Designing the Right RPS

A GUIDE TO SELECTING GOALS AND PROGRAM OPTIONS FOR A RENEWABLE PORTFOLIO STANDARD

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and

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by

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About This Report

This report has been adapted from a previous report, *Analysis of Renewable Energy Policy Options for Vermont: The SPEED Program and Renewable Portfolio Standard*, which was designed specifically for the State of Vermont. Because that report included considerable information and advice that is applicable to other states, the Clean Energy States Alliance (CESA) decided to extract the relevant sections, remove Vermont-specific information, and frame the report for a nation-wide audience.

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A. INTRODUCTION

A renewable portfolio standard (RPS) is a mandate that a state's electricity supply include a minimum quantity of renewable energy. It requires electricity suppliers to get a certain percentage of their electricity from renewable energy sources. To stimulate the gradual but continued development of new renewable energy facilities, the percentage generally increases over time. Because an RPS does not set a specific price that electricity suppliers must pay for renewable energy generation, there is competition among generators to sell to electricity suppliers and that competition theoretically ensures that renewable energy is secured at the least cost. Electricity suppliers typically are required to demonstrate RPS compliance on an annual basis and RPS policies are backed by various types of compliance enforcement mechanisms.

The RPS is the most popular and widely used state policy mechanism for encouraging wholesale renewable energy power development. Currently, 29 states plus the District of Columbia and Puerto Rico have a mandatory RPS, and eight other states have a nonbinding goal. Similar policies have been adopted by various countries in Europe and Asia.

A variety of alternative terms are used somewhat interchangeably to describe a "renewable portfolio standard." These include renewable electricity standard, renewable energy standard, clean energy standard, and clean energy portfolio standard. When the term "clean" is used rather than "renewable," it often, but not always, refers to a standard that includes non-renewable technologies or energy efficiency measures.

The report you are about to read looks at issues of RPS program design. It considers how to set appropriate goals for an RPS and how to choose program design features that will enable the RPS to achieve those goals efficiently and cost-effectively. Because RPSs have been in operation in so many states, there has been considerable experience with this type of policy and lessons can be drawn from those experiences. The report starts by discussing some of the most important lessons that have been learned so far.

Several others reports and presentations have examined the states' experiences with RPSs and have drawn lessons learned. This new report builds on those earlier efforts. However, those earlier reports remain valuable and should be consulted by policymakers and stakeholders interested in RPS program design. The following resources are especially useful:

- On the subject of lessons learned, the State-Federal RPS Collaborative has previously produced *Recommended Principles and Best Practices for State Renewable Portfolio Standards* (Montpelier, VT: Clean Energy States Alliance, 2009). It is available at www.cleanenergystates.org/resource-library/resource/recommended-principles-and-best-practices-for-state-renewable-portfolio-standards.

- The Electricity Markets and Policy Group at Lawrence Berkeley National Laboratory (LBNL) have produced many useful reports related to renewable portfolio standards. An earlier effort to draw lessons from state RPSs and to consider program design criteria was a report by Ryan Wiser, Kevin Porter, and Robert Grace titled *Evaluating Experience with Renewable Portfolio Standards in the United States* (Berkeley: Lawrence Berkeley National Laboratory, 2004). It is available at http://eetd.lbl.gov/ea/ems/reports/54439.pdf. Key messages from that report on RPS program design were summarized and updated in the slides for an April 2011 webinar for the Connecticut Energy Advisory Board by one of the initial report's authors, Robert Grace of Sustainable Energy Advantage (see www.ctenergy.org/pdf/RPS_WebinarP.pdf). The current status of state RPSs was summarized by Ryan Wiser and Galen Barbose of LBNL in an October 2011 presentation for the National Summit on RPS on *The State of the States: Update on the Implementation of U.S. Renewable Portfolio Standards* (see http://www.cleanenergystates.org/assets/Uploads/2011-RPS-Summit-Combined-Presentations-File.pdf).

- Another LBNL report by Ryan Wiser and Galen Barbose, as well as by Edward Holt, on *Supporting Solar Power in Renewable Portfolio Standards: Experience from the United States* (Berkeley: Lawrence Berkeley National Laboratory, 2010) is especially good on designing an RPS that effectively promotes the implementation of electricity from photovoltaics, but some of the discussion of program design options is applicable to other technologies as well. The report is available at http://eetd.lbl.gov/ea/ems/reports/lbnl-3984e.pdf.

- The National Renewable Energy Laboratory (NREL) has also produced many useful reports. In *Renewable Portfolio Standards in the States: Balancing Goals and Implementation Strategies* (Golden, CO: National Renewable Energy Laboratory, 2007). K.S. Cory and B.G. Swezey looked at four key issues related to RPS program design and implementation: resource availability, resource-specific provisions, political and regulatory consistency, and ability to finance new renewable projects. See www.nrel.gov/docs/fy08osti/41409.pdf.

- NREL has compiled valuable data on how RPS markets are working in a recent report by Jenny Heeter and Lori Bird on *Status and Trends in U.S. Compliance and Voluntary Renewable Energy Certificate Markets (2010 Data)* (Golden, CO: National Renewable Energy Laboratory, 2011), which is available at http://apps3.eere.energy.gov/greenpower/pdfs/52925.pdf. The same authors, along with Claire Kreycik looked at *Solar Renewable Energy Certificate (SREC) Markets: Status and Trends* (Golden, CO: National Renewable Energy Laboratory, 2011), which is available at http://apps3.eere.energy.gov/greenpower/pdfs/52868.pdf.

- Finally, Robert C. Grace, Deborah A. Donovan, and Leah L. Melnick of Sustainable Energy Advantage, in a recent report from the National Regulatory Research Institute, looked at the issue of selecting RPS program goals, but also examined other renewable energy policies. They took a different but complementary approach than the report you are currently reading. We encourage you to look at their report. See *When Renewable Energy Policy Objectives Conflict: A Guide for Policymakers* (Silver Spring, MD: National Regulatory Research Institute, 2011), which is available at http://www.nrri.org/pubs/electricity/NRRI_RE_Policy_Obj_Conflict_Oct11-17.pdf.

B. RPS LESSONS LEARNED

Various RPS stakeholders and analysts have looked at the track record of state RPS programs to identify best practices to emulate and pitfalls to avoid. From the findings in those reports and CESA's own analysis, the following principles and practices are especially important to keep in mind when designing or updating an RPS:

1. The best RPS design is not obvious.

There is great variation among the RPSs of the different states that have adopted them. No single approach is optimal for all situations or all states.

A state's goals, the nature of its electricity system, its current electricity supply, the extent and cost of potentially available renewable energy resources, the regional market, the RPS designs of nearby states, and other factors should all influence the many detailed rules, requirements, targets, and enforcement mechanisms that comprise the design of an RPS. This large number of variables creates numerous design options. The design choices a state makes will determine whether its RPS will be successful and be perceived to be a useful state policy.

2. It is important to be clear and specific about goals.

As discussed in section C below, an RPS can help meet a variety of different environmental, economic, and political goals. But different goals and combinations of goals require different RPS designs. For an RPS to be successful, the state should be very clear up front about what specifically it wants to accomplish. It then needs to keep those goals firmly in mind when designing an RPS and should make sure that the policymakers explain how the specific design relates explicitly to those goals.

3. An RPS is only one component of a successful state clean energy policy.

RPSs have proven to be highly useful policy mechanisms, but there are limitations to what they can accomplish efficiently. An RPS should be focused on those specific goals and activities that it can best address, while other clean energy policies and programs are used for goals and activities for which an RPS is too unwieldy, inefficient, or costly a policy mechanism. (For example, because of its least-cost approach, an RPS is generally ineffective at supporting investment in emerging renewable energy technologies.)

4. A successful RPS needs to balance competing design features.

The various studies of RPS best practices identify a long list of desirable features, each of which seems appropriate and important when viewed in isolation. But what can make designing an RPS complicated is that some of these different features pull in opposite directions. RPS designers therefore must be conscious of the trade-offs between different design features and should try to find the optimal balancing point for their state's particular situation. Here are some of the ways in which there is tension between RPS design features:

- ***Keep it simple but design it to meet specific goals.*** RPS experts encourage states to give an RPS a simple structure that will be easy to administer and to comply with. But the desire to address multiple goals strategically and with specificity inevitably introduces complexity into the design and administration of an RPS. The more objectives an RPS tries to achieve, the more provisions, components, and compliance mechanisms it needs. For example, if an RPS is designed to ensure support for a range of technologies through technology-specific carve-outs, for example, this will complicate procurement and compliance monitoring. By keeping such implications in mind, RPS designers and administrators can avoid reaching the point where the sheer number of objectives starts to make an RPS overly complicated and cumbersome to administer (or even understand).

- ***Maximize cost-effectiveness but achieve multiple objectives***. The issue of cost-effectiveness is generally viewed through the lens of whether an RPS is stimulating the most energy development at the lowest cost. Invariably, an RPS that allows eligibility for a large number of technologies without regard to their size or geographic location will be more cost-effective on a megawatt-hours-generated basis. And that is *one* important way to assess an RPS. But to the extent that an RPS has other objectives, there should be an assessment of whether *those objectives* are being achieved as cost effectively as possible, even if they increase the cost of the total quantity of new energy generation that comes online. To find the right balance, two types of analysis are needed:

    1. For each objective, consider which RPS design will maximize the results at the lowest cost. Which RPS targets, provisions, and cost-control measures will achieve that particular objective as cost-effectively as possible?

    2. To find the right balance among objectives, one can imagine having a set budget for the RPS and then consider the best way to divide up those dollars in order to get the optimal set of outcomes and overall most cost-effective results. For example, if

shifting $X million towards the goal of advancing a particular technology or towards the goal of encouraging distributed generation within the state will reduce the total amount of renewable energy the RPS will generate by Y megawatt-hours, is that tradeoff desirable?

- ***Make it predictable and stable, but allow it to respond to changing market conditions.*** In the case of most laws and regulations, predictability and stability are important so that those affected will know what is expected and can plan ahead. This is especially true with an RPS. The long lead-time required to get an energy generating facility financed, permitted, and installed means that project developers need to have a good sense of what the situation will be several years into the future. And because they will rely on the income from the RPS after the project is built, they need to know that the RPS will remain in place and provide reasonable support long after construction. If project developers do not have a clear sense of future RPS targets, compliance costs, and price levels, they will likely be hesitant to invest or to move forward with their projects.

  Therefore, when an RPS is first established, it should have targets that extend many years into the future and have administrative procedures, provisions, and compliance mechanisms that can remain constant. Once an RPS is in place, policymakers should try to avoid making frequent changes to it. When frequent changes are made, market players understandably begin to assume that there will be yet more changes in the future and will not believe that they can count on the RPS over time. Investment can dry up and projects can be cancelled or delayed.

