

The Cost of Net Zero*

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Abstract

We quantify how renewable energy mandates affect local borrowing costs. Exploiting the staggered adoption of Renewable Portfolio Standards across 32 U.S. states, we find mandates raise bond yields by 10–13 basis points. The effect is driven entirely by aggressive targets; modest targets reduce yields, indicating they resolve policy uncertainty without high costs. Consistent with an energy-cost channel, effects strengthen where electricity demand is high and disappear where wind resources are abundant. Technology-neutral Clean Energy Standards explain lower borrowing costs. Our results show that the fiscal burden of decarbonization depends on policy design, not on the commitment to decarbonize itself.

Keywords: Net zero, Renewable energy, Energy transition, Municipal finance

JEL Classification: G1, G2, H2, H7, Q4, Q5

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1 Introduction

In the absence of federal clean energy legislation, U.S. state governments have become the primary regulators of the energy transition. Thirty-two states have adopted Renewable Portfolio Standards (RPS), mandates requiring electricity providers to source minimum shares of power from renewable sources such as wind, solar, and geothermal. These policies are consequential: states have generally met their interim targets, and RPS account for approximately half of the growth in U.S. renewable energy generation ([Deschenes, Malloy, and McDonald, 2023](#)). Yet despite their central role in domestic climate policy, the fiscal consequences of these mandates for the governments that impose them are largely unknown. We provide the first evidence that renewable energy mandates materially alter the cost of capital for local governments.

The direction of this effect is theoretically ambiguous. Mandates may stimulate local economies through investment in renewable infrastructure and job creation, and they reduce uncertainty about future energy pathways ([Mai et al., 2016](#); [Zhou, Solomon, and Brown, 2024](#)). Alternatively, mandates may have little effect if energy markets can flexibly substitute across sources. On the other hand, existing evidence shows that renewables raise retail electricity prices substantially (prices increase by 11% seven years after passage and 17% after twelve years ([Greenstone and Nath, 2020](#))) and that the cost of carbon abatement through RPS is roughly four times higher than through comparable cap-and-trade programs ([Johnson, 2014](#)). When the direction of technological change is itself uncertain, market forces need not guide innovation toward efficient outcomes, leading to persistent uncertainty about future production costs ([Acemoglu, 2023](#)). Whether these costs are large enough to affect the borrowing terms of local governments is an open empirical question.

Using secondary market municipal bond transactions from 2005 to 2024, we find that implementing an RPS raises yields by 10 to 13 basis points. However, this average masks much heterogeneity. The effect is driven entirely by states with aggressive targets requiring rapid increases to high renewable thresholds. States adopting modest targets actually experience yield *reductions* of 5 to 7 basis points relative to states without mandates, suggesting that modest commitments occupy a favorable position: they resolve policy uncertainty about future energy pathways without imposing disproportionate compliance costs. Aggressive mandates, while also reducing uncertainty, generate cost burdens that more than offset this benefit. We also find that aggressive mandates are associated with credit rating reductions, while modest mandates enhance credit ratings. Consistent with an energy-cost channel, RPS explain significantly higher electricity prices, particularly for residential and commercial customers. The yield effects strengthen in areas with high electricity demand and weaken where renewable resources are abundant: in counties with above-median wind generation potential, the RPS–yield relationship reverses sign and becomes statistically insignificant. We also study Clean Energy Standards (CES), a newer policy instrument adopted by 14 states that permits nuclear power, natural gas with carbon capture, and other non-renewable clean technologies to satisfy compliance obligations. CES adoption is associated with marginally lower municipal yields. Together, these findings indicate that the fiscal burden of decarbonization depends critically on policy design (specifically, on whether mandates constrain the set of permissible technologies) rather than on the commitment to decarbonize itself.

