THE STATE OF STATE RENEWABLE PORTFOLIO STANDARDS

Prepared for the

State-Federal RPS Collaborative

by

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DISCLAIMER

ABOUT THIS REPORT

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The following clean energy experts participated in interviews in which they offered their valuable insights into RPS challenges and renewable energy trends:

- Lori Bird, Senior Analyst, National Renewable Energy Laboratory
- Jeff Deyette, Senior Energy Analyst, Union of Concerned Scientists
- Jenny Heeter, Market Transformation and Policy Analyst, National Renewable Energy Laboratory
- Lars Kvale, Head of Environmental Markets, APX
- Jennifer Martin, Executive Director, Center for Resource Solutions
- Mark Muro, Senior Fellow and Policy Director, Brookings Institution Metropolitan Policy Program
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- Brendan Pierpont, Analyst, Climate Policy Initiative
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- Tom Stanton, Principal Researcher for Renewable Resources and Energy Efficiency, National Regulatory Research Institute
- Matthew Stepp, Senior Policy Analyst, Information Technology and Innovation Foundation

Representatives of the public agencies that administer the renewable portfolio standards in the following states either responded to a written questionnaire or participated in a telephone interview: Arizona, California, Colorado, Hawaii, Iowa, Kansas, Maine, Maryland, Massachusetts, Michigan, Montana, Nevada, New Hampshire, New Mexico, New York, North Carolina, Ohio, Oregon, Pennsylvania, Rhode Island, Texas, Washington, and Wisconsin.

ABSTRACT

A renewable portfolio standard (RPS), or a similar policy under a different name, has been established in 29 states plus the District of Columbia and Puerto Rico. These standards require electricity suppliers to get a certain share or amount of their electricity from renewable energy and other clean energy technologies. Most of these standards have now been in place sufficiently long that it is possible to identify trends and patterns in their impacts and operations.

This report highlights several key achievements of RPS policies, in addition to the striking fact that they have become so widely adopted by states. In particular, they have led and are leading to considerable renewable energy generation; they have altered the decisionmaking and operations of electricity regulators, utilities, the energy industry, and other stakeholders; they have created jobs and contributed to local economic development; and they have laid the foundation for a national market for renewable energy.

The report analyzes the RPS as a policy mechanism in order to identify its strengths as well as its weaknesses. The report also discusses five current challenges that could threaten the ability of RPSs to continue to be successful. It recommends two steps states may take to increase the effectiveness of their RPSs.

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I. INTRODUCTION

It is an appropriate time to step back and assess the state of state standards to advance clean energy. Most of these standards have been in place long enough that it is possible to observe how they have operated and what they have achieved. With 29 states plus the District of Columbia and Puerto Rico having a renewable portfolio standard (RPS) or a similar standard with a different name,[1] there are a sufficient number of state RPS programs to be able to identify trends, patterns, and emerging issues and challenges.

The Clean Energy States Alliance (CESA) prepared this report to identify some of these trends, patterns, issues, and challenges. It does not attempt to duplicate the important research on RPS trends that has been published regularly by the Electricity Markets and Policy Group at Lawrence Berkeley National Laboratory (LBNL).[2] Instead, it seeks to complement that work—and draws on it when appropriate, as well as on the work of other researchers.

To compile the research for this report, we read the compliance and evaluation reports produced by many states and tracked news about RPS developments. We collected direct input from 23 states in the form of CESA staff interviews with staff members of RPS administering agencies and written responses to questionnaires. We also interviewed or otherwise collected input from leading RPS experts.

This report will present an overview of state RPSs and their accomplishments. Although we will make generalizations and point out trends, it is important to keep in mind that each state RPS is unique. In fact, the differences among the state standards are as important as the similarities. In terms of energy resources, different ones qualify in different states. Solar and wind are mainstays, but various jurisdictions allow biomass of many different definitions, geothermal, hydropower of different sizes, tidal, wave, fuel cells, poultry waste, renewable thermal, energy efficiency, and nuclear. RPSs also vary in whether all technologies compete equally or whether some are eligible for special carve-outs, extra

[1] Although the standards have varying names ranging from alternative energy portfolio standard to energy portfolio standard to renewable energy standard, this report will group them under the generic name of renewable portfolio standard", which is the most commonly used term for these policies.

[2] LBNL researchers give excellent periodic RPS status overview presentations and reports (see Galen Barbose, "Renewables Portfolio Standards in the United States: A Status Update," a presentation to the National Conference of State Legislatures, May 2, 2013, available at http://www.cleanenergystates.org/assets/2013-Files/RPS/Barbose-RPS-Presentation-NCSL-Spring-2013.pdf) and also produce reports on specific RPS-related topics [see, for example, Ryan Wiser et al., *Supporting Solar Power in Renewable Portfolio Standards: Experience from the United States* (Berkeley: Lawrence Berkeley National Laboratory, 2010), available at http://eetd.lbl.gov/ea/ems/reports/lbnl-3984e.pdf].

credits, or other special treatment. RPS timetables, targets, and administrative procedures vary greatly. Some RPSs have achieved a great deal, while others have been less important or are just getting started.

The one common denominator is that all RPSs require electricity suppliers to get some of the electricity they supply from clean energy sources. Almost all the states express this requirement as a percentage of the supply, often with the percentage increasing over time, but Iowa and Texas have goals of a set number of megawatts of capacity for the main portion of their RPS.[3]

The following sections of the report will discuss what RPSs have accomplished so far, what their strengths are as a policy mechanism, what their weaknesses are, and what challenges they face. The report concludes by setting out some actions that state RPS administrators and policymakers might consider taking in the near term.

[3] In Massachusetts and Oregon, the main portion of the RPS has a percentage target, but the solar carve-out is expressed in megawatts.

II. THE IMPRESSIVE TRACK RECORD OF STATE RENEWABLE PORTFOLIO STANDARDS

Renewable portfolio standards have become so common and so much a part of the energy policy landscape that it is easy to take them for granted and to undervalue what they have accomplished. There are at least five main accomplishments that deserve to be highlighted.

1. RPSs have been established in a large number of states

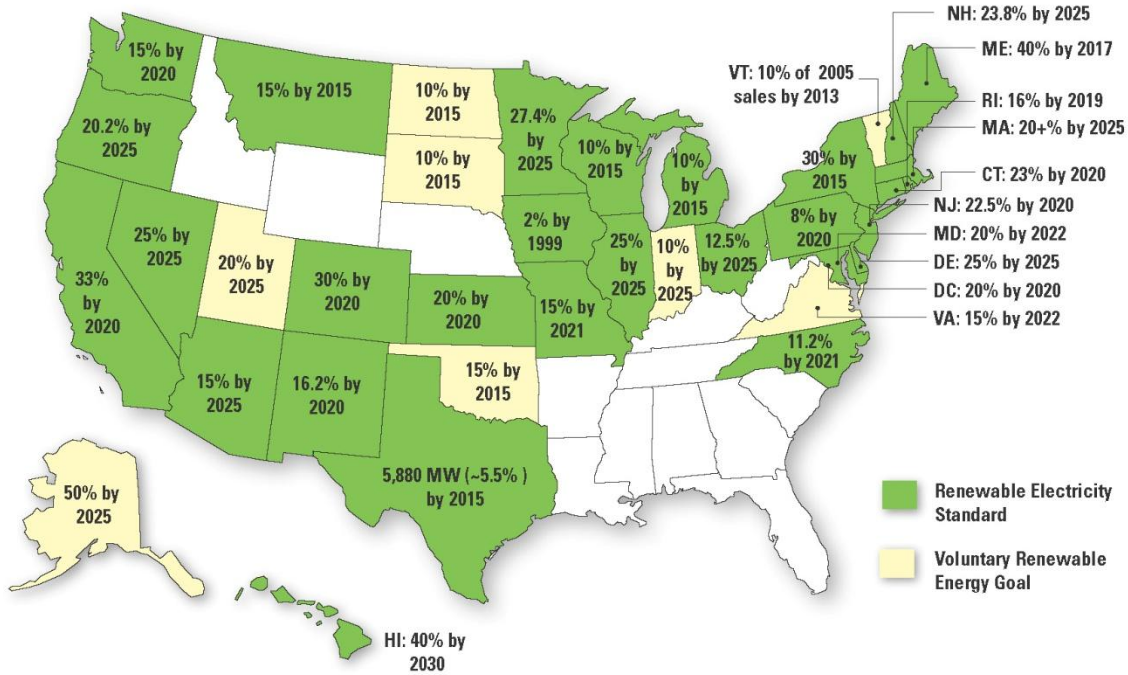
Perhaps the most remarkable achievement of RPSs is their sheer ubiquity, with an RPS being in place in 29 states plus the District of Columbia and Puerto Rico. Just 20 years ago, only Iowa had an RPS.[4] Since then, state after state has joined in, despite the fact that the states differ greatly in their available clean energy resources, the structure of their electricity system, and the price of electricity for ratepayers.