  On the other hand, some RPS alterations are unavoidable, because it is impossible for anyone to accurately predict the future. Unexpected developments—either in the economy, in the energy market, in federal policy, or in specific technologies—can cause an RPS to fall short of its goals or can cause RPS prices to fall or rise dramatically. In those cases, a change may be necessary in order to maintain confidence in the RPS and stabilize RPS prices. An RPS set in stone that policymakers refuse to update can collapse under its own weight.

  So how can a state remain flexible and respond to changing circumstances without making so many frequent alterations that investors and project developers will be scared away? Here are a few suggestions:

- Targets and rules are less likely to need to change if they are realistic and are based on a careful assessment of the available renewable energy resources, of industry trends, and of economic conditions. Initial RPS program design is therefore key. Policymakers need to think carefully about their goals and how to achieve them, so that they will be confident that they have made the right decisions for the state and will be unlikely to want to add or change goals in the near term. Similarly, the percentage targets for the RPS need to be selected with great care, based on sufficient data (rather than aspirational hopes), so that policymakers will be confident that even if the targets are ambitious, they are achievable based on realistic assumptions. They should also make sure that the resource and technology eligibility definitions are clear enough that there will not be any ambiguity requiring future regulatory clarification, because that would inevitably involve time-consuming administrative and/or legislative proceedings. Of course, markets, supply-and-demand imbalances, and other factors can still develop in unexpected ways and changes could turn out to be necessary, but good planning will reduce the likelihood of that.

- The more complexity an RPS has—detailed eligibility requirements and multiple carve-outs and credit multipliers—the more likely that there will be a particular feature that needs to change over time. RPS designers should therefore make sure that each feature is indeed necessary for meeting important objectives and its implications are evaluated.

- When RPS policy changes are made, they should be implemented with sufficient lead time that program participants can respond effectively. It is especially important to try to avoid changes that significantly diminish the value of investments that generators and electricity suppliers have already made in good faith based on the RPS rules that were in place.

- RPS program administrators need to devote considerable attention to monitoring the market and regularly evaluating the RPS. This will increase the likelihood of identifying and fixing potential problems well before there is a crisis that requires instant action and sudden changes. Program administrators should also keep legislators and stakeholders well informed of the RPS's progress.

5. A state should be aware of how its RPS relates to and interacts with the RPSs of nearby states.

The electricity grid in most states is part of a regional system and often part of a single regional wholesale market. Because electricity and RECs can be traded within the region, a state should consider how its RPS affects the supply of RECs for the other RPSs in the region and how those RPSs impact the state's compliance, REC prices, and rate impacts. Markets will be more robust and procurement costs will be lower if nearby states have similar resource eligibility definitions, compliance mechanisms, compliance periods, and other RPS features. Any variations from the other states in a region should be made consciously, for well-thought-out reasons.

6. Renewable Energy Certificates (RECs) have proven to be a useful feature of an RPS.

These certificates typically occur in electronic form. A REC gets created every time a qualifying renewable energy facility generates one megawatt-hour of electricity. They have become the common currency for renewable energy generation, making it possible to accurately track and verify that the correct quantities of renewable energy have indeed been generated to satisfy the RPS. Depending upon a state's rules, RECs can be sold "bundled" as a package with the actual electricity produced or they can be traded separately.

Here is how the National Renewable Energy Laboratory describes the way RECs works: "The RECs provide an accurate, durable record of what was produced and a fungible commodity that can be traded among suppliers. A REC is spent or 'retired' from circulation once it is matched uniquely with an identical quantity of electricity consumed by an end-user."[1] After the REC is retired, it cannot be sold again into another market or used again in the same market for future RPS compliance.

In almost all states with an RPS, RECs have become the dominate mechanism for RPS compliance

7. An RPS should include measures to control compliance costs.

An RPS runs the risk of being dismantled if the cost of complying with it escalates to unsustainable levels. For that reason, states have included several mechanisms to limit the cost of compliance. These mechanisms, including Alternative Compliance Payments (ACPs), rate caps, contract caps, and regulatory agency discretion, will be discussed in section D10 below.

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[1] 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), p. 3.

Flexibility measures, such as REC banking, REC borrowing, and compliance waivers, also tend to reduce compliance costs, and they will be discussed in section D3.

8. Policymakers should consider how to help renewable energy projects secure financing and/or long-term contracts.

One weakness of an RPS as a policy mechanism is that it is not inherently adequate to guarantee that a project developer can secure financing for a cost-effective renewable energy project. Even when a developer can show that the projected revenue stream would make the project economically viable, financial institutions may remain hesitant to lend or invest money in the project. They may feel that, because of fluctuating REC prices and the possibility that the state will make future changes to the RPS, REC revenue is not sufficiently assured to justify an investment. Long-term contracts for both power and RECs may be required to ensure that a project can receive financing.

There are a variety of ways in which a state can address the financing and long-term contracts issues within the context of an RPS or with related policies.

9. Other relevant best practices and principles.

In addition to the major points discussed above, here are some additional lessons that can be drawn from the experiences of other states:

- It generally makes sense to make it clear in the RPS policy that prudently incurred RPS compliance costs will be allowed to be recovered in electricity rates.

- Because all ratepayers, regardless of the nature of their electricity supplier, receive the general benefits of renewable energy, it is usually best for an RPS to apply to all load-serving entities—investor owned, municipal, and electric cooperatives—and the cost of RPS compliance should be shared by all utility customers.

- An RPS should be designed in a way that anticipates the possible creation of a federal RPS or clean energy standard. For example, there might be provisions that allow the RPS administrator to make adjustments to the RPS in order to harmonize it with a federal RPS without having to go back to the legislature to change the law.

C. POSSIBLE POLICY GOALS AND THEIR IMPLICATIONS FOR RPS DESIGN

A state can have a variety of reasons for supporting the development of renewable energy. Just saying that an RPS will be used to get more of a state's electricity from renewables is insufficient, because it begs the question of why. One of the most important steps in designing an RPS is deciding what the specific reasons are for establishing it and what its goals will be.

The various possible goals overlap and a single RPS design can seek to accomplish several things at the same time. But, by knowing *which specific goals are most important* and which are subsidiary, an RPS can be constructed to be as effective as possible. A state may conclude that it wants to have a "balanced" RPS that will simultaneously address several goals, but it is important to know how to strike the right balance.

We have divided the large number of possible goals into the following categories:

- Energy system goals
- Environmental goals
- Economic goals
- Technology development goals
- Administrative and political goals

For each goal, we show below how an RPS might be designed to address it and we discuss some of the factors to consider in deciding whether it should be a priority.

1. Energy Goals

An RPS can influence the mix of energy sources used in the state's electricity supply. Reasons for being concerned about this can transcend the environmental and economic goals that will be discussed in sections 2 and 3 below. They include:

a. Reduce dependence on fossil fuels and nuclear power

b. Increase long-term rate stability and reduce the risk of fluctuating energy prices and fuel supply shortages

c. Decrease reliance on centralized power plants

d. Preserve existing clean energy generation

Reduce dependence on fossil fuels and nuclear power. When the RPS was first developed as a policy mechanism in the 1990s, it was with this very general goal in mind. RPS advocates believed that it would be good for America to move away from relying primarily on fossil fuels and nuclear power—for environmental reasons, for public health reasons, for economic reasons, and for energy security reasons.

If this general goal is a state's priority, an RPS should seek to bring the most new renewables online at the lowest cost. That implies:

- An RPS should include the maximum number of possible renewable technologies in the RPS and then allow them all to compete equally based on price. It would not matter if all the renewables development uses the same technology, as long as total development is maximized.

- It should allow projects of all different sizes to qualify and compete as part of the RPS. It would not matter if all the renewables development comes from a single large project or many small projects, as long as total development is maximized.

- It would not matter if the projects are in the state or outside the state.

Factors to consider related to this goal:

- A sole focus on this goal leads to a simple, easy-to-understand, easy-to-administer RPS in which the only competition among eligible projects relates to the price at which they are willing to sell their RECs.

- To the extent that the state has specific reasons for wanting to shift away from fossil fuels and nuclear power, this very general goal may not produce the optimal result. For example, if climate change is a primary reason for reducing fossil fuel use, an RPS that takes this approach may not produce as good a result as an RPS that makes distinctions between the varying climate change impacts of different renewable energy technologies (see 2a below).

- The relative cost and merits of energy efficiency versus renewable energy should be given some consideration, since efficiency, as well as renewables, reduces the need for fossil fuels and nuclear power, and generally at a lower cost.

Increase long-term rate stability and reduce the risk of fluctuating energy prices and supply shortages. A virtue of certain renewables—especially solar, water, and wind—is that they do not require fuel. Once a project gets installed, the future price of the electricity from that project is predictable and considerably more stable than from facilities that need to purchase fuel.

If this is the state's priority goal, it implies:

- Bringing the most renewables (with the possible exception of woody biomass) online at the lowest cost, regardless of technology, size of project, or location.

Factors to consider:

- Because solar, wind, and water do not use fuels, they accomplish this goal well.
- Although landfill gas, farm digesters, and geothermal use fuel, the ongoing supply and cost of their fuel are relatively predictable at the time the projects are built and are generally not linked to fossil fuel prices.
- The situation for wood for biomass facilities is more complicated, because the demand for wood goes up when fossil fuel prices rise, since users switch to wood. Moreover, the cost of harvesting and transporting wood goes up. The price and supply of wood are therefore partially but not fully linked to fossil fuel prices. For this goal, it would therefore be undesirable to rely primarily on wood, even though wood could be part of the mix.
- When determining the value of rate stability and reduced risks of supply shortages, it is important to keep in mind that future fuel prices could theoretically move lower as well as higher. If increased fuel supply (for example, because of shale gas) causes fossil fuel prices to go down, stable renewable energy prices will seem less attractive. It is therefore important to use realistic projections of the likelihood of both higher *and* lower future fossil fuel prices.

Decrease reliance on centralized power plants. Some, but certainly not all, energy experts believe that the electricity system should move decisively in the direction of distributed, small-scale electricity generation and move away from reliance on large power plants that require long-distance transmission. Amory Lovins of the Rocky Mountain Institute, for example, argues that the electricity industry is undergoing a profound transition and that small-scale distributed generation will increasingly be embraced as the route to increased overall system reliability and decreased costs.[2] Even if a state's RPS designers do not agree that the electricity system needs to undergo the dramatic transformation that Lovins calls for, they may conclude that there would be benefits to moving modestly in the direction of distributed generation.

If distributed generation is a top priority for a state's RPS, it implies:

- Having an RPS with a preference (carve-out or multiplier) for distributed generation.
- Allowing higher price support for distributed generation than for large-scale power plants.
- Including as wide a range of distributed generation technologies as possible, including ones that are not renewable, such as stationary fuel cells and combined heat and power (CHP).