These results are economically meaningful, with magnitudes comparable to or exceeding the documented impact of sea level rise on coastal municipal debt

([Goldsmith-Pinkham et al., 2023](#)). Back-of-the-envelope calculations suggest that the yield increases attributable to RPS represent approximately \$36 billion in present value costs to local issuers. This estimate underscores projections of unfunded budgets for renewable energy credits from agencies in states like Washington, Oregon, and Illinois (see Figure A1 in the Internet Appendix). The effects emerge gradually following mandate implementation and persist over time, consistent with evidence that most renewable energy capacity additions occur more than five years after RPS legislation is passed ([Deschenes, Malloy, and McDonald, 2023](#)). Importantly, these mandates are politically fragile: Kansas and Ohio repealed their RPS during our sample, and Arizona did so shortly after. This fragility underscores both the policy uncertainty that motivates our analysis and the timeliness of studying how markets price these commitments.

Our results are robust across multiple specifications. We verify parallel pre-trends in dynamic event studies and implement stacked difference-in-differences estimators following [Cengiz et al. \(2019\)](#) and [Sun and Abraham \(2021\)](#) to address concerns about heterogeneous treatment effects in staggered designs. We also control for concurrent changes in states' legislative environments using machine learning to classify over 500,000 state laws into the thematic categories identified by [Ash, Morelli, and Vannoni \(2025\)](#), confirming that our findings reflect RPS rather than correlated legislative activity. Results persist in primary market issuance data, though magnitudes are smaller, consistent with issuers timing offerings to mitigate elevated borrowing costs.

This paper contributes to two literatures. First, we add to the growing body of research on the financial consequences of climate and energy policy. Existing work concentrates on private-sector consequences: [Matsumura, Prakash, and](#)

Vera-Muñoz (2014) document firm-value declines associated with carbon emissions, Bolton and Kacperczyk (2021) show that investors demand compensation for carbon risk, Ilhan, Sautner, and Vilkov (2021) provide evidence of carbon risk pricing in options markets, and Hong, Kubik, and Shore (2024) demonstrate that renewable mandates increase yield spreads for utilities. We extend this literature to the public sector, showing that the design of energy transition policy, not merely its existence, determines whether decarbonization raises or lowers government borrowing costs. Mandates that tightly constrain the set of permissible technologies impose measurable fiscal costs on local issuers, whereas policies that preserve technological flexibility attenuate (or even reverse) these effects. In doing so, we link the climate finance literature to public finance and demonstrate that decarbonization strategies affect not only private investment incentives, but also the borrowing costs borne by taxpayers.

Second, we contribute to the literature on determinants of the cost of local debt. The municipal bond market carries about \$4 trillion in outstanding obligations, and prior work documents that local borrowing costs respond to a wide range of political, demographic, economic, and environmental factors, including corruption (Butler, Fauver, and Mortal, 2009), population aging (Butler and Yi, 2022), corporate subsidies (Chava, Malakar, and Singh, 2024), medical marijuana (Cheng, De Franco, and Lin, 2023), the opioid crisis (Cornaggia et al., 2022), newspaper closures (Gao, Lee, and Murphy, 2020), sea level rise (Painter, 2020; Goldsmith-Pinkham et al., 2023), climate risk (Acharya et al., 2022; Kyung Auh et al., 2022), credit ratings (Cornaggia, Cornaggia, and Israelsen, 2018), natural disasters (Jerch, Kahn, and Lin, 2023), the exit of bond underwriters (Ivanov and Garrett, 2025), immigration (Cornaggia, Cornaggia, and Israelsen, 2025; Zimmerschied, 2025), and

lax cybersecurity ([Curti et al., 2024](#)). We show that state-level energy transition policies are an economically meaningful and previously unexplored determinant of local borrowing costs, with magnitudes that rival or exceed many of these established channels.

2 Institutional Background: State Governments and the Pursuit of Net Zero

A majority of countries worldwide have adopted net zero emissions targets, generally targeting full decarbonization by 2050, with some jurisdictions committing to earlier deadlines ([Becht, Pajuste, and Toniolo, 2023](#)). Within the United States, however, the federal government has been slow to translate these ambitions into binding policy. The U.S. only recently announced plans for a fully clean electrical grid by 2035 and net zero carbon emissions by 2050 ([U.S. Department of Energy, 2023](#)), but these goals are not supported by explicit, escalating targets for renewable electricity production and are not enshrined in federal law. At least 76 proposals for a national portfolio standard have been introduced in Congress, but none have become law ([Congressional Research Service, 2021](#)). The White House has also recently withdrawn the United States from the Paris Agreement ([Donald J. Trump, 2025](#)). Observers view federal clean energy goals as vague, with congressional support remaining a persistent obstacle ([Waldman, 2021](#)).

