater maturity and lower cost than competing RE technology. But such a heavy reliance on one form of RE erodes some of the purpose of an RPS which was to promote energy resource diversity. Also, without sufficient investments in other RE technologies, the technologies will not be able to mature and achieve the necessary economies of scale to drive down their overall costs so that they can be competitive with wind and conventional energy resources in the future.

5.5.1 Preference Options

In response to the initial experiences in states such as Iowa, California, and Texas, which saw most RE development focused on wind energy, many states adopted policy mechanisms as part of their RPS in order to encourage investments in RE technologies beyond wind energy. The first policy mechanism for promoting development in non-wind RE technologies is the use of a REC multiplier for specific types of RE technologies. A REC multiplier policy subsidizes the cost of generating electricity from selected RE technologies by allocating additional RECs for the generation of each MWh of electricity from the technology. For instance, New Mexico use to employ a REC multiplier system that provided geothermal electricity generated in the state with two RECs for each MWh of electricity generated and three RECs for each MWh of electricity generated from solar rather than the standard one REC per MWh of electricity generated (DSIRE, 2008). In total, nine states have used REC multipliers at one time or another, most commonly to encourage the development of solar technologies or to encourage the early development of RE facilities. In more recent years, REC multipliers have begun to be used to promote specific implementation goals such as having the RE facility be located in-state, on a customer's side of the meter, or be a small, distributed generation facility.

A more aggressive means of ensuring a greater diversity of RE resources are used to comply with an RPS is to create a RE technology set-aside or mini-tier that requires that a certain percentage of the overall RE requirement come from specific technologies. Seventeen states currently utilize set-aside policies, most commonly to ensure that at least a small percentage of the overall RPS is met from solar energy technologies.

While more states than not provide either REC multipliers or technology specific requirements, eight state currently do not show any preference for one eligible RE technology over another.

5.5.2 Interested Stakeholders

Specific renewable energy technology sellers, developers, and operators: Have a clear interest in getting an RPS to provide a preference for their own technology over competing technologies. The less competitive the technology is currently, the stronger the interest.

Utilities: have an interest in seeing compliance costs kept at a minimum which typically translates into an opposition of specific technology implementation requirements.

Ratepayers: also have an interest in making sure that any rate increases caused by an RPS are kept to a minimum which typically is exhibited in the form of opposition to technology implementation requirements with the exception of solar PV. Solar PV has the potential to be sited at ratepayers homes or business where it can reduce electricity bills.

5.5.3 Component Evaluation

Table 7 – Evaluation of Options for Technology Preference Components

	Best Practice Principles					
Component Options	Social Benefits	Cost-Effectiveness & Flexibility	Predictability	Non-discrimination	Enforcement	Consistent with Market Structure
REC multipliers	+	+		–		
Technology Set-asides	+ +	–		–		
No preferences	±	±		+		

Social Benefits: Including renewable technology preferences will not increase the overall required amount of RE that must be generated to achieve full RPS compliance. States that utilize REC multipliers are actually allowing utilities to achieve full RPS compliance without generating

100% of the unweighted electricity initially required to achieve compliance which could reduce the overall amount of RE development that results from an RPS. By using REC multipliers, some of the economic and environmental benefits of increased RE development are sacrificed in favor of increasing the amount of RE development achieved for specific RE resources or technologies. The benefits sacrificed by an RPS can be especially pronounced if they encourage the development of RE resources or technologies that would have been utilized regardless of whether multiple RECs were created for each MWh of energy generated.

But there are additional social benefits beyond those associated with greater RE development that can be generated by encouraging or requiring the development of specific RE technologies that are considered environmentally or economically preferable. In particular, increasing the diversity of RE technologies that are utilized to achieve RPS compliance can make REC prices and electricity prices more stable. Likewise, technology innovation can be promoted by encouraging or requiring the development of immature RE technologies.

Cost-Effectiveness & Flexibility: The use of REC multipliers will actually reduce compliance costs and increase the potential compliance flexibility of a program in comparison to an RPS without any technology preference components since the development of RE technologies that receive multiple RECs is completely voluntary. Utilities will only purchase RECs from RE technologies that are eligible for REC multipliers if their REC price is the lowest among all available REC options. The effect of REC multipliers is to increase the potential RE resources that will be competitive.

The use of set-aside requirements to mandate the development of specific RE technologies that would not be competitive with low-cost RE technologies like wind energy is a more aggressive method of promoting innovation of immature RE technologies than the use of REC multipliers. Unlike with a REC multiplier, set-aside requirements raise RPS compliance costs in exchange for market demand certainty for technologies given set-asides and a guarantee that a more diverse set of RE technologies will be used to achieve RPS compliance. So long as the total percentage of an RPS that is set-aside for specific technology requirements is small,[9] the overall impact on compliance costs may remain relatively small as well. More aggressive requirements will likely result in significant increases in compliance costs unless the technologies requiring development are competitive or nearly competitive with the least-cost RE technologies.

Assuming set-aside requirements are applied only to uncompetitive or marginally competitive RE technologies, an RPS that uses set-aside requirements will more aggressively pursue the goal of promoting the innovation of immature RE technologies than REC multipliers do and will guarantee a more diverse set of energy resources will be used to meet retail electricity demand. These benefits may outweigh the compliance cost impacts of any set-aside requirements so long as the requirements represent only a small portion of the overall RPS requirements.

Abuse of technology implementation requirements is possible when they are used to require that a large portion of an RPS be met using specific RE technologies.[10] Such use of technology

[9] I.e. less than 5% of an RPS's total RE requirements for most technologies, less than 2% for solar PV.
[10] For instance, Illinois' RPS requires that at least 75% of the standard be met with wind energy. A requirement that is both unlikely to be necessary in the short-term and potentially inefficient in the long-run.

implementation requirements effectively does away with the primary reason for a portfolio standard, the cost-effectiveness of letting the market decide which resources and technologies to use in order to achieve compliance with the state's primary program objective of having larger percentage of the state's electricity demand met with RE.

Nondiscrimination: The goal of having a nondiscriminatory RPS is clearly affected by any technology preferences within an RPS since such components are encouraging or requiring the development of specific RE technologies while not extending these benefits to all potential RE suppliers. While this is a form of market discrimination, it is not necessarily a bad form of discrimination so long as a state has a strong rationale for why preference is being given to specific RE technologies. One common rationale is to provide preference to technologies that can be sited at customer facilities and reduce customer electricity bills. A second rationale is to provide preference to particular in-state energy resources the state would like to see developed.