Preserve existing clean energy generation. States sometimes seek to protect existing clean energy generators, either because of the environmental benefits that those generators provide or because the power plants are perceived to be valuable local businesses that provide jobs and other economic benefits. The existing facilities may be at risk of closing down, because they need repairs and equipment upgrades and/or they have a Public Utility Regulatory Policy Act (PURPA) contract or other long-term contract that is about to end.

The desire to preserve existing renewable energy facilities is quite logical, since it generally requires smaller incentives per kilowatt-hour to keep them operating than is necessary to incentivize the construction of a new clean energy facility. This can therefore be a cost-effective way to help maximize renewable energy generation. Although it would be uninspiring to structure a renewable energy policy that *only* protects existing generation and does not lead to new generation, it can be reasonable to make the protection of existing generation one of several goals.

If this is a priority goal for an RPS, it implies:

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[2] Amory B. Lovins et al., *Small Is Profitable: The Hidden Economic Benefits of Making Electrical Resources the Right Size* (Snowmass, Col.: Rocky Mountain Institute, 2007). See www.smallisprofitable.org/index.html.

- Either allowing existing facilities to compete equally with new facilities for RPS support, setting up a separate tier of the RPS just for existing facilities, and/or creating an early "vintage date" for RPS eligibility.

Factors to consider:

- Although some states have included existing facilities in their RPSs, an RPS is a blunt, inefficient tool for accomplishing the objective of preserving endangered, older renewable energy generation. Here is why:
  - Many older facilities are profitable and do not need any extra support in order to continue to operate. No public interest is served by giving them additional money through an RPS. It is simply a windfall for the owners.
  - Because the profitable older facilities do not need the revenue stream that comes from selling renewable energy certificates, they can sell those certificates at low prices and thereby set the price for RECs from old facilities. That price could very well not provide the endangered facilities with enough additional revenue to keep them operating. That means that an RPS for older facilities may not succeed in its primary objective of preserving endangered facilities.
  - Because of the Commerce Clause of the Constitution (see sidebar in section D4 below), it could be difficult to design an RPS that focuses specifically on endangered in-state facilities, because of its obvious in-state economic benefit motivation. Therefore, many of the beneficiaries of a constitutionally valid RPS could be out of state.

2. Environmental Goals

An RPS can be used to address global, regional, and state environmental issues. Possible environmental goals include:

a. Slow climate change
b. Improve air quality
c. Improve water quality, reduce water use, and/or protect fish habitat
d. Preserve traditional land use patterns, natural resource areas, and the appearance of the landscape.

Slow climate change. The use of fossil fuels for electricity is a primary contributor to the carbon dioxide emissions that cause climate change. The use of renewable energy is one of the most effective ways to reduce those emissions. But not all renewable energy technologies are equally effective at cutting emissions.

If slowing climate change is the state's priority goal, it implies:

- Bringing the most renewables online at the lowest cost, regardless of size of project or location.
- Among the renewable technologies, it may make sense to place less emphasis on the use of woody biomass than other technologies, although not necessarily exclude woody biomass altogether, and on new hydropower development due to its effect on release of methane.

Factors to consider:

- Even among people who believe that climate change represents an extremely serious threat to a state and to the planet, there can be disagreements about how aggressive the state should be in tackling climate change. On the one hand, because a state represents just a very small share of the world's population and emissions, anything it does will have only a statistically modest impact on the trajectory of climate change. It may therefore make sense to aim for less than the maximum possible reductions in climate change emissions in order to accomplish some of the other possible renewable energy goals listed in this section of the report. On the other hand, some people may argue that maximizing emission reductions is necessary so that the state can make a powerful statement to other parts of the country that it is necessary to do as much as possible to slow climate change, even if other energy-related goals need to take a back seat.
- Over past several 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. The 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. A highly publicized and widely debated study for the

Commonwealth of Massachusetts spearheaded by the Manomet Center for Conservation Studies laid out the issues and concluded that many wood-using power plants have very negative impacts on climate change, especially in the short run.[3] Although the Manomet study may have used assumptions that exaggerate the negative climate change impacts of woody biomass and some of its conclusions may not apply to states other than Massachusetts, it seems clear that:

  - Wood is less desirable from a climate change perspective than other renewable energy technologies, even though it can be better than fossil fuels. (The main points of disagreement among the experts are how often and under what circumstances wood is better than fossil fuels.)
  - Climate change impacts of generating facilities that use wood can be reduced by improving the efficiency of those facilities, by carefully choosing feedstocks, and by managing forests well.

- Farm methane digesters and landfill gas electricity generators are highly beneficial from a climate change perspective, because they produce electricity from methane that would otherwise be emitted into the atmosphere. Methane is 20 times more potent a greenhouse gas than carbon dioxide.
- Large-scale hydroelectric projects produce inexpensive clean energy with low climate change. However, they can impact large areas of land, affecting natural habitats and the people who depend upon them, and contributing to methane release from inundation of trees and vegetation. There are differences of opinion among environmentalists and other observers about which possible additional large hydropower projects would be desirable.

Because nuclear power plants do not produce carbon dioxide or other greenhouse gas emissions, renewable energy is not better than nuclear power from a climate change perspective. Other factors need to be considered when deciding about the relative merits of nuclear power and renewables.

[3] 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 critics of it, is available at http://www.manomet.org/sites/manomet.org/files/Manomet_Biomass_Report_Full_LoRez.pdf.

Large Hydro Projects and Climate change

At first glance, hydroelectric projects might appear to have no climate change impacts, since no carbon dioxide or other greenhouse gas emissions are produced when the electricity is generated. However, a lifecycle analysis of hydroelectric projects shows that they do indeed add to global emissions.

The main way in which a hydro project contributes to climate change is from the impacts related to creating a water reservoir behind a dam. When land is inundated to create a reservoir, the flooded vegetation and soil organic matter decompose, releasing methane and carbon dioxide. This release is greatest in the initial years after the land is flooded. Even after this initial period, emissions can continue to be greater than would have occurred if the reservoir had never been created.

When scientists and environmentalists first focused on this phenomenon, there was considerable debate and some uncertainty about the total lifecycle climate change impacts of new, large hydroelectric projects. There were even suggestions that some hydro projects could have higher emissions than some fossil-fuel generating stations. That led to many scientific studies of particular reservoirs and of the general phenomenon.

In 2011, two comprehensive, peer-reviewed scientific reports summarized what is currently known: the Intergovernmental Panel on Climate Change reviewed the environmental impacts of hydroelectric projects as part of a *Special Report on Renewable Energy Sources and Climate Change Mitigation* and an international team of researchers surveyed the various studies of carbon emissions from hydroelectric reservoirs.[1/] Here are key points from these documents:

- The Intergovernmental Panel on Climate Change has concluded that "lifecycle assessments indicate [hydropower has] very low carbon emissions."[2/]
- The emissions from reservoirs in northern latitudes are much lower than those in the tropics.[3/]
- Emissions are greatest in the first several years after a new reservoir is created. This means that hydroelectric power from older facilities or run-of-the-river generating stations is responsible for fewer emissions proportionately than power from new dams. However, the emissions from new dams fall rapidly and tend to reach equilibrium at a very low level after 10-15 years.
- There is variation between hydroelectric facilities in their lifecycle emissions, mostly connected to the amount and type of land inundated to create a reservoir. The poorer performing projects have a low ratio of electricity generated to amount of land inundated. But a more typical hydroelectric project does much better than even the most efficient fossil fuel plant in terms of greenhouse gas emissions.

It is also worth keeping in mind that no generating source, no matter how clean, is entirely emissions-free over its entire lifecycle. In the case of solar and wind, for example, there are emissions associated with manufacturing and installing the solar panels and wind turbines.

[1/] Arun Kumar et al., "Hydropower," in *IPCC Special Report on Renewable Energy Sources and Climate Change Mitigation* (Cambridge: Cambridge University Press, 2011), available at http://srren.ipcc-wg3.de; and Nathan Barros et al., "Carbon Emission from Hydroelectric Reservoirs Linked to Reservoir Age and Latitude," *Nature Geoscience* (September 2011), pp. 593-596.

[2/] Kumar, "Hydropower," p. 5.

[3/] Barros, "Carbon Emissions," p. 594.

- ***Improve air quality.*** Unlike climate change, which is a global problem, air quality is primarily a local matter. Switching away from burning fossil fuels can be an important way to improve air local quality.

If this is the state's priority goal, it implies:

- Having an RPS that encourages the use of non-combustion technologies (e.g., hydro, wind, solar) regardless of the size or location of renewable energy projects.

Factors to consider:

- It is important to be specific about the reasons for concern about air quality. Are there specific existing electricity-generation facilities that are causing air quality problems for people in the state? Is the primary concern that an increase in electricity use in the future will lead to the construction of more fossil fuel plants (likely natural gas) that will cause a decline in air quality? Is an RPS the most efficient way to address concerns about air quality? For example, will an RPS lead to retirement of the specific existing facilities that are perceived to be a problem and will the cost of achieving that be worth the benefit?

- The use of wood-burning technologies will not lead to significant improvements in air quality, although they may also not cause a significant decline in air quality. It depends upon the specific technologies that would be used and what they would displace. If air quality is a priority and biomass facilities are included in the RPS, there should be some restrictions on air pollution emission levels from wood-burning power plants.

Improve water quality, reduce water use, and/or protect fish habitat. This is comparable to improving air quality in that it is primarily a local issue. Here too, switching away from fossil fuels can be beneficial. But not all renewable energy technologies are equally benign in terms of their water impacts.

Although fossil fuels cause significant water pollution from oil spills and mining operations, there are generally few water pollution impacts from fossil fuels in states without mines, oil and gas wells, refineries, or major fossil fuel shipping facilities. Instead, the bigger water-related problems from fossil fuels—as well as from nuclear power—relate to the use of water to deal with the heat produced by the electricity-generating process. A coal or nuclear plant, for example, may require between 20 and 60 gallons of water for every kilowatt hour of electricity it produces.[4] Even though that water is usually returned to the body of water from which it is taken, it returns warmer. Changing the temperature of a river or lake can disrupt its aquatic ecosystem. Moreover, the process of taking in and discharging water at a power plant can trap and kill fish and fish larvae.[5]

Renewable energy technologies vary in their water impacts. During operation, photovoltaic and wind installations do not use or pollute water (although initial construction of wind facilities on ridgelines can result in stormwater runoff concerns), while large biomass and geothermal power plants use technologies comparable to a coal or natural gas power plant and have a similar need of water for cooling. Concentrating solar power plants generally also require water for cooling, although there are some dry cooling technologies that can be used in arid climates. By definition, hydroelectric facilities require water and, depending upon the facility, the impact on both aquatic ecosystems and surrounding land can be quite significant or modest.