In the meantime, the goal of clean energy transition has been left primarily to state governments. As [Engel \(2006\)](#) notes, “Here it is the state governments that are actively pursuing programs to reduce emissions of greenhouse gases and sequester carbon while the federal government has adopted a nonregulatory approach, and,

many would argue, a mostly do very little approach” (pp. 1015). Renewable Portfolio Standards have emerged as states’ most common policy tool for this purpose (Thombs and Jorgenson, 2020). RPS are mandates that require electricity suppliers to provide their customers with a stated minimum share of electricity from renewable sources. In the United States, RPS are exclusively a policy tool of state governments.

Thirty-two states have adopted RPS, implemented in a staggered fashion over time. Figure 1 displays the mandated renewable percentage for all state-years, conditional on adopting an RPS at any point over the sample period. Targets range widely: California mandates that 60% of its electricity derive from renewable sources by 2030, while many states maintain more modest schedules in the range of 15–25%. Two states (Kansas and Ohio) repealed their active RPS targets during our sample, and Arizona repealed its RPS shortly after our sample ends.¹ These developments illustrate that adopting and preserving an RPS is a fragile political process. Once adopted, states frequently adjust their targets or repeal them outright, generating significant policy uncertainty.

[Insert Figure 1 here.]

States have generally met their interim RPS targets in recent years (Barbose, 2021), and these mandates have proven effective at expanding renewable capacity. Deschenes, Malloy, and McDonald (2023) find that RPS policies increase wind generation capacity by 44 percent, accounting for approximately half of the growth in U.S. renewable energy generation. However, this expansion comes at a cost. Existing evidence shows that renewables raise the cost of electric systems and retail electricity prices (Barbose et al., 2015), and these cost increases can be substantial.

¹“Arizona regulators vote to repeal state renewable energy target, efficiency rules,” Fargo (2024).

Moreover, the distribution of renewable energy resources is highly heterogeneous across the country, with some areas rich in wind potential, others in solar potential, and some with neither (Cornaggia and Iliev, 2024). This geographic variation implies that the cost of complying with renewable mandates will differ markedly across jurisdictions. We test this prediction in our empirical analysis.

Figure 2 shows the timeline of state adoptions. “Adoption” refers to a state government’s legislative passage of the mandate, which often precedes actual implementation by several years. Many RPS mandates are not active (in the sense that they require actual changes to the electricity mix) until years after their passage. This distinction matters for our empirical strategy. Adopted RPS are hypothetical at the time of passage; they can be amended or repealed before taking effect, and they carry significant uncertainty about actual implementation. Active and implemented RPS, by contrast, represent solidified policies that market participants can price with greater confidence. We therefore focus our main analysis on the years when renewable targets become active, though we also examine event-time dynamics around the passage date.

[Insert Figure 2 here.]

A relatively new development, Clean Energy Standards (CES) are similar to RPS in that they require a certain percentage of electricity to come from clean sources. However, CES differ from RPS in a fundamental respect: they are technology-neutral, allowing a broader set of energy sources, including nuclear power and fossil fuels fitted with carbon capture technologies, to satisfy compliance obligations.²

²CES have been criticized for this inclusivity. For example, Friends of the Earth President Erich Pica commented that there is “no role” for nuclear in a least-cost, low-carbon world, and that including nuclear in a clean energy standard would incentivize keeping aging facilities online (Muyskens and Eilperin, 2020).

Like RPS, CES operate through tradable credits: energy producers earn clean energy credits, and retail electricity suppliers must hold a sufficient quantity at the end of each compliance period [Bipartisan Policy Center \(2020\)](#). Because clean energy targets are market-based and technology-neutral, they are potentially a more cost-effective approach to pricing and restricting carbon emissions in the electricity sector ([Cleary, Palmer, and Rennert, 2019](#)).