5.5.4 Conclusions

Recent trends have shown states favoring the use of set-asides over REC multipliers. The total number of states currently using set-asides is twice the number of states using REC multipliers while two states, Arizona and New Mexico, have phased out their REC multipliers in favor of set-aside requirements. In both these cases, the primary cause for the transition was because REC multipliers were not providing the level of demand certainty necessary to generate the intended RE development for specific RE technologies. Consequently, recently enacted and amended RPS programs have utilized set-aside requirements more frequently than REC multipliers, despite their compliance cost impacts, because they provide definite amounts of development for the preferred RE technologies. The trend towards use of set-aside requirements is sensible since one of the biggest barriers to the development of immature RE technologies is the uncertainty of how economically competitive the RE generated will be with the energy generated more established RE technologies. By demarcating a small amount of renewable energy development for a particular technology that does not have to compete against other RE resources and technologies, the market risk associated with the development of immature RE technologies is significantly reduced.

5.6 Compliance Flexibility

Key to creating a stable RE market is providing the compliance flexibility utilities need so that they can comply with RPS requirements annually while keeping their compliance costs at a minimum. Because the supply and demand of RE is largely insensitive to price in the short-run, shortages and surpluses of RE can result in significant price volatility in the RE market at the end of compliance periods (Chupka, 2003).

Addressing the issue of price volatility is important for several reasons. First, price volatility undermines the purported RPS benefit of creating greater electricity price stability. Price volatility also creates greater financial risk for RE developers which deters overall RE development and raises the total cost of an RPS. Third, price volatility may undermine political support for an RPS, which may discourage future increases in the RE standard and may encourage reductions in the standard (Chupka, 2003).

5.6.1 Compliance Flexibility Options

There are several ways to combat price volatility by making utility compliance with an RPS more flexible. One of the simplest methods of increasing compliance is to create a true-up period for several months after the compliance period has ended in order to provide utilities with more time to acquire the RECs needed for compliance. In many cases, RECs created during this true-up period can also be used to comply with the previous year's REC requirements. The use of RECs generated during the true-up period for compliance with the previous year's RPS requirements is a form of short-term REC borrowing where a utility can avoid non-compliance in a given year by generating additional RECs in the future.

REC borrowing helps stabilize market prices by providing utilities that would otherwise fall into non-compliance with the opportunity to avoid expensive non-compliance penalties by instead redoubling their efforts to generate or acquire additional RECs so that they will exceed future RE requirements. REC borrowing is also useful for addressing unexpected delays in the development of renewable energy facilities by allowing utilities to borrow RECs from facilities that have not yet been completed or started generating RECs. While short-term borrowing of RECs is allowed in many states, long-term borrowing of RECs has only been implemented in Texas where it is limited to 5% of a utility's total annual obligation (Chupka, 2003).

While the borrowing of RECs does not enjoy much support, many states have allowed RECs generated in one year to be "banked" and used to meet compliance with future RE requirements. Banking RECs allows utilities to acquire excess RECs in order to ensure future compliance or even out the costs of acquiring RE over time while decreasing the potential for these excess RECs to be dumped on REC markets just before the annual compliance period ends. The amount of time RECs are permitted to be saved before use varies widely from state to state with some states allowing RECs to be saved for only a few months before they must be used[11] while other states allowed RECs to be saved for four or more years.

One last compliance flexibility measure is the use of an alternative compliance payment (ACP), which allows utilities to buy an unlimited number of alternative RECs from the state at a given price. Typically, the price of an ACP is set well-above the prevailing market price and is intended to act as a REC price ceiling. ACP payments are made to the state government and are typically allocated for the funding of further renewable energy development. This option will be discussed below in sections 5.7 and 5.8.

5.6.2 Interested Stakeholders

Utilities: Are interested in reducing their compliance costs and recovery risk through increased compliance flexibility through the use of RECs that can be banked or borrowed across multiple years.

Renewable energy developers and operators: Are interested in creating stable prices for RE and RECs and consequently support the use of banking and, to a lesser degree, borrowing.

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[11] A short REC banking period measured in months is intended to ensure the RECs generated at the end of a year are just as valuable as RECs generated at the start of a year. Without at least some ability to bank RECs generated during one compliance period for use in the next, RECs generated at the end of a year are either worthless or incredibly valuable depending upon whether all utilities in a state have achieved compliance with the state's RPS.

Environmental groups: Typically seek to limit compliance flexibility to banking RECs having a shorter useful life so that the utilities can have some compliance flexibility but not so much that they can generate or purchase significantly less than the RE standard during a given year.

5.6.3 Component Evaluation

Table 8 – Evaluation of Compliance Flexibility Component Options

Component Options	Best Practice Principles					
	Social Benefits	Cost-Effectiveness & Flexibility	Predictability	Non-discrimination	Enforcement	Consistent with Market Structure
True-up period	±	+	±		±	±
REC Banking	+	+ +	+		+	+
REC Borrowing	±	+ +	+		+	+
ACP	–	+	+ +		+	+

Cost-Effectiveness & Flexibility: Without the use of any compliance flexibility components, REC prices are likely to fluctuate wildly within a year and even within months as changing RE generation puts utilities ahead of or behind schedule for achieving compliance with an RPS. [12]

[12] An example of the price fluctuation that result from a lack of compliance flexibility can be seen the European Union's greenhouse gas trading system which saw major price fluctuations in 2006 and 2007, in large part because the greenhouse gas allowances issued prior to 2008 could not be used for compliance with the program post-2007.

This price volatility significantly increases RPS compliance costs. True-up periods provide some market flexibility by giving utilities additional time to achieve compliance. But in many cases additional time will not provide a utility with an inexpensive method of achieving compliance since eligible RECs might be scarce throughout the state.

Real compliance flexibility is not achieved without providing utilities with some means of changing the supply of RECs available in a particular year in which to achieve compliance with. The use of banking and borrowing provide the necessary temporal flexibility to achieve RPS compliance inexpensively with RECs generated before or after the compliance period. Allowing RECs to be transferred between compliance years has the advantage of smoothing out any fluctuations in REC prices and leading to more gradual trends in REC markets. Likewise, the banking and borrowing of RECs reduces the likelihood that a regulated utility will lose money by being forced into purchasing uncharacteristically expensive RECs in order to achieve compliance in a given year and then have much of those costs be deemed imprudent by the state utility commission and not allowed to be passed through to ratepayers.

The use of an ACP is another method of increasing compliance flexibility. At the same time, it also tends to be an expensive method of providing compliance flexibility since ACP payments tend to be well-above the market rate set for RECs. But if there is a persistent shortage of RECs, REC prices will rise and the price ceiling created by an ACP may actually improve the long-run

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As a result, greenhouse gas allowances issued pre-2008 had zero economic value in 2008 and beyond. Once it was identified in 2006 that there was an abundance of greenhouse gas allowances not yet retired in the compliance period ending in 2007, the value of carbon allowances plummeted.

cost-effectiveness of an RPS program if the ACP revenue is used to generated further RE development.

