The Intended and Unintended Consequences of Renewable Portfolio Standards

By Gregory B. Upton Jr .and Brian F. Snyder*

Introduction

Over the past two decades, the federal government and many state governments have implemented a wide array of policies aimed at reducing the CO_2 intensity of the electricity sector by increasing the market penetration of renewable energy technology. Renewable portfolio standards (RPSs) are state-level policies in the U.S. that require a proportion of state electrical generation be produced by renewable sources. RPSs target electric utilities and require that they comply with the regulatory mandate, typically including a system of renewable energy credits (RECs) in which renewable energy providers generate one REC for every MWh of renewable electricity produced. RECs can be bought and sold independently of the electricity to help electricity providers meet their RPS obligations.[1] To date, thirty states have implemented RPSs. There are a number of potential impacts of RPSs on statewide electricity markets, both intended and unintended. This article will discuss recent research on RPSs and in particular focus on recent research presented at the 2015 IAEE conference in Antalya Turkey.[2]

Potential Impacts of RPS on Electricity Markets

There are three potential hypotheses on the impact of RPSs on renewable energy generation and electricity prices. The first hypothesis is based on the assumption that renewable energy generation is more expensive than traditional fossil fuel or nuclear powered generation, and therefore, increases in renewable energy generation spurred by an RPS will lead to increases in electricity prices. Thus, the first hypothesis is that RPSs will lead to increases in both renewable energy generation and electricity prices. Both proponents[3] and opponents[4] of RPSs have acknowledged that higher electricity prices are a likely side effect of RPSs.

The second hypothesis is that RPSs will neither lead to increases in electricity rates nor renewable energy generation. RPSs are just one mechanism that allows state utility commissions to approve utility scale renewable energy projects. While an RPS legislatively puts a very specific renewable energy target in place, the normal regulatory framework in most states already allows regulators to approve relatively expensive renewable projects and pass these costs onto ratepayers. Therefore, both RPS and non-RPS states might experience increases in renewable energy generation and electricity prices due to the implementation of renewable energy projects.

The third hypothesis is that RPSs lead to increases in electricity prices but do not increase renewable energy generation. There are two potential explanations for why this is plausible. First, the mechanism by which RPSs spur renewable energy generation is through renewable energy credit (REC) markets. Utilities have the choice to either produce enough renewable energy themselves to meet the RPS requirement and retire the RECs at the end of the year, or to purchase the needed RECs from the market. RECs purchased on the market may be generated within the state, or in some cases, may be imported from other states. While some states have attempted to limit RECs such that they can only be produced in-state, utilities have been known to import RECs from out of state[5], therefore subsidizing renewable generation in surrounding states while passing the cost onto in-state ratepayers.

Second, there are multiple potential funding sources for renewable energy, only one of which is higher electricity prices. When a utility builds more expensive renewable capacity, or purchases RECs from the market, this cost is passed onto ratepayers in the form of higher electricity prices. But this is not the only mechanism by which a state can choose to incent renewable energy generation; the obvious alternative is direct taxing and spending. For instance, many states without RPS policies have implemented other financial incentives such as property tax exemptions for utility scale renewable energy projects (Nebraska, Tennessee), sales tax exemptions for expenditures associated with renewable energy projects (Georgia, Utah) or state renewable production tax credits (Nebraska, Oklahoma, South Carolina, Utah) that serve as direct subsidies to renewable projects. These states might still experience increases in renewable energy generation and still have to pay a premium for this generation, but the cost passes through to taxpayers through the form of increased taxes or decreased spending on other government services—not increased electricity rates.