Massachusetts passed the first CES in 2017, and 13 additional states have since adopted such standards. [Figure 3](#) displays states' clean energy targets, conditional on having adopted a CES by the end of the sample. Only two states have active clean energy targets as of 2024, with most targets expected to become active after 2030 and four not binding until 2050. In practice, CES rarely replace RPS outright. In some states, such as Massachusetts, RPS compliance counts toward a broader CES obligation, so the two operate in tandem. In others, such as New York, the CES effectively supersedes the earlier RPS framework by folding renewable obligations into a more technology-neutral architecture. In either case, once a CES is in place, additional decarbonization is typically routed through the more flexible standard, so that the marginal constraint on utilities effectively becomes the CES rather than an expansion of the tighter renewables-only RPS. Our main variable measuring clean energy pledges, *Clean Energy Law*, is an indicator taking a value of one in years after a state adopts a clean energy law. We use adoption years rather than active-target years because observations with active clean energy targets remain scarce as of the end of our sample.

[Insert Figure 3 here.]

3 Conceptual Framework

We develop a simple model of the relationship between state renewable energy policy and municipal bond yields. The model identifies two channels through which Renewable Portfolio Standards affect borrowing costs: policy uncertainty and electricity costs. This simple model generates predictions that we test in the data.

3.1 Setup

Consider municipalities indexed by i in states indexed by j . Each state chooses whether to implement a Renewable Portfolio Standard and, conditional on adoption, whether to set a modest or aggressive target. We can represent the adoption of an aggressive target as the solution to an objective that depends on expected costs and benefits as well as non-pecuniary preferences:

$$\textit{Aggressive Renewable Target}_j^* = \mathbf{1} \{ \mathbb{E}[B_j - C_j \mid \mathcal{I}_j] + \nu_j \geq 0 \}, \quad (1)$$

where B_j and C_j denote the expected benefits and costs of aggressive renewable mandates in state j , $\mathcal{I}_j$ is the information set at the time of adoption, and ν_j captures non-pecuniary preferences that shift policy choices independently of local credit fundamentals. We do not attempt to separately identify ν_j . Equation (1) highlights that states with similar observable economic conditions may nonetheless adopt different policy targets. In the empirical analysis, identification comes from the staggered timing of mandate implementation combined with controls for observable state and county characteristics, rather than from isolating the underlying non-pecuniary component.

Investors price municipal bonds based on default risk. Let $RPS_j \in \{0, 1\}$ indi-

cate whether state j has an active renewable target, and let $Aggressive\ Renewable\ Target_j \in \{0, 1\}$ indicate whether the target is aggressive. The yield $y_{i,j}$ on a bond issued by municipality i in state j equals the risk-free rate plus a default premium:

$$y_{i,j} = r_f + \pi_{i,j}. \quad (2)$$

3.2 Risk Channels

The default premium reflects two components related to renewable energy policy.

The first is *policy uncertainty due to transition risk*. States without renewable targets face uncertainty about their future energy transition pathway. Investors cannot assess how these states will respond to federal regulations, climate events, or shifting energy markets. States that adopt any RPS, whether modest or aggressive, resolve this uncertainty by committing to a specific policy path. Let $\delta > 0$ denote the policy uncertainty premium. States with $RPS_j = 0$ bear this premium; states with $RPS_j = 1$ do not.

The second is *electricity costs*. Renewable energy is more expensive to produce and transmit than traditional sources due to infrastructure requirements, intermittency, and storage needs. Aggressive RPS impose substantial electricity cost burdens on local economic activity. Let $\gamma_i > 0$ denote the cost premium from aggressive targets. This premium varies across municipalities with two local characteristics: the supply of renewable energy resources (areas with abundant wind or solar potential face lower compliance costs) and the demand for electricity (areas with high consumption face larger cost increases). States with $Aggressive\ Renewable\ Target_j = 1$ bear this premium.

3.3 Predictions

Combining the two channels, the default premium becomes:

$$\pi_{i,j} = \delta \cdot (1 - RPS_j) + \gamma_i \cdot \textit{Aggressive Renewable Target}_j + \varepsilon_{i,j}, \quad (3)$$

where $\varepsilon_{i,j}$ captures municipality-specific factors. Substituting into Equation (2) and rearranging:

$$y_{i,j} = (r_f + \delta) - \delta \cdot RPS_j + \gamma_i \cdot \textit{Aggressive Renewable Target}_j + \varepsilon_{i,j}. \quad (4)$$

Equation (3) generates four testable predictions.