It is especially noteworthy that the vast majority of the RPSs were established through legislation or a ballot initiative, reflecting broad political support for them, with the exception of the greater Southeast (from West Virginia to Louisiana), where North Carolina is the only one of 12 states with an RPS, 74% of the remaining 38 states plus DC have one. An additional eight states—Virginia in the Southeast and seven others spread across the country—have voluntary renewable energy goals. This leaves only three states outside the Southeast—Idaho, Nebraska, and Wyoming—without either an RPS or voluntary goals.

But if the only accomplishment of RPSs was the fact that they existed, they would ultimately not be particularly meaningful. There are four other ways in which they have been significant public policies.

[4] Although ten other states established RPSs during the 1990s, because of the delay between RPS enactment and the first compliance period, until 1999 Iowa remained the only state in which electricity suppliers were required to supply electricity from renewables.

Figure 1. State Renewable Portfolio Standards[5]



2. RPSs have led and are leading to considerable renewable energy generation

According to LBNL, current RPSs require 3-5 gigawatts (GW) of new renewable energy capacity to be added annually to the nation's electricity supply between 2013 and 2020.[6] Moreover, "67% of the 69 GW of non-hydro renewable additions from 1998-2012 (46 GW) occurred in states with active/ impending RPS compliance obligations."[7] As LBNL acknowledges, this last statistic is an imperfect measure of the impact of RPSs, because some of those renewable energy projects would have been installed even without the impetus of an RPS. On the other hand, because most RPSs allow renewable energy generators beyond a state's border to qualify for an RPS, there are additional projects that have been made possible by state RPS policies. In Wyoming, a non-RPS state, wind farms

[5] This graphic appeared in Union of Concerned Scientists, *How Renewable Electricity Standards Deliver Economic Benefits* (Cambridge: Union of Concerned Scientists), p. 2, available at http://www.ucsusa.org/assets/documents/clean_energy/Renewable-Electricity-Standards-Deliver-Economic-Benefits.pdf. It is reprinted here courtesy of the Union of Concerned Scientists.

[6] Barbose, "Renewables Portfolio Standards in the United States," slide 10.

[7] Ibid., slide 9.

participate in the Oregon RPS.[8] Likewise, North Dakota wind farms participate in the Minnesota RPS and Vermont landfill gas facilities participate in the Massachusetts RPS.[9] There are many other examples of projects that have benefitted from the existence of an RPS in a nearby state.

The exact contribution of RPS policies to the growth in renewable energy capacity is therefore impossible to quantify with precision, but there can be no doubt that it has been significant. When we asked RPS program administrators whether their state's RPS was (a) the most important state policy advancing the installation of utility-scale clean energy generation, (b) one of the most important policies, or (c) relatively unimportant compared to other state policies, 15 out of the 23 states that responded stated that it was the most important policy. Most of the remainder thought it was one of the most important policies. In addition, 7 of the state representatives believed the RPS to be the most important policy advancing the installation of distributed generation.

Table 1. RPS Program Managers' Perceptions of the Importance of Their State's RPS

	The most important policy	One of the most important policies	Relatively unimportant compared to other state policies
Compared to the other state-level policies in your state that seek to advance the installation of utility-scale clean energy, the RPS is:	15	6	2
Compared to the other state-level policies in your state that seek to advance the installation of distributed generation, the RPS is:	7	12	3

[8] PacificCorp, *Oregon Renewable Portfolio Standard Compliance Report 2011* (Portland: PacificCorp, 2012), p.6, available at http://www.oregon.gov/energy/RENEW/RPS/docs/PacifiCorp_OR%20UM-%20RPS%20Compliance%20for%202011%20and%20Motion%20%286-1-12%29.pdf.

[9] Minnkota Power Cooperative compliance submission letter to the Minnesota Public Utilities Commission, May 22, 2012, available at xx. Massachusetts Department of Energy Resources, "RPS Class 1 Renewable Generation Units," table updated May 20, 2013, available at www.mass.gov/eea/docs/doer/rps-aps/eligible-class1-units.xls.

3. RPSs have catalyzed far-reaching changes, altering the decisionmaking and operations of electricity regulators, utilities, the energy industry, and other stakeholders

In many states, the RPS has been the catalyst for a wide range of changes. When a state institutes an RPS goal, such as requiring ten percent of a state's electricity supply to come from designated clean energy sources, it concentrates the mind and alters the behavior of the various players involved in supplying and overseeing the state's electricity. These organizations, businesses, and individuals begin to think of all the changes they need to make in order to meet the RPS mandate. This can involve changes in how utilities and other electricity suppliers contract for electricity, how public utility commissions plan for new transmission capacity, and how project developers decide about which projects to develop. It has required the creation of new systems for tracking the production and sale of electricity from renewables and to modify existing systems.[10] Because of RPSs, electricity planning, regulation, and tracking are all different than they would otherwise be.

RPSs have also given many participants in the electricity system experience with clean energy technologies. For diverse stakeholders, the implications of significant renewable energy development are now much better known and are given much greater attention. For example, before RPSs, most utilities had little familiarity or experience with smaller-scale, more distributed, variable-output electric power generation technologies.

4. State RPSs have laid the foundation for a national market for renewable energy

RPSs have caused market players to think about renewable energy development in a context that transcends state boundaries. For one thing, almost all states use renewable energy certificates (RECs) as the mechanism for compliance with the RPS. These certificates typically occur in electronic form. A REC is created every time a qualifying renewable energy facility generates one megawatt-hour of electricity. Tracking RECs verifies that the correct quantities of renewable energy have indeed been generated to satisfy the RPS. RECs have become the common currency for renewable energy generation, serving as a building block for a national market for renewable energy.

Because most RPSs allow some out-of-state renewable energy generation to qualify, it is necessary for a state to be concerned about RECs produced beyond its borders. The tracking systems, most of which are regional in nature, facilitate the trading of these RECs regionally. Moreover, some of the

[10] A recent webinar for the State-Federal RPS Collaborative described the operations of three regional tracking systems: New England Power Pool (NEPOOL), the Western Renewable Energy Generation Information System (WREGIS), and Midwest Renewable Energy Tracking System (M-RETS). A recording of the webinar is available at http://www.cleanenergystates.org/assets/Uploads/2013-05-28-12.00-RPS-Webinar-Overview-of-Regional-Tracking-Systems.wmv.

tracking systems are sufficiently compatible with each other so that expanded inter-regional trading would be relatively easy. For example, because Missouri and North Carolina allow projects in any location to qualify for their RPSs, APX, a firm that helps administer the tracking systems in those regions, developed procedures for transferring renewable energy certificates across regions.

Beyond the existence of tracking systems, state RPSs, with their out-of-state compliance feature, encourage state energy policymakers to think beyond the boundaries of their state and to consider the potential renewable energy resources throughout their region. This has increased the cross-state contact among policymakers.

If the federal government decides to establish a national renewable portfolio standard or broader clean energy standard, experience with state RPSs would inform the design of such a standard. The infrastructure already in place for the state RPSs could make it easier to get a national standard up and running. Even in the absence of a national standard, there is likely to be increased contact among market players across regions.