If protecting water quality, water supply and aquatic ecosystems is a top state priority, it implies:

- Having an RPS that allows for and encourages out-of-state renewable energy development, since usually that would not have any negative impacts on water in the state.
- When it comes to in-state renewables development, giving some priority to photovoltaics and wind, and having strong rules on the water-related impacts of biomass, geothermal, concentrating solar, and hydro facilities.

Factors to consider;

- In recent years, some environmental organizations have called for the removal of certain dams in order to protect fish habitat and have called for restrictions on further

[4] US Department of Energy, *Energy Demands on Water Resources: Report to Congress on the Interdependency of Energy and Water* (Washington: Department of Energy, 2006). Available at http://www.sandia.gov/energy-water/docs/121-RptToCongress-EWwEIAcomments-FINAL.pdf.

[5] For more on the relationship between electricity generation and water, see several linked pages on the Union of Concerned Scientists' webpage, starting with http://www.ucsusa.org/clean_energy/technology_and_impacts/impacts/energy-and-water.html.

small hydro projects. Other environmental organizations have been more accepting of additional hydro development.

- It is very site specific as to whether an existing dam or a new hydro facility causes environmental damage. This suggests that there is merit in designing an RPS policy that makes eligibility distinctions between facilities in order to weed out the problematic ones and allow the relatively benign ones.

- The Low Impact Hydropower Institute (LIHI) is a non-profit organization that seeks to reduce the environmental impacts of hydropower by evaluating and certifying individual projects. They have high standards and a rigorous methodology. It can be expensive for a small facility to get certified. State policymakers may not want to give a role to LIHI certification in an RPS, because that could, in effect, involve turning over some of the state's regulatory role to a private organization.

- There are situations in which the continued operation of a hydroelectric facility can be beneficial, because the owner of the dam can then afford to pay for the maintenance of that dam, which may be important for flood control, recreational use, or another purpose.

Preserve traditional land use patterns, natural resource areas, farm land, and the appearance of the state's landscape. The types of visual and land use issues that are considered significant vary considerably among states. In some states, for example, the installation of large wind turbines in rural areas is viewed as providing valuable economic support for farmers in the form of lease payments, while other states may view large wind turbines as a visual intrusion on the rural landscape.

If this is the state's priority goal, it implies:

- Being clear and specific about exactly what it is the state is trying to preserve. Policy-makers should then run through the list of all the possible technologies that could be included in an RPS to see which aid preservation and which would would undercut it.

- The RPS should have biomass rules that help protect and ensure sustainable yields from forests.

- Providing meaningful incentives for the installation and ongoing use of farm methane digesters to help preserve and increase the economic viability of farms.

- Having rules or procedures that ensure the location of large solar arrays is consistent with traditional rural land uses and does not significantly reduce the agricultural potential of primary agricultural land.

Factors to consider:

- The most important way to protect natural resource areas and the rural landscape from inappropriate wind development is through the state's permitting process and municipal regulations on wind siting, rather than through the design of an RPS.

- Effective biomass regulations can help protect the health of forests. An RPS might therefore want to include rules on how RPS-eligible biomass is harvested.

3. Economic Goals

An RPS can aim to achieve broad-based economic development, as well as have more narrowly focused economic objectives. Among the possibilities are:

a. Maximize the number of organizations and residents who can deploy and benefit from distributed clean energy installations

b. Provide economic benefits to particular industries or sectors of the economy

c. Maximize the economic benefits of renewable energy development for the state

Maximize the number of organizations and residents who can deploy and benefit from distributed clean energy installations. A state can decide that it wants its residents, businesses, and institutions to be able to benefit from installing renewable energy. This can be done as a response to those organizations and individuals' expressed desire to help move society towards clean energy or can be based on a calculation that it would be good for electricity users to have the opportunity to lock in long-term electricity costs and ultimately save money from installing renewable energy systems. For example, lower, more predictable, energy costs could make some businesses more competitive and feel more secure.

If this is the state's priority goal, it implies:

- Structuring the RPS in a way that emphasizes customer-sited distributed systems within the state, regardless of the technology.

Factors to consider:

- Distributed, customer-sited systems usually produce power at a higher cost per kilowatt-hour than larger power plants. That means that an emphasis on distributed generation does not maximize the quantity or minimize the cost of the renewable energy that gets produced.

Provide economic benefits to particular industries or sectors of the economy. A state may conclude that a specific industry is so important to its future well-being that it deserves special consideration in the design of its RPS. The Maryland RPS, for example, includes poultry litter incineration facilities, in part as a way to aid the state's important poultry industry. The Connecticut RPS includes fuel cells powered by natural gas, in part to support the locally based fuel cell companies that make those products.

If this is a priority goal, it implies:

- Structuring the RPS in a way that gives advantage to technologies that are used by or otherwise benefit particular industries or economic sectors that are especially important to the state.

Maximize the economic benefits of renewable energy development for the state. Virtually every state understandably wants to ensure that renewable energy development is carried out in a way that benefits the state economically.

If maximizing economic benefits for the state is a top priority, it implies:

- Choosing RPS design features that will have the most economic benefits rather than those that will have the greatest environmental or energy benefits.
- Determining the specific ways in which the state has an economic advantage compared to other states in terms of renewable energy development.
- Directing renewable energy development in-state to the extent that that is economically advantageous.

Factors to consider:

- It is often assumed that creating the largest number of renewable energy jobs in-state is synonymous with maximizing economic benefits for the state. Although local job creation is *one* important measure of economic impact, it is not the only one. Impacts on electricity rates also need to receive close consideration. If it is more expensive to focus on in-state development than to purchase renewable energy from elsewhere, the resulting higher electricity rates could suppress local economic activity sufficiently to eliminate more jobs than are created by the in-state development. Economic analysis is necessary to determine the economically best course for the state.

- As assessment of likely future electricity prices and the value of the price stabilizing features of renewable energy should be part of the analysis of the most economically advantageous RPS design for the state.

- It is possible that, if a particular segment of the renewable energy industry grows in the region or the nation as a whole, a disproportionately large number of the jobs will be located in the state in question. It is useful to identify any segments where that could be the case.

4. Technology Development Goals: Advance Emerging Technologies

A state that is thinking about the long term may conclude that, rather than focus solely on aiding the clean energy technologies that are most available and least expensive, it would be desirable to advance promising emerging technologies. Although emerging technologies may currently be slightly or significantly more expensive, near-term support could help them become cost-competitive in the future.

If it is a priority to use an RPS to advance emerging technologies, it implies:

- Establishing a preference (carve-out or multiplier) within the RPS for the specific technology or technologies that the state wishes to aid.

Factors to consider:

- An RPS is a weak policy mechanism for aiding technologies that are still in the experimental or beta-testing stage. Direct support for research and development through a clean energy fund or economic development agency can be better targeted and be more efficient for early-stage technologies.

- The further a technology is from being widely commercialized, the harder it is to structure an RPS that will provide useful assistance at a reasonable cost. On the other hand, an RPS carve-out can work, as long as the technology is commercially available and there is evidence that there will be sufficient supply to meet the carve-out. Carve-outs and multipliers for solar have been used successfully in several states. A multiplier is the least risky approach but it has other disadvantages (see section D7 below for more on preferences).

5. Administrative and Political Goals

When setting up an RPS, a state can have goals beyond the ones already discussed. These can include:

a. Minimize administrative costs.

b. Build public support for renewable energy.

c. Make the state a visible leader in renewable energy.

Minimize administrative costs and complexity. A state may choose to make this goal a priority, either because of a general desire to reduce the administrative costs of state government or because there will be limited resources available for administering an RPS.

If this is a priority, it implies:

- Keeping the RPS simple, with the fewest number of carve-outs, multipliers, and special features necessary to accomplish the RPS's other goals.
- Having clear-cut eligibility rules that are not subject to varying interpretations and do not require the RPS administrators to certify or review whether individual facilities meet the qualifying standards for the RPS.

Build public support for renewable energy. A state may choose to design its RPS explicitly in a way that will ensure strong and increasing public support for renewable energy policy in the future.

If this is a priority, it implies:

- Focusing on those technologies and types of projects that are most popular with the public, while avoiding those projects that are perceived to be problematic (even if policymakers think they are beneficial).
- Focusing on technologies, such as solar, that all residents and businesses can install.
- Making sure that the RPS will be perceived to be a success. This means having targets that are ambitious enough to be perceived to be meaningful, but not so aggressive that the state will fall short or that the public will conclude that it costs too much for the state to support renewable energy through an RPS.

Factors to consider:

- The most aggressive or most cost-effective RPS will not necessarily lead to the most renewable energy generation in the long run. A popular RPS that does not seem too costly and does not lead to controversial projects could lay the groundwork for stronger action in the future.

Make the state a visible leader in renewable energy. A state may choose to use an RPS as a vehicle for playing a leadership role in advancing renewable energy and to provide concrete evidence to other states that it is a leader.

If this is a priority, it implies:

- Either being more aggressive than other states, pioneering novel RPS design features that others states can emulate, or emphasizing public benefits that benefit the broader society rather than the state's narrow economic interests.

D. ANALYSIS OF PROGRAM DESIGN OPTIONS

This section of the report identifies and describes major RPS design elements and practices that a state can consider if it decides to adopt or modify an RPS. The section sets out the advantages and disadvantages of each option. The design elements covered are:

1. Size and timing of targets
2. Use of tradable Renewable Energy Certificates (RECs)
3. Flexibility mechanisms
4. Geographic eligibility and deliverability
5. Resource eligibility
6. Vintage eligibility
7. Preference mechanisms (carve-outs and multipliers)
8. Including energy efficiency in an RPS
9. Participation of some or all load-serving entities in the RPS
10. Mechanisms to limit ratepayer costs
11. Contracting and financing
12. The central procurement approach
13. Reverse auctions

1. Size and Timing of Targets

The size and timing of targets for an RPS are probably the most important variables in RPS design. Will the renewables requirement go up 1% a year or 2% a year? Will the end goal be 15% or 35% renewables?

If the final target or the speed of reaching it is too modest, an RPS will appear to be a meaningless policy that is not worth the time and effort to administer it. But if the target is too ambitious, the cost of the RPS can rise dramatically. Moreover, if there are regular shortfalls in RPS-eligible supply so that utilities fall short in meeting their obligations, the public will perceive the RPS to be a failure. To retain the RPS program, it will then be necessary for administrators to engage in time-consuming and disruptive revisions.

To illustrate the way in which unrealistically ambitious targets can lead to greatly increased costs for an RPS, consider these two scenarios for a state that uses tradable RECs:

1. In the first, a state establishes targets based on accurate projections of how much renewable energy can and will come online. During the fifth year of the RPS, 40,000 megawatts-hours of additional renewable electricity are needed to meet the target for that year. Because the projects being developed require a $30 per megawatt-hour RPS subsidy in order to be constructed, that is the price at which RECs are sold. The cost of RECs for the additional renewable generation that is added to the system in that year is therefore $1.2 million.

