16. Increase Clean Energy Procurement Requirements

1. Profile

Increasing the proportion of clean energy resources (i.e., zero- and low-emission technologies) in the electricity supply portfolio is among the most promising ways to reduce carbon emissions from the levels currently produced by a fossil-fuel–heavy portfolio.[1] The technical potential for renewable technologies is considerable, especially for wind and solar, exceeding existing electric demand by orders of magnitude, and far exceeding all other categories of clean energy resources. Chapter 6 focused on the inherent potential of these technologies to reduce greenhouse gases (GHGs) and other air pollutant emissions, and the costs and cost-effectiveness of the technologies themselves. Chapter 6 also considered public policies that can reduce the costs of these technologies.

In this chapter, we focus on a different set of public policy measures that may be used to accelerate deployment of clean energy technologies at a large "utility" scale. Specifically, this chapter focuses on policies that mandate that electric utilities and competitive retail suppliers procure clean energy in specified amounts, or in a specified order of priority, or at specified prices.

In some jurisdictions, electricity is sold at retail by monopoly utilities that procure and deliver electricity to end users. These utilities are obligated to procure and deliver enough electricity to meet the demands of all paying customers within their service territory. In other locations, multiple retail suppliers compete for the right to sell energy to customers, and the monopoly utility's role is limited to *delivering* that energy over a transmission and distribution system. The concept of procurement is relevant in either model. When we speak of "procurement," what we mean is that the utility or retail supplier obtains wholesale energy from generating assets that they own, or through bilateral contracts with other utilities or "independent power producers" that own generating assets, or through purchases in an organized wholesale energy commodity market. The mix of assets procured by a utility or competitive supplier is its "portfolio."

Many states have adopted public policies that require utilities to procure clean energy in specified amounts, or give preference to clean energy procurements. Procurement requirements for utility-scale clean energy resources can be a cost-effective way to reduce carbon emissions. Some of the frameworks for promoting utility-scale projects through procurement requirements include renewable portfolio standards (RPS), clean energy standards, legislative targets for renewables, loading orders, emissions performance standards (EPS), and feed-in tariffs (FITs) (also referred to as standard offers).[2] Each of these frameworks is addressed in this chapter. Also featured in this chapter are various regulatory frameworks that can be used as a complement to procurement frameworks to help reduce barriers to participation by independent power producers. These include timely and well-formed interconnection policies.[3]

Several policies featured in this chapter have been particularly instrumental in moving emerging technologies forward and hold significant promise for air regulators exploring avenues to reduce power sector carbon dioxide (CO_2) emissions. In particular, electricity portfolio standards (i.e., RPS and clean energy standards) that apply to the purchasing requirements of utilities and competitive retail suppliers have a proven track record of strong results.

1 Energy efficiency, however, provides the most cost-effective path with the longest list of co-benefits for meeting energy portfolio requirements.

2 FITs are more often associated with the procurement of smaller distributed resources rather than utility-scale resources, and so are mentioned only briefly in this chapter but are discussed in more detail in Chapter 17.

3 Additional complementary policies that are necessary or helpful to integrate higher levels of renewable resources into the power system are addressed in Chapter 20.

2. Regulatory Backdrop

Under US law, the Federal Energy Regulatory Commission (FERC) has nearly exclusive jurisdiction and fairly broad authority to regulate *wholesale* electricity transactions. *Retail* energy transactions are generally the purview of state governments, with regulatory authority residing in a state public utility commission (PUC).[4] Procurement is an issue addressed under both federal and state laws.

Under federal law, specifically the Public Utility Regulatory Policy Act of 1978 (PURPA) and administrative rules promulgated by FERC, utilities must offer to purchase electric energy from most "qualifying small power production facilities" (80-megawatt [MW] capacity or less) and "qualifying cogeneration facilities" at rates that are just and reasonable to the utility's customers and in the public interest, and nondiscriminatory toward qualifying facilities. There are limited exceptions to this federal purchase obligation. FERC does not, however, decide what those "just and reasonable" rates should be. That authority remains in the hands of states, but with one important limitation. State regulators may not require utilities to offer to purchase energy at rates in excess of the utility's "avoided costs." The net effect of this federal law is that utilities have an obligation to *offer* to procure clean energy from most qualifying facilities, but they do not have to offer a price that is above what it would otherwise cost the utility to produce or procure that clean energy from other sources.[5]

The development of independent power projects, largely in the form of hydroelectric, biomass, and natural gas cogeneration (a.k.a. combined heat and power) projects, was impacted significantly by PURPA. Non-utility generation stimulated by PURPA was responsible for 6.7 percent of total generation in the United States by 1995, much of which was from smaller hydro and biomass projects.[6] But despite the concerted efforts of Congress and the federal government to foster more deployment of hydro, and to a lesser degree biomass, the total contribution of these resources to the national electricity portfolio remains modest and stable to this day (at roughly 8.2 percent) with only limited prospects for growth.[7]

In contrast, emerging technologies like wind and solar generation are seeing rapid growth with considerable potential for further expansion looking forward. Estimates of the central policy case or reference case scenarios from both the International Energy Agency and the US Energy Information Administration show increasing potential with the passage of time with respect to these technologies. The policy frameworks designed to spur these technologies are working and have largely focused on state-regulated procurement strategies.

State procurement requirements tend to be very different from the PURPA purchase obligation in scope and structure. To begin with, states have the legal authority to impose portfolio requirements on utilities and retail suppliers that mandate procurement of specified amounts or types of clean energy. States can also impose requirements on utilities to conduct long-term resource planning, including energy procurement plans.[8]

States have enacted a variety of procurement policy frameworks in statutes and regulations to spur the acquisition of lower-carbon resources. These frameworks include portfolio requirements, loading order requirements, emissions performance standards, dedicated funds for clean energy procurement, performance-based incentives for clean energy, and interconnection rules. Even in states that lack these mandatory requirements, regulators can have an indirect impact on clean resource procurement by imputing a carbon value into the evaluation of alternatives in the planning and procurement phase of resource acquisition. Another option is to facilitate the procurement of clean energy by utilities or competitive retail suppliers

4 For a more detailed and nuanced discussion of this complicated subject, refer to: The Regulatory Assistance Project. (2011, March). *Electricity Regulation in the US.* Available at: http://www.raponline.org/document/download/id/645.

5 The impact of PURPA and the federal purchase obligation is more pronounced for distributed generators and less important for utility-scale procurement. For that reason, the topic is covered in more detail in Chapter 17.

6 Refer to: Hirsh, R. (1999). *Power Loss: The Origins of Deregulation and Restructuring in the American Electric Utility Industry*. Figure 6.8, p. 116. Also refer to electricity net generation data published by the US Energy Information Administration at: http://www.eia.gov/electricity/data.cfm#generation.

7 Hydro still accounts for only approximately 7 percent of generation and biomass only 1.4 percent, with biomass seeing little growth in recent decades.

8 Broader utility planning frameworks like integrated resource planning can be used to promote lower-cost, low-carbon technologies over the long term, without clean energy procurement policies in place or as a complement to those policies. Integrated resource planning is the subject of Chapter 22.

on behalf of customers who voluntarily agree to pay a higher "green price" to purchase renewable energy (RE). This can be accomplished by approving "green price" tariffs proposed by utilities, allowing competitive suppliers to offer "green price" products, and allowing large customers or aggregations of customers to buy energy directly from renewable generators.

