Renewables

Costs and Benefits of U.S. Renewables Portfolio Standards

By Galen Barbose, Jenny Heeter, Lori Bird, Samantha Weaver, Francisco Flores-Espino, and Ryan Wiser*

Renewables portfolio standards (RPS) obligate electricity suppliers to procure a specified amount of electricity from renewable sources, often with increasing targets over time. Adopted by 29 states, Washington D.C., and Puerto Rico, RPS policies have helped spur a roughly eightfold increase in U.S. renewable generation capacity over the past decade. Still, concerns exist about the effect of these policies on electricity costs and the economy. At least a dozen states have proposed repealing, reducing, or freezing RPS requirements over the past several years. At the same time, other recent legislative proposals have sought to expand state RPS policies. Understanding the actual historical costs and benefits of existing RPS policies is critical to informing these legislative debates, but the subject is poorly understood. To inform the debate, we examined the historical and potential future costs of RPS programs as well as key issues surrounding cost-estimation methods. We published our findings in the 2014 report, *A Survey of State-Level Cost and Benefit Estimates of Renewable Portfolio Standards*.[1] That report also synthesizes recent estimates of the broader societal benefits of state RPS programs, though those findings are not summarized here. Compared to the summary of estimated RPS costs, the summary of RPS benefits is more limited, as relatively few states have undertaken detailed benefits estimates, and then only for a few types of potential policy impacts. In some cases, the same impacts may be captured in the assessment of costs. For these reasons, and because methodologies and level of rigor vary widely, direct comparisons between the estimates of benefits and costs are challenging.

Estimating Incremental RPS Compliance Costs

We present estimated RPS compliance costs for 25 states with data available for the 2010–2012 period. The analysis focuses specifically on the *incremental* cost to the utility—the above-market cost or the cost of RPS resources "net" of the avoided costs of non-renewable generation. Incremental costs are estimated using different approaches, depending on the retail electricity market structure of each state.[2] Restructured states achieve RPS compliance principally through purchasing renewable energy certificates (RECs), which represent the renewable energy "attribute" and are a commodity separate from the underlying electricity. We estimate RPS compliance costs for those states based on REC and alternative compliance payment (ACP) prices and volumes.[3] In contrast, states with traditionally regulated electricity markets typically achieve RPS compliance through long-term power-purchase agreements or utility-owned renewable generation facilities encompassing both the REC and the underlying electricity commodity. Estimating incremental costs for regulated states is more complicated, requiring a comparison of the gross cost of RPS procurement against the cost of resources that would have been procured but for the RPS. For those states, we synthesize compliance-cost estimates published by utilities and regulators, which rely on widely varying methods and conventions.

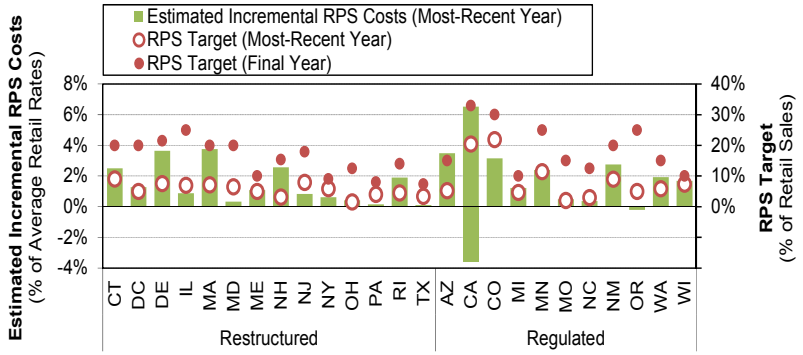
We estimate incremental costs in terms of two metrics: dollars per megawatt-hour ($/MWh) of renewable energy required or procured, and percent of average statewide retail electricity rates. The first metric represents the average incremental cost per unit of renewable electricity used for RPS compliance compared to conventional generation. It answers the question: On average, how much more was paid for each unit of renewable energy than would otherwise have been paid? The second metric represents the dollar magnitude of RPS compliance costs relative to the total cost of retail electricity service (generation, transmission, and distribution). It answers the questions: How significant are RPS costs compared to the overall cost of retail electricity service, and what impact would that have on retail electricity prices and consumer electricity bills were those costs passed fully and immediately to customers?

Results: Incremental Costs are Typically Less Than 2% of Average Retail Rates

Incremental costs per unit of renewable electricity generation ranged from -$4/MWh in Oregon (i.e., a net savings) to upwards of $60/MWh in Ohio, with costs in most states and years below $20/MWh. When multiplied over the volume of renewable energy purchased and divided by average retail electricity rates, these costs typically constituted less than 2% of average retail rates (as illustrated in

* Galen Barbose, Samantha Weaver, and Ryan Wiser are with Lawrence Berkeley National Laboratory. Jenny Heeter, Lori Bird, and Francisco Flores-Espino are with the National Renewable Energy Laboratory. Mr. Barbose may be reached at glbarbose@lbl.gov
See footnotes on page 32.

the figure, which shows costs for the most recent year available). That said, substantial variation clearly exists, which is due to several factors. RPS costs are partly a function of the RPS target (the open circles in the figure)—higher costs occurred in states with more aggressive targets and lower costs in states with more modest targets. In restructured states, cost variation also reflects differences in REC pricing, which can be volatile depending on whether the available REC supply is greater or less than the compliance target in a particular year. The structure of the target also affects compliance costs; in particular, costs can be higher in states with large solar or distributed-generation set-asides, given the relatively high cost of such resources. Utilities in regulated states often procure solar or distributed-generation resource credits through rebates or other financial incentives, which "front loads" the costs. Methodological differences also contribute to cost variation across regulated states. For example, compliance costs tend to be relatively high when calculated by comparing gross renewable energy procurement costs to contemporaneous wholesale electricity market prices. As a case in point, California used two alternate methods, which produced very different cost estimates.



** 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).*

Estimated incremental RPS costs compared to recent and future RPS targets[4]

RPS targets in most states are scheduled to increase, often substantially, by the final program year (the solid circles in the figure). Those rising targets could put upward pressure on RPS compliance costs; however, future compliance costs will depend on many factors, such as underlying renewable energy technology cost trends, natural gas prices, federal tax incentives, and environmental regulations. Cost-containment mechanisms, which are built into many state RPS policies, are an important limiting factor. Many states, for example, cap RPS compliance costs with ACP mechanisms; future RPS costs in those states are generally capped at less than 6%–9% of average retail rates. Cost-containment mechanisms in other states are generally more stringent, typically limiting future compliance costs to less than 4% of average retail rates, and in some instances have already become binding.

Conclusions: RPS Costs Appear Modest, but Improved Data and Methods are Needed

States have largely complied with RPS targets thus far. Based on our data, they appear to have done so with modest impacts on retail electricity rates. Because of the limitations of the underlying data and methods, however, those findings must be interpreted with caution. For example, the incremental cost estimates for many states omit potentially important costs (such as renewable energy integration costs) and some benefits to customers (such as wholesale electricity market price and natural gas price suppression). These data also neglect broader societal costs and benefits, which may be important for evaluating RPS programs as public policies.

We anticipate that evaluating RPS costs and benefits—and the associated impacts on economic growth—will become even more important as RPS targets rise and cost caps increasingly become binding (potentially curtailing achievement of RPS targets). As our analysis reveals, however, the methods and quality of data available for analyzing RPS costs vary widely. Those data and methods must be improved to meet the emerging analytical demands of utilities and regulators as they assess the costs and benefits of RPS policies.

See footnotes on page 32