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Background

Ohio's foray into renewable energy began in 1999, when the city of Bowling Green, along with nine other communities, began a wind energy project. Four years later, construction began in Bowling Green with the erection of two wind turbines, and two more followed in 2004. The four-turbine system could purportedly produce around seven megawatts of power, or about enough to power about 1,850 homes.[1] Today, the Bowling Green farm is one of several in the state.

In an effort to grow Ohio's renewable energy sector, Governor Ted Strickland included an RPS in his 2007 "Energy, Jobs, and Progress" plan. In response to the Governor's proposal to promote the use of renewable resources in Ohio, and restructure the regulatory system under which utility companies were then operating, legislators fashioned SB 221, which passed with near unanimous votes in both the state House and Senate.[2] Governor Strickland then signed the RPS bill into law in 2008, officially creating Ohio's Alternative Energy Portfolio Standard (AEPS).[3] In 2014, however, the Legislature passed SB 310, placing a freeze on required renewable energy ramp-ups and making Ohio the first state to scale back its RPS.[4]

When Ohio's AEPS first passed in 2008, it commanded utility companies to derive 25 percent of their energy from renewable resources by 2025. Half of that standard was to be met with "advanced" generating sources, i.e., "any new, retrofitted, refueled, or repowered generating facility located in Ohio," including fossil fuels, or any other sources that do not contribute extra carbon dioxide emissions to the atmosphere. The other half of the standard was to be met using renewables.[5] It also required utilities to implement energy efficiency and peak demand reduction programs. These programs had to achieve a cumulative energy savings of 22 percent by the end of 2025, and reduce peak demand by 1.0 percent in 2009 and 0.75 percent annually thereafter, through 2018.

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[1] Downing, B. (2010, January 10). Bowling Green wind farm might grow. Akron Beacon Journal. Retrieved from http://www.ohio.com/news/bowling-green-wind-farm-might-grow-1.161553. We note that capacity figures do not exactly reflect the actual amount of electricity sold to ratepayers, meaning such figures are inherently overoptimistic.

[2] Bricker & Eckler LLP. (2008). Ohio Senate Bill 221: A summary of its advanced energy and energy efficiency provisions. Retrieved from http://documents.lexology.com/23dba353-7d43-4e88-9db9-f414875607d5.pdf

[3] Ohio General Assembly. (n.d.a). Status Report of Legislation, 127th General Assembly, SB 221. Retrieved from http://lsc.state.oh.us/coderev/sen127.nsf/Senate+Bill+Number/0221?OpenDocument

[4] Ohio General Assembly. (n.d.b). Status Report of Legislation, 130th General Assembly, SB 310. Retrieved from http://lsc.state.oh.us/coderev/sen130.nsf/Senate+Bill+Number/0310?OpenDocument

[5] United States Department of Energy. (2014). Database of state incentives for renewables & efficiency. Retrieved from http://programs.dsireusa.org/system/program/detail/2934/

Ohio legislators also included a list of qualifying renewable technologies as a part of the AEPS. Those technologies include solar thermal and photovoltaics, landfill gas, wind, biomass, hydroelectric, geothermal, municipal solid waste, CHP/cogeneration, waste heat, energy storage, clean coal, coal mine methane, advanced nuclear, anaerobic digestion, fuel cells using renewable fuels, and microturbines.[6]

SB 310 put a two-year freeze on the mandates, pushing the final benchmark year back to 2026. In addition, it removed in-state requirements for renewable energy procurement, meaning utilities could use as much electricity generated out of state as is needed to satisfy the AEPS.[7] During the two-year freeze, a committee will study the target goals of the RPS and make changes if they feel the requirements have been set too high. It is imperative that the committee and Legislature have access to sound information prior to further dialogue and decisions over Ohio's Renewable Portfolio Standards.[8]

There have been scarcely any examples of such controversies creating the requisite political pressure to repeal a law so quickly after first passage, but SB 310 is indicative of a climate conducive to such action. The bill is notable for a few reasons: Not only is it the first and only successful piece of legislation in the United States to scale back an already-existing RPS, but the timing with which it appeared is unprecedented, as it was passed just a few years after near unanimous acceptance of SB 221.[9] Such occurrences are rare opportunities to inform the public and decisions makers on the merits of RPS. The following sections of our report—detailing the results of our analyses—will be crucial toward that end.