5. RPSs have created jobs and contributed to local economic development

While it is difficult to know exactly how many jobs RPSs have created, there can be little doubt that some new jobs can be traced to them. Renewable energy companies seeking to expand their operations in the United States have sought out locations where the existence of an RPS indicates a commitment to renewable energy on the part of the state.

In the case of solar, for example, solar carve-outs (which require solar energy specifically to be used to provide a certain percentage or amount of the electricity supply) and other RPS provisions have led to a rapid increase in the number of solar installers in states with an RPS. The top four solar job states—California, Arizona, New Jersey, and Massachusetts—all have state RPSs that have played an important role in incentivizing solar and are locations where a high share of the solar jobs are in installation and project development.[11]

A recent report by the Union of Concerned Scientists discusses the many ways in which renewable energy development has gone hand in hand with job growth, and it includes case studies of a few states. For example, it makes a link between the Colorado Renewable Energy Standard (RES) and in-state jobs. “Wind power is currently the largest contributor to Colorado’s annual RES requirements, with more than 2,300 MW of installed capacity providing enough electricity to power some 500,000 homes. In 2011, Colorado’s wind industry supported 4,000 to 5,000 jobs, made property tax payments totaling more than $10 million, and paid about $5.4 million in land lease payments.”[12]

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[11] The Solar Foundation, “State Solar Jobs Map,” website released April 18, 2013, available at http://thesolarfoundation.org/solarstates.

[12] Union of Concerned Scientists, *How Renewable Electricity Standards Deliver Economic Benefits*, p. 13.

III. STRENGTHS OF THE RPS AS A POLICY

As a policy mechanism designed to advance clean energy, the RPS has proven to have six important strengths.

1. An RPS is based on an appealing, straight-forward concept

The concept of requiring electricity suppliers to get a designated share of their electricity from specified clean energy sources is easy to explain and easy to understand. For policymakers and the public, the results are measurable and meaningful. Because the RPS targets usually rise gradually, an RPS promises to achieve steady, incremental progress in a way that will not be overly disruptive to the electricity system.

Even though many RPSs can be administratively quite complex, the ***concept*** of requiring a certain share of electricity to come from renewables is simple and clear. This helps explain why so many legislators in so many states have decided to institute RPSs over the past two decades, and why the public has been largely supportive. So much about electricity policy and the electricity system is opaque and confusing to those who do not work in the energy industry, but an RPS is readily understandable. It is not surprising that RPSs have captured the attention of the public and the media in ways that other policies for reshaping the electricity system, such as integrated resource planning or cap-and-trade systems, never have.

2. An RPS uses a market-based approach

With an RPS, the government typically sets general requirements, but does not decide exactly what gets built and at what price. Instead, utilities, other electricity suppliers, project developers, and other private sector players make those decisions. As Nancy Rader and Scott Hempling, early champions of the RPS as a policy, wrote in a 2001 report, "The RPS creates a market for renewable energy in which private investors make decisions about which projects and technologies are the most promising in terms of cost, location, timeliness of development, and reliability."[13]

Rader and Hempling predicted that the market-based nature of the RPS would allow each retail electricity seller to meet its obligation as efficiently and cost-effectively as possible, and that "if based on tradable credits, the policy allows *the market as a whole* to meet the overall obligation as

[13] Nancy Rader and Scott Hempling, *The Renewables Portfolio Standard: A Practical Guide* (Washington: National Association of Regulatory Utility Commissioners, 2001), p. 3, available at http://www.naruc.org/grants/Documents/rps.pdf.

efficiently as possible."[14] And indeed, experience has shown that the competition among potential renewable energy generators can lead to downward price pressure that avoids unnecessarily or arbitrarily high payments for procuring renewable energy.

In a situation where renewable energy projects are sufficiently cost competitive with conventional power that they are being built without the need for the RPS mandate, the market will work to keep the RPS-related cost premium to a minimum. Indeed, in Texas, where the wind resource is large and wind projects can be built cheaply, the amount of wind energy developed is greater than needed to meet the RPS. Renewable energy certificates, which embody the RPS-related price premium, have consequently sold in Texas in recent years for a nominal price of between 0.1 cents and 0.3 cents per kilowatt hour, meaning that the RPS has a negligible impact of electricity rates.

Nevertheless, although RPSs harness market forces, they do not always create perfect or completely efficient markets. The cost of procuring renewable energy is not always as low as some RPS proponents initially hoped. We will discuss that in section IV below.

3. An RPS is a long-term policy

In almost all cases, government policies work best when they are stable and give market players clear guidance on what the rules will be for an extended period of time. In that way, those players can develop and implement plans that respond efficiently and appropriately to what the rules and regulations will be. One of the problems with federal clean energy policy—which has largely been promoted through the tax code—is that it is unpredictable, with changes coming frequently and without sufficient time for developers, utilities, or the clean energy industry to plan. The production tax credit for wind energy has exemplified this inefficient approach, with the credit lapsing several times before being renewed, generally for just a short period of time.[15]

In contrast, an RPS is, by definition, a relatively long-term policy. It sets out clear future targets for the amount of renewable electricity that will be required and gives market players an extended period to prepare for and meet those targets. That creates a sense of policy certainty and predictability.

4. An RPS is a flexible policy mechanism

When the RPS concept was first being promoted in the 1990s, it was assumed that all state RPSs would be quite similar—and quite simple. They would allow for a broad range of renewable technologies and would allow those technologies to compete equally based on cost alone. But the

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[14] Ibid., p. 3.

[15] For the on-again, off-again history of the wind production tax credit, see the page on the "Renewable Energy Production Tax Credit (PTC)" on the website of the Database of State Incentives for Renewables and Efficiency (DSIRE): http://dsireusa.org/incentives/incentive.cfm?Incentive_Code=US13F.

differences between state RPS policies have turned out to be much greater than anticipated and that has been a strength of the RPS concept.

With each state having its own policy needs and renewable energy resources, the RPS concept has been adaptable to those varying needs. States can decide how ambitious to be by varying the percentage RPS targets and compliance dates. They have been able to choose which technologies to incentivize in order to best match their economic development goals and environmental objectives. Special RPS features, such as carve-outs (which distinguish between different energy resources or types of projects, and set different targets for each) and credit multipliers (which give different energy resources or types of projects extra or reduced credit towards meeting the RPS target) allow states to fine-tune their policies.

The flexibility of the RPS has enabled learning from experience over time. As state policymakers and regulators have observed the workings of their state's RPS, they have learned what is working as expected and what is not. They have then been able to respond nimbly by modifying the RPS's targets, timetables, technologies, provisions, and administrative procedures.

LBNL's tracking of year-by-year revisions to state RPSs found that 23 of the 31 had undergone at least one major revision and some of them had made major revisions three or four times.[16] Among other things, they added technologies, created carve-outs, extended the life of an RPS, and increased the annual targets. In addition to these major revisions, there have been numerous smaller changes, such as redefining the procedures for how a project qualifies for the RPS, creating mechanisms for determining whether a rate cap has been reached, and altering whether electricity suppliers can save renewable energy certificates for future use or delay their obligation for future periods.

Solar carve-outs have been especially popular in a way that was unforeseen when RPSs were first being established. As Ryan Wiser of LBNL points out, starting with Arizona in 2001, 16 states plus the District of Columbia have added either a solar carve-out or a distributed generation carve-out that favors solar. Some of these carve-outs are combined with credit multipliers. In addition, three other states that do not have a carve-out have a credit multiplier for solar.[17] Solar has accounted for eight percent of the cumulative renewables capacity increase in states with RPSs between 1998 and 2012,

[16] Barbose, "Renewables Portfolio Standards in the United States," slide 9.