Social Benefits: Little is traded in the area of social benefits in order to provide utilities with greater compliance flexibility through the use of banking and borrowing of RECs. Neither the use of banking nor borrowing changes the amount of RE generation that must occur over a period of multiple years. Consequently, the economic and environmental impacts from allowing the use of banking and borrowing are negligible.

The lack of political support for REC borrowing beyond a few months may be because the capacity to borrow RECs reduces the market incentive for the rapid development of RE projects in the initial years of an RPS. The banking of RECs likely enjoys more political support than REC borrowing because it significantly increases the market incentive for RE projects to be developed ahead of the RPS RE generation schedule.

If used, an ACP is likely to reduce the total social benefits created by an RPS program since it exempts a utility from needing to generate an equivalent amount of renewable energy generation and the associated economic and environmental benefits. At the same time, making use of ACPs to achieve compliance is not a complete loss to social benefits since the revenue generated is typically allocated to fund additional renewable energy generation.

Predictability: Allowing for the banking and/or borrowing of RECs helps stabilize REC prices over time, acting as a buffer against dramatic swings in REC prices. Stabilizing the price of RECs over time allows for RE developers, utilities, and states to better project the future costs of an RPS program so that future market opportunities or challenges can be identified more easily.

Similarly, an ACP provides a clear REC price ceiling which can be helpful for RE developers concerned about future demand for RECs.

Consistency with Market Structure: The use of compliance flexibility measures within an RPS is also consistent with the overall market structure of the electric industry and the limitations of RE generation. Because the energy generation of most RE facilities cannot be precisely controlled or predicted, the overall supply of RE can fluctuate from year to year. Likewise, RE projects are frequently delayed or fall through altogether. While these challenges can be overcome by utilities contracting for the purchase of more RECs than is necessary in order to achieve compliance, such behavior conflicts with the electric utility industry's goal of providing reliable electricity at the least-cost. Compliance flexibility, especially banking and borrowing, allows utilities to have more efficient REC acquisition plans without the need for oversubscribing and to more easily fit RE procurement into a utility's least-cost planning process.

Enforceability: The enforceability of an RPS is also affected by the compliance flexibility measures utilized in an RPS. Without any compliance flexibility measures, REC prices will fluctuate wildly, making it especially difficult for utilities commissions to determine whether the compliance costs of regulated utilities are prudent or not. Likewise, the failure of a utility to achieve compliance with an RPS's requirements could be the result of many factors outside the control of the utility. Punishing utilities in these situations would be considered heavy-handed regulation but if utility commissions start exempting utilities from compliance requirements, uncertainty will start to be created about the binding nature of the RPS.

Compliance flexibility in the form of banking and borrowing allow utilities to achieve compliance even in the face of unexpected or unlikely events. Increased compliance flexibility reduces the challenge of utilities achieving compliance and makes it more straightforward for utility commissions to punish utilities if they fail to achieve compliance. Likewise, the availability of an ACP further improves the flexibility of an RPS program, decreasing the potential excuses a utility might have for non-compliance.

5.6.4 Conclusions

Compliance flexibility is an essential aspect of an RPS program if it is to successfully and cost-effectively promote RE development. The popularity of banking as a flexibility measure is understandable because it encourages utilities to accumulate excess RECs during the initial years of an RPS to act as a buffer against non-compliance. Consequently, banking encourages a more rapid development of RE resources than is required by an RPS program. The borrowing of RECs can be equally useful to a utility but suffers from the perception that it enables laggard utilities to avoid non-compliance and punishment when their lack of investment in RE ought to be discouraged.

In addition to banking and borrowing, another important compliance flexibility measure that could be used to supplement or replace the banking and/or borrowing of RECs is the use of an ACP, discussed below in section 5.7 and 5.8. Jumping ahead a little, the use of an ACP as a compliance flexibility measure is not as preferable as the use of banking and borrowing of RECs because it does not ensure that the required amount of RE is generated. Consequently, an ACP does not help guarantee the environmental and economic benefits of an RPS the same way that banking and borrowing of RECs do. If an RPS program were to utilize both REC banking and borrowing, then the use of an ACP would be largely unnecessary for providing compliance flexibility (although it has further purposes as mentioned below) since the ability to bank and borrow would provide compliance flexibility for any situation.

5.7 Enforcement

Among the key components of an RPS is a non-compliance penalty for when a utility fails to meet its RPS requirements. Renewable portfolio legislation that lacks a non-compliance penalty is typically referred to as a Renewable Portfolio Goal (RPG) rather than an RPS because the standards created are interpreted to be voluntary. The methods used to make an RPS compulsory vary significantly between states but regional consensus is beginning to form around specific penalty methods.

5.7.1 Enforcement Options

The first RPS programs enacted tended to rely on undefined penalties for non-compliance that would be determined by the state's PUC. Many states continue to leave it up to the state PUC's discretion to determine the appropriate penalty for a particular utility's non-compliance. Such penalties may be financial but also might take the form of requirements on the actions that a utility must make to achieve future compliance with RPS requirements.

Recently implemented RPSs have more commonly enforced compliance by requiring utilities to pay a set amount for each REC that a utility is short of their required amount. This method of enforcement breaks down into a spectrum with some states considering these payments in lieu of RECs to be an ACP while other states consider the payments to be financial penalties for non-compliance. A common value for an ACP or MWh-based penalty is $50 per MWh. The main distinction between an ACP and an MWh-based penalty is whether the utility is allowed to recover the cost of the payments by passing the costs on to ratepayers in electricity bills or whether the cost of the payments must come out of the utility's profits. Five states allow for automatic recovery of ACP costs while another four states leave the decision of whether ACP costs for a utility can be recovered up to the determination of the state PUC. Another seven states utilize MWh-based financial penalties. Typically these states do not allow the costs from these penalties to be recovered through a utility's ratebase.

5.7.2 Interested Stakeholders

Renewable energy developers and operators: Typically seek greater REC price certainty and a well-defined price ceiling at which a utility commission will exempt utilities from the acquisition of further RECs. As such, RE developers typically advocate for an energy-based ACP or penalty to enforce an RPS program and advocate for as high a price or penalty per MWh as is feasible in order to increase the range of prices at which an RPS's requirements will be enforced.

Utilities: Are typically interested in minimizing compliance costs and its financial risks. The enforcement measures that utilities advocate for varies between states and is determined in part by the relationship between utilities and the state utility commission. If the discretion of the commission is perceived to be favorable to utilities, then utilities may advocate for undefined, commission determined penalties. If the commission is perceived to be likely to dole out major penalties for non-compliance, then utilities may advocate for an ACP that allows for automatic recovery of payment costs.

Environmental groups: Generally interested in promoting increased RE development and distrustful of utility commissions in many states, environmental groups tend to encourage the creation of an ACP or energy-based penalty that is set at a high price several multiples of the expected market price for RECs.