Results

Empirical Analysis: State Coincident Event Study

Using an event study for state coincident indices—a methodology first fashioned by the Federal Reserve Bank of Philadelphia.[10] The event study indexes the economic conditions of all states across multiple points in time, and assigns as "point zero" each state's economic conditions on the dates of their respective RPS implementations. The study compares said economic conditions over a span from 48 months before to 48 months after that enactment date. The indices of each state RPS policy, therefore, while enacted in different calendar months and years, can thus be lined up in this so-called "event time," and the economic conditions in each state can be averaged. Given that RPS have been implemented in many states over a long period, this will minimize the effects of anomalies such as recessions and the enactment of

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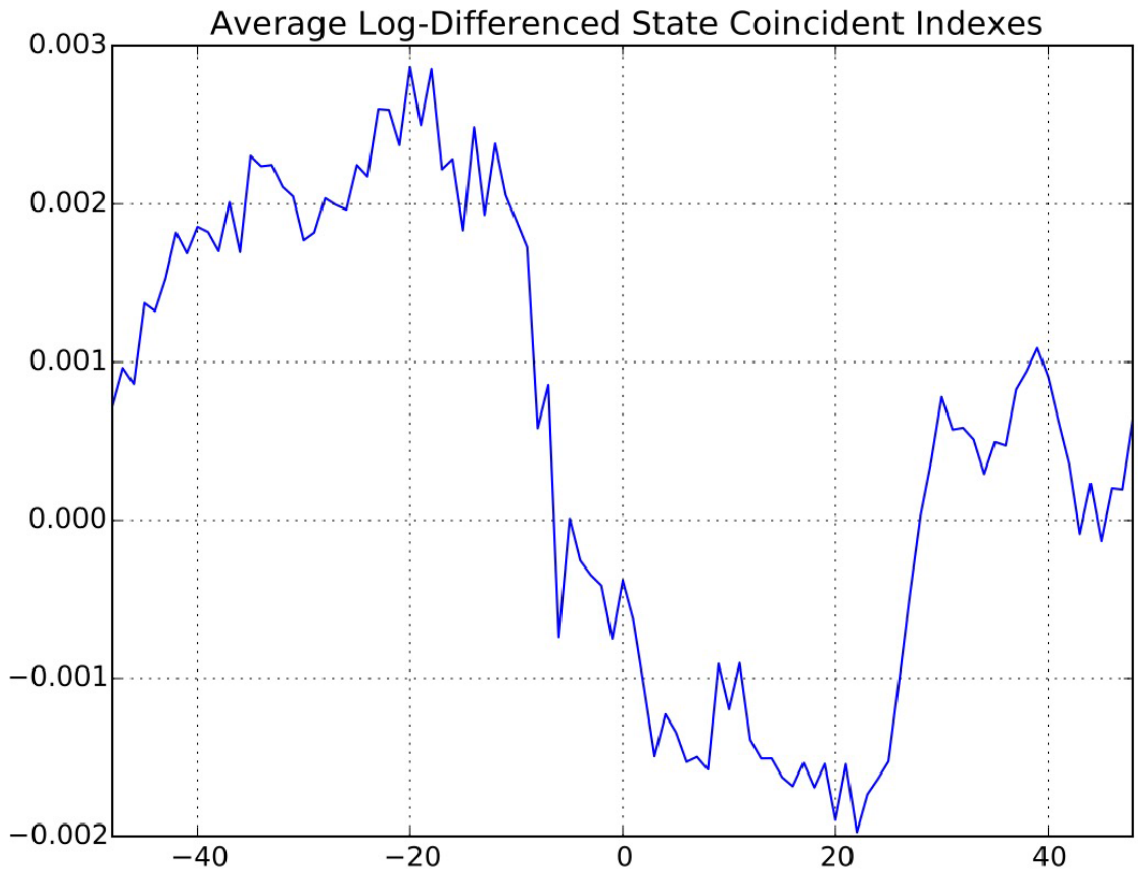
[6] *Ibid.*
[7] *Ibid.*
[8] Ohio General Assembly (n.d.b), op. cit.
[9] Gallucci, M. (2014, June 11). Ohio Gov. Kasich to sign "freeze" on state clean energy mandate by Saturday. International Business Times. Retrieved from http://www.ibtimes.com/ohio-gov-kasich-sign-freeze-state-clean-energy-mandate-saturday-1598602
[10] Federal Reserve Bank of Philadelphia. (2015, January 29). State coincident indexes. Retrieved from http://www.philadelphiafed.org/research-and-data/regional-economy/indexes/coincident/