2. In the second scenario, the state establishes a target that requires 60,000 additional megawatt-hours of renewable electricity during the fifth year. Because of limitations on the speed at which projects can be developed, only 40,000 megawatt-hours ends up being added to the system. There is now a shortage of RECs to meet the 60,000 MWH requirements. The excess demand and short supply creates a competition in which buyers bid up the price for RECs to $50. Although the sellers only need $30 to develop their projects, they are able to ask for and receive the higher price. The total cost of the RPS for the additional generation added in that year is therefore $2 million, even though no more renewable energy is produced than in the first scenario. Moreover, the negative financial consequences of the shortfall in supply would not end there: projects built during the first four years of the RPS continue to sell their RECs into the market and they could now ask for additional money because the market price is $50. That means that the projects from the first four years may receive unnecessarily high payments, thereby further increasing the total cost of the RPS.

Because the RPS operates on market principles, some fluctuation in REC prices is to be expected and is not a cause of alarm. But the ideal is for the variations in price to be within a relatively narrow band on either side of the actual premium price that renewable energy facilities need to be built and to remain operating.

Although it is impossible to predict the future with total accuracy, the best way to determine the size and timing of RPS targets is to collect relevant data, conduct detailed analysis, and then choose realistic targets based on that data and analysis.

2. Use of Tradable Renewable Energy Certificates (RECs)

In most cases, it makes sense for a state RPS to use renewable energy certificates. The design questions are then: what should be the role of RECs and should they be able to be traded independently from the electricity to which they are connected?[6]

The answers to these questions will depend in part on whether there is an accurate, easy-to-use REC tracking system available in the region. Within the New England Power Pool (NEPOOL), for example, there is a Generation Information System (GIS) that keeps track of all the electricity that is generated within the region. Every time a MWh of electricity is generated and registered with NEPOOL, an electronic GIS Certificate is created. NEPOOL does this for all generation, whether or not it qualifies for an RPS. But when it does qualify for an RPS, NEPOOL notes that and keeps track of the information. These RPS-related GIS certificates are called RECs. To ensure that an individual REC is not counted more than once, an entity that wishes to use it, retires it within the NEPOOL GIS; it can no longer be traded, sold or otherwise used.

Another factor in deciding on the best role for RECs within an RPS is whether the state's electricity system has been restructured and includes retail choice or whether there are instead vertically integrated utilities subject to regulation. In the latter case, some states have had utilities comply with the RPS by including renewable energy in power purchase agreements approved by the public utilities commission.

In general, RECs provide verification of compliance with an RPS, reducing the risk of double counting and fraud. A state using RECs normally has two main options: (1) allow electricity and RECs to be sold separately but require RECs to be retired, and (2) require utilities to purchase electricity and RECs together (bundled).

Allow RECs and electricity to be sold separately. With this approach, utilities (or whatever other entities are subject to the RPS) are required to purchase and retire an appropriate number of RECs in order to meet their RPS obligations. They can choose to get those RECs through the REC marketplace from facilities other than the ones with which they have electricity contracts. This is the approach used by the vast majority of states that have RPSs.

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[6] For a good description and analysis of the use of RECs, see Edward Holt et al., *The Role of Renewable Energy Certificates in Developing New Renewable Energy Projects* (Golden, CO: National Renewable Energy Laboratory, 2011). Available at http://apps3.eere.energy.gov/greenpower/pdfs/51904.pdf.

Advantages of this approach:

- Keeping the sale of RECs separate from the sale of electricity should usually increase the efficiency of the marketplace for renewable energy.
- Separately traded RECs help create a liquid market for renewable energy by making a spot market for RECs possible while also allowing for a forward market that enables hedging and financing.
- The use of separately traded RECs can reduce the cost of compliance by providing access to a larger quantity and geographic scope of resource options. Use of RECs allows utilities to seek the lowest-cost renewable energy attributes regardless of where the RECs are generated.
- RECs facilitate transactions across regional boundaries, because they are not subject to the same geographic constraints as commodity electricity.
- They help solve the issue of variability and the mismatch between renewable energy supply and load. Buyers can procure just what they need when they need it.[7]

Disadvantages of this approach:

- As discussed in the previous section (D1), an unexpected shortage of RECs can drive up REC prices, causing renewable energy projects to receive more money from ratepayers than is necessary.
- It can be confusing for people not involved with the creation, trading, and retirement of RECs to understand how the REC trading system works and why it is desirable.
- The utilities may end up purchasing RECs from facilities with which they do not have contracts for power. That could be confusing for the public and can create a more complicated relationship between the utilities and renewable energy facilities.

Require electricity and RECs to be sold together. A few states require electricity and RECs to be bundled together. It is a straight-forward approach—easy to explain and easy to understand. Each utility is required to have contracts with a sufficient number of renewable energy generators to purchase the right quantity of renewably generated electricity and RECs to meet its RPS obligation.

[7] Some of these advantages of RECs were listed by Bob Grace in the slides for *Webinar: Connecticut's RPS Policy Report: A Common Starting Point*, April 4, 2011, p. 36. Available at www.ctenergy.org/pdf/RPS_WebinarP.pdf

Advantages of this approach:

- It is simple and clean.
- Utilities and the state are able to identify easily the specific facilities that are under contract to provide renewable energy to meet the RPS targets.

Disadvantages of this approach:

- This can make the cost of RPS compliance greater than with an approach where electricity and RECs are sold separately. However, it depends upon the market context in the particular state as to whether this is likely to be a problem.
- It can be difficult for utilities to contract for exactly the right quantity of renewable energy. At the end of the year, they may end up with contracts for too much or too little renewable energy, and it can be hard for them to rectify the situation. That increases the cost of RPS compliance.
- Without an independent market where RECs can be traded efficiently, the average price that utilities have to pay for RECs can be higher. Again, it depends upon the market context in the state as to whether this is a serious risk.

3. Flexibility Mechanisms

Some states have incorporated flexibility mechanisms into their RPSs to make it easier for obligated entities to meet their RPS obligations, both financially and administratively. The three basic flexibility mechanisms that have been used are REC banking, REC borrowing, and compliance waivers. Because flexibility measures help to smooth out annual fluctuations in REC prices, they can make the implementation of an RPS proceed more smoothly and can decrease the overall cost to ratepayers of renewable energy development.

REC banking. REC banking allows utilities or other obligated entities to purchase excess RECs during a year when there is a surplus and to use those RECs to meet their RPS obligation in a future year. In New England states with RPSs, for example, RECs purchased to comply with a class one or "new" RPS requirement can be banked and then used in the subsequent two years. The maximum bankable quantity of RECs is 30% of an entity's current year obligations.

Advantages of REC banking:

- Smoothes out year-to-year fluctuations in REC prices by reducing the number of years in which there is a large REC surplus or shortage.

- Utilities or other obligated entities can prepare ahead by purchasing extra RECs if they think that there will be a future year with a shortage of RECs. In addition, they do not have to try to guess the exact number of RECs they will need; they do not waste money if they inadvertently purchase too many RECs, since they can bank the extra.
- Removes a reason for utilities to avoid contracting for RECs.
- Reduces the risk that a renewable energy project will not be able to sell its RECs in a year in which there is a REC surplus or that there will be a REC price crash.
- Reduces the incentive for a developer to delay bringing a project online in a year in which there could be a REC surplus.
- To the extent that REC banking encourages faster development of renewable energy, it provides modest additional environmental and climate change benefits.

Disadvantages of REC banking:

- Produce a modest additional administrative tracking burden for RPS administrators.
- Makes the annual increased renewable energy percentage in the state's RPS plan a less accurate predictor of how much increased renewable energy will actually come online in a given year.

REC borrowing. This is the reverse of REC banking. Utilities or other obligated entities that are unable to purchase a sufficient number of RECs in a given year can defer the shortfall to a future year—usually no later than the second subsequent year. This has some of the same advantages as REC banking but it also has some additional disadvantages. The practice has therefore been less widely adopted by states with RPSs, although some have done so. In the case of Colorado, borrowing has been allowed during the first four years of the RPS but not after that, under the assumption that greater flexibility is needed when a policy is new.

REC borrowing benefits utilities and other obligated entities, but provides few advantages to renewable energy developers or generators. From the ratepayer's perspective, it can reduce the overall cost of RPS compliance.

Advantages of REC borrowing:

- Smoothes out year-to-year fluctuations in REC prices by reducing the number of years in which there is a large REC surplus or shortage.
- Makes it easier for utilities to manage their RPS obligations. If they are unable to find and purchase a sufficient number of RECs in a given year, they can defer their obligation to a future year. In addition, they do not have to worry about paying a penalty or the ACP price if they miscalculate their needs and inadvertently purchase too few RECs.

- Reduces the risk that there will be a REC shortage in a given year and that REC prices will rise to the ACP price or to whatever maximum is set by the state.

Disadvantages of borrowing:

- Increases the administrative burden for RPS administrators.
- It can encourage utilities to delay taking action to contract with renewable energy projects.
- Delays the ability of RPS administrators to deal with a utility that may be ignoring its RPS obligation.
- To the extent that it delays renewable energy projects from coming online, it modestly reduces the environmental benefits of the RPS.
- Makes the annual increased renewable energy percentage in the state's RPS plan a less accurate predictor of how much increased renewable energy will actually come online in a given year.

Compliance waivers. This is a different type of flexibility mechanism than either REC banking or borrowing. It allows a utility to request a waiver of its obligation in a particular year because it has been unable to purchase sufficient renewable energy. Many states allow utilities to apply for a compliance waiver.

As with REC borrowing, compliance waivers provide benefits to utilities and other obligated entities, but provide few advantages to renewable energy developers or generators. They reduce the overall cost of RPS compliance.

Advantages of allowing compliance waivers as part of an RPS:

- Reduces the risk that utilities will have to pay high REC prices or ACP payments in a year in which there is a significant shortage of renewable energy generation beyond the utilities' control.
- Can avoid significant increases in REC prices which provide renewable energy generators with much higher price premiums than they need and drive up the cost of the RPS for ratepayers.
- Introduces considerable flexibility into the administration of the RPS, acknowledging the uncertainties associated with attempts to predict the pace of future renewable energy development.

Disadvantages of compliance waivers:

- Makes the RPS seem less predictable, certain, and stable, which can discourage renewable energy developers from proceeding with projects and making it more difficult for them to secure financing.
- Can incentivize utilities to focus their attention on securing compliance waivers rather than on procuring renewable energy.
- Could significantly increase the administrative burden for RPS administrators and involve them in lengthy, acrimonious regulatory proceedings.