Portfolio Requirements

Electricity portfolio standards are by far the most common formulation for a state procurement requirement. In most cases, these standards are expressed as a requirement that regulated utilities or retail suppliers procure a specified percentage of the retail energy they sell to end-use consumers from qualifying resources in a given calendar year. Market forces can then operate to enable development of the more economic resources to meet the standard. So, for example, a utility might be required to procure 20 percent of retail energy from qualifying resources in the year 2020. A few states have procurement requirements that are expressed not as a percentage of retail sales but as a total installed capacity requirement, for example 1100 MW by 2015. Most states limit the qualifying resources to renewable resources, and thus the policies are referred to as Renewable Portfolio Standards or RPS policies. Some states have extended the framework of qualifying resources to include other technologies, including nuclear, "clean coal," and natural gas generation. Where the list of qualifying resources includes non-renewable resources, the policies are sometimes referred to as Clean Energy Standards, Alternative Energy Standards, and so on.[9] But for the purposes of simplicity, all RPS and Clean Energy Standards policies will be described as RPS policies for the remainder of this chapter.

Portfolio requirements are typically established first in state law (with the broad legal mandates established in state law, and the finer details of implementation left for the utility regulator). States like Arizona have also established such requirements through PUC-level regulation. Federal RPS requirements have been featured in numerous bills introduced in the US Congress over the past decade, but no such requirements have ever been enacted.

Most state policies rely on renewable energy credit (REC) systems that enable trading of credits among regulated entities. Each REC represents one megawatt-hour (MWh) of qualifying generation.[10] Tracking systems keep track of the creation and disposition of RECs. Regulated utilities and retail suppliers are generally allowed to purchase, trade, and bank RECs, and they demonstrate compliance with state requirements by retiring RECs.[11] Some states also allow regulated entities to comply by making alternative compliance payments in lieu of retiring RECs. Compliance with state electricity portfolio standards is normally monitored and enforced by state PUCs or state energy offices.

In the Clean Power Plan emission guidelines that the Environmental Protection Agency (EPA) proposed on June 2, 2014 using its authority under section 111(d) of the Clean Air Act, the EPA determined that increasing generation from renewable resources is an adequately demonstrated and cost-effective measure for reducing power sector CO_2 emissions.[12] Although the proposed 111(d) regulation would not require states to include increased renewables in their compliance plans, the emissions targets that the EPA proposed for each state are based on assumed levels of RE deployment that could be achieved in each state. The levels assumed by the EPA for each state are based on the average requirements of state RPS policies in different geographic regions of the country. In a technical support

9 These states include Michigan, Ohio, Pennsylvania, and West Virginia. The first three propose a clean energy standard that operates in parallel to the RPS, whereas West Virginia's operates in lieu of an RPS. Refer to: Barbose, G. (2012, December). *Renewables Portfolio Standards in the United States: A Status Update*. Presented at 2012 National Summit on RPS, Washington D.C. Available at: http://www.cesa.org/assets/2012-Files/RPS/RPS-SummitDec2012Barbose.pdf.

10 Some states (e.g., Arizona) allow non-electric technologies such as solar hot water heating to earn RECs and contribute toward RPS compliance. Each state that does this has its own methods for converting a quantity of eligible non-electric energy into a number of RECs.

11 The trading of RECs enables markets to separate the "renewable" attributes of these resources from the flow of the electrons. The effect is to facilitate the liquid flow of these attributes in markets that ease the ability of obligated entities to meet requirements under a state RPS policy.

12 US Environmental Protection Agency. (2014, June). *Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units*. Available at: https://www.federalregister.gov/articles/2014/06/18/2014-13726/carbon-pollution-emission-guidelines-for-existing-stationary-sources-electric-utility-generating.

document, the EPA asserts that "[t]hese state-level goals and requirements have been developed and implemented with technical assistance from state-level regulatory agencies and utility commissions such that they reflect expert assessments of RE technical and economic potential that can be cost-effectively developed for that state's electricity consumers… Because the EPA did not quantify potential that could be tapped through any [other RE] policy approaches, the agency believes that the RE targets derived from RPS mandates represent a conservative estimate of cost-effective generation that could actually be developed by states."[13]

Loading Order Requirements

A few states have adopted a "loading order" policy, generally through state legislation, that establishes a priority order for the different types of resources from which a utility or retail supplier might procure energy. The highest priority is generally assigned to energy efficiency, with second priority assigned to some or all forms of RE. Fossil generation tends to be the lowest priority. Loading order requirements are not dispatch order requirements – they don't dictate which power plants operate on an hourly or daily basis. Instead, loading order requirements focus on the decisions that are made when new resources are procured through a construction project or power purchase agreement. Loading order tends to be an investment guideline for state utilities and utility regulators. It should also be noted that loading order requirements are not absolute – costs are considered in such a way that the highest priority resource is not procured in every case.

Emissions Performance Standards

In September 2013, the US EPA released a proposed rule creating federal New Source Performance Standards (NSPS) limiting GHG emissions from new electric generating units (EGUs).[14] The proposed rule would set separate standards for certain natural gas-fired stationary combustion turbines and for fossil fuel-fired utility boilers and integrated gasification combined-cycle units. The emissions limits in these proposed standards range between 1000 and 1100 pounds of CO_2 per gross MWh. We include the proposed NSPS rule in this chapter because any federal rule that limits the emissions of new EGUs will also restrict the future energy procurement options of utilities and retail suppliers. The connection between these concepts becomes even more apparent when we consider state EPS.

Several states have already adopted an EPS policy that is similar to the proposed federal NSPS in form and scope, that is, a policy that establishes a maximum level of CO_2 emissions per unit of output from EGUs. However, there are significant differences between some EPS policies and the proposed NSPS rule. California, Washington, and Oregon have each adopted an EPS that applies to new and existing baseload generation for which electric utilities enter into long-term commitments. This would include not just new construction, as would be covered by the NSPS rule, but also long-term power purchase contracts. In other words, the EPS in these states regulates the procurement of energy.[15]

The EPA's proposed 111(d) emission guidelines for existing sources would also create an EPS, but in this case the EPS would apply to existing EGUs in each state. Because the standards are developed with an assumption that states can increase generation from clean energy resources, as previously noted, they would certainly provide an impetus for the procurement of new clean energy. However, unlike EPS policies for new resources, the 111(d) standards would not impose an emissions limit on individual EGUs but instead would impose a limit on the average emissions across all covered EGUs, with certain adjustments specified in the proposal. In other words, new resources could be added to the system that emit more than the state 111(d) goals, provided that the average emissions of all covered sources (with adjustments) meet the goals. This makes the 111(d)

13 US EPA. (2014, June). *GHG Abatement Measures – Technical Support Document (TSD) for Carbon Pollution Guidelines for Existing Power Plants: Emission Guidelines for Greenhouse Gas Emissions from Existing Stationary Sources: Electric Utility Generating Units.* Docket ID No. EPA-HQ-OAR-2013-0602. Available at: http://www2.epa.gov/carbon-pollution-standards/clean-power-plan-proposed-rule-ghg-abatement-measures.

14 The proposed rule was published in the Federal Register on January 8, 2014.

15 Massachusetts also enacted legislation calling for the promulgation of "rules and regulations to adopt and implement for fossil fuel-fired electric generation facilities uniform generation performance standards of emissions produced per unit of electrical output on a portfolio basis for any pollutant determined by the department of environmental protection to be of concern to public health, and produced in quantity by electric generation facilities." (Massachusetts General Laws, Chapter 111, Section 142N.) Such rules and regulations have yet to be implemented.

proposal significantly different from any of the existing state EPS policies.