5.7.3 Component Evaluation

Enforceability & Predictability: Successful enforcement methods emphasize both clarity and certainty in order to ensure that utilities understand the punishment that will result from non-compliance. Based on these two principles, unspecified penalties determined by the state utility commission are not a good enforcement method. While the penalties doled out by a utility commission for non-compliance might be fair, light penalties might embolden utilities to reduce their efforts to achieve compliance while harsh penalties may result in utilities going to inefficiently expensive extremes to achieve compliance and avoid potential penalties. Uncertainty about the financial impacts of non-compliance can be especially pronounced during the initial phases of an RPS before a history of non-compliance penalties or other regulatory actions can be developed to help inform utilities about the financial risks presented by non-compliance.

ACP and energy-based penalties provide more clarity and certainty. In deregulated markets, ACP and energy-based penalties provide a simple REC price ceiling that also assists RE developers in determining whether a RE project will be able to find a market for the RECs generated from the

Table 9 – Evaluation of Enforcement Component Options

Component Options	Best Practice Principles					
	Social Benefits	Cost-Effectiveness & Flexibility	Predictability	Non-discrimination	Enforcement	Consistent with Market Structure
PUC discretionary penalties	±	±	–	±	±	
ACP w/ automatic cost recovery	+	+	+	+	±	
ACP w/ potential cost recovery	+	+	–	±	+	
Energy-based penalties w/o cost recovery	+ +	±	+	+	+ +	

project. Energy-based penalties and ACPs do not provide the same level of certainty in states with regulated markets because utility commissions control whether regulated utilities can recover their ACP or energy-based penalty costs by including them in the electricity rates they charge customers. How an ACP or energy-based penalty is treated by a commission is critical to interpreting how utilities view the payments/penalties.

The automatic cost-recovery of ACP costs provides utilities with the certainty needed to treat ACPs as a price ceiling on the value of RECs. If the pass-through of ACP costs is up to the determination of a state commission, then greater uncertainty exists and utilities may be willing to buy RECs above the ACP price in the hopes that the utility is more likely to approve cost recovery on the REC purchases than on ACP costs. If cost recovery is ruled out complete for energy-based penalties, then it becomes very unclear how a regulated utility will behave since it will be rational for the utility to pursue purchasing RECs up to and beyond the point where a utility commission would begin ruling the REC purchases to be imprudently incurred compliance costs.

Cost-Effectiveness & Flexibility: The benefit of using discrete financial penalties to address non-compliance or as an alternative to acquiring the required RECs is that it provides a more distinct price ceiling to guide utilities and RE developers in making investment decisions. ACP and financial penalty payments are typically set at a level significantly above the market price of RECs but at a level that will ensure that compliance costs for the RPS do not become excessively burdensome on the utility or ratepayers. States that have separate compliance tiers for different types of RE or set-aside percentages for specific renewable technologies (i.e. solar requirements) have to create separate ACP or penalty values for separate REC requirements.

Social Benefit: One positive benefit of ACP and financial penalty payments is that the revenue generated from these payments is most often explicitly directed into a state fund in charge of investing in RE projects and other socially beneficial energy investments such as RE research or energy efficiency projects. By investing in these types of projects, the intended goals of the RPS are being furthered even when the intended percentage of RE is not being acquired. By comparison, PUC-determined penalties are frequently non-monetary in nature and the destination for revenue generated from monetary fines varies widely from case to case and state to state.

Nondiscrimination: The enforcement of an RPS can also determine how nondiscriminatory the program is. States that provide the commission with discretion to determine the nature and severity of non-compliance penalties invite the potential for discrimination to occur as a result of unfair discrepancies between the penalties delivered by the commission. Automatic and well-defined penalties, while potentially not as fair as penalties determined by a commission, do insure that no discrimination occurs in the enforcement of an RPS.

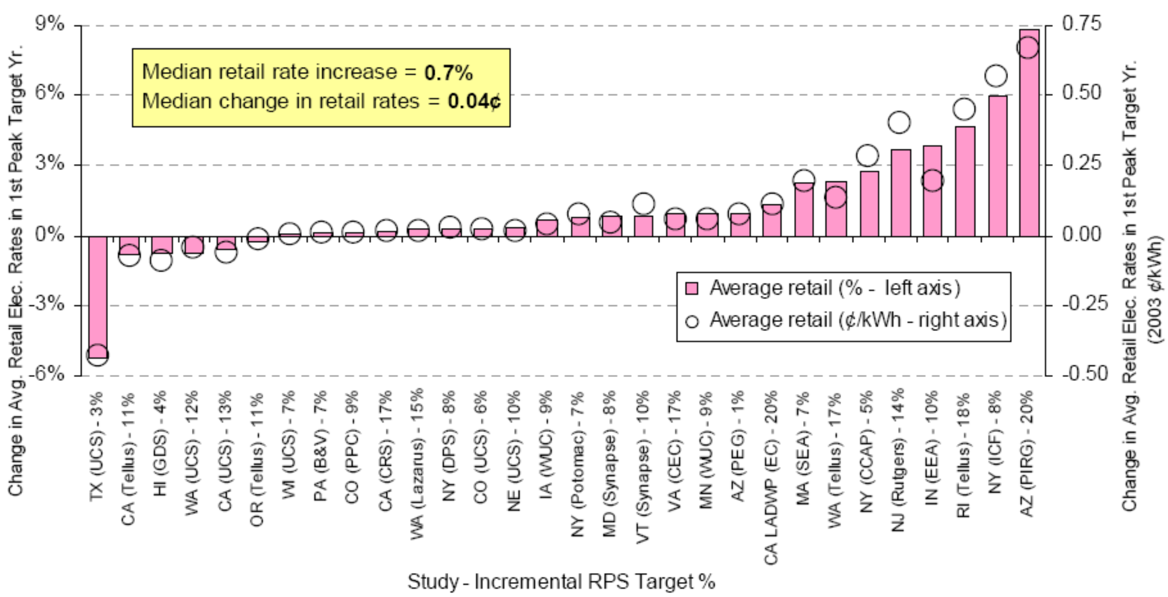
5.7.4 Conclusions

As is noted by Wiser et al., the appropriate enforcement method can vary between regulated and deregulated states. In regulated states where the state utility commission is typically more involved in the resource planning and cost recovery decisions of utilities, strong oversight and action to develop a plan for achieving compliance or keeping a utility in compliance may be all that is necessary to enforce an RPS so long as the clear threat of financial penalties exists as a last resort to motivate compliance. In deregulated states, where state utility commissions have much less oversight over utilities, a well-defined ACP system that utilities must use to cover any REC shortfalls is likely to provide the necessary motivation for utilities to aggressively pursue compliance.