Compliance waivers generally work best when the system for administering them is made specific and clear ahead of time. For example, a state can specify exactly when and how a utility can apply for a waiver, and can be explicit about the circumstances under which a waiver may be granted and for how long. But, as a recent report by NREL found, the provisions related to compliance waivers in most of the states that have them:

> tend to be vague as to when and how a waiver is to be granted. For example, the Arizona statute allows a utility to request a waiver from any provision, "for good cause." And in Hawaii, the Public Utilities Commission has, "the option to either grant a waiver from the renewable portfolio standard or an extension for meeting the prescribed standard." Some waivers are based on, "economic and competitive pressure" (Minnesota), or whether renewable resources are, "reasonably available" (Pennsylvania).[8]

4. Geographic Eligibility and Energy Delivery Requirements

Although it is possible to design an RPS that allows the use of tradable RECs from any facility anywhere in the country, most RPSs limit qualifying facilities to those whose electricity is actually delivered to the RPS state or region.

Several states go further and give preference to in-state generation. For example:

- Colorado has no restriction on generator location but provides credit multipliers for in-state projects.[9]

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[8] Cory and Swezey, *Renewable Portfolio Standards in the States*, p. 15.

[9] See section D6 below for a discussion of credit multipliers.

- Illinois has required in-state resources unless insufficient cost-effective resources are available. In that case, obligated entities may procure from adjoining states. If there are still insufficient cost-effective resources, they may procure from other regions. Starting this year, however, equal preference will be given to in-state and adjoining states.

It is common that states require customer-sited systems to be located within the state. This tends to be the case if the state has a separate RPS tier that focuses on customer-sited solar or distributed generation. For example, in Massachusetts, starting in 2010, retail suppliers have been required to provide a portion of the required renewable energy from in-state, interconnected solar facilities up to 6 MW.

Advantages of geographic restrictions:

- A geographic restriction that requires energy delivery to a broad regional control area guarantees that the renewable power will replace some other generation in the region. To the extent that polluting fossil-fired generators are displaced, air quality in the broader region, including the state, will be improved. The jobs and economic activity associated with the generation will be focused on the region.

- Narrower state-focused restrictions provide support to local generation, focus the economic and environmental benefits on the state, and ensure that there will be visible evidence to the public of renewable energy.

Disadvantages of geographic restrictions:

- By definition, limiting the location of eligible generators to certain geographic areas constrains where renewable energy gets developed and this can make it more difficult for a sufficient quantity of renewable energy to be installed quickly. Where the eligible region is large this may not be a significant constraint. But even in a geographically large area, there can be problems if the cumulative RPS demand in states within the region is high relative to available supply.

- As with any other design feature that limits the options for renewable energy development, the potential competition to supply renewable energy is reduced and the cost of compliance with the RPS can increase.

- A requirement or preference for in-state projects can conflict with the Commerce Clause of the US Constitution and lead to a legal challenge by an aggrieved party. (See sidebar on the Commerce Clause below.)

Factors to consider:

- A state should consider how its policies will relate to and interact with the RPS policies of neighboring states.
- A state should consider the potential to develop different technologies within the state at a reasonable cost before imposing geographic restrictions.

Implications of the Commerce Clause for RPS Design

When establishing an RPS, a state often wants to accomplish economic development objectives, including building an in-state renewable energy industry. The Commerce Clause of the United States Constitution, however, prohibits states from taking economic protectionist measures that favor local businesses to the disadvantage of out-of-state competitors. When designing geographic and deliverability requirements for an RPS program, a state should therefore consider the constitutional limitations imposed by the Commerce Clause. A report published by the Clean Energy States Alliance in 2011 provides useful guidance.[1]/ Here are some of the key points:

First, requirements that a project be located in a state to qualify for the RPS discriminate on their face because they treat in-state and out-of-state projects differently solely for geographic reasons. Such location-based RPS requirements can avoid invalidation under the Commerce Clause *only* if the state can show that there are no other options available to achieve legitimate state goals.

As an alternative to an in-state location requirement, states can sometimes use a neutral, in-state deliverability or other functional eligibility requirement. For example, a state may argue that there is a legitimate reason for an in-state deliverability requirement because it ensures that “dirtier” generation within the region will be displaced. That is, to the extent that fossil-fired generators are displaced, the delivery requirement will improve air quality both locally and in the broader region and contribute to regional development. Without such a delivery requirement, there would be no certainty of local or even regional economic and environmental benefits. Where such neutral alternatives are available to meet the state’s legitimate objective, a location-based RPS violates the Commerce Clause.

RPS statutes with functional eligibility requirements, such as in-state deliverability, interconnection or consumption, are facially neutral because any company, whether in or out of a state, can meet those requirements. While an out-of-state developer may face added costs to connect to an in-state distribution facility, the costs are a product of a project’s distance to distribution facilities rather than geographic boundaries. Moreover, the added costs are not discriminatory; an in-state project located in a remote or transmission-constrained portion of a large state might also face increased costs in meeting an in-state deliverability or distribution requirement. It is generally believed by legal experts that delivery requirements will survive Commerce Clause review, while geographic or location-based requirements are vulnerable to legal challenges.

In the case of distributed generation (DG) or solar carve-outs, location-based eligibility requirements may raise Commerce Clause concerns. However, to reduce Commerce Clause challenges, a state can impose functional eligibility requirements, such as in-state deliverability or power displacement, which may accomplish nearly the same results as location requirements for DG. As a practical matter, the vast majority of DG or solar projects that are capable of meeting RPS functionality requirements will also be located in-state.

Moreover, DG or solar carve-outs generally impose minimal burdens on commerce since they comprise only a small percentage of a utility's RPS obligation. The minimal burdens to commerce are further offset by states' compelling interest in DG as a way to meet certain legitimate state goals, such as improved reliability, diversity of supply, and avoidance of new transmission. Without DG carve-outs, a state has few alternatives to ensure that utilities will use DG or solar resources to comply with the RPS because utilities are more inclined to favor larger or lower-cost renewable projects to meet their RPS obligations. Given the minimal burden to commerce occasioned by carve-outs, strong state interest, and lack of alternatives to achieve legitimate state goals, functional-based eligibility requirements for DG carve-outs will likely pass muster under the Commerce Clause.

Moreover, DG or solar carve-outs generally impose minimal burdens on commerce since they comprise only a small percentage of a utility's RPS obligation. The minimal burdens to commerce are further offset by states' compelling interest in DG as a way to meet certain legitimate state goals, such as improved reliability, diversity of supply, and avoidance of new transmission. Without DG carve-outs, a state has few alternatives to ensure that utilities will use DG or solar resources to comply with the RPS because utilities are more inclined to favor larger or lower-cost renewable projects to meet their RPS obligations. Given the minimal burden to commerce occasioned by carve-outs, strong state interest, and lack of alternatives to achieve legitimate state goals, functional-based eligibility requirements for DG carve-outs will likely pass muster under the Commerce Clause.

[1]/ Carolyn Elefant and Edward A. Holt, *The Commerce Clause and Implications for Renewable Portfolio Standard Programs* (Montpelier, Clean Energy States Alliance, 2011). Available at http://www.cleanenergystates.org/assets/Uploads/CEG-Commerce-Clause-paper-031111-Final.pdf

5. Resource Eligibility

Any RPS needs to decide which renewable energy resources will qualify for it in terms of energy source (e.g., biomass, solar), specific technologies (e.g., biomass gasification, photovoltaic), size (e.g., facilities less than 200 MW), and type (e.g., distributed generation). The best way for a state to select which resources to make eligible for its RPS is to take a step-by-step approach:

1. ***Decide on the primary goals for the RPS and the relative priority of those goals***.

2. Create a matrix in which the resources that match each goal are listed, as well as the relative importance for each of those resources for the goal. (For example, as shown in section C2 above, if addressing climate change is selected as a priority goal, both wind and biomass may be listed as appropriate technologies, but wind would rank higher.)

3. For each resource, assess its potential to be developed in the state and the region.

4. Decide which resources should be included in the RPS.

5. Project the likely resource mix that will occur if all the eligible resources are allowed to compete equally in a single tier RPS. Those projections should be made based on solid data.

6. Analyze the projected results to determine whether the anticipated results would actually achieve the RPS's primary goals. (For example, if the even-playing-field, single-tier RPS would likely be met 50% by hydro but only 10% by wind and virtually no solar, would that be a satisfactory result?)

7. Adjust the list of qualifying resources or introduce preference mechanisms (see section D7 below) into the RPS, if necessary.

Beyond the big picture question of which resources should be eligible for the RPS, there is the more technical, but still quite important issue of how exactly those resources get defined. When the definitions are poorly crafted or imprecise, it can lead to confusion, unintended consequences, and the need to engage in complicated and time-consuming clarifications. On the other hand, precise definitions ease RPS administration and provide clear guidance for potential project developers.

In 2008, the Clean Energy States Alliance developed a set of model resource definitions.[10]

6. Vintage Eligibility

When designing an RPS, a state needs to determine whether there will be a cutoff date for the age of renewable energy facilities that qualify for the RPS, and if there is such a cutoff what it should be. Most states' RPSs include a cutoff date, because they want their RPS to focus

[10] The "Model Resource Eligibility Definitions" were included as Appendix B in Edward A. Holt, *CESA State RPS Policy Report: Increasing Coordination and Uniformity among State Renewable Portfolio Standards* (Montpelier: Clean Energy States Alliance, 2008). Available at http://www.cleanenergystates.org/assets/Uploads/Resources-pre-8-16/CESA-Holt-RPS-policy-report-dec2008.pdf.

explicitly on stimulating new renewables rather than supporting existing facilities. As noted in section C1 above, some states have tried to use an RPS to protect endangered older facilities, but, as discussed there, making all older facilities eligible for an RPS is an inefficient and often ineffective policy mechanism for accomplishing that goal.

In most cases, it makes sense to make the date for RPS eligibility be the date when RPS compliance starts. In that way, all the generation that is used to meet the RPS is entirely new generation. However, there can be situations where a state can have good reasons for having the eligibility date precede the start of RPS compliance, either to mesh the RPS with a different pre-existing state renewable energy program or to align the RPS with those in other nearby states.

7. Preference Mechanisms: Carve-Outs and Multipliers

Different technologies provide different benefits, but an RPS without a preference mechanism will lead to the development of only the least-cost eligible technologies. In order to accomplish goals other than simply maximizing the total quantity of renewable energy generation, a state may therefore choose to give a preference to some technologies or types of projects over others. There are two general ways to accomplish this: carve-outs and multipliers. Each approach has advantages and disadvantages.[11]

Carve-outs (which are also called set-asides) distinguish between different technologies or types of projects, and set different targets for each. To acknowledge that some of the technologies or types of projects will be more expensive than others, any cost control mechanisms, such as alternative compliance payments, are set at different rates for the different technologies or types of projects. They are sometimes placed into different tiers or classes of the RPS, each with its own rules.

A carve-out can be expressed and calculated in a variety of ways: As examples of carve-outs, the Arizona RPS requires that 30% of its RPS in 2025 must be met by distributed generation, the New Jersey RPS mandates that there be 5,316 gigawatts of solar electricity by 2026, and the Connecticut RPS establishes three different classes within the RPS.