other energy-related laws. For these reasons, the event study has become a time-honored empirical methodology in finance and economics and a standard course of analysis for the Philadelphia Fed. It is a simple but powerful method for measuring the effect of an exogenous shock to an economic variable of interest. MacKinlay gives an in-depth discussion of the event study methodology.[11]

The results of the event study are presented in Figure 1, wherein we see the response of the state coincident index to the enactment of RPS policies. The coincident index is a summary measure of the strength of a state economy, and is comprised of four economic indicators: nonfarm payroll employment, average hours worked in manufacturing, the unemployment rate, and wage and salary disbursements deflated by the Consumer Price Index (CPI).[12]

FIGURE 1: THE RESPONSE OF THE STATE COINCIDENT INDEX TO THE ENACTMENT OF RPS POLICIES.



The horizontal axis shows months before and after point zero (RPS enactment). The vertical axis shows an indexed scale measuring the average reaction of states in terms of several economic indicators.

[11] MacKinlay, A.C. (1997). Event studies in economics and finance. Journal of Economic Literature, 35(1), 13-39.
[12] Federal Reserve Bank of Philadelphia. (2015, January 29). State Coincident Indexes. Retrieved from http://www.philadelphiafed.org/research-and-data/regional-economy/indexes/coincident/

As can be seen in Figure 1, the average effect on the state coincident index is a precipitous drop surrounding the enactment of an RPS policy. This evidence is suggestive of a negative effect of an RPS policy on a state economy. While suggestive, the evidence from the event study warrants further exploration into the effects, since state economies also appear to decline several months prior to the enactment of an RPS. The next section presents the structural panel VAR-X model, which provides further evidence of the negative economic effects of an RPS.

The Structural Panel VAR-X Model

The VAR model takes into account the nature of the state macroeconomic variables that could provide unwanted feedback into the model, and considers their dynamic interactions. By including a panel dimension to the model we can include the data for multiple states in a single model. We include fixed effects to control for state-level heterogeneity. We impose a recursive causal ordering on the VAR-X model to allow for structural interpretation of dynamic multiplier analysis of the RPS policy variable. Table 1 presents the cumulative effects of an RPS on the state economy via structural policy simulations.

TABLE 1: THE LONG-RUN EFFECTS ON STATE MACROECONOMIC VARIABLES

State Economic Variable	**Long-Run Effect**
Electricity Sales	-13.7075%
Real Personal Income	-3.6369%
Non-farm Employment	-2.8416%
Manufacturing Employment	3.7454%
Unemployment Rate	9.6841%

The cumulative effect of the enactment of an RPS policy on state electricity sales is a staggering 13.7-percent decline. This is, perhaps, not surprising as the RPS increases the cost of electricity generation. Real personal income declines in the long run by 3.6369 percent, which figures to a loss of $18 billion in 2013, or $3,842 less per family.[13] Non-farm employment declines in the long run by 2.8 percent. Only one analyzed component of non-farm employment, manufacturing employment, does not experience a long-term suppression in response to an RPS policy, although as we see in the later graphical analysis, it does still experience a sharp decline in the short term. Most significantly, the state unemployment rate increases by 9.6 percent. This means that, at the end of last year, Ohio had 29,366 fewer jobs than it would have had without the RPS.[14] There can be no doubt that the combined economic effect on an RPS enactment, as measured by the structural panel VAR-X model, is a severe decline in the Ohio economy. A graphical representation of the analysis, showing the changes over time that lead to these results, can be found in Appendix C.