Public Benefits Funds

About 20 states and the District of Columbia have some form of public benefits fund that is leveraged to foster the development of clean energy projects. Public benefits funds are typically supported through one or more of the following sources: a surcharge on retail utility bills; federal funding;[16] auction revenues from a GHG cap-and-trade program;[17] or an alternative compliance payment framework in conjunction with an RPS. The Clean Energy States Alliance reports that, since 1998, roughly $3.4 billion has been used from these funds to support the development of approximately 130,000 clean energy projects with a total capital investment of $16 billion.[18] Public benefits funding for clean energy development can be viewed as analogous to a mandatory procurement policy; a public benefit fund for clean energy requires ratepayer money to be invested to procure clean energy, energy efficiency, and associated research and development that may foster clean energy investment. However, much the same result could be achieved by simply requiring the utility to make clean energy investments and allow recovery of those investments as a matter of rate recovery, rather than separating the collection to pay for such investments in a directed way.

Performance-Based Incentives

In this chapter, we use the term "performance-based incentives" to refer to a variety of policies that simultaneously require utilities to procure clean energy and provide incentives to the generators for each kilowatt hour (kWh) generated. Although PURPA creates an obligation in most cases for utilities to offer to procure energy from qualifying facilities, PURPA rates are not incentive rates because the purchasing utility does not have to offer a price higher than its avoided costs (i.e., what it would cost to procure energy from an alternative source).[19] In contrast, FITs are an example of a performance-based incentive. Under a FIT policy, the utility is required to offer to purchase energy from specified clean energy sources at rates that include an incentive in the form of a higher price for each kWh than the utility's avoided costs.[20] The FIT concept is conceivably applicable to clean energy sources of all types and sizes, and thus is suitable for inclusion in this chapter. However, in the United States, nearly all examples of FIT policies to date have restricted the scope of the policy to small distributed generation sources. For this reason, the concept is mentioned briefly here but addressed in more detail in Chapter 17. Production tax credits are another form of performance-based incentive, but their primary impact is that they reduce the effective cost of the technology, and thus were addressed in Chapter 6. An RPS with an accompanying framework for trading RECs creates an associated premium for attributes of qualifying generation, and therefore could also be viewed as a performance-based incentive. However, for purposes of this discussion we treat RPS policies not as performance-based incentives but as a portfolio requirement. Green pricing schemes can also be viewed in a similar vein.

Interconnection Rules

FERC has authority to regulate the interconnection of generators to all transmission facilities that are subject to FERC jurisdiction. FERC has established separate rules and procedures for smaller generators (less than 20 MW)

16 Notably, the American Recovery and Reinvestment Act of 2009 provided $3.1 billion in State Energy Program grants.

17 The nine states currently participating in the Regional Greenhouse Gas Initiative use the funds generated from allowance auctions to support a variety of clean energy initiatives, including investments in energy efficiency and renewable projects. Refer to Chapter 24 for details.

18 Refer to the Clean Energy States Alliance website at: http://www.cesa.org/about-us/what-we-do/.

19 Although, as we note below, FERC has made provision for differentiating the costs of procuring energy from an alternative source by technology. The effect of this latitude is to allow for state consideration of cost differences above an undifferentiated avoided cost rate. In other words, if a state has an RPS policy, the cost of procuring RPS-eligible energy can be differentiated from the cost of procuring ineligible energy.

20 The establishment of a state FIT may, however, need to navigate the respective legal authorities reserved for states and FERC. In an October 21, 2010 Order, FERC provided clarification on how states can navigate the legal limits through the use of a multi-tiered, avoided cost designation that is consistent with PURPA. For a discussion and further clarification, see: Passera, L. (2010, October). *FERC Provides Clarification on Feed-In Tariff Options for States*. Interstate Renewable Energy Council. Available at: http://www.irecusa.org/2010/10/ferc-provides-clarification-on-feed-in-tariff-options-for-states/.

and larger generators (greater than 20 MW). Independent system operators (ISOs) and regional transmission organizations have also established comprehensive interconnection requirements to assure all aspects of the grid and the generator are adequately protected and uniformly treated consistent with FERC requirements. The FERC and ISO/regional transmission organizations procedures can potentially serve as models for states that wish to regulate interconnection to state-jurisdictional facilities, largely distribution and sub-transmission–level facilities. In addition, the Energy Policy Act of 2005 ensured that the IEEE 1547 standard would serve as the engineering standard for interconnecting distributed generation.[21] And finally, the Mid-Atlantic Distributed Resources Initiative has also developed model procedures for interconnecting small generators.[22] Forty-four states have now established some form of regulation over distributed generation. However, the applicability of existing state requirements varies on a size basis from state to state. The detailed requirements of interconnection procedures for larger generation among the states also varies. States that have not adopted interconnection regulations or that have substantial gaps between coverage of smaller generation and FERC jurisdictional facilities, can look to either the FERC model or to states with "best practices" such as Oregon, Virginia, Connecticut, Maine, and Massachusetts that are considered best practices among the states.[23]

3. State and Local Implementation Experiences

As shown in Figure 16-1, most regions of the United States are covered by RPS policies. Details on each state policy are available at www.dsireusa.org. Figure 16-1 clearly shows that the stringency of state requirements varies dramatically, from 10 percent requirements or goals in several states up to a 40-percent requirement in Hawaii. What is not evident from the figure is that states vary widely in terms of qualifying resources, whether all utilities and retail suppliers are regulated, and other details.

One noteworthy area of variation in state policies is the treatment of hydro projects. Almost all such projects predate the adoption of state RPS policies, and the policies – which are intended to spur new clean energy resource deployment – generally exclude existing large hydro projects from the list of qualifying resources. Large hydro projects have been incorporated in the definition of renewables in certain states as part of either an RPS goal (Vermont) or a mandatory RPS requirement (New York, Wisconsin, and Montana). This is relevant mostly because of the potential for imports from new, large hydro projects in Canada. The potential for hydro in the United States will likely be limited to community-based projects and expansion of preexisting dam projects; these smaller hydro resources qualify for compliance under many state RPS laws.

To date, only Ohio has included advanced nuclear energy as a qualifying resource in a clean energy standard. Still, the long lead times in development, combined with cost, concerns for safety, and uncertainty around disposal of spent fuel and high-level waste, may present formidable barriers going forward. Almost all nuclear power in the United States is generated from facilities that came on line between 1967 and 1990. Currently five nuclear projects are under construction in Tennessee, Georgia, and South Carolina, but plans for further development may be hindered by long lead-time requirements, challenges associated with permitting, and low wholesale costs resulting from competitive natural gas prices.[24]

Twenty-nine states and the District of Columbia have implemented an RPS, and RPS requirements have now

21 Refer to: Basso, T., & Friedman, N. (2003, November). *IEEE 1547 National Standard for Interconnecting Distributed Generation: How Could It Help My Facility?* National Renewable Energy Laboratory. NREL/JA-560-34875. Available at: http://www.nrel.gov/docs/fy04osti/34875.pdf. Also refer to Energy Policy Act of 2005 at Section 1254, available at: http://www.gpo.gov/fdsys/pkg/BILLS-109hr6enr/pdf/BILLS-109hr6enr.pdf.

22 Mid-Atlantic Distributed Resources Initiative. (2005, November). *MADRI Model Small Generator Interconnection Procedures.* Available at: http://sites.energetics.com/MADRI/pdfs/inter_modelsmallgen.pdf.