5.8 Cost Containment

One of the greatest concerns raised when a state considers enacting an RPS is what the impact will be on utility costs and the electricity rates that end consumers pay. In order to address this concern, most every state that has enacted an RPS has also funded a study to look at the rate impact from meeting a moderate percentage (5%-20%) of retail electricity demand through the generation of RE. The results from these studies have varied widely depending upon the RE percentage being evaluated and the RE resources present in the state and region but the majority of studies have shown electricity rate impacts of less than 2-3% when an RPS is fully implemented with the median retail rate impact being a 0.7% rate increase. Moreover, these studies have shown that states such as California, Texas, and Oregon are likely to actually see retail electricity rates decrease as a result of implemented an RPS (Wiser et al., 2007b).

Figure 3 – Projected RPS Electricity Rate Impacts by Cost Study



Source: Lawrence Berkeley National Laboratory

Estimated retail rate impacts for states with RPS programs that have existed long enough to be in their compliance phase show that retail rate impacts in most states are currently well below 1.0% (Wiser et al., 2007a). But even with the studies and initial results, there is still no guarantee that retail rate impacts won't rise unexpectedly as compliance requirements increase. In response to the concerns of important political stakeholders such as organizations that represent ratepayers or large commercial and industrial electricity consumers, 21 states have included some form of cost containment measure within their RPS in order to ensure that the cost impacts remain reasonable.

5.8.1 Cost Containment Options

The simplest and most common cost containment measure used by states is a limit on the percentage retail rate impact caused by the RPS. The retail rate impact of the RPS is typically calculated by measuring a utility's energy generation and acquisition costs with the RPS against a cost projection of what the utility's energy generation and acquisition costs would be without the RE requirements. Once this cap has been exceeded, further RE procurement is suspended until the rate impact declines below the limit once again. The cost cap percentage varies widely from one state to the next with some states limiting the retail rate increase to less than 1% while others permit retail rate increases of more than 10%. Most states set the cost cap in the 2-5% range (Wiser et al., 2007a).

A slightly more complicated cost cap measure is to limit the rate impact to specific types of electricity consumers. Under such a policy, the rate impact to the average residential customer may be limited to $5 per month while the average industrial customer energy bill impact may be limited to $50,000 per month. As with a percentage cost cap, the requirements of an RPS are suspended if the cost to any one class of customers exceeds its limit. Typically this type of cost cap is imposed on an RPS due to strong political pressure from large industrial and commercial customers who want to limit the incremental costs of an RPS and to redirect the cost burden of an RPS onto smaller residential and commercial electricity customers.

A third form of cost containment is for utilities to define the maximum price that utilities can pay for renewable energy. This method of cost containment is more common to states that do not use RECs for compliance and/or are regulated utility states where the utility commission is aggressively involved in the resource procurement activities of the utilities it regulates.

In addition to the formal cost containment measures that states use to control RPS costs, many states utilize ACPs which act as cost cap by providing a ceiling on the price of RECs. The use of an ACP as the sole method of cost containment typically results in a maximum rate impact several times larger than if another method of cost containment is used.

5.8.2 Interested Stakeholders

Utilities: Primarily concerned with minimizing the costs of RPS compliance, they tend to push hard for the creation of cost caps and to set these caps as low as possible so that minimal overruns are allowed without triggering the cost cap provisions.

Renewable energy developers and operators: Typically oppose the implementation of cost caps because the potential that a cost cap might be triggered creates uncertainty about the market value of the RECs being generated by a RE facility.

Environmental groups: Frequently work to increase the level that cost caps are set at because a cost cap makes the benefits of an RPS, both economic and environmental, secondary to one particular cost, the RPS's financial impact on electricity rates, without doing any systematic analysis of whether an RPS's benefits outweigh its costs. For many environmental groups, the environmental and economic benefits of an RPS are sufficiently large that only a very high cost cap is justifiable.

Ratepayers and large industrial and commercial electricity customers: Are typically interested in controlling the potential electricity rate increases that might be passed on to them. Large commercial and industrial electricity customers typically advocate for a cost cap that limits the impact that an RPS program can have on the electricity bills of different classes of electricity customers.

5.8.3 Component Evaluation

Cost-Effectiveness & Flexibility: The value of a cost containment measures is in their ability to restrict the runaway costs of RPS compliance if RE development proves to be more difficult or expensive than has been projected. A broad limit on the increase in the retail rate of electricity sets a clear ceiling on RPS compliance costs. Differentiating between customer classes when creating cost caps reduces the overall flexibility by limiting how the costs of RPS compliance can be distributed among customers. Without the use of cost containment measures, a state runs the risk of incurring RPS compliance costs several times greater than the program's projected costs without any clear measure to determine when an RPS program's requirements ought to be re-evaluated.

Table 10 – Evaluation of Cost Containment Component Options

Component Options	Best Practice Principles					
	Social Benefits	Cost-Effectiveness & Flexibility	Predictability	Non-discrimination	Enforcement	Consistent with Market Structure
No cost containment measures	+ +	–		+		
Retail rate impact cap	–	+ +		+		
Customer class rate cap	– –	+		–		
Maximum RE contract price cap	±	+		+		
ACP	+	+		±		

The lack of a cost containment measure may be interpreted in one of two ways. First, the lack of a cost cap may be seen as a demonstration of commitment by a state or utility commission to achieving full compliance with an RPS, regardless of the costs. Second, the lack of a formal cost cap may be interpreted to mean there is a hidden and undeclared cost cap that, when reached, will cause the utility commission to act and freeze an RPS somewhat unexpectedly. This latter interpretation can have important impacts on the willingness of RE developers to enter a market if REC price start to rise and the cost of RPS compliance starts to cost significantly more than projected. Rather than increasing RE development, higher REC prices may cause RE developers to hold off on projects, which would only exacerbate the problem of high REC prices. How the lack of any cost containment measures is interpreted depends upon the state, utility commission, and RE developer.

Social Benefits: An RPS without any cost containment has a firm requirement for the generation of RE that each utility must meet. These firm requirements create market certainty that is beneficial to RE developers when they are planning, financing, and implementing RE projects.

The implementation of a cost containment measure creates certainty about the maximum compliance costs that might result from the implementation of an RPS, but makes the RE requirements of an RPS less than certain. If an RPS cost containment measure is triggered, an RPS's RE standard will froze until compliance costs sink below the cost ceiling once more. Freezing compliance requirements will likely halt RE development, resulting in at least temporary reductions in the economic and environmental benefits generated by an RPS. By freezing demand for RE, cost containment measures could potentially damage the profitability of numerous RE projects.

A cost cap based on the overall impact of the RPS program on retail electricity rates has the advantage of allowing utilities to pass compliance costs along to electricity customers in proportion to their electricity consumption. But a basic limit on the increase in electricity rates does not recognize that some classes of electricity customers, such as larger electricity consumers, might be more negatively affected by higher electricity rates than other customer classes.