[13] Bureau of Economic Analysis. (n.d.). Regional Data, Annual State Personal Income and Employment. Retrieved from http://www.bea.gov/iTable/iTable.cfm?reqid=70&step=1&isuri=1&acrdn=1#reqid=70&step=1&isuri=1

[14] Bureau of Labor Statistics (n.d.). Ohio. Retrieved from http://www.bls.gov/regions/midwest/ohio.htm

Conclusions from the Empirical Analysis

We demonstrate strong empirical evidence that a Renewable Portfolio Standard has a lasting negative effect on a state economy. We present this evidence from both an event study of the state coincident index as measured by the Federal Reserve Bank of Philadelphia, as well as from structural policy simulations from a panel VAR-X model. The long-run effect of an RPS on state industrial production, as measured by electricity sales, is greater than a 13-percent decline. Real personal income declines in the long run after an RPS by almost 4 percent. The cumulative effect of an RPS on non-farm employment is nearly 3 percent. While the effect of an RPS on manufacturing employment is not as severe in the long run, it too demonstrates an initial sharp decline lasting for several years. Finally, the state unemployment rate increases in the long run in response to an RPS by nearly 10 percent. These are strong and lasting effects in 4 of the 5 variables measuring the state economy. The combined econometric evidence makes clear that an RPS policy has a severely negative economic effect on a state that enacts such.

Institutional Analysis

Our survey of the legal rules surrounding the AEPS provides a detailed account of all the regulations that hinder the state, generators, and utilities in achieving compliance. This "institutional analysis" reveals a number of factors that add arduousness to the process of complying with the requirement that electric utilities supply 25 percent of their retail electricity sales through renewable and advanced energy sources by 2026.

The Public Utilities Commission of Ohio (PUCO) uses Renewable Energy Certificates (RECs) to track utility compliance. One REC represents exactly one megawatt-hour (MWh) of electricity generated from a qualifying source, and has a lifetime of five years from the date the utility acquires it.[15]

A utility's renewable electricity obligation is equal to the AEPS' statutory requirement as applied to the preceding three-year average of a utility's total retail sales.[16] States with restructured electricity markets, i.e., where utilities trade RECs on one or more exchanges, generally follow this model, basing renewable electricity obligations on total retail sales—an alternative method being to base the obligation on total generating capacity, as is the case in Kansas—but there are some notable drawbacks with this.[17] Many utilities have expressed reservations about the historical sales volume model, which, "given customer migration, may require companies to 'over-comply' relative to current sales base […]"[18] Compensating for this

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[15] Public Utilities Commission of Ohio. (2010, January 22). Ohio Administrative Code, Chapter 4901:1-40. Retrieved from http://codes.ohio.gov/oac/4901%3A1-40

[16] *Ibid.*

[17] National Renewable Energy Laboratory. (2014, May). A survey of state-level cost and benefit estimates of Renewable Portfolio Standards. J. Heeter, G. Barbose, L. Bird, S. Weaver, F. Flores-Espino, K. Kuskova-Burns, & R. Wiser. Retrieved from http://www.nrel.gov/docs/fy14osti/61042.pdf

[18] Public Utilities Commission of Ohio. (2014). DRAFT Alternative Energy Portfolio Standard Report. Retrieved from http://dis.puc.state.oh.us/TiffToPDf/A1001001A14A14B02242C15874.pdf, p.29

risk would cause an overly large corrective reaction that ultimately slows compliance, but the equally undesirable alternative is to invest more than is necessary, translating into higher-than-necessary economic costs. At the very least, this creates uncertainty in the market, which "creates some unwillingness by companies [utilities] to enter longer-term contracts."[19] Renewable electricity generators, on the other hand, have a strong affinity for such contracts, which are integral in securing the capital investment required to build generation facilities.