[17] Ryan Wiser, "Supporting Solar Power in Renewables Portfolio Standards: Experience, Impacts, Issues," a presentation to the US Department of Energy Solar Policy and Deployment Coordination Meeting, January 25, 2013, slides 8 and 9.The DSIRE website includes a map, updated in March 2013, showing the states with solar and distributed generation provisions, http://dsireusa.org/documents/summarymaps/Solar_DG_RPS_map.pdf.

and the percentage has been much higher than that in the most recent years. Currently, solar carve-outs require the addition of approximately 700 megawatts of solar annually.[18]

Unfortunately, there can be a tension between two RPS strengths—that of flexibility and that of being a long-term policy. If policymakers give the impression that they will be constantly tinkering with an RPS and will make changes that invalidate market players' plans, they undercut the RPS as a stable, predictable policy. Policymakers should therefore make sure that any modifications they make to an RPS are indeed sufficiently important to risk creating the perception that the RPS is not as stable as previously assumed.

It is important to note that not all changes to an RPS undercut the sense of policy predictability and stability. For example, when Minnesota added a solar tier in May 2013, that carve-out was added as an extra obligation that did not disrupt existing RPS requirements or targets. And, of course, changes that extend the RPS further into the future by adding additional target dates with higher renewable energy requirements strengthen an RPS as a long-term policy.

5. An RPS works well in combination with federal tax policies

So far, state RPSs have meshed well with federal policies to support the development of renewable energy. The respective policies have addressed different barriers to renewable energy development and have avoided duplication of efforts. The RPSs have created the demand for renewable energy, while federal tax credits and grants have reduced the cost of project development, thereby increasing the supply of renewable energy. An RPS signals to the federal government that a state is committed to clean energy and is willing to devote financial resources to help develop it.

6. RPSs appear to have had modest costs

Although it requires a full cost-benefit evaluation to determine all the many indirect economic costs and benefits of an RPS,[19] the available estimates suggest that the impact on electricity rates so far has been modest. When LBNL examined the 2009–2011 compliance reports of the 18 states for which cost data was available, the researchers found that the RPS in only one state—Arizona—had an impact on electricity rates greater than 2.3 percent. The rate impact was well below one percent in 12 of the 18 states.[20] The consistently low impact on rates shown in compliance reports and cost-benefit studies is especially noteworthy, because the studies have used a variety of methods and, of

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[18] Barbose, "Renewables Portfolio Standards in the United States," slides 11 and 13.

[19] On RPS evaluation, see Warren Leon, *Evaluating the Benefits and Costs of a Renewable Portfolio Standard: A Guide for State RPS Programs* (Montpelier, VT: Clean Energy States Alliance, 2012), http://www.cleanenergystates.org/assets/2012-Files/RPS/CESA-RPS-evaluation-report-final-5-22-12.pdf.

[20] Barbose, "Renewables Portfolio Standards in the United States," slide 16.

course, different people to conduct the assessments. They have been carried out in a range of states in different regions with differently structured RPSs and different political make-ups.[21]

Moreover, the state compliance reports generally do not account for indirect positive effects of an RPS on electricity rates, such as price-suppression effects produced by reducing the need for expensive peaking electricity generators to come online during times of peak demand. And a single-minded focus on the short-term RPS rate impacts can ignore the considerable benefits that the state gets from renewable energy development, including cleaner air, reduced greenhouse gas emissions, decreased water use, more local jobs, and lower risk of rate increases should natural gas prices rise in the future.[22]

Of course, RPS rate impacts could increase in the future as compliance targets rise (there is obviously a greater impact when suppliers pay an extra three cents per kilowatt-hour for ten percent of their electricity supply than for five percent). For that reason, even though RPSs seem to be accomplishing their objectives at a reasonable cost, it is important for RPS administering agencies to track ratepayer impacts to make sure that they remain modest. As one of our interviewees points out, “Ratepayer impacts of an RPS can derail it politically. States should therefore carefully do an unbiased study of such impacts and include provisions in their RPS to prevent costs from escalating rapidly.”

Most states have protected themselves to some extent by including a cost containment measure, such as a rate cap, a contract price cap, or an alternative compliance payment, whereby an electricity supplier can pay a set fee instead of purchasing renewable energy certificates. Only five states are without such a measure.[23] Although some of the alternative compliance payment levels may be set too high to prevent rate impacts that some ratepayers may view as significant, the states could adjust those levels in the future, if necessary.

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[21] For brief summaries of price impact studies from eight states, see Union of Concerned Scientists, *How Renewable Electricity Standards Deliver Economic Benefits,* p. 5.

[22] See, for example, Mark Bolinger, *Revisiting the Long-Term Hedge Value of Wind Power in an Era of Low Natural Gas Prices* (Berkeley: Lawrence Berkeley National Laboratory, 2013), available at http://emp.lbl.gov/sites/all/files/lbnl-6103e.pdf.

[23] Barbose, “Renewables Portfolio Standards in the United States,” slide 17.

IV. RPS WEAKNESSES AND STRATEGIES FOR OVERCOMING THEM

Just as they have strengths, renewable portfolio standards also have limitations as a policy mechanism. Fortunately, as RPS administrators and policymakers have gained more experience with RPSs, they have developed strategies for dealing with and minimizing some of the weaknesses.

1. There can be significant volatility in the price of renewable energy certificates

This is the flip side of an RPS's strength as a market-based policy. With the price of renewable energy certificates being set by the market, project developers cannot know exactly how much money they will be able to receive in total for the two things they will have to sell—electricity and RECs. Especially in restructured electricity markets, the price of RECs can vary dramatically. In the case of Connecticut, for example, Class One RECs have sold for as low as 1.2 cents per kilowatt hour when there was a surplus of renewable energy supply, and at nearly 5 cents per kilowatt hour when there was a shortage. Such price volatility and unpredictability make planning difficult and can discourage some developers from pursuing projects.

States do not have an obligation to guarantee a profit for developers, but the current situation can make it difficult for projects to secure financing. The reason for this is that lending institutions and investors seek a guaranteed, stable revenue stream to secure their loans or investments. Because contracts for RECs are most often for a relatively short period of time, project developers cannot guarantee that their projects will have such a stable revenue stream. In some regulated markets, this has been less of an issue as utilities have been able to secure long-term contracts with renewable energy generators, thereby providing revenue predictability. But it can be an important factor in deregulated markets. Even if project developers can find financing, they may be paying such high rates that the cost of the renewable energy from their projects ends up being higher than it would be otherwise.

Some restructured states have found ways around this problem. New York has a successful approach for its RPS that uses central procurement, whereby the New York State Energy Research and Development Authority (NYSERDA) offers ten-year REC contracts to selected renewable energy projects. Illinois uses a variant on the central procurement model. Connecticut in June 2013 enacted a law that "allows the commissioner of the Department of Energy and Environmental Protection to solicit proposals and enter into long-term agreements with certain renewable energy source providers."[24] Massachusetts has required its investor-owned utilities to enter into long-term contracts with renewable energy generators and has developed a complicated but effective strategy for ensuring relative price stability for the solar renewable energy certificates that are used for the state's solar carve-out. Other states have taken steps to encourage long-term contracting, either in conjunction with an RPS or through a separate initiative.[25]

2. An RPS can have free riders

From the standpoint of state government and the public, a renewable energy policy with optimal economic efficiency would provide the minimum financial incentives to get renewable energy projects built and no more. If a project did not require a financial incentive, it would not receive one. But it is difficult to design such a policy.

As a market-based mechanism, an RPS has the advantage of price flexibility—meaning that the price premium paid for renewable energy falls when the supply is ample and rises when greater incentives are needed to stimulate the development of additional projects. On the other hand, an RPS market cannot distinguish between those generating facilities that require the incentive and those that do not. All sellers of renewable energy certificates are able to receive payments equally, even for projects that would be profitable without incentives.

There are few ways to avoid this problem without moving away from a market-based strategy and involving government or utility officials in making subjective judgments about how big an incentive a particular project needs and deserves. Such a procedure has its own problems, would have high administrative costs, and could lead to gaming of the system.