Cost caps that differentiate between classes of electricity customers and create different cost caps for different classes of customers allows for the maximum compliance costs to be set at different levels for different customer classes so that electricity customers that are particularly sensitive to the price of electricity may have low cost caps while other customer classes may have high cost caps.

Nondiscrimination: The use of a cost containment measure does not necessarily have discrimination ramifications for an RPS if it treats all electricity customers equally. But cost containment that is structured around different customer classes has the potential to encourage various customer classes to pursue getting their cost cap set at the lowest level possible. This type of rent seeking behavior can result in cost containment levels that are set too low if many customer classes succeed in getting their own maximum compliance costs reduced.

5.8.4 Conclusions

The use of cost containment measures is a clear example of the tension and need for balance between the social benefits of an RPS and the potential costs of compliance. For states that have ample low-cost RE resources, the concern that an RPS program's costs will be excessively high are small and consequently the need for a cost cap is small as well. For smaller states or states with limited RE resources, the value of a cost containment measure can be significantly greater since the potential for high or volatile compliance costs is greater. For most states, the retail rate impact cap is the most straightforward and fair method of containing RPS compliance costs.

The use of a cost containment measures can provide a valuable measure of cost certainty to the uncertain endeavor of trying to dramatically increase the RE generation within a state or region. But cost containment measures should not be intended as a means of limiting an RPS program's costs to the costs projected by an initial RPS cost study. Cost caps are a very blunt instrument best suited to controlling runaway compliance costs that would otherwise damage a state's economy. Freezing the implementation of an RPS until compliance costs decrease would be an excessive step to take if RPS cost overruns were small given the major impact such a demand freeze would have on RE developers and operators. As a result, cost containment measures should be set at several multiples of the projected costs of an RPS program and used as a cost control mechanism of last resort. Less blunt methods of controlling compliance costs, such having a broader definition of resource eligibility, allowing out-of-state RECs to be used for compliance, and increasing compliance flexibility, are available and should be used to increase the likelihood that an RPS program will be cost-effective.

6. OPTIMAL RPS DESIGN CASE EXAMPLES

To demonstrate the conclusions drawn in section 5 and how state-specific factors can affect the optimal structure of an RPS program, in this section I will analyze what an optimal RPS program design would look like for two states, Idaho and Georgia, neither of which currently have plans to enact an RPS.

6.1.1 Idaho

Were the state of Idaho to consider enacting an RPS program, the state ought to make the following design considerations in order to give the state's program an optimal structure.

Compliance Metric & Tracking: In structuring an optimal RPS program for the state, Idaho should set its RE requirement in terms of percentage of total retail electricity sales. Because of the state's large stock of RE resources and small population, I recommend Idaho set an RE standard in the realm of a 20% RE requirement that must be achieved 18 years after program is enacted and 15 years after the first RE requirements. For tracking purposes, Idaho should utilize unbundled RECs in order to make RPS compliance more cost-effective and flexible.

Resource Eligibility: Relative to its population, Idaho has ample RE resources, including large amounts of wind and biomass resources. As a result, the state can afford to define eligible RE resources more narrowly without triggering significantly higher compliance costs. But in order to allow for as aggressive a standard as possible, Idaho should consider defining eligible resources to include some less typical energy resources such as waste heat and energy efficiency. The inclusion of small hydro as an eligible resource is an interesting option given the political hot potato that is hydropower in the Pacific Northwest. Idaho ought to consider allowing small hydro that is restricted by specific environmental standards but it may be easier to leave the resource out for political expedience.

Facility Eligibility: In order to facilitate as much RE generation in the state as possible, Idaho should permit existing RE facilities to be eligible for use in RPS compliance. Because the state is a middle-income state, and likely to be concerned about compliance costs, the state's RPS might be best structured so that existing facilities are given their own, secondary tier within the RPS.

Location Eligibility: Idaho is almost completely surrounded by other RPS states, the exceptions being Wyoming and Utah. The Western states are already finalizing the creation of a regional REC tracking system and many states within the region will allow RECs to be traded regionally once the tracking system is operational. As a result, the cost-effectiveness of Idaho's RPS program would benefit from the state following the regional trend and allowing RECs certified by the regional tracking system to be used for compliance with the state's RPS program.

Coverage: The vast majority of Idaho's electricity customers are served by three main utilities while the remaining electricity customers in the state are served from local electric coops. While it is preferable for the requirements of the state's RPS to apply equally to all utilities, regardless of size, the impact on RE development from giving Idaho's small electric coops a partial or complete exemption from the state's RPS requirements would be small. Consequently, exempting smaller utilities from some or all the state's RPS requirements might significantly improve the political feasibility of the program while not sizably affecting the amount of RE development that results.

Technology Preference: In order to encourage RE development beyond wind energy, Idaho should consider other, immature RE technologies to support through the creation specific set-aside requirements. Potential RE technologies to support with a set-aside requirement might include solar, geothermal, and specific agricultural biomass fuels.

Compliance Flexibility: Idaho ought to allow for the banking of RECs for several years in order to help stabilize the price of RECs. In order to create further market price certainty and to reduce compliance cost fears, Idaho should also consider implementing an ACP.

Enforcement: The most efficient method of enforcement for Idaho is likely to be using an ACP. In order to create a stronger incentive for utilities to make every reasonable effort to achieve RPS compliance through the acquisition of RE rather than an ACP, Idaho ought to consider making the cost recovery of any use of the ACP contingent upon state PUC review.

Cost Containment: Because Idaho is a middle-income state, Idaho will need to have a strong cost containment mechanism in order to ease concerns within the state that an RPS will lead to significant electricity rate increases and potential economic costs. The most straight-forward method of achieving this objective is to create a cap on the percentage retail rate impact that an RPS program is allowed to have. I recommend this cap be set in the area of a 5% increase in electricity rates.

6.1.2 Georgia

Were the state of Georgia to consider enacting an RPS program, the state ought to make the following design considerations in order to give the state's program an optimal structure.

Compliance Metric & Tracking: In structuring an optimal RPS program for the state, Georgia should set its RE requirement in terms of percentage of total retail electricity sales. Because of the state's moderate stock of RE resources and limited wind energy resources, I recommend Georgia set an RE standard in the realm of a 15% RE requirement that must be achieved 18 years after program is enacted and 15 years after the first RE requirements. For tracking purposes, Georgia should utilize unbundled RECs in order to make RPS compliance more cost-effective and flexible.

Resource Eligibility: Because Georgia is not a state with ample RE resources, the state would likely benefit the most from defining eligible RE resources broadly to include resources like small hydro, wave and ocean energy, waste heat, energy efficiency, and other resources whose development does not result in significant environmental impacts. Since the state does not have significant conventional energy resources, it is unnecessary for Georgia to attempt to enact an AEPS.