The AEPS originally required utilities to meet half of their total obligations using electricity provided by facilities within Ohio, but that requirement was dropped in 2014 via SB 310, largely due to the fact that average costs for out-of-state RECs were significantly lower than for in-state RECs.[20] The underlying reason for that cost disparity—the limited supply of in-state RECs, especially solar RECs—was a concern that several Ohio utilities have expressed in their annual mandated compliance reports.[21] Although SB 310 addressed this problem, the old requirement likely contributed to utilities' solar sluggishness in the early years of the program. In 2009, utilities retired enough RECs to satisfy only 22 percent of the in-state solar requirement.[22]

The in-state generation bias was not the only self-defeating aspect of the AEPS, however. Only facilities with a placed-in-service date of January 1, 1998 or later qualify to meet the standard, excluding many older, yet working, renewable or advanced electricity generating facilities.[23]

Even forgetting the aforementioned concerns, the process of gaining approval to generate RECs is not as painless as the regulatory verbiage suggests. First, in order to qualify their alternative generation facilities under the law and generate RECs, electricity generators must submit an application to PUCO.[24] The application is operated on a 60-day auto approval process,[25] although human error and applications asking for permission to generate from new, unfamiliar, alternative technologies not covered by the law will cause appreciable delays in the approval process. Once approved, generators must then register their generated RECs with a tracking system, typically PJM Interconnection's Generation Attribute Tracking System (PJM-GATS). Only once generation facilities have been registered can generators make their RECs available for buying/selling or retirement for meeting the annual benchmarks.[26]

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[19] *Ibid.*
[20] *Ibid.*
Ohio Legislative Service Commission. (n.d.). Am. Sub. S.B. 310. Retrieved from http://www.lsc.ohio.gov/analyses130/s0310-ps-130.pdf
[21] Public Utilities Commission of Ohio. (2014). DRAFT Alternative Energy Portfolio Standard Report. Retrieved from http://dis.puc.state.oh.us/TiffToPDf/A1001001A14A14B02242C15874.pdf, p. 29
[22] Public Utilities Commission of Ohio. (2012, August 15). Alternative Energy Portfolio Standard Report by the Public Utilities Commission to the General Assembly of the State of Ohio for Compliance Years 2009 and 2010. Retrieved from http://dis.puc.state.oh.us/TiffToPDf/A1001001A12H15B51144H86168.pdf
[23] United States Department of Energy (2014), op. cit.
[24] Public Utilities Commission of Ohio (2010, January 22), op. cit.
[25] *Ibid.*
[26] *Ibid.*

Utilities that fail to meet the renewable energy benchmarks must make an Alternative Compliance Payment (ACP) to the Ohio Advanced Energy Fund, which is used to fund renewable energy and energy efficiency projects.[27] The amount due for an ACP differs depending on the type of generation source for which a utility lacks renewable electricity certificates, and the Commission updates these amounts annually. For solar RECs, the amount of the ACP is reduced by $50 every two years through 2026, to a minimum of $50. For example, in the years of 2014 through 2016, lacking a sufficient number of solar RECs results in a $300 fine per MWh deficient; for the years 2017 through 2018, and years 2019 through 2020, these ACPs will cost $250 and $200 respectively. On the other hand, failure to meet the non-solar renewable energy benchmark in 2009 resulted in a fine of only $45 per MWh deficient, and in 2014 the fine was $49.22 per MWh deficient. PUCO increases the non-solar ACP amounts in accordance with the Consumer Price Index.[28]