One promising approach that can reduce total RPS costs while still relying on a market mechanism is a reverse auction, such as the California Public Utilities Commission has used with its Renewable Auction Mechanism (RAM). With a reverse auction, project developers submit bids to sell their power and renewable energy certificates, indicating the lowest price they are willing to accept. The agency managing the auction accepts the least-cost viable projects in order, until it has secured the amount of electricity generation it needs. In this way, it pays the minimum amount necessary. But a reverse auction only works well when a market is sufficiently mature that there are many experienced project developers. In that case, many bidders will compete, encouraging all of them to keep their bids low. The low prices justify the administrative costs associated with running the auction.

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[24] State of Connecticut General Assembly, "Substitute Senate Bill No. 1138 As Amended," May 30, 2013, available at http://www.cga.ct.gov/2013/FC/pdf/2013SB-01138-R000879-FC.pdf.

[25] For a table showing long-term contracting provisions in 15 states, see Kevin Porter and Ed Holt, *Pros and Cons of Four Renewable Energy Policy Options for the Arkansas Public Service Commission to Consider* (Washington: National Association of Regulatory Utility Commissioners, 2012), available at http://www.naruc.org/Publications/FINAL%20AR%20SERCAT%20for%20posting%20on%20website.pdf.

California's RAM focuses on system-side projects up to 20 megawatts and has achieved favorable results from its auction.[26] New York's central procurement model for its RPS includes elements of a reverse auction, although it also considers other factors when comparing projects and deciding which ones should receive contracts for renewable energy certificates.

3. For an RPS to work well, it needs to be fine-tuned over time, but that can be difficult

When an RPS is established, policymakers may not have enough information to select the optimal program design or to know exactly how special provisions, such as carve-outs or multipliers or alternative compliance payments, will work out in practice. Even if policymakers design an RPS as well as could possibly be done at the time, changes to the economy, the electricity market, or energy technologies could outdate some of the initial decisions. In addition, new information can alter policymakers' views of which clean energy resources most deserve support through an RPS.

The need for these modifications is not a weakness of the RPS as a policy mechanism and, in fact, the previous section of this report argued that flexibility was a key strength of the RPS. But it becomes a problem when it is overly difficult to make changes to an RPS. In too many cases, the legislation that established an RPS was overly detailed and prescriptive, giving RPS administrators too little ability to make necessary revisions. In other words, the RPS is insufficiently nimble.

When it is necessary to go back to the legislature to address a problem with an RPS, the legislative calendar may be too slow and inflexible to get the changes completed fast enough to efficiently address the problem. Moreover, it may not make sense to go through the arduous and unpredictable legislative process to address a relatively small issue, so the problem remains unsolved.

Even when legislation is not required, making minor changes through the regulatory process of a public utility commission may be difficult and time consuming. Most RPSs have a few small provisions that should be modified, but would be so hard to modify that they will likely remain unchanged.

The obvious solution to this problem is for legislators to plan for RPS flexibility by giving the RPS administrating agency some latitude to make minor adjustments and modifications, and by preparing ahead of time for periodic legislative review of RPS progress under the assumption that mid-course corrections will be necessary.

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[26] For information on the California Renewable Auction Mechanism, see the California Public Utilities Commission's website, http://www.cpuc.ca.gov/RAM, as well as Paul Douglas, "Renewable Auction Mechanism (RAM): New Procurement Tool for Distributed Renewable Generation" a presentation to the National Summit on RPS, December 3, 2012, available at http://www.cleanenergystates.org/assets/2012-Files/RPS/CESA-2012-RPS-Summit-RAM-Overview-and-Resultsfinal-paul-douglas.pdf.

V. CURRENT CHALLENGES

In the research for this report, we devoted considerable attention to identifying the key challenges that RPSs currently face and will likely face in the coming few years. As part of that research, RPS program managers from 16 states gave responses to questions about the main issues their state faces.

Table 2. Which of the Following Are Issues in Your State Related to the RPS?

	Major Issue	Minor Issue	Not an Issue
Possible future rate impacts of the RPS	5	8	3
Infrastructure needed to support renewable energy development (e.g., transmission, managing intermittency)	5	5	5
Rate impacts caused so far by the RPS	4	5	7
Low natural gas prices	3	8	4
Uncertainty about federal renewable energy policy	3	6	5
Potential future shortage of renewable energy to meet the RPS	3	4	8
Volatility of REC prices	2	7	7
The RPS could be significantly weakened by legislation	2	4	8
Lack of long-term contracts for renewable power or RECs	2	3	10
Current oversupply of renewable energy to meet the RPS	1	5	9
Potential future oversupply of renewable energy to meet the RPS	1	5	9
Complexity or other problems related to multiple RPS tiers or carve-outs	1	4	11
Difficulty of determining whether cost/rate caps have been reached	1	3	11
Current shortage of renewable energy to meet the RPS	1	3	12
The final RPS target will soon be met and there is no plan to increase the target	1	1	13
Lack of diversity in the renewable technologies supported by the RPS	0	4	11
Insufficient in-state development compared to out-of-state development	0	4	12
Difficulty of tracking RECs or renewable energy generation	0	3	13

Among the other topics that were identified as issues by these 16 states or by other people we interviewed were:

- Market and regulatory uncertainty.
- Many RPS laws have ambiguous legal language, creating uncertainty and requiring excessive time on the part of regulators to deal with the ambiguity.
- What to do about technologies that are included in the RPS but are not being developed, because other RPS-eligible technologies are less expensive.
- Insufficient staff resources to manage the RPS effectively.
- The best renewable resources being often located far from population centers.
- Increased administrative burdens primarily because of the establishment of new RPS classes and carve-outs.
- Difficulty in developing an easy, transparent methodology for determining whether cost caps have been met.
- Changes in neighboring states' RPS rules that could impact a state's RPS.

These responses reinforce the finding that there are large differences among RPSs and it is hard to make generalizations that apply to all states. Strikingly, there is no single issue that is perceived to be a major concern by the majority—or even a third—of the 16 states.

Nevertheless, when we take all the input CESA staff members received from our sources and incorporate our own analysis of the situation, we conclude that RPSs face five primary challenges. Most of the responses in the figure above track to one or more of these issues.

1. Some state RPSs need to be refreshed

Even though most RPSs are relatively long-term policies, some of them have been around long enough and have been successful enough that they are reaching or exceeding the targets set out in the original legislation. Additional or increased targets need to be added in order for the RPS to continue to stimulate renewable energy development. For example, Michigan's final target will be reached in 2015, when utilities are required to secure 10 percent of their electricity from designated eligible technologies. Montana's RPS obligation caps out at 15 percent in 2015 and Maine's in 2017. Oregon currently has a glut of renewable energy certificates on the market.

It is especially noteworthy that most large California utilities have already signed contracts sufficient to meet the state's ambitious RPS target of 33 percent renewables in 2020. The California RPS has been an especially important driver of renewable energy development, but the pace of development could fall sharply if the RPS target is not increased and extended.

In part because some states are already or will soon bump up against their maximum RPS target, LBNL estimates that RPSs collectively require only 3-5 gigawatts of additional capacity to be added each year through 2020. Although that is surely a significant amount, it is much less than the amount of renewables that has come online in the United States in recent years—over 8 gigawatts in 2011 and over 16 gigawatts in the banner year of 2012.[27] Of course, not all recent development has taken place in locations with RPS incentives, but most of it has. If RPSs are not refreshed and given continued relevance, renewable energy development could slow. In some cases, impressive local clean energy industry clusters that have grown up to meet the project development required by an RPS could begin to wither if the RPS ceases to incentivize additional development.