Facility Eligibility: In order to facilitate as much RE generation in the state as possible, Georgia should permit existing RE facilities to be eligible for use in RPS compliance. Because the state is a middle-income state, and thus likely to be concerned about compliance costs, the state's RPS might be best structured so that existing facilities are given their own separate tier within the RPS.

Location Eligibility: Because only one neighboring state, North Carolina, has its own RPS program, Georgia should consider placing limits on the usage of out-of-state RECs until such time as a regional RE market begins to develop. In order to balance the desire to promote in-state RE development with the goal of creating a cost-effective RPS program with stable REC prices, Georgia ought to consider following North Carolina's lead and allowing out-of-state RECs to be used for a percentage of the state's overall RPS requirements.

Coverage: While the state's electricity industry is geographically dominated by a single utility, Georgia Power, almost half of the state's population is served by small electric coops. Because of this market structure, it is key to the overall promotion of RE development in the state that few or no exceptions to the main RPS requirements are given to smaller utilities.

Technology Preference: While Georgia does not have an abundance of RE resources, the state does have a diverse array of potential RE resources located within its boundaries that might be used with cutting-edge RE technologies. Specific energy resources that Georgia ought to consider giving specific set-asides to should include solar, offshore wind, wave, and agricultural and forestry based biomass.

Compliance Flexibility: As with Idaho, Georgia ought to allow for the banking of RECs for several years in order to help stabilize the price of RECs. In order to create further market price certainty and to reduce compliance cost fears, Georgia should also consider implementing an ACP.

Enforcement: The most efficient method of enforcement for Georgia is likely to be using an ACP. In order to create a stronger incentive for utilities to make every reasonable effort to achieve RPS compliance through the acquisition of RE rather than an ACP, Georgia ought to consider making the cost recovery of any use of the ACP contingent upon state PUC review.

Cost Containment: Because Georgia is a middle-income state, Georgia will need to have a strong cost containment mechanism in order to ease concerns within the state that an RPS will lead to significant electricity rate increases and potential economic costs. The most straight-forward method of achieving this objective is to create a cap on the percentage retail rate impact that an RPS program is allowed to have. I recommend this cap be set in the area of a 5% increase in electricity rates.

7. CONCLUSIONS

The clearest conclusion that can be drawn from analyzing current state RPS programs is that there is a vast array of options for designing an RPS program and a number of different design components that can be used to encourage any particular goal, whether that be environmental, economic, or particular to the energy industry. Finding an RPS design that effectively balances the disparate goals of an RPS is no easy feat and one that is made all the harder by the political process that ultimately has the final say on an RPS program's design. In particular, RPS programs face a clear tension between maximizing the benefits from RE development and minimizing the associated costs.

While state RPS program designs continue to be diverse, recent trends have seen RPS program designs moving towards some consensus on specific design categories. As more state have enacted RPS programs, regional REC trading markets have developed in order to take advantage of the benefits of larger, more liquid REC markets. The greater fungibility of unbundled RECs , REC banking, and regional tracking systems has created greater RPS program flexibility and certainty that the program will be cost-effective but also created more uncertainty about the in-state economic and social benefits that an RPS program might deliver. In response, RPS states have begun to include additional components within an RPS specifically intended to promote in-state environmental and economic interests such as creating REC multipliers and/or set-aside requirements for RE resources that are prevalent within the state.

Table 11 below shows the component options within each category of RPS components that perform the best for each principle that is significantly influenced. What can be seen from the table is that for most categories, one design option does perform best for all important principles. In many cases,

Table 11 – Conclusion Matrix

Components	Best Practice Principles					
	Social Benefits	Compliance Costs & Flexibility	Predictability	Nondiscriminatory	Enforceable	Consistent With Market Structure
Compliance Metric	Bundled RECs	Unbundled RECs		Unbundled RECs	Unbundled RECs	Unbundled RECs
Resource Eligibility	Narrow eligibility	Separate resource tiers	Separate resource tiers	Broad eligibility		
Facility Eligibility	Allow existing RE facilities, adjust RE requirements accordingly	Allow existing RE facilities, leave RE requirements unadjusted		Allow existing RE facilities, leave RE requirements unadjusted		
Location eligibility	Only in-state generated RECs	Allow all RECs	Allow RECs for RE delivered to region	Allow all RECs		
Coverage	Universal	Universal	Universal	Universal		Universal
Technology	Technology set-	REC multipliers		No preferences		

Components	Best Practice Principles					
	Social Benefits	Compliance Costs & Flexibility	Predictability	Nondiscriminatory	Enforceable	Consistent With Market Structure
Preference	aside					
Compliance Flexibility	REC banking	REC banking	ACP		ACP	ACP
Enforcement	Energy-based penalties w/o cost recovery	ACP w/ potential cost recovery	ACP w/ automatic cost recovery or energy-based penalty w/o cost recovery	ACP w/ automatic cost recovery or energy-based penalty w/o cost recovery	Energy-based penalties w/o cost recovery	
Cost Containment	No cost containment	Retail rate impact cap		No cost containment or retail rate impact cap		

extreme component options perform the best for specific principles while performing badly for others. Under-represented within the table are the component options that represent a compromise between policy extremes. More often, it is these component options that are used in the design of RPS programs and are most likely to result in a balanced RPS design.

This give and take between different RPS components is all intended to promote an optimal balance between different goals and stakeholder interests, and when done right it can achieve a good balance. But an overly ornamented RPS program can also result in program failure. As an example, in recent years RPS states have begun an arms-race of sorts, each setting more aggressive RE requirements than previous states. Faster RE development requirements are likely to drive compliance costs up but many of the states with aggressive RE requirements have also created restrictive cost containment measures in order to ease the legitimate concerns of state stakeholders concerned about the potential cost implications of rapid RE development. As a result, many states run a serious risk of their RPS compliance costs rising to the point that the program's cost containment provisions are triggered and additional RE development requirements are postponed or cancelled. As has been seen in the wind energy industry over the previous three decades, creating a boom and bust cycle for RE development can be very taxing on both RE developers and utilities and can be expected to result in higher compliance costs per MWh of RE generated.

What can be seen from Section 6 is that the optimal RPS structure for a given state is in large part dependent upon how state-specific factors, such as the state's endowment of RE resources, median income, and proximity to other RPS states, interact with particular component options and groups of components.[13] By understanding the RPS design options that are available, how state-specific factors are likely to interact with an RPS program, and the potential performance ramifications of structuring an RPS in a specific manner, a state policymaker can be better prepared to respond to the political pressure of interested stakeholders and negotiate an overall RPS design program that appropriately balances the goals and interests of a particular state.