Prediction 1: Modest RPS reduce yields. For states with $RPS_j = 1$ and $\textit{Aggressive Renewable Target}_j = 0$, yields are lower by δ relative to states with no RPS. These states benefit from policy clarity without incurring excessive electricity costs.

Prediction 2: Aggressive RPS raise yields relative to modest RPS. Moving from $\textit{Aggressive Renewable Target}_j = 0$ to $\textit{Aggressive Renewable Target}_j = 1$ increases yields by γ_i , reflecting the electricity cost burden of ambitious mandates. The net effect of aggressive RPS relative to no-RPS states is $(\gamma_i - \delta)$, which is positive when electricity cost burdens exceed the value of policy clarity.

Prediction 3: The yield effect varies with local resource endowments and energy demand. Because γ_i depends on local conditions, the cost of aggressive mandates should be larger in areas with high electricity demand and smaller (potentially zero, even) in areas with abundant renewable energy resources. In wind-rich or solar-rich counties, compliance requires less costly infrastructure investment, reducing γ_i and potentially reversing the sign of the net yield effect.

Prediction 4: Technology-neutral standards attenuate the cost. Clean Energy Standards broaden the set of technologies eligible for compliance, effectively relaxing the constraint that makes γ_i large under renewables-only mandates. If CES reduce the effective cost premium, then CES adoption should attenuate (or even reverse) the yield increases associated with RPS.

The main empirical question is whether the data support $\mathbb{E}[\gamma_i] > \delta$: that the expected costs of aggressive mandates exceed the value of policy clarity. If so, aggressive RPS should increase yields on net, while modest RPS should reduce them. We test these predictions using detailed data on municipal bond yields and local and state economic conditions.

4 Data and Sample Description

4.1 Bond Data

Our primary dataset consists of secondary market municipal bond transactions from the Municipal Securities Rulemaking Board (MSRB), covering 2005 to 2024. We merge trading data with bond characteristics from the Mergent Municipal Bond Securities Database. We restrict the sample to general obligation, tax-exempt bonds that carry at least one credit rating and are not related to energy projects.³ These filters ensure our sample captures economic activity distinct from the utility sector, as RPS in some states apply only to private utility companies and exempt municipal utilities [Hong, Kubik, and Shore \(2024\)](#). We obtain a list of state-issued bonds from the Electronic Municipal Market Access website and exclude them, focusing on local issuers.

We construct two spread measures. *Spread MMA* is the difference between the

³We eliminate bonds with Mergent use of proceed codes CUTI, ELEC, OUTI, and GAS.

bond’s yield to maturity and the maturity-matched Municipal Market Advisors (MMA) AAA-rated curve, averaged across all trades for a bond in a given month and weighted by transaction amount. *Spread Treasury* benchmarks instead to the maturity-matched Treasury curve, adjusted for state and federal taxes using the NBER TAXSIM approach. Results throughout the paper are generally insensitive to the choice of benchmark.

We obtain up to three credit ratings for each bond from Moody’s, Standard & Poor’s, and Fitch at the time of each transaction. We assign numerical values to ratings, where AAA (Aaa) equals 21, AA+ (Aa1) equals 20, and so on. *Credit Rating* is the lowest rating assigned to a bond at the time of trade. *Spread MMA*, *Spread Treasury*, and *Credit Rating* are our main dependent variables.

We separately examine bond issuance in the primary market using offer yields from Mergent, covering 2001 to 2024. We adjust offer yields using the same two benchmarks. The primary market sample extends further back in time, which is useful for the stacked difference-in-differences analysis. All other variables are measured at the point of initial issuance rather than at the time of trade.

4.2 Treatment Variables

Our key independent variables capture the implementation of Renewable Portfolio Standards and Clean Energy Standards, as described in Section 2.

Renewable Target is an indicator equal to one if the state has an RPS with a positive target in effect as of a given year, and zero otherwise. We focus on the year targets become active rather than the year legislation is passed, because adopted but not-yet-active mandates carry substantial uncertainty about actual implementation (Section 2).