Table 3 below, from a January 2013 report by Bloomberg New Energy Finance and the Business Council for Sustainable Energy, shows an assessment of the balance between renewable energy supply and demand to meet the utility-scale component of RPSs (not counting carve-outs, such as those for solar) for states in different regions. The situation varies by region and particular states within a region have greater need for additional development than others, but the report concludes that "for states to continue to see the rates of growth [in clean energy supply] achieved over the past five years, some may have to raise their clean energy targets."[28]

Table 3. Supply-Demand Balance of Selected "Class 1" RPS Programs (grouped by region)[29]

Region	Representative states with RPS	High-level evaluation of supply-demand balance
California	CA	Most large utilities have contracted enough renewable capacity to meet targets through 2020 (though portion of contracted capacity may not materialize)
PJM	IL, MD, NJ, OH, PA	Both of these regions have enough renewable capacity to meet targets through at least mid-decade
Midwest	IA, MN, MO	
New England	CT, MA, ME, NH	Demand is tight, with current assessments showing overall renewable generation is slightly short of regional demand[30]

[27] Barbose, "Renewables Portfolio Standards in the United States," slide 9.

[28] Bloomberg New Energy Finance L.P. and the Business Council for Sustainable Energy, *Sustainable Energy in America 2013 Factbook* (New York: Bloomberg New Energy Finance L.P., 2013), p. 22, available at http://www.bcse.org/factbook/pdfs/BCSE_BNEF_Sustainable_Energy_in_America_2013_Factbook.pdf.

[29] Ibid., pp. 22-23. The original table includes the following notes: "Analysis of supply-demand balance assumes current policy; naturally, this balance will change if RPS targets are adjusted. RPS programs are enacted and administered at the state level, but the supply-demand balance here is shown at the regional level; this is because many states allow their RPS to be met through credits generated in neighboring states. Regions denoted above roughly correspond to the territories covered by specific renewable energy credit tracking systems. 'Class I' generally refers to the portion of REC markets that can be served by a variety of renewable technologies, including wind. In contrast, SREC markets are not Class I, as these can only be met through solar. The 'Class I' component is usually the bulk of most states' renewable portfolio standards."

[30] Legislation enacted in Connecticut in June 2013 to expand the eligibility of large-scale hydropower could change the supply-demand balance in New England.

Region	Representative states with RPS	High-level evaluation of supply-demand balance
New York	NY	Shortage, with more renewable capacity needed to be contracted to meet 2015 target
Texas	TX	Enough capacity (12GW wind) to meet even long-term goal (10GW by 2025)
West US	CO, NM, OR, WA	Region overall has enough renewable capacity to meet near-term targets

2. Some RPSs may have difficulty achieving their goals

While the first challenge for RPSs suggests that targets need to be raised in some states, the second challenge is that the goals could be difficult to achieve in other states. In states that still need to bring significant additional renewable energy generation online in order to reach their RPS targets, the financial picture for major renewable energy projects could make it hard to install enough renewable energy.

Up to now, RPSs combined with federal incentives have provided sufficient support for renewable projects to compete with conventional electricity generation, most notably natural-gas-fired power plants, which are typically the least-cost choice for new power generation. Unfortunately, two factors may make it more difficult for renewable energy projects to get developed. First, low natural gas prices reduce the price with which renewable energy projects need to compete. Second, there is great uncertainty about whether adequate federal support will continue to exist, given that the production tax credit for utility-scale wind is scheduled to end on December 31st of this year, investment tax credits for fuel cells and small wind systems expire at the end of 2016, and the solar investment tax credit is scheduled to be reduced sharply at the end of 2016.

Although this set of problems could slow renewable energy development, most states will likely find ways to modify their RPS, if necessary, just as they have made adjustments to address other unexpected circumstances. But it would certainly be easier for the states and much better for renewable energy if the federal government were to continue some meaningful support programs.

3. There is a need to prepare for greater market penetration of renewables

As more renewables are integrated into the utility grid, the challenge of dealing with issues like intermittency increases. Policymakers need to be aware of the extent to which specific RPS targets could or will pose an integration challenge. For example, will additional transmission have to be built and can it come online fast enough to accommodate the RPS-required renewables? At what point will the market penetration of solar and wind be sufficiently great to require additional solutions for addressing their intermittency?

As with almost everything related to renewable portfolio standards, there is significant variance among the states in terms of how difficult it will be to integrate renewables into the system in order to meet RPS targets. Variables include how ambitious the targets are, how ample current transmission capacity is, what the mix of renewable technologies is, and the state's geography. Hawaii, for example, faces special challenges, because it has small isolated grids, with no connections between islands.

Researchers are giving increased attention to the integration of renewables and distributed generation.[31] RPS administrators should monitor this work to help determine what supporting policies or actions would be needed to meet their state's RPS targets. The National Renewable Energy Laboratory (NREL) is especially active in examining grid integration issues.[32]

Beyond monitoring research and developments related to this important subject, RPS administrators and policymakers should consider whether the RPS can be or should be modified to prepare the way for greater penetration of renewables. For example, can an RPS support energy storage and/or smart grid technologies that facilitate greater use of intermittent resources? Are there other policies outside of the RPS that can help accomplish that?

RPS administrators and policymakers should also be mindful of the costs associated with meeting the integration challenge when they assess the costs and benefits of an RPS. These costs should not be ignored, but they also should not be exaggerated. Some costs related to transmission, for example, are already paid by the developers of renewable energy projects. And the scope of the entire integration challenge should not be exaggerated, since a benefit of current low natural gas prices is that there is greater availability of gas plants that can cycle on and off as needed. A recent report by the Brattle Group analyzing the ERCOT grid, which covers most of Texas, found that high market penetrations of wind energy and readily available cheap nature gas are complementary.[33]

4. RPSs face determined opposition

In many states, legislators and advocates, often affiliated with or influenced by the American Legislative Exchange Council, are pushing to have the state RPS eliminated or watered down. These RPS opponents tend to express one or more of the following concerns—(1) the RPS has had or will have too large an impact on electricity rates, (2) the RPS gives an unfair advantage to some energy technologies at the expense of unfavored technologies, (3) the RPS is an inappropriate policy

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[31] See, for example, Lisa Schwartz et al., *Meeting Renewable Energy Targets in the West at the Least Cost: The Integration Challenge* (Denver: Western Governors' Association, 2012), available at http://www.westgov.org/reports/cat_view/95-reports/263-2012;

[32] As a starting point, see the relevant section of the NREL website: http://www.nrel.gov/electricity/erbsi_center.html.

[33] Jurgen Weiss et al., *Partnering Natural Gas and Renewables in ERCOT* (Cambridge: The Brattle Group, 2013), available at http://www.texascleanenergy.org/Brattle%20report%20on%20renewable-gas%20FINAL%2011%20June%202013.pdf.

mechanism—either because it interferes in the unfettered working of the free market or because it is wrong for the government to take action to reduce greenhouse gas emissions.

As a result, RPS-weakening legislation has been introduced in many states and could be passed in several of them, either this year or in future years. But as Justin Barnes and Chelsea Barnes of Keyes, Fox & Wiedman LLP reported in a recent paper, there are nearly as many bills pending that would strengthen RPSs as weaken them.[34] As evidence that there will not likely be a cascading trend to roll back RPSs, Minnesota added a new solar carve-out in May 2013, requiring investor-owned utilities to get 1.5 percent of their electricity from solar by 2020.[35] In June 2013, Colorado enacted a law doubling the RPS requirements for rural co-ops.[36]

The debates over RPS policies in various states this year have shown that these policies have benefitted many people of a variety of political persuasions and that there are strong constituencies that support retaining the policies. In those states where the RPS has been most successful in increasing renewable energy use and stimulating growth of clean energy businesses, it will be especially difficult to build a political consensus for overturning the policy. With many bills still up in the air in this year's legislative session, in terms of major changes so far, Colorado and Minnesota have expanded their RPSs as noted above, while Nevada also made changes that tend strengthen its RPS.[37] On the other hand, Connecticut has made a variety of changes that on balance make its RPS less stringent.[38] When the dust settles at the end of the legislative sessions this year and next year, there will probably be no overwhelming trend: some RPSs will be weakened while others will be strengthened.