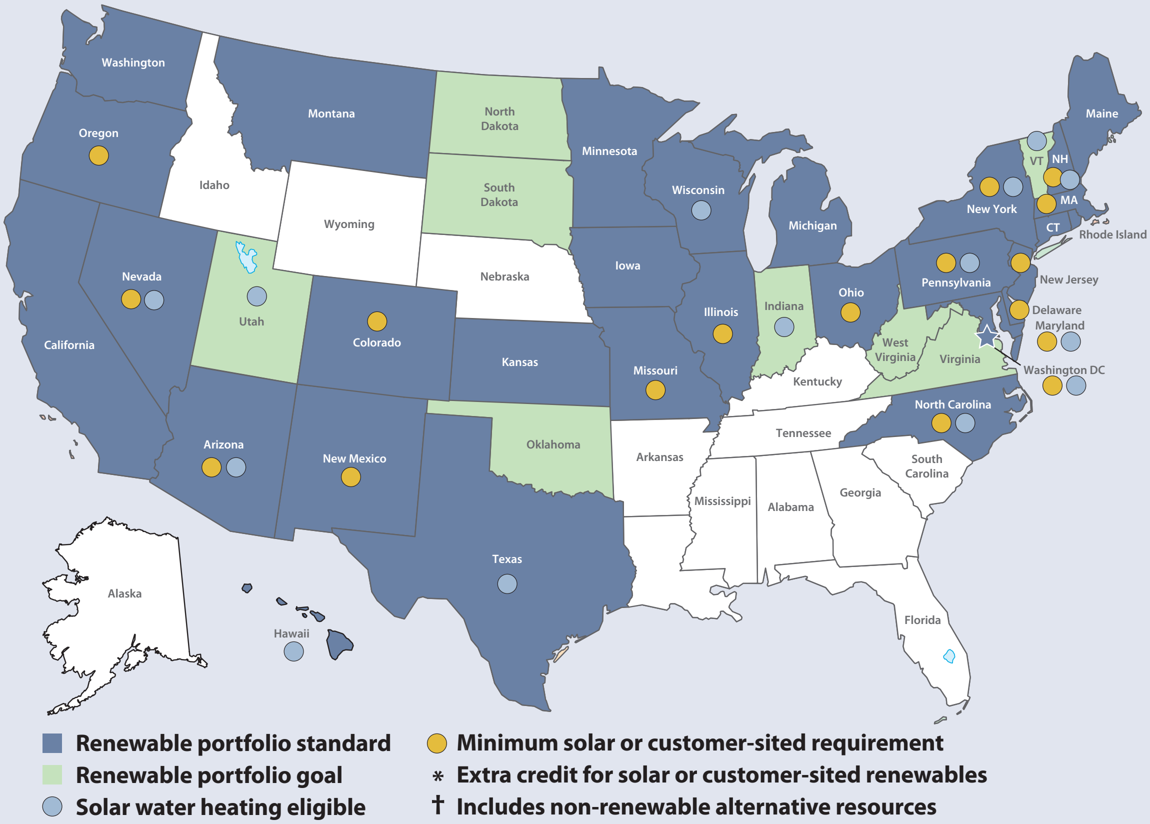
23 Sheaffer, P. (2011, September). *Interconnection of Distributed Generation to Utility Systems: Recommendations for Technical Requirements, Procedures and Agreements, and Emerging Issues.* Montpelier, VT: The Regulatory Assistance Project, page 7. Available at: http://www.raponline.org/document/download/id/4572.

24 World Nuclear Association. (2014, July). *Nuclear Power in the USA.* Available at: http://www.world-nuclear.org/info/Country-Profiles/Countries-T-Z/USA--Nuclear-Power/.

Figure 16-1

States With RPS Policies[25]

29 states, Washington DC, and two US Territories have renewable portfolio standards. Eight states and two territories have renewable portfolio goals.



Arizona: 15% by 2025
California: 33% by 2020
Colorado: 30% by 2020 (IOUs), 10% by 2020 (co-ops and large munis)*
Connecticut: 27% by 2020
Delaware: 25% by 2026*
Hawaii: 40% by 2030
Illinois: 25% by 2025
Indiana: 10% by 2025†
Iowa: 105 MW
Kansas: 20% by 2020
Maine: 30% by 2000. New RE: 10% by 2017
Maryland: 20% by 2022
Massachusetts: 22.1% by 2020. New RE: 15% by 2020 (plus 1% annually thereafter)
Michigan: 10% and 1,100 MW by 2015*
Minnesota: 25% by 2025 (Xcel: 30% by 2020)
Missouri: 15% by 2021
Montana: 15% by 2015
Nevada: 25% by 2025*
New Hampshire: 24.8% by 2025
New Jersey: 20.38% RE by 2021 plus 4.1% solar by 2028
New Mexico: 20% by 2020 (IOUs), 10% by 2020 (co-ops)
New York: 29% by 2015
North Carolina: 12.5% by 2021 (IOUs), 10% by 2018 (co-ops and munis)
North Dakota: 10% by 2015
Ohio: 12.5% by 2024
Oklahoma: 15% by 2015
Oregon: 25% by 2025 (large utilities)* 5% - 10% by 2025 (smaller utilities)
Pennsylvania: ~18% by 2021†
Rhode Island: 16% by 2020
South Dakota: 10% by 2015
Texas: 5,880 MW by 2015*
Utah: 20% by 2025*
Vermont: 1.) RE meets any increase in retail sales by 2012; 2.) 20% RE and CHP by 2017
Virginia: 15% by 2025*
Washington: 15% by 2020*
Washington DC: 20% by 2020
West Virginia: 25% by 2025*†
Wisconsin: varies by utility; ~10% by 2015 statewide

US Territories:
Northern Mariana Islands: 80% by 2015
Puerto Rico: 20% by 2035
Guam: 25% by 2035 (goal)
US Virgin Islands: 30% by 2025 (goal)

been in place for more than five years in 22 states. More than half of all retail sales in the United States are made by a utility or retail supplier subject to an RPS requirement.[26] Figure 16-2 shows the pattern of commitments to this policy approach that has evolved with time. As the figure shows, most of the states that committed to an RPS policy eventually revised the policy, usually because early successes revealed that more ambitious requirements could be imposed without significant additional costs or system performance problems.

RPS data compiled by the Lawrence Berkeley National Laboratory (LBNL) and others offer strong evidence that RPS requirements are in fact a primary driver for renewable resource deployment. To date, states with RPS policies

25 North Carolina State University. (2014). *Database of State Incentives for Renewables & Efficiency (DSIRE)*. Available at: www.dsireusa.org.