RPSs also have the potential to impact CO_2 emissions associated with electricity generation. There are two potential mechanisms through which CO_2 emis-

* Greg Upton is Assistant Professor and Brian Snyder is Research Associate at the Louisiana State University Center for Energy Studies. Corresponding author: Greg Upton. E-mail: gupton3@tigers.lsu.edu
See footnotes at end of text.

sions can plausibly be reduced. First, if emission free renewable energy generation displaces fossil fuel electricity sources, then CO_2 emissions associated with electricity generation would logically decrease. This effect is through the *supply side* of the electricity market. The second mechanism that could cause RPSs to decrease CO_2 emissions is through the *demand side* of the electricity market. If electricity prices increase after an RPS is implemented, basic economic theory predicts that a decrease in electricity demand will also occur and therefore a decrease in emissions.

Prior Empirical Estimates

Due to the number of plausible scenarios discussed above, understanding RPSs impact on electricity markets is therefore an empirical question and has been analyzed in a number of studies. For instance, a number of studies test the impact of RPSs on renewable energy capacity[6] and while results have varied, have generally found that RPS states have relatively more renewable energy generation to non-RPS states. Recently, there have also been empirical studies that have analyzed the potential impact of RPSs on CO_2 emissions.[7] These studies have found that RPS states have lower CO_2 emissions than non-RPS states.

While there have been no empirical tests to examine the impact of RPSs on electricity prices, theoretical models suggest that RPSs will lead to increases in electricity prices of about 2 to 3 percent.[8] Due to the estimated long run elasticity of demand of approximately -.5,[9] this implies that we should also see a reduction in electricity demand by 1 to 1.5 percent.

Nonrandom selection into policy serves as a threat to our ability to unbiasedly estimate the impact of RPSs on these outcomes of interest.[10] For instance, if states that are comprised of citizens concerned about emissions reductions are more likely to implement an RPS, but are also more likely to (a) pass other policies that aim to reduce emissions and (b) whose citizens make personal lifestyle chances to reduce their personal carbon footprint, then any decrease in emissions observed after an RPS is passed might be associated with these other factors—not the RPS. Similar logic can be applied for each outcome of interest. For this reason, careful attention must be given to non-random policy adoption, as changes in outcomes in RPS states relative to non-RPS states after adoption are *not* necessarily due to the implementation of the RPS. Empirical microeconomists refer to this phenomenon as *endogenous policy adoption* and a large literature has emerged that addresses this issue.

Results

After addressing non-random selection through a number of empirical techniques, placebo treatment tests and falsification tests, we find that RPSs lead to an increase in electricity prices by approximately .9-1¢/kwh, or about 12-13 percent. We also estimate that energy demand decreases by approximately 7 percent due to the price increase induced by the RPS. The implied elasticity of demand comparing the change in electricity prices and electricity demand is similar to prior empirical estimates. We find no evidence that RPSs have led to increases in renewable energy generation and weak evidence that RPSs are associated with declines in CO_2 emissions of 3 to 4 percent. Due to lack of evidence of RPSs increasing renewable energy generation, any reductions in CO_2 emissions are therefore likely associated with the observed decrease in electricity demand.

Conclusions

The results of this research have profound policy implications. RPS states have chosen to fund renewable energy through increased electricity prices, while other states have also chosen to fund renewable energy generation, but have done so through other channels. The obvious alternative channel is taxing and spending. Who bears the burden of increased costs associated with electricity generation should be considered when implementing policies aimed at funding renewable energy.

Footnotes

[1] Mack, Joel H., Natasha Gianvecchio, Marc T. Campopiano, and Suzanne M. Logan, "All RECs are Local: How In-State Generation Requirements Adversely Affect Development of a Robust REC Market," *The Electricity Journal*, *24* (4), 8-25.

[2] Upton Jr, B. Gregory, Brian E. Snyder, "Funding Renewable Energy: An Analysis of Renewable Portfolio Standards." *LSU Center for Energy Studies Working Paper.*

[3] Nogee, Alan, Steven Clemmer, Bentham Paulos, and Brent Haddad, "Powerful Solutions. 7 Ways to Switch America to Renewable Electricity," Technical Report, Union of Concerned Scientists 1999.

(footnotes continued on page 15)