Even if RPS weakening bills do not become law, the vocal opposition to RPSs poses challenges to the smooth and successful functioning of RPSs. In some states, RPS managers and stakeholders have become hesitant to propose a legislative fix to correct problems with an RPS, because they fear that

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[34] Justin Barnes and Chelsea Barnes, *The Report of My Death Was an Exaggeration: Renewables Portfolio Standards Live On* (Chapel Hill: Keyes, Fox & Wiedman LLP, 2013), available at http://www.cleanenergystates.org/assets/2013-Files/RPS/2013RPSLegislationKFWBarnes.pdf.

[35] Elizabeth Dunbar, "FAQ: Minnesota's New Solar Energy Law," *MPR News,* June 14, 2013, available at http://minnesota.publicradio.org/display/web/2013/06/14/business/faq-solar-energy-law.

[36] Cathy Proctor, "Hickenlooper Signs Controversial Rural Renewable-Energy Bill," *Denver Business Journal,* June 5, 2013, available at http://www.bizjournals.com/denver/blog/earth_to_power/2013/06/hickenlooper-doubles-renewable-energy.html?page=all.

[37] "Nevada Clean Energy Advocates Celebrate Successful 2013 Legislative Session," Nevadans for Clean Affordable Reliable Energy website, n.d., available at http://nevadanscleanenergy.org/nevada-clean-energy-advocates-celebrate-successful-2013-legislative-session/#more-943.

[38] Paul N. Belval et al., "Governor Malloy Signs Connecticut Clean Energy Bill," Day Pitney LLP, June 6, 2013, available at http://www.daypitney.com/news/newsDetail.aspx?pkid=4709.

it could turn into a vehicle for attacking and undermining the RPS. In addition, to the extent that attempts to repeal or water down an RPS create uncertainty about the policy's future, they undermine one of the cornerstones of a successful RPS—that it is a stable, long-term policy. Uncertainty can make project developers hesitant to move forward and can drive up the cost of achieving RPS targets.

5. Some RPS provisions could be vulnerable to legal challenges

States seeking to use an RPS to advance local economic interests and provide local economic development benefits can run the risk of having particular RPS provisions challenged for being incompatible with the Commerce Clause of the United States Constitution. As Carolyn Elefant and Ed Holt explain in a highly useful report on the relationship between RPSs and the Commerce Clause, that section of the Constitution "prohibits states from favoring local industry to the disadvantage of out-of-state competitors for economically protectionist reasons."[39] Location-based RPS eligibility requirements that explicitly prohibit out-of-state projects in order to favor in-state businesses have the potential to run afoul of the Commerce Clause, because they can appear designed to be protectionist. Although most RPS provisions in most states are not vulnerable to legal challenges, some are.

The first Commerce-Clause-related lawsuit challenging an RPS was filed in Massachusetts in 2010 and was settled out of court.[40] Since then, there have been a few more lawsuits or threats of lawsuits, but none has led to invalidation of a state RPS. The high cost of litigation and the lack of parties that have experienced sufficient harm or have sufficient motivation to file legal action have helped limit the number of cases.

However, *Illinois Commerce Commission v. FERC*, a June 2013 decision of the Seventh Circuit of the U.S. Court of Appeals, has received significant attention and may heighten interest in RPS-related Commerce Clause issues even though the case actually focused on cost allocation among states for regional transmission, not on renewable portfolio standards. The Commerce Clause entered into it indirectly, when the court responded to one of Michigan's arguments for why that state should not have to pay fully for the transmission. In rejecting the argument, the court pointed out that there is an insurmountable constitutional barrier to broad location-based RPS eligibility restrictions.[41] These comments do not overturn the Michigan RPS. "In the short-term," as attorney Elefant points out,

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[39] Carolyn Elefant and Edward A. Holt, *The Commerce Clause and Implications for State Renewable Portfolio Standard Programs* (Montpelier, VT: Clean Energy States Alliance, 2011), p. 3, available at http://www.cleanenergystates.org/resource-library/resource/cesa-report-the-commerce-clause-and-implications-for-state-renewable-portfolio-standard-programs-pdf.

[40] On the Massachusetts case, see Ibid., pp. 19-23.

[41] The court's decision is available at http://media.ca7.uscourts.gov/cgi-bin/rssExec.pl?Submit=Display&Path=Y2013/D06-07/C:11-3421:J:Posner:aut:T:fnOp:N:1148803:S:0.

"the Seventh Circuit's decision has no real-world or immediate implications for state RPS programs."[42] However, the case highlights the vulnerability of certain location-based RPS provisions and could motivate some parties to consider bringing suit against an RPS.

In light of this, states should do what they already should have been doing—and that many have done—which is to review their RPS and take steps, if necessary, to reduce the risk of a lawsuit. The Elefant and Holt report provides guidelines for how a state can accomplish a wide range of legitimate public policy goals without running afoul of the Commerce Clause.

[42] Carolyn Elefant, *Case Summary: Implications of Illinois Commerce Commission et al. v. Federal Energy Regulatory Commission, Docket No. 11-3421 et al., (7th Cir. June 7, 2013) for State RPS Programs* (Montpelier, VT: Clean Energy States Alliance, 2013), p. 1, available at http://www.cleanenergystates.org/assets/2013-Files/RPS/Elefant-CaseStudy-DocketNo11-3421.pdf. This short paper provides a good explanation of the case and its implications.

VI. TIMELY ACTIONS FOR MAKING RENEWABLE PORTFOLIO STANDARDS MORE EFFECTIVE

This report will not repeat previously written compendiums of RPS best practices or advice on ways to structure an RPS to achieve particular goals.[43] Instead, this section of the report focuses on two areas for action in light of what has been learned about RPS strengths, weaknesses, and challenges.

1. Give increased attention to the benefits and impacts of different energy resources and technologies

Because of the way RPSs are generally structured—with various clean energy projects, resources, and technologies competing against each other on the basis of cost—there is an implicit starting assumption that all renewable resources have equal value to the electricity system and to the state. In the early stages of an RPS, when there is relatively little renewable energy installed, it is logical to focus on the quantity of renewables and not worrying too much about whether one type of clean energy resource is marginally more valuable than another. But, as the penetration of various technologies increases, it becomes desirable to have a more complete understanding of different technologies' specific benefits and the ways they impact the electricity system. This understanding can help policymakers know whether any changes should be made to the design of their state's RPS.

While the various renewable resources all help diversify the electricity system, they vary in their potential contribution to the electricity supply, environmental impacts, job benefits, public acceptance, and whether they provide long-term price stability, can be depleted over time, or are intermittent (and what the pattern of intermittency is). Although some of the advantages and disadvantages of the different resources are the same across states, there are also differences. Certain resources have more value to some states than to others.

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[43] See Warren Leon, *Designing the Right RPS: A Guide to Selecting Goals and Programs Options for a Renewable Portfolio Standard* (Montpelier, VT: Clean Energy States Alliance, 2009), available at http://www.cleanenergystates.org/assets/2012-Files/RPS/CESA-RPS-Goals-and-Program-Design-Report-March-2012.pdf; State/Federal RPS Collaborative, *Recommended Principles and Best Practices for State Renewable Portfolio Standards* (Montpelier, VT: Clean Energy States Alliance, 2009), available at http://www.cleanenergystates.org/assets/Uploads/Resources-post-8-16/Principles-Best-Practices-RPS-2.pdf; Wiser, *Supporting Solar Power in Renewable Portfolio Standards*; K.S. Cory and B.G. Swezey, *Renewable Portfolio Standards in the States: Balancing Goals and Implementation Strategies* (Golden, CO: National Renewable Energy Laboratory, 2007), available at http://www.nrel.gov/docs/fy08osti/41409.pdf; and Robert C. Grace et al., *When Renewable Energy Policy Objectives Conflict: A Guide for Policymakers* (Silver Spring, MD: National Regulatory Research Institute, 2011), available at http://www.nrri.org/pubs/electricity/NRRI_RE_Policy_Obj_Conflict_Oct11-17.pdf.

The California Public Utilities Commission and the California Energy Commission have begun to refine their methodologies for evaluating the value and cost of different resources in relationship to a range of renewable energy programs.[44] California's efforts could become useful models for other states, even though many smaller and less populous states cannot afford as extensive and in-depth assessment reports as California.