26 Supra footnote 9.

Figure 16-2

State Commitments Toward RPS Policies Over Time[27]

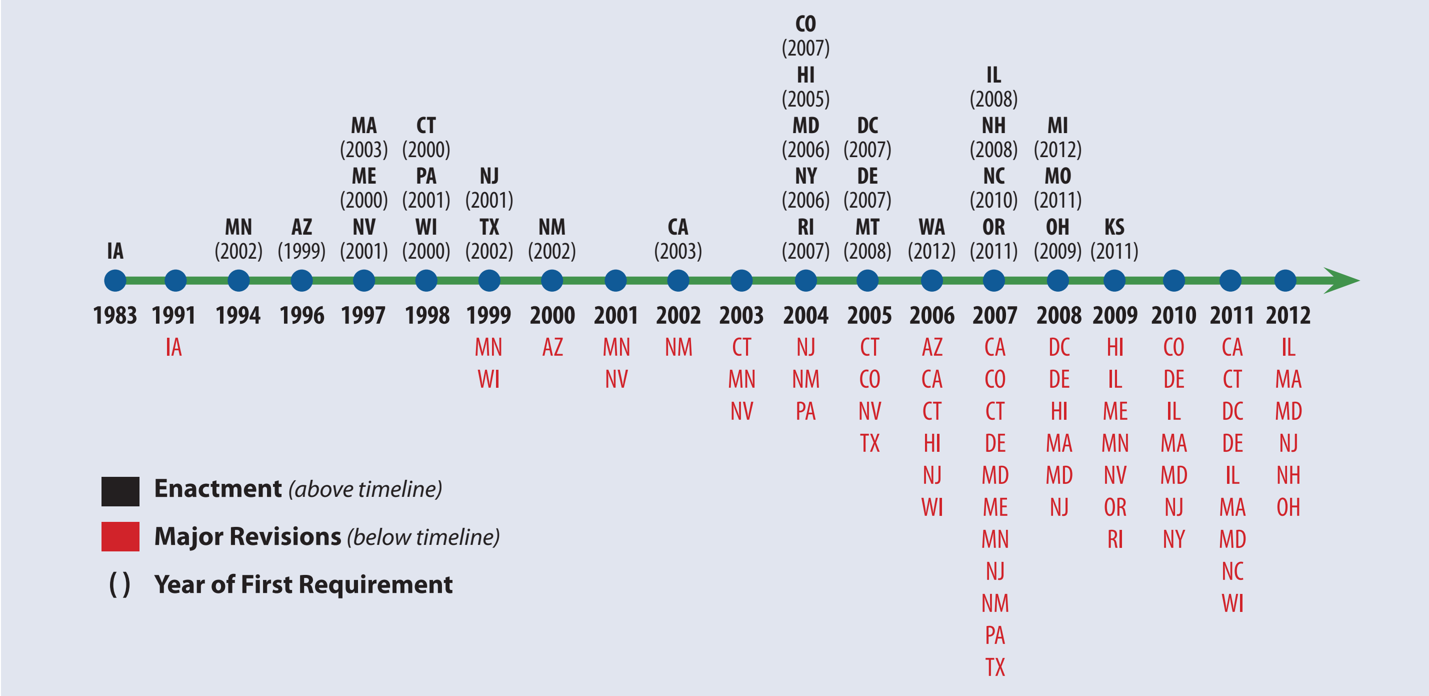
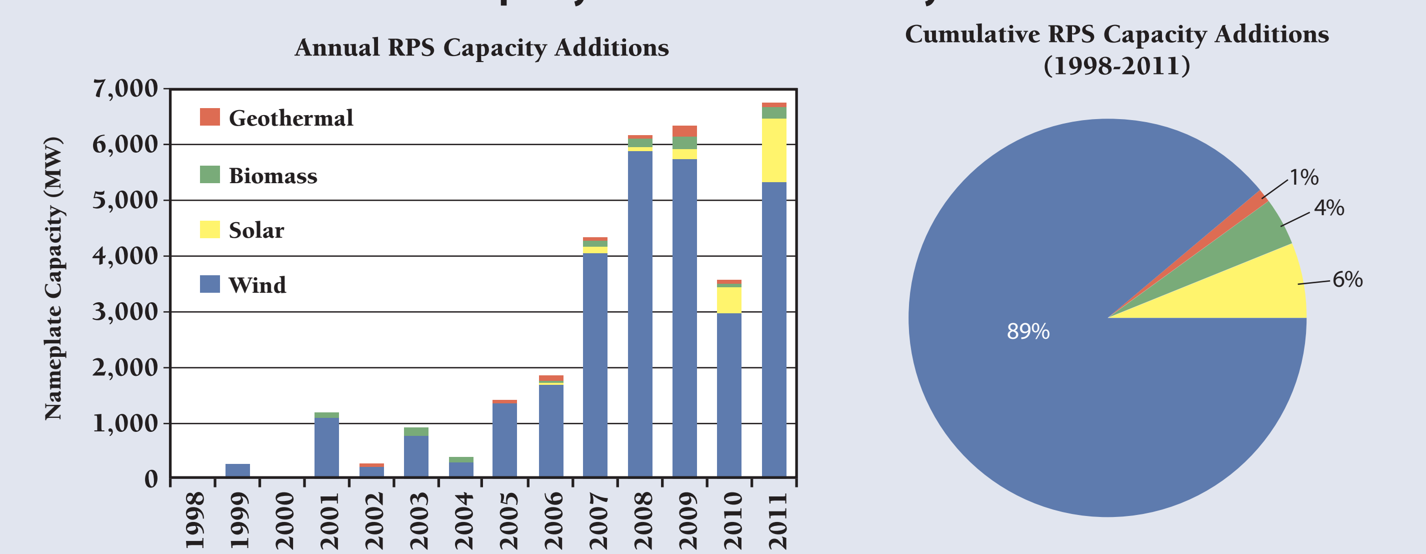


Figure 16-3

Renewable Capacity Additions Motivated by RPS Policies[28]