Advantages of carve-outs:

[11] This discussion of carve-outs and multipliers draws on the excellent analysis in Ryan Wiser et al., *Supporting Solar Power in Renewable Portfolio Standards* (Berkeley: Lawrence Berkeley National Laboratory, 2010), pp. 6-8.

- They increase certainty about how much of different types of renewables will be developed. This makes it relatively easy to focus on and achieve specific RPS goals.

- It is possible to calculate the maximum cost to ratepayers of each carve-out.

Disadvantages of carve-outs:

- It is more expensive per megawatt-hour of renewables than letting all technologies and projects compete equally on price.

- Depending upon the technology, a carve-out can be quite expensive in terms of cost per megawatt-hour of electricity produced.

- Compared to a multiplier, it picks winners more directly.

- Because there are multiple targets for different types of renewables, RPS designers are, in effect, making multiple projections about the future. This increases the likelihood that some of the targets will turn out to be either too ambitious or too easily met, and therefore require adjustment over time.

- If the carve-out is established through legislation, it can be difficult to adjust it in response to changing market circumstance.

Credit multipliers give different technologies or types of projects extra or reduced credit towards meeting the RPS target. A Lawrence Berkeley National Lab report describes how a credit multiplier works: “generation from the designated technologies or applications, although issued one REC for each MWH, may be credited as more than one REC (depending on the multiplier) for RPS compliance purposes.”[12] A credit multiplier can also be designed to give less than one REC for RPS compliance purposes for each MWH of production.

Examples of credit multipliers include: Maine offers a 1.5 credit multiplier for eligible community-based projects, Nevada has a 2.4 times multiplier for photovoltaic projects, and Massachusetts’ new biomass rules provide biomass facilities that achieve exactly 40% efficiency with one-half the standard RPS credit. Some multipliers can be quite narrowly targeted, such as one in Colorado that gives double credit for projects smaller than 30 MW that are connected to transmission or distribution lines owned by a cooperative or municipal utility.

[12] Ibid, p. 6.

Advantages of multipliers:

- They allow a state the opportunity to express precisely how much more or less valuable it thinks one technology is than another.
- This approach does not pick winners as directly as a carve-out does, since it does not mandate exactly how many megawatts of a particular type of project will be built.
- Unlike a carve-out, a state does not need to set or worry about multiple targets.
- Even if the results are significantly different than expected, a state does not necessarily have to make adjustments or revisions to the RPS targets or rules. It can simply accept the unexpected results.

Disadvantages of multipliers:

- Like other preference mechanisms, including carve-outs, they are more expensive per megawatt-hour of renewables than letting all technologies and projects compete equally on price.
- Compared to a carve-out, the results are less predictable. Depending upon the size of the multiplier, more or less of a technology or project type may be built than the RPS designers anticipate.
- It is impossible to predict the total amount of renewable energy that will be developed, because the total will vary depending upon the number of credit multipliers that are used.
- As projects take advantage of a credit multiplier, the total RPS percentage of electricity generation is reduced.

Some states have combined a carve-out with a credit multiplier for the same technology.

8. Integrating Energy Efficiency into a Renewable Portfolio Standard

Among the states with mandatory RPS policies, four—Hawaii, Nevada, North Carolina, and Ohio—allow demand-side energy efficiency to qualify for a portion of the state RPS requirement, enabling utilities to substitute energy efficiency for renewable energy as a portion of its RPS compliance.

Nevada, for example, allows up to 25% of the RPS target to be met with energy efficiency, defined as utility-subsidized efficiency measures installed after 2004, and district heating from geothermal hot water. Energy efficiency receives a multiplier of 1.05 for non-peak savings and 2.0 for peak savings. Utilities can purchase energy savings credits from third parties.

Two other states, Connecticut and Pennsylvania, have a combined RPS/energy efficiency program with separate targets for renewable resources and for other resources, including energy efficiency.

The advantages of integrating energy efficiency into an RPS include:

- From both an economic development and environmental improvement perspective, energy efficiency and renewable energy are both valuable.
- Combining efficiency and renewable energy targets can broaden public support for mandatory targets
- Including efficiency can address concerns that there are not sufficient viable renewable energy projects in a state to make an RPS practical and cost effective.
- Because energy efficiency is generally a lower-cost resource than renewable energy, including it in the RPS can reduce the cost of compliance.

The disadvantages are:

- Because energy efficiency is generally a lower-cost resource than renewable energy, integrating the two into a single RPS tends to slow the growth of renewable energy unless energy efficiency is placed in a separate tier from renewables or there is a defined minimum renewable energy requirement.
- Renewable energy resources face different and more difficult challenges to deployment than energy efficiency measures, including regulatory and market barriers, lack of ready financing mechanisms, long pay-back periods, lack of public understanding, and sometimes higher costs. An RPS is a critical tool to support promising renewable energy technologies that might otherwise be shut out of the market because of higher costs and other market barriers. The RPS policy framework is diluted with a competing focus on energy efficiency procurement.
- A state may already have other well-established and more efficient delivery mechanisms for energy efficiency.

9. Participation of Some or All Load-Serving Entities in the RPS

When a new RPS is established, there is sometimes a question of whether it should apply to all of the load-serving entities in a state or only to some of them. Absent some especially compelling reason, it generally makes sense to apply an RPS to all suppliers of retail load. As the State-Federal RPS Collaborative explained in its *Recommended Principles and Best Practices for State Renewable Portfolio Standards*, "State RPS program costs should be shared as fairly and as broadly among all ratepayers as possible, as the benefits of increased renewable energy production will accrue to all energy customers and the public at large." The Collaborative enunciated as a recommended principle that "An RPS program should apply to all load serving entities—investor owned, municipal, and electric cooperatives, including suppliers of last resort."[13]

Some states have restricted their RPSs to investor-owned utilities. They have excluded municipal utilities or cooperatives, because those utilities are predominately self-regulated, or given municipal utilities and cooperatives the option to join the RPS voluntarily.

10. Mechanisms to Limit Ratepayer Costs

Most states with an RPS include at least one mechanism to limit the cost of RPS compliance. These mechanisms include annual cost caps on retail rates or utility annual revenue requirements, alternative compliance payments (ACP), a price cap on renewable energy contracts, and use of agency discretion. In addition, a number of states have established *force majeure* mechanisms to allow electricity suppliers to limit their renewable energy purchases if they can demonstrate to regulators that those purchases would unduly raise electricity rates.

In a 2008 report, researchers at LBNL translated the different types of cost caps used by states into the maximum possible incremental retail rate increase caused by RPS policies for the year in which each state's RPS achieves its highest percentage target. LBNL found that, "though a

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[13] State-Federal RPS Collaborative, *Recommended Principles and Best Practices for State Renewable Portfolio Standards* (Montpelier, VT: Clean Energy States Alliance, 2009), p. 3.

sizable range exists, the majority of states have capped incremental rate impacts at well below 10%, and in seven states rate impacts are capped at or below 2%."[14]

Alternative compliance payment. Many states with RPSs primarily rely on an alternative compliance payment. ACP policies allow electricity suppliers that cannot meet their RPS obligations to instead make financial payments to meet their obligation. This creates a de facto cost cap. ACPs are distinct from financial penalties as they are considered a lawful form of compliance, and, typically, suppliers are allowed to recover the costs of an ACP from ratepayers.

ACP prices vary by state and are established by statutes or by state regulators. In some states, the legislature has established statutory guidelines for ACPs but allows state regulators to actually set the price through rule-making.

When a state has a solar or DG carve-out, it typically establishes a higher ACP rate for that carve-out than for general RPS obligations, to reflect the higher cost of solar electricity and distributed generation.[15] In the case of solar ACPs, states such as Maryland and New Jersey assume that the cost of solar electricity will decline in future years, so they have established schedules of declining solar ACP rates over time. For example, Maryland's current solar ACP is $400 but will decline by $50 every two years. A gradually decreasing solar ACP helps put downward pressure on REC prices and on the cost of solar installation.

Advantages of an ACP:

- Sets an ultimate, clear price ceiling on compliance. The total maximum cost of the RPS can be estimated with reasonable accuracy.
- Allows utilities another means to comply with an RPS in addition to REC or renewable generation procurement.
- Serves as an important mechanism for consumer protection where the cost of RECs or renewable generation procurement is unknown or prohibitively high.

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[14] Ryan Wiser and Galen Barbose, *Renewables Portfolio Standards in the United States: A Status Report with Data Through 2007* (Berkeley: Lawrence Berkeley National Laboratory, 2008), p. 30. Available at http://eetd.lbl.gov/ea/ems/reports/lbnl-154e.pdf.

[15] See Wiser, *Supporting Solar Power in Renewable Portfolio Standards,* p.22.

- Money collected via an ACP can be used to fund renewable projects, thereby increasing the likelihood that there will be a sufficient supply of renewable generation in future years.
- Eliminates the need to establish or adjudicate enforcement penalties.

Disadvantages of an ACP:

- The ACP level must be properly set to ensure the integrity of an RPS. If set too low, utility suppliers are discouraged from procuring renewable energy. If set too high, the RPS can become very expensive.
- Unless used to fund renewable projects, ACP payments do not help ensure that the actual goals of the RPS are achieved.
- If different states in a region use different ACP levels, then generators, developers, and REC providers will be incentivized to sell their RECs in states with more severe consequences of non-compliance, creating market balkanization.

Rate and revenue caps. An RPS rate cap limits RPS compliance expenditures to an amount that raises the rates of different customer classes by a set percentage over a specified time period. An annual rate cap sets the allowable rate increase for a given year. For example, Colorado's RPS authorizes its utilities to collect up to 2% of its customers' bills annually to meet the RPS (1% for cooperatives). New Mexico's rate cap ramps up to 3% of customers' aggregated electric bills through 2015.

In general, states that use rate caps have specified them for the entire RPS policy and include the cost of complying with any solar or DG carve-out. However, the states of Delaware, Maryland, and New Jersey have established retail rate-based cost caps that are specific to their carve-outs and separate from the overall RPS cost caps. Delaware and Maryland have established a 1% cap on retail rates for their solar set-asides, while the New Jersey solar retail cap is 2%.

A related but distinct cost cap mechanism is an annual utility revenue expenditure cap. Several states cap utility expenditures for RPS compliance at a set percentage of a utility's retail revenue requirements.

The most challenging issue related to revenue caps is how to calculate the incremental costs of renewable resources. Kansas, Ohio, Oregon, and Washington all use a revenue cap mechanism that allows utilities to count the levelized annual incremental costs of obtaining eligible renewable resources against the cap. However, each state uses a different approach to calculating those costs. As an example, Washington defines incremental cost as the difference between the cost of the renewable resources and the levelized delivered cost of an equivalent amount of reasonably available substitute non-renewable resources with the same contract length or facility life. Oregon 's law goes further by stating that levelized annual incremental costs should capture the costs of capital, operating, financing, transmission and distribution, ancillary services, and R&D.