As renewable energy use increases, national organizations and academic researchers will produce more analysis that can be useful to states as they look to understand the value of different energy resources. For example, Tom Stanton of the National Regulatory Research Institute is completing a report on "State and Utility Solar Energy Support Programs" that, among other things, will examine the financial value of distributed solar to the electricity system.

Several of the people we interviewed for this report singled out biomass as a resource that deserves special attention and analysis to determine its value compared to other renewable energy sources. In recent years, there has been increasing controversy and uncertainty about the extent to which electricity generating facilities that rely on wood are desirable from a climate change standpoint,[45] but there are also questions about its other environmental impacts, its economic impacts, and the value of its base-load power compared to intermittent resources. To help set Massachusetts RPS policy related to biomass, that state's Department of Energy Resources commissioned a major study that examined the carbon dioxide emissions and sustainability of biomass.[46] It has become known as the Manomet study and its state-specific findings were quite critical of large-scale use of wood for electricity. Even people we interviewed who dispute the study's findings applauded Massachusetts for trying to understand the real value of biomass and they encouraged other states to carry out similar analyses.

Complicating matters for energy policymakers when assessing the value of biomass—or any other energy source for that matter—is the question of how to consider non-energy-related factors. A good example is the relationship between biomass use and forest fires in California (a similar

[44] The most publicly available information relates to the California Public Utilities Commission's work on net metering. See http://www.cpuc.ca.gov/PUC/energy/Solar/nem_cost_benefit_evaluation.htm.

[45] Experts agree that, if the trees that are used to produce electricity are replaced by newly planted trees, there will ultimately be a climate neutral cycle because the growing new trees will absorb the same amount of carbon dioxide as was released when the wood was used in the power plant. But beyond that, there is much less agreement. Much of the uncertainty relates to the fact that the carbon dioxide is released all at once when the wood is consumed in the power plant, but the re-growing forest only absorbs it gradually. Depending upon one's assumptions about how the wood is obtained and what will happen to the forests from which it is harvested, the gap between emissions and absorption produces a smaller or larger spike in near-term emissions.

[46] Thomas Walker et al., *Biomass Sustainability and Carbon Policy Study* (Manomet, Mass.: Manomet Center for Conservation Studies, 2010). The study, along with the authors' response to its critics, is available at http://www.manomet.org/sites/manomet.org/files/Manomet_Biomass_Report_Full_LoRez.pdf.

relationship would apply to some other western states). Greater use of wood for electricity could lead to thinning of forests and removal of vulnerable trees. If done in careful coordination with the California Department of Forestry and Fire Protection, this could significantly reduce the serious risk of high-intensity forest fires.[47] But it is unclear to what extent an agency administering an RPS should consider such a non-energy benefit when deciding whether ratepayers should pay a premium for electricity from biomass.

2. Assess possible RPS modifications carefully

As noted earlier in this report, an RPS has considerable flexibility and it should be tweaked over time to ensure that it is operating as well as possible for achieving the state's goals. Each state should continue to assess whether to include new technologies and resources, and should identify whether the inclusion of any of them would give the state an advantage or help it to achieve its environmental and economic goals.

Over time, additional possible policy goals are sure to emerge. For example, in the wake of major storms like Hurricane Sandy, many states are increasingly interested in ensuring that facilities necessary for the provision of emergency services (e.g., medical facilities, police stations, fire stations, gas stations, community shelters) can continue to operate if power from the electricity grid is interrupted. As a recent report for the RPS Collaborative showed, a few states are exploring ways to use an RPS to help make such critical facilities more energy resilient.[48]

Another topic that seems poised for greater attention from RPSs is thermal energy. There is increased awareness that thermal energy has not received as much attention as electricity generation when states set energy policy. Certain thermal applications of renewables offer environmental and economic benefits. In addition, when appropriately sited, combined-heat-and-power systems can provide advantages over generators that only produce electricity. North Carolina, for example, has long included solar thermal and combined-heat-and-power. In 2012, New Hampshire became the first state to include thermal-only applications that use wood.[49]

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[47] For more on this issue, see Black and Veatch, "Small-Scale Bioenergy: Resource Potential, Costs, and Feed-In Tariff Implementation Assessment," draft report prepared for the California Public Utilities Commission, April 9, 2013, appendix C, available at http://www.cpuc.ca.gov/NR/rdonlyres/9ABE17A5-3633-4562-A6DA-A090EB3F6D07/0/SmallScaleBioenergy_DRAFT_04092013.pdf.

[48] Todd Olinsky-Paul, *Using State RPSs to Promote Resilient Power at Critical Infrastructure Facilities* (Montpelier, VT: Clean Energy States Alliance, 2013), available at http://www.cleanenergystates.org/assets/2013-Files/RPS/Using-State-RPSs-to-Promote-Resilent-Power-May-2013.pdf.

[49] For more information on thermal applications and other non-conventional resources in RPSs, see Jenny Heeter and Lori Bird, 2012. *Including Alternative Resources in State Renewable Portfolio Standards: Current Design and Implementation Experience* (Golden, CO: National Renewable Energy Laboratory, 2012), available at http://www.nrel.gov/docs/fy13osti/55979.pdf.

On the other hand, it is important to avoid unnecessarily complicating an RPS. New provisions should not be added frivolously. Because every additional feature makes the task of administering the policy more difficult, there should be a compelling reason for adding the feature. Unfortunately, there are many examples of RPS policy features that were included without sufficient advance consideration. Any changes to an RPS should be made deliberately after careful analysis and deliberation.

When deciding on a possible change, policymakers should ask the following questions and only proceed if there are solid, credible answers:

- What is the policy goal that would be addressed by the proposed RPS change?
- How specifically will the change achieve the goal?
- Is there sufficient information to have confidence that the specific RPS feature will work as intended?
- What could be possible negative unintended consequences of the change and is there reason to believe that the risk of those consequences is low?[50]

[50] For information on the relationship between some possible policy goals and specific RPS technologies and design features, see Leon, *Designing the Right RPS* and Grace, *When Renewable Energy Policy Objectives Conflict.*

VII. CONCLUDING THOUGHTS FROM THE AUTHOR

Renewable portfolio standards have been an effective vehicle for states to advance clean energy. Like any public policy, they have weaknesses as well as strengths, but they have proven to be popular with the public and are helping to diversify the electricity supply while reducing the environmental impacts of energy use, all at a manageable cost. They set out a long-term direction that provides guidance to government officials, industry, and stakeholders.

When speaking to RPS program managers, market participants, and other stakeholders—not only in interviews for this report, but in the many meetings and conversations with several hundred people who participate in the RPS Collaborative—I have been struck by how optimistic and positive they are when discussing state RPSs. Although RPSs can be complicated and hard to administer, the vast majority of people involved in managing and implementing them indicate that RPSs are nevertheless desirable. They feel that any difficulties are well worth dealing with, because of the results already being achieved and the potential for even greater impacts in the future.

Even though RPSs face serious challenges, I believe they will continue to be important energy policies. Experience up to now has shown them to be flexible and adaptable, and policymakers have frequently shown creativity in designing and implementing RPS modifications. As circumstances change, policymakers will likely be able to adjust RPSs as necessary to keep them relevant.

About the Author

Warren Leon was appointed Executive Director of Clean Energy States Alliance (CESA) in June 2013, after serving CESA in several other capacities in recent years, including as Deputy Director of the organization. He oversees the organization's day-to-day operations and leads strategy development. He directs CESA's State-Federal RPS Collaborative and is staff lead on PV. He is an Adjunct Professor at the Brandeis University International Business School and head of the school's sustainability specialization. Prior to working for CESA, Warren was Director of the Massachusetts Renewable Energy Trust, Executive Director of the Northeast Sustainable Energy Association, and Deputy Director for Programs at the Union of Concerned Scientists. He co-authored the influential book The Consumer's Guide to Effective Environmental Choices. He holds a Ph.D. from Harvard University.

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