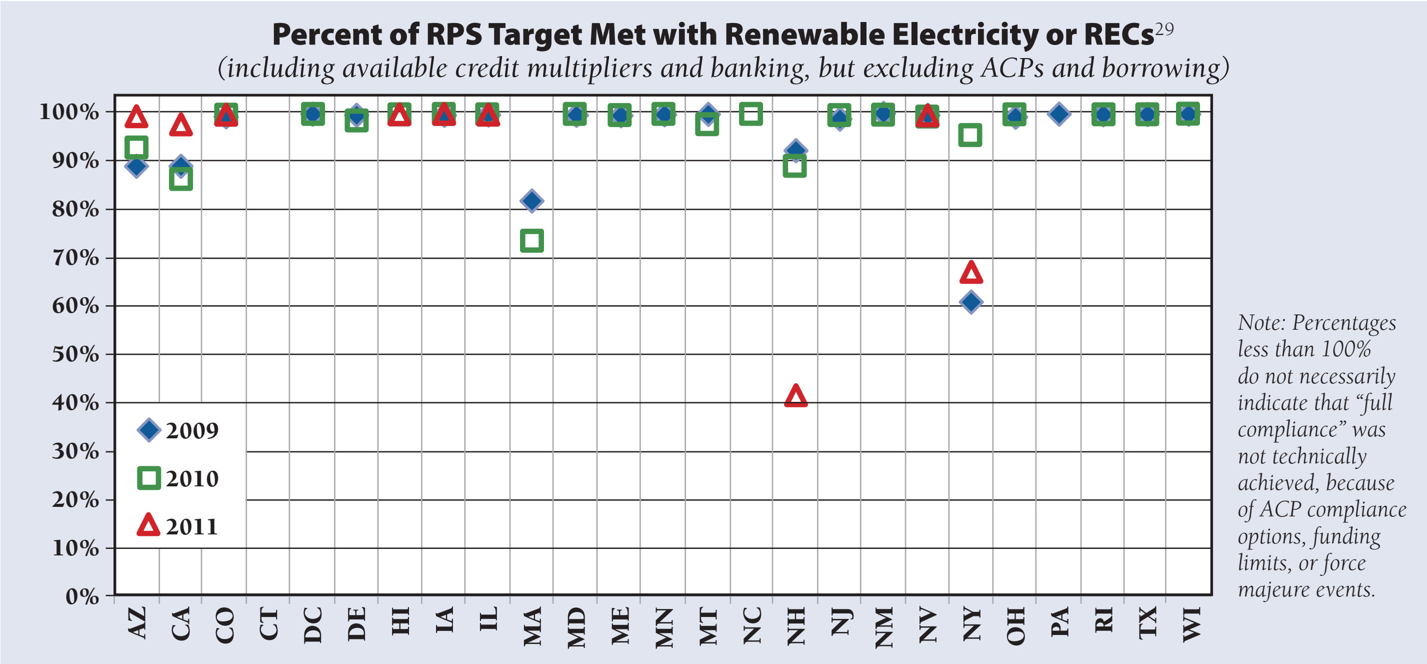


**Renewable additions are counted as "RPS-motivated" if and only if they are located in a state with an RPS policy and commercial operation began no more than one year before the first year of RPS compliance obligations in that state. On an energy (as opposed to capacity) basis, wind energy represents approximately 86%, biomass 8%, geothermal 3%, and solar 3% of cumulative RPS-motivated renewable energy additions from 1998-2011, if estimated based on assumed capacity factors.*

27 Supra footnote 9.

28 Ibid.

Figure 16-4



are credited with the addition of 46,000 MW of new renewable generation.[30] Between 1998 and 2011, most of the renewable capacity additions in the United States (63 percent) occurred in states with an RPS.[31] Figure 16-3 summarizes the amount of renewable capacity additions that were motivated by state RPS policies, as determined by LBNL.

Experience to date also indicates very high levels of compliance with state RPS policies, as summarized in Figure 16-4.

As noted earlier, RPS policies are not the only means of influencing RE procurement. EPS policies, or similar policies that create incentives for utilities to procure energy from better-performing generating units, have been adopted in six states. In California, Oregon, and Washington, the EPS policy specifies emissions limits applicable to the construction of new power plants and to procurement of

Colorado – Renewable Portfolio Standards

In 2004, Colorado became the first state to adopt an RPS via ballot initiative. The standard initially applied only to the state's investor-owned utilities, but was extended to cover electric cooperatives in March of 2007. At that juncture, the state also expanded the range of eligible renewable technologies consistent with the standard. Further modifications and expansion of the program took place in 2013. Each successive action to update and expand the goals has been the result of changes to state statutes. The yearly RPS schedule for investor-owned utilities is currently as follows:

- 3 percent of retail sales procured from eligible renewable resources for the year 2007;
- 5 percent for the years 2008 to 2010;
- 12 percent for the years 2011 to 2014;
- 20 percent for the years 2015 to 2019; and
- 30 percent for the year 2020 and thereafter.[32]

The RPS requirements established a different schedule for electric cooperatives and municipal utilities. Separate procurement requirements were established specifically for distributed generation.

Special multipliers were established for solar projects, community-based projects, in-state generation, and projects implemented prior to 2014 such that more than one REC is awarded per MWh of generation from those resources.

RECs can be applied to meet the standard.

29 Supra footnote 9. "ACP" refers to alternative compliance payments used for compliance in lieu of renewable electricity or RECs.

30 Heeter, J., Barbose, G., Bird, L., Weaver, S., Flores-Espino, F., Kuskova-Burns, K., & Wiser, R. (2014, May). *A Survey of State-Level Cost and Benefit Estimates of Renewable Portfolio Standards.* National Renewable Energy Laboratory and LBNL. Available at: http://emp.lbl.gov/sites/all/files/lbnl-6589e.pdf.

31 Supra footnote 9.

32 Supra footnote 25.

energy from existing power plants. Illinois, Montana, and New Mexico have policies that don't include emissions limits but instead create requirements or incentives for utilities to procure energy from new, coal-fired power plants with carbon capture and storage capabilities.[33]

Another approach that has been useful in stimulating investment in renewables is to address the initial costs of adding transmission capacity to facilitate the integration of new generating capacity. Transmissions enhancement costs may serve as a barrier to individual renewable generation projects, if the first new project that requires an enhancement is expected to pay for the enhancement. On the other hand, transmission enhancements can be an enabler of multiple renewable generation projects if they can be done cost-effectively and as part of a plan to connect resource-rich areas to customers. In 2005, Texas passed a law requiring a minimum installation of renewable generating capacity of 5880 MW by 2015 through the establishment of Competitive Renewable Energy Zones (CREZ). (California implemented a similar initiative in 2007.) The Texas law also required that the Public Utilities Commission of Texas designate CREZ throughout the state and develop a plan to construct transmission capacity necessary to deliver the output from RE technologies in the CREZ. The Electric Reliability Council of Texas, the state's market and grid operator, released a CREZ Transmission Optimization Study in 2008 that identified and quantified transmission costs of four different CREZ scenarios previously chosen by the Utilities Commission. The cost estimates for the transmission plans ranged from $2.95 billion to $6.38 billion. The Public Utilities Commission of Texas, which regulates utilities in the state, then granted approval for an approximate cost of just over $5 billion and awarded the development of the transmission plan segments to several transmission developers.[34] More discussion of transmission planning processes and how they affect GHG emissions can be found in Chapter 22.

Finally, eight states have adopted a performance-based incentive policy that involves a FIT arrangement: California, Hawaii, Maine, Minnesota, Oregon, Rhode Island, Vermont, and Washington. Some of these state policies do not apply to all utilities and retail suppliers in the state. A relatively small number of utilities that are not subject to state performance-based incentive policies also offer FITs. National data on the impact of FIT policies are currently not available, but anecdotal evidence suggests that FITs, where they are offered, can effectively motivate the deployment of a balanced mix of renewable technologies. Because FIT policies in the United States are generally targeted toward distributed renewable resources, more information on this topic will be found in Chapter 17.

4. Greenhouse Gas Emissions Reductions

The inherent potential of clean energy *technologies* to reduce GHG emissions was addressed in detail in Chapter 6, and will not be repeated here. Instead, this section will focus on some of the specifics related to clean energy *procurement policies.*

The principal difficulty in assessing the GHG reduction potential of clean energy procurement policies stems from the fact that the mix of resources that will be procured is uncertain. Some "clean" resources, notably solid biomass and any fossil fuel resources that might meet a state's definition of clean energy or satisfy a state EPS, emit GHGs in varying amounts. Other clean resources emit no GHGs at all. The expected electricity output of some clean resources can also vary with time of day or vary seasonally, as is the case for solar, wind, and hydro technologies. Projecting the emissions reductions from a procurement policy like an RPS is therefore challenging.

Regardless of the challenge, the GHG emissions reduction potential from clean energy procurement strategies like an RPS is potentially substantial. Clean energy technologies operating in the United States usually displace energy from combustion-based resources, typically fossil fuel generation. Because the observed effect of RPS policies to date has predominantly been to increase wind generation, and to a lesser extent solar and geothermal generation, the impacts of these policies can readily be approximated using representative production profiles of

33 Simpson, C., Hausauer, B., & Rao, A. (2010, August). *Research Brief: Emissions Performance Standards in Selected States.* Montpelier, VT: The Regulatory Assistance Project. Available at: http://www.raponline.org/document/download/id/250.