There are two ways utilities can exempt themselves from AEPS' requirements, but even these processes carry inherent problems. For example, utilities are exempt from the obligation to meet annual benchmarks if the cost of compliance raises costs by three percent or more above what they would have been otherwise.[29] The burden of proof in claiming that costs will exceed the cap, however, rests solely on the utility, which encumbers it with further administrative burdens.[30] Alternatively, in the event that a utility is unable to meet its annual benchmark, it may apply for a force majeure determination, temporarily excluding the utility from its requirements due to unforeseen economic circumstances and constraints. This process can take up to 90 days.[31]

During the force majeure determination process, utilities will be uncertain as to their liability—not only for the preceding year, but for the following year, since the Commission "retains the right to increase a future year's compliance obligation by the amount of any under compliance in a previous year that is attributed to a force majeure determination."[32] This can make decisions to invest alternative energy technologies both tenuous and perilous. In addition, the imposition of costs caps can, as discussed in previous reports, effectively neuter the prospects of compliance, since recovering the costs of compliance from ratepayers is a necessary action in meeting RPS benchmarks.[33,34]

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[27] *Ibid.*
[28] United States Department of Energy (2014), op. cit.
[29] Public Utilities Commission of Ohio (2010, January 22), op. cit.
[30] *Ibid.*
[31] *Ibid.*
[32] *Ibid.*
[33] Climate Policy Initiative. (2012, December). Renewable portfolio standards – the high cost of insuring against high costs. San Francisco: Brendan Pierpont. Retrieved from http://climatepolicyinitiative.org/2012/12/17/renewable-portfolio-standards-the-high-cost-of-insuring-against-high-costs/
[34] Simmons, R. T., Yonk, R. M., Brough, T., Sim, K., Fishbeck, J. (2015, February). Renewable Portfolio Standards: North Carolina. Institute of Political Economy, Utah State University. Retrieved from http://www.strata.org/wp-content/uploads/2015/03/FINAL-RPS-North-Carolina.pdf

As mentioned previously, utilities are also required to take measures to increase energy efficiency. The AEPS mandates that utilities reduce peak energy demand by one percent in 2009 and an additional 0.75 percent every year through 2018.[35] Additionally, utilities are required to achieve energy savings of 22 percent by 2025 through energy efficiency programs.[36] Consumption-side generation practices, such as net metering, can be used toward this end. For example, a qualified utility customer with a rooftop solar array will receive a credit for any generated electricity that is added to the grid. Homeowners must hassle themselves with the same application process as the larger generators, however; and net metering, specifically, presents its own set of problems in terms of trans-customer cost-shifting and grid reliability.

Conclusions from the Institutional Analysis

Even in judging the AEPS on its own terms, and assuming that all potential economic ramifications are acceptable, the legal and regulatory structure behind the AEPS makes compliance itself a difficult task; this fact does not change even in spite of the good-faith efforts made by utilities. Proponents of RPS often gloss over these considerations and assume that the mere presence of a law is solely required to effect their desired outcome. Our analysis clearly demonstrates that reality is more complicated.

Conclusion

The evidence from these studies paints a clear picture about the effects of RPS. Our tax analysis with STAMP found that Ohio's RPS will increase fiscal and economic costs significantly between now and 2026. These costs include a $1.92-billion burden on Ohio ratepayers, a loss of 3,590 jobs, a decrease in investment by $52 million, and a decrease in personal disposable income of $258 million in 2026 alone. Our empirical analysis more than corroborates these projections, finding a drop in industrial electricity sales by almost 14 percent, real personal income by almost four percent, non-farm employment by nearly three percent and an increase of 10 percent in the unemployment rate, which for Ohio equals a loss of 29,366 jobs. Our analysis of the legal rules surrounding Ohio's AEPS describes the barriers that make it difficult for utilities to comply and for bureaucracies to enforce it, finding that Ohio's excessive bureaucracy and cost caps hinder compliance by creating uncertainty and erecting political barriers to reaching the mandates. Any state currently deliberating on implementing a new RPS, or strengthening an existing one, should heed these results as a warning of their harmful effects. Finally, states should refrain from following the fad of enacting such costly regulations, in spite of the policy's political palpability or expediency.

[35] United States Department of Energy. (2014), op. cit.
[36] *Ibid.*