[13] In many ways, it is these state-specific factors that make the implementation of a national RPS program so difficult to achieve, both politically and administratively. The optimal structure for an RPS is one state is likely to be, in some way, sub-optimal for most other states, eroding political support for any one RPS design structure.

8. LITERARY CITATIONS

Berendt, Christopher, 2006. "A State-Based Approach to Building a Liquid National Market for RE Certificates: The REC-EX Model." *The Electricity Journal*, 19:5 54-68.

Berry, Trent & Mark Jaccard, 2001. "The Renewable Portfolio Standard: Design Considerations and an Implementation Survey." *Energy Policy*, 29:4 263-277.

Bolinger, M., Wiser, R., Milford, L., Stoddard, M., Porter, K., 2001. "States Emerge as Clean Energy Investors: A Review of State Support for RE." *The Electricity Journal*, 14:9 82-95.

Chen, C., Wiser, R., Bolinger, M., 2007. "Weighing the Costs and Benefits of State Renewables Portfolio Standards: A Comparative Analysis of State-Level Policy Impact Projections." Lawrence Berkeley National Laboratory.

Chupka, Marc, 2003. "Designing Effective Renewable Markets." *The Electricity Journal*, 16:4 46-57.

Database of State Incentives for Renewables & Efficiency (DSIRE). Retrieved January 22, 2008. http://www.dsireusa.org/.

Energy Efficiency and RE Division, 2008. "Annual Report on U.S. Wind Power Installation, Cost, and Performance Trends: 2007." U.S. Department of Energy.

Espey, Simone, 2000. "Renewables Portfolio Standard: A Means for Trade with Electricity From RE Sources?" *Energy Policy*, 29: 557-566.

Ferrey, Steven, 2005. "Renewable Orphans: Adopting Legal Renewable Standards at the State Level." *The Electricity Journal*, 19:2 52-61.

Holt, Ed & Ryan Wiser, 2007. "The Treatment of RE Certificates, Emissions Allowances, and Green Power Programs in State Renewables Portfolio Standards." Lawrence Berkeley National Laboratory.

Kammen, D., Kapadia, K., Fripp, M., 2004. "Putting Renewables to Work: How Many Jobs Can the Clean Energy Industry Generate?" RAEL Report, University of California, Berkeley.

Kolcins, Andrew & Ned Stainthorpe, 2007. "Renewable Portfolio Standards Gain in Popularity." *Natural Gas & Electricity*, 23:7 1-7.

Kydes, Andy, 2007. "Impacts of a Renewable Portfolio Generation Standard on US Energy Markets." *Energy Policy*, 35:2 809-814.

La Capra Associates, 2006. "Analysis of a Renewable Portfolio Standard for the State of North Carolina: Technical Report." North Carolina Public Utility Commission.

Langniss, Ole & Ryan Wiser, 2003. "The Renewables Portfolio Standard in Texas: An Early Assessment." *Energy Policy*, 31:6 527-535.

Mozumder, Pallab & Achla Marathe, 2004. "Gains from an Integrated Market for Tradable Renewable Energy Credits." *Ecological Economics*, 49:3 259-272.

Palmer, Karen & Dallas Burtraw, 2005. "Cost-effectiveness of Renewable Electricity Policies." *Energy Economics*, 27:6 873-894.

Rader, Nancy & Scott Hempling, 2001. "The Renewables Portfolio Standard: A Practical Guide." National Association of Regulatory Utility Commissioners.

Rabe, Barry, 2006. "Race to the Top: The Expanding Role of US State Renewable Portfolio Standards." Pew Center on Global Climate Change.

Roland-Holst, David, 2008. "Energy Efficiency, Innovation, and Job Creation in California." Center for Energy, Resources, and Economic Sustainability, University of California, Berkeley.

Sedano, Richard & Catherine Murray, 2005. "Electric Energy Efficiency and RE in New England: An Assessment of Existing Policies and Prospects for the Future." The Regulatory Assistance Project.

Sovacool, Benjamin & Christopher Cooper, 2007. "Green Means 'Go?' – A Colorful Approach to a US National Renewable Portfolio Standard." *The Electricity Journal*, 19:7 19-32.

US Census Bureau, 2007. "Current Population Survey, 2005 to 2007 Annual Social and Economic Supplement." Retrieved November 6, 2008. http://www.census.gov/hhes/www/income/income06/statemhi2.html.

Wingate, Meredith & Matthew Lehman, 2003. "The Current Status of RE Certificate Tracking Systems in North America." Center for Resource Solutions.

Wisconsin State Legislature. Retrieved January 22, 2008. http://www.legis.state.wi.us/.

Wiser, R., Porter, K., Bolinger, M., 2000. "Comparing State Portfolio Standards and System-Benefits Charges Under Restructuring." Lawrence Berkeley National Laboratory.

Wiser, R., Porter, K., Grace, R., Kappel, C., 2003. "Evaluating State Renewables Portfolio Standards: A Focus on Geothermal Energy." National Geothermal Collaborative.

Wiser, R., Bolinger, M., Porter, K., Raitt, H., 2005. "Does It Have To Be This Hard? Implementing the Nation's Most Aggressive Renewables Portfolio Standard in California." *The Electricity Journal*, 18:8 55-67.

Wiser, R., Porter, K., Grace, R., 2005. "Evaluating Experience with Renewables Portfolio Standards in the United States." *Mitigation and Adaptation Strategies for Global Change*, 10:2 237-263.

Wiser, R., Namovicz, C., Gielecki, M., Smith, R., 2007. "The Experience with Renewable Portfolio Standards in the United States." *The Electricity Journal*, 20:4.

Wiser, Ryan & Galen Barbose, 2008. "Renewables Portfolio Standards in the United States: A Status Report with Data Through 2007." Lawrence Berkeley National Laboratory.

APPENDIX 1

Wiser Criteria

Outcome Criteria

- Amount of New RE Development
- Full Compliance with RPS Policies
- Reasonable and Stable Cost Impacts
- Prudently Incurred Compliance Costs Born by Ratepayers

Policy Design Criteria

- Broad Applicability
- Carefully Balanced Supply/Demand Condition
- Sufficient Duration and Stability of Targets
- Well-Defined and Stable Resource Eligibility Rules
- Well-Defined and Stable Treatment of Out-of-State Resources
- Credible and Effective Enforcement
- Flexible Verification Mechanisms
- Adequate Compliance Flexibility

- Contracting Standards and Cost Recovery Mechanisms for Regulated Utilities and Standard Offer and Default Service Providers
- Product-Based, as Opposed to Company-Based, Compliance Mechanisms

Market Context Criteria

- Presence of Creditworthy Long-Term Power Purchasers
- Stable Political and Regulatory Support
- Adequate and Accessible Developable Resource Potential