34 The Regulatory Assistance Project. (2011). *Securing Grids for a Sustainable Future: Case Studies.* Available at: www.raponline.org/document/download/id/4624. See also: Fink, S., Porter, K., Mudd, C., & Rogers, J. (2011, February). *A Survey of Transmission Cost Allocation Methodologies for Regional Transmission Organizations.* Exeter Associates, Inc. for the National Renewable Energy Laboratory. NREL/SR-5500-49880. Available at: http://www.nrel.gov/docs/fy11osti/49880.pdf.

these technologies. As seen in Figure 16-3, 89 percent of capacity additions associated with an RPS to date have been from wind generators, whereas only 4 percent have come from biomass technologies. However, the mix of clean resources can and does vary geographically, and that variation can shape the emissions impact of the policy.

Thus, the GHG reduction potential of clean energy procurement policies ultimately depends on the mix of resources procured, as well as the mix of fossil fuel resources that are displaced (or never procured) when clean energy generation increases. The specifics vary not just geographically but also with time (as noted in Chapter 6). Regional grid operators and ISOs may be in the best position to provide data or estimate the GHG reduction potential from the addition of specific categories of renewable technologies, considering all of these factors. These operators have developed and refined the modeling tools to conduct such analyses for their own planning purposes.

A recent analysis of PJM, the largest ISO in the United States, is instructive. Analysts from GE Energy Consulting found that the GHG reduction potential from a 30-percent renewable mix in some scenarios could lead to a 41-percent reduction in GHG emissions at the high end and a 27-percent reduction at the low end.[35]

In nearly all of the states that have RPS policies, future clean energy procurement requirements will increase well above the requirements that are in effect in 2014. This suggests that these policies will continue to drive thousands of megawatts of clean energy deployment and their contribution to GHG emissions reductions will increase with time.

5. Co-Benefits

Some of the co-benefits associated with clean energy technologies were detailed in Chapter 6 and need not be repeated here. Table 16-1 summarizes the co-benefits that are relevant to policies specifically designed to encourage procurement of utility-scale, clean energy generation resources.

6. Costs and Cost-Effectiveness

The inherent costs and cost-effectiveness of clean energy *technologies* were addressed in detail in Chapter 6, and will not be repeated here. Instead, this section will focus on some of the specifics related to clean energy *procurement policies.*

The costs and cost-effectiveness of state efforts to rely on zero and low-emission resources vary by category of technology, geographic regions of the United States, and pre-existing state and federal support for these initiatives. They can also be quite variable and depend in large measure on the characteristics of eligible resources in each procurement policy. But irrespective of those differences, one of the virtues of procurement policies used in utility regulation, notably RPS policies, is that they tend to promote competition among qualifying renewable or clean energy resources. This competition leads to the procurement of clean energy at least cost, and it also tends to promote innovation, supply chain improvements, and economies of scale that drive down the costs of clean technologies. Utility procurement initiatives have fostered the development of a thriving marketplace for clean energy. In the United States, for example, 83 percent of all wind generation is owned by independent power producers, and 95 percent of new wind power capacity installed in 2013 was developed by independent power producers.[36] RPSs have also promoted a competitive market for the trading of RECs that similarly serves to drive down the costs of RECs and thus the costs of RPS compliance.

The National Renewable Energy Laboratory and LBNL recently completed the most comprehensive review to date of the incremental costs of state RPS policies.[37] The methodology used to estimate costs in these studies most closely reflects the incremental costs to the utility of complying with the policy, as might be reflected in rates, rather than the costs to society as a whole. Figure 16-5 provides a state-by-state visual summary of these costs alongside state objectives.

In most regions of the country, the RPS obligations have been met primarily with wind generation (see Figure 16-3). In those cases, the costs of the RPS can be viewed as strongly correlated with the costs of new wind energy

35 General Electric International, Inc. (2014, February). *PJM Renewable Integration Study.* Available at: http://www.pjm.com/~/media/committees-groups/committees/mic/20140303/20140303-pris-executive-summary.ashx.

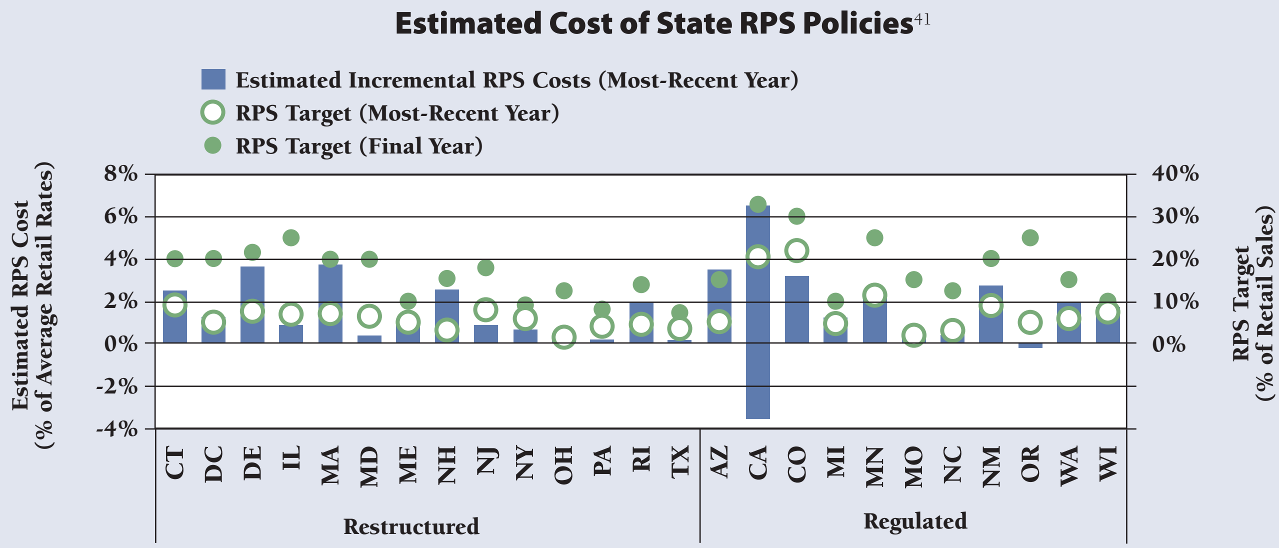
36 Wiser, R., & Bolinger, M. (2014, August). *2013 Wind Technologies Market Report.* LBNL for the US Department of Energy, p. vi. Available at: http://eetd.lbl.gov/sites/all/files/2013_wind_technologies_market_report_final3.pdf.

37 Supra footnote 30.

Table 16-1

Types of Co-Benefits Potentially Associated With Clean Energy Procurement Requirements	
Type of Co-Benefit	**Provided by This Policy or Technology?**
Benefits to Society	
Non-GHG Air Quality Impacts	*Yes*[38]
Nitrogen Oxides	*Yes*
Sulfur Dioxide	*Yes*
Particulate Matter	*Yes*
Mercury	*Yes*
Other	*Yes*
Water Quantity and Quality Impacts	*Yes – varies by technology*
Coal Ash Ponds and Coal Combustion Residuals	*Yes*
Employment Impacts	*Yes – varies at the local level*
Economic Development	*Yes (the economic development impacts will vary at the local and regional level and can be positive or negative)*[39]
Other Economic Considerations	*Maybe*
Societal Risk and Energy Security	*Yes*
Reduction of Effects of Termination of Service	*Only for some customer-owned distributed generation*
Avoidance of Uncollectible Bills for Utilities	*Likely limited*
Benefits to the Utility System	
Avoided Production Capacity Costs	*No*
Avoided Production Energy Costs	*Yes – the primary technologies relied on (wind and solar) are typically capital-intensive and with no energy and small operating costs*
Avoided Costs of Existing Environmental Regulations	*Yes*
Avoided Costs of Future Environmental Regulations	*Yes*
Avoided Transmission Capacity Costs	*Not generally – transmission capacity may be needed to help increase system flexibility to accommodate certain categories of variable energy resources*
Avoided Distribution Capacity Costs	*Generally applies for low to moderate levels of distributed generation and varies by technology*
Avoided Line Losses	*Generally applies for low to moderate levels of distributed generation and varies by technology*
Avoided Reserves	*No – the details matter, but the addition of variable energy resources, in isolation of other changes, could increase the need for more system flexibility and capacity during periods of system stress*
Avoided Risk	*Yes, but specific risks are particular to the circumstances*
Increased Reliability	*Maybe*
Displacement of Renewable Resource Obligation	*No*
Reduced Credit and Collection Costs	*No*
Price Suppression Effect	*The addition of variable energy renewables is typically associated with wholesale price reduction and stabilization effects*[40]
Other	*No, in most cases*