In addition to the costs of the renewable generation development, there are additional costs that can be considered to count towards a revenue cap, including costs of RECs, power purchase agreements, and ACPs. States differ on whether these costs count in the cap. For example, Oregon's 4% annual revenue requirement cap includes the costs of RECs and ACPs as well as the incremental levelized costs of developing renewable projects. In Ohio, however, utilities are not allowed to count ACPs toward the cap (or to recover ACPs from ratepayers). Further complicating cost cap decisions, Oregon and Washington provide that only "prudently incurred costs" are recoverable.

Advantages of Cost Caps:

- Limit RPS compliance expenditures.
- Can be a valuable consumer protection mechanism.

Disadvantages of Cost Caps:

- Can be administratively complicated, difficult to calculate, and burdensome to apply.
- The annual process of determining the cap is time consuming.
- Requires clear rules on what costs of compliance count toward the cap and what are the avoided costs against which the costs of renewables are compared.
- If different states in a region use different types or levels of cost caps, then generator developers and REC providers will be attracted to states with more severe consequences of non-compliance, creating market balkanization.

Cap on contract price. Montana and Hawaii use a cost containment limit on a per-contract basis. In both states, utilities may petition the utility commission if they are not able to meet the RPS obligation because contracts for procuring generation or RECs are above the market price for other available resources. For example, in Montana, a utility is not required to take electricity from an eligible renewable resource unless the price premium per kWh is less than or equal to 15% of the cost of power from other available generating resources.

Advantages of Individual Contract Caps:

- Highly cost protective for consumers, limiting the cost of compliance to close to the cost of alternative, non-renewable resources (e.g., natural gas).
- A strong mechanism for consumer protection in situations where the cost of RECs or renewable generation procurement is unknown or prohibitively high.

Disadvantages of Individual Contract Caps:

- Can be administratively burdensome to apply.
- Requires clear rules on what are the avoided costs against which the renewable contract is compared.
- Can significantly limit the ability to achieve RPS targets as the price of renewables is often higher than non-renewable resources.

Regulatory agency discretion. In several RPS states, excessive RPS-related costs are controlled by using utility commissions' traditional responsibility and authority to ensure just and reasonable rates. In a regulated state, the public utility commission can employ its statutory authority to ensure just and reasonable rates in rate cases and to approve individual utility renewable energy contracts as an alternative to a specifically defined rate cap. RPS states that do not have a defined cap include Iowa, Minnesota, Nevada, and Wisconsin.

Advantages:

- Relies on a public utility commission's traditional regulatory and administrative practices, which are familiar to utilities, stakeholders, and legislators.
- Utilities recover costs that are reasonable and justified to meet the RPS.
- Does not rely on an arbitrary cap but on actual rate impacts and relevant case-specific considerations.

Disadvantages:

- Requires case-by-case decision-making with a degree of uncertainty and risk for utilities and ratepayers.
- Can create a significant regulatory burden.

11. Contracting and Financing

As noted in section B8 above, a main weakness of some RPSs is that they are not sufficient to lead to the long-term contracts that many renewable energy projects need to receive financing. States have used a variety of approaches to overcome this problem, focusing either on long-term contracts for power or price guarantees for RECs. It is easier for a regulated market to address this problem than a restructured electricity market.[16]

Advantages of implementing RPS design features that seek to overcome the financing barriers to renewable energy development include:

- Given that this is the single biggest limitation of an RPS, it is desirable for a state to implement appropriate solutions to this problem.

Disadvantages of implementing RPS design features that seek to overcome financing barriers:

- Any additional design features add complexity to an RPS and is accompanied by some administrative burden.

Among the approaches that can work, especially in regulated markets, are:

- Require or encourage utilities to enter into extended contracts with renewable energy generators in which they purchase the power ***and*** the RECs from those facilities, and then retire an appropriate number of RECs. Of course, requiring this bundling of power and RECs eliminates some of the flexibility associated with the use of RECs. Utilities could therefore be required to meet an RPS partly but not completely with RECs that are bundled with the power from the same generating units.

- Include a requirement that all or some renewable energy power and/or REC contracts be for a specified minimum duration.

- For smaller-scale, distributed generation contracts, include a standard offer REC purchase program. Several states have taken this approach specifically for photovoltaic installations as part of a solar carve-out.

- Require utilities to own certain distributed generation assets.[17]

12. Central Procurement Approach

[16] For more on policy design options that help to overcome the barriers to project financing, see Wiser, *Supporting Solar Power in Renewable Portfolio Standards,* pp. 14-16.

[17] For more on long-term contracting approaches, see Holt, *Role of Renewable Energy Certificates.*

Central procurement is another approach for addressing contracting and financing while also dealing with other issues related to an RPS. Illinois and New York are the only two states to use this model, in which a procurement agent, rather than individual utilities, is given responsibility for meeting the state's RPS obligation.

In the case of New York, investor-owned utilities collect a surcharge through end-users' electricity bills and turn the money over to NYSERDA. NYSERDA issues periodic RFPs to solicit RECs from new renewable energy projects and enters into long-term contracts with the project developers for those RECs. In addition, NYSERDA uses some of the money for a rebate and grant program for small-scale distributed generation. In the case of Illinois, the Illinois Power Agency (IPA) develops a state-wide RPS compliance and procurement plan, but the individual utilities contract with the bidders who respond to IPA's solicitations.

Advantages of the central procurement approach:

- It can make it easier for projects to receive financing, because the state offers guaranteed REC contracts at a pre-determined price for a period of years.
- It can reduce the cost of adding renewable energy to the system. Because project developers receive a guaranteed REC contract for a period of years, they may be willing to accept a lower price for RECs than they would require and receive in an open competitive-market RPS. An evaluation of the New York RPS suggests that this is likely the case, since NYERDA paid much lower REC prices in the years up to 2009 than were common in nearby New England states with conventional RPSs.[18] (As a caveat, because of declines in REC prices in New England, the gap between New England and New York REC prices has diminished since 2009.)
- It can be easier to direct RPS support to in-state projects.
- It is easier to include factors other than the price of the RECs in the decision about which projects receive RECs. In New York, projects submit information about the number of jobs they will create in-state and other economic development benefits, and that becomes a factor in determining which projects should receive support through the RPS.

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[18] Liz Hicks et al., *New York Main Tier RPS: Impact and Process Evaluation* (Burlington, Mass.: KEMA Inc., 2009), p. 6-2

Disadvantages of this approach:

- It makes the state a direct player in the marketplace.
- It increases the administrative complexity of the RPS for the state, because the state needs to conduct periodic solicitations, review proposals, and enter into contracts.
- It could be difficult for a small state with a need to purchase a relatively modest number of RECs to identify and contract with the right number and size of projects to meet that need.

13. Reverse Auctions

A reverse auction is yet another way to address project financing while potentially reducing costs. It is currently being used in California through that state's California Renewable Auction Mechanism. Some other states have expressed interest in exploring the concept.[19]

A reverse auction is a mechanism to competitively distribute government or utility contracts and subsidies to private entities. It requires private firms to submit bids that stipulate the minimum price or subsidy level that they will accept for an eligible output. The entity tasked with managing the reverse auction then reviews all bids and accepts the lowest one(s). As a mechanism for procuring renewable energy, the lowest price bid(s) from project developers, expressed in kWh generated per dollar, would win the auction.

The United Kingdom used a series of reverse auctions in the 1990s to distribute subsidies for non-fossil fuel electricity. Power providers in the US have used reverse auctions to procure power supplies for standard offer default services in Connecticut, Delaware, Illinois, Maryland, New Jersey, Ohio, and Pennsylvania.

The California Public Utilities Commission (CPUC)'s reverse auction focuses on distributed generation projects from 1 to 20 MW. The state's investor-owned utilities are required to hold biannual auctions for power purchase agreements with ready-to-build projects. The California

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[19] Clean Energy States Alliance held a webinar on the topic of reverse auctions on January 27, 2012. To see the presentations or listen to the webinar, go to http://www.cleanenergystates.org/projects/state-federal-rps-collaborative/rps-events-and-webinars/showevent/cesa-rps-webinar-reverse-auctions-renewable-energy-and-rps?d=2012-01-27.

PUC believes that the approach eliminates any potential conflicts with FERC's exclusive authority to set wholesale power prices under the Federal Power Act and PURPA.[20]

Advantages of Reverse Auctions:

- An effective mechanism to maximize output per ratepayer dollar spent to procure renewable energy.
- Fosters private-sector competition among renewable resource developers.
- Drives down technology costs.
- In contrast to a fixed incentive price that will either be inefficient (because the incentive is higher than needed) or ineffective (because it is too low to deploy a particular renewable resource), a reverse auction allows the level of incentive to be set by the lowest-cost renewable projects, while not paying more than necessary.
- Transaction costs are reduced for the developer, utility, and regulator.
- Avoids the limitations on feed-in tariffs under the Federal Power Act and PURPA.
- Particularly suitable as a procurement tool for system-side renewable distributed generation.
- The regulator and utility can target renewable development in specific locations.
- Auction rules and design can be adjusted based on lessons learned from prior auctions.

Disadvantages of Reverse Auctions:

- An auction requires careful design.
- Tends to favor technologies that represent the least-cost option today, rather than newer technologies that may have the potential to achieve significant performance improvements and cost reductions with economies of scale in the future.
- Large, sophisticated firms may dominate reverse auction markets because of their size and experience.
- Some developers may be discouraged from planning projects or participating in the market because of uncertainty about whether they could win an auction at the price they need to proceed with construction.
- Requires safeguards to ensure that winning projects are actually completed on time.

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[20] For more information on the California auction, see the CPUC's webpage on "Renewable Action Mechanism." Available at www.cpuc.ca.gov/PUC/energy/Renewables/hot/Renewable+Auction+Mechanism.htm.

About Clean Energy States Alliance

Clean Energy States Alliance (CESA) is a national nonprofit organization dedicated to advancing state and local efforts to implement smart clean energy policies, programs, technology innovation, and financing tools to drive increased investment and market making. CESA works with the leading state and public clean energy programs and provides information sharing and technical assistance to states and local governments on "best in class" clean energy programs and policies. CESA also facilitates collaborative networks to coordinate efforts between states, federal agencies, and other stakeholders to leverage accelerated progress on deploying clean energy projects and markets.

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About National Association of Regulatory Utility Commissioners

NARUC is the national association representing the State Public Service Commissioners who regulate essential utility services, including energy, telecommunications, and water. NARUC members are responsible for assuring reliable utility service at fair, just, and reasonable rates. Founded in 1889, the Association is an invaluable resource for its members and the regulatory community, providing a venue to set and influence public policy, share best practices, and foster innovative solutions to improve regulation.

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