Figure 16-5



**For most states shown, the most-recent year RPS cost and target data are for 2012; exceptions are CA (2011), MN (2010), and WI (2010). MA does not have single terminal year for its RPS; the final-year target shown is based on 2020. For CA, high and low cost estimates are shown, reflecting the alternate methodologies employed by the CPUC and utilities. Excluded from the chart are those states without available data on historical incremental RPS costs (KS, HI, IA, MT, NV). The values shown for RPS targets exclude any secondary RPS tiers (e.g., for pre-existing resources). For most regulated states, RPS targets shown for the most-recent historical year represent actual RPS procurement percentages in those years, but for MO and OR represent REC retirements (for consistency with the cost data).*

contracts over and above the costs of alternative market-based technologies, likely natural gas in most regions.[42] But as noted in Chapter 6, the costs of wind power have decreased over time and are increasingly competitive with all other technologies; thus, in an increasing number of cases the incremental cost of procuring wind energy is zero.

Some states have created specific requirements for solar energy procurement within a broader RPS policy. These kinds of "set-aside" or "carve-out" requirements were designed to increase procurement from what is still a more expensive resource than wind in most locations, and thus they generally increase the overall cost of an RPS policy. As solar costs decrease (refer again to Chapter 6), the incremental costs of a solar set-aside policy will decrease.[43]

Many state RPS policies include a legislated cap on compliance costs, expressed in either of two common ways. First, some policies automatically suspend compliance requirements, or allow the regulated entity to request suspension of compliance requirements, if the costs of compliance exceed some specified amount (typically a value roughly equal to six to nine percent of retail rates). Second, some policies allow regulated entities to comply by making an alternative compliance payment (ACP), which requires a payment of some specified amount for each MWh that the obligated entity falls short of its RPS target.[44] The ACP sets a *de facto* cap on compliance costs.

In summary, the costs of an RPS policy depend critically on three important factors among many others that affect the costs and cost-effectiveness of the policy. The first factor is the resource base. Even ambitious targets like those of Minnesota and Oregon can be met with modest impacts on rates if there are ample resources. Both states appear to be

38 Non-GHG impacts will vary with respect to generation technologies that rely on biomass or fossil fuel resources that qualify under some state RPS policies.

39 One survey suggested an economic development benefit range of between $22 and $30 per MWh. Supra footnote 30 at page vii.

40 One survey estimated the impacts at about $1/MWh of total wholesale generation in specific markets. Ibid.

41 Ibid.

42 Oregon, for example, uses a natural gas combined-cycle generator as the proxy (counterfactual) generator for estimating incremental costs. Michigan, on the other hand, relies on coal generation as a proxy.

43 A graphic representation of the solar REC price levels can be seen in various LBNL presentations on the topic. See, for example: Supra footnote 9.

44 Supra footnote 30.

in proximity of good wind resources. Second, the targets themselves can be a factor. Massachusetts and Colorado, for example, have relatively ambitious near-term targets and are seeing a larger effect on rates. Third, cost mitigation strategies can be a factor. Most states have established an alternative compliance payment framework that serves to cap the cost impacts at the level of the alternative compliance payment.[45]

7. Other Considerations

Most of the considerations associated with clean energy *technologies* were discussed in Chapter 6 and need not be repeated here. One additional point that is associated specifically with *procurement policies* is that the policies can be (and in some cases, have been) designed to simultaneously meet multiple public policy objectives. Some states, for example, have designed their policies to favor instate deployment of clean energy resources in the hope of spurring economic development.[46]

8. For More Information

Interested readers may wish to consult the following reference documents for more information on clean energy procurement requirements:

- Barbose, G. (2012, December). *Renewables Portfolio Standards in the United States: A Status Update.* Presented at 2012 National Summit on RPS, Washington D.C. Available at: http://www.cesa.org/assets/2012-Files/RPS/RPS-SummitDec2012Barbose.pdf.
- Simpson, C., Hausauer, B., & Rao, A.. (2010, August). *Research Brief: Emissions Performance Standards in Selected States.* Montpelier, VT: The Regulatory Assistance Project. Available at: http://www.raponline.org/document/download/id/250.
- General Electric International, Inc. (2014, February). *PJM Renewable Integration Study.* Available at: http://www.pjm.com/~/media/committees-groups/committees/mic/20140303/20140303-pris-executive-summary.ashx.
- Heeter, J., Barbose, G., Bird, L., Weaver, S., Flores-Espino, F., Kuskova-Burns, K., & Wiser, R. (2014, May). *A Survey of State-Level Cost and Benefit Estimates of Renewable Portfolio Standards.* National Renewable Energy Laboratory and Lawrence Berkeley National Laboratory. Available at: http://emp.lbl.gov/sites/all/files/lbnl-6589e.pdf.
- North Carolina State University. (2014). *Database of State Incentives for Renewables & Efficiency (DSIRE).* Available at: www.dsireusa.org.
- Sheaffer, P. (2011, September). *Interconnection of Distributed Generation to Utility Systems: Recommendations for Technical Requirements, Procedures and Agreements, and Emerging Issues.* Montpelier, VT: The Regulatory Assistance Project, page 7. Available at: http://www.raponline.org/document/download/id/4572.
- US Environmental Protection Agency. (2014, June). *GHG Abatement Measures – Technical Support Document (TSD) for Carbon Pollution Guidelines for Existing Power Plants: Emission Guidelines for Greenhouse Gas Emissions from Existing Stationary Sources: Electric Utility Generating Units.* Docket ID No. EPA-HQ-OAR-2013-0602. Available at: http://www2.epa.gov/carbon-pollution-standards/clean-power-plan-proposed-rule-ghg-abatement-measures.

9. Summary

The last decade has been marked by the widespread introduction and expansion of renewable and clean energy procurement requirements, in particular RPS policies, which now exist in a majority of states. Purchase obligations imposed on utilities and retail suppliers by state governments have been arguably the most successful legal and regulatory policy mechanism for spurring growth in clean energy technology deployment, especially wind turbine deployment. In most states, regulated entities have shown a willingness and ability to comply with procurement requirements. Evidence suggests that RPS policies have led to small increases in retail electricity rates where they exist, in most cases amounting to an increase of less than two percent.

45 For a summary of alternative compliance payment levels across all state RPS policies, refer to: http://www.dsireusa.org/rpsdata/RPSspread042213.xlsx.

46 It is worth noting that policies that explicitly favor instate resources over imported resources have been questioned on constitutional grounds.