Aggressive Renewable Target is an indicator equal to one if the state has an RPS in place that mandates more than 5% renewable generation at 5 years, more than 10% at 10 years, and more than 15% at 15 years after implementation. This classification separates states with steep compliance ramps from those with modest, gradual targets. We collect this information from the supplementary data included with the August 2024 “U.S. State Renewables Portfolio & Clean Electricity Standards: 2024 Status Update” report provided by the Lawrence Berkeley National Laboratory and U.S. Department of Energy.

Clean Energy Law is an indicator equal to one in years after a state adopts a Clean Energy Standard, and zero otherwise. Unlike *Renewable Target*, which takes the value of one when mandates become active, *Clean Energy Law* is coded from the year of legislative adoption because only two states have active CES targets as of the end of our sample.

4.3 Control Variables

We obtain bond-level characteristics from Mergent, including coupon rate, offering amount, remaining years to maturity, call features, whether the bond is insured, and whether it was sold through a negotiated offering. Time-varying characteristics are measured at the time of trade (secondary market) or issuance (primary market).

We merge state-year data from the U.S. Census Bureau and Bureau of Economic Analysis, including population, income per capita, real GDP, and real GDP growth. We include state-level age dependency ratios (the population above 65 relative to the population aged 15–64) to control for effects of population aging on municipal bond yields, following [Butler and Yi \(2022\)](#).

We employ the geolocation procedure outlined in [Cornaggia et al. \(2022\)](#) to

allocate bonds to their respective counties. This approach allows us to merge county-year characteristics from the U.S. Census and Bureau of Labor Statistics, including county income per capita, unemployment rate, population, and age dependency. We measure electricity prices using state-by-month data from the U.S. Energy Information Administration, disaggregated by customer type (overall, residential, commercial, and industrial).

For the mechanism tests in Section 6, we measure county-level electricity consumption (megawatt hours) and expenditures (millions of USD) as of 2016 from the City and County Energy Profiles provided by the National Renewable Energy Laboratory (NREL). We measure wind energy generation potential using maximum average wind speed across zip codes in a county and solar energy generation capacity using kilojoules per square meter from the Centers for Disease Control, following [Cornaggia and Iliev \(2024\)](#).

4.4 Summary Statistics

Table 1 presents summary statistics. Panel A describes the secondary market sample, which contains approximately 7 million cusip-month observations for local issuers. Panel B describes the primary market sample of approximately 1 million issuance-level observations.

Several features of the data stand out. First, 85% of secondary market bond-months occur in states with active RPS (*Renewable Target* mean of 0.849). This relatively high percentage reflects the characteristic that most states have active RPS by the end of the sample. Second, secondary market spreads are larger than primary market spreads (*Spread MMA* of 33.70 versus 20.53 basis points), consistent with municipalities timing new issuance to avoid unfavorable pricing conditions.

Third, the mean *Credit Rating* of approximately 18 (AA−/Aa3) in both samples indicates that our bonds are predominantly investment-grade, as expected for general obligation municipal debt. Summary statistics for bond characteristics, state-level variables, and county-level variables are broadly consistent with samples appearing in other studies of the U.S. municipal bond market with overlapping sample periods.

[Insert Table 1 here.]

5 Results from Bond Trades

Secondary market transactions provide within-issuer time-series variation in yields and credit ratings without conditioning on local governments’ decisions to issue new debt, which are themselves a function of market conditions. We present our main results using secondary market data, then complement with primary market analysis and robustness tests.

5.1 Secondary Market Yields

We estimate the following difference-in-differences specification using secondary market observations for local issuers:

$$\begin{aligned} Spread_{i(j,k),t(y)} = & \alpha + \beta \cdot Renewable\ Target_{j,y} + Bond\ Controls_{i,t} + State\ Controls_{j,y} \\ & + County\ Controls_{k,y} + Month-Year\ Fixed\ Effects_t \\ & + County\ Fixed\ Effects_k + \varepsilon_{i,t}. \end{aligned} \tag{5}$$

where i indexes bond (j indexes state and k indexes county), and t indexes month

(y indexes year). We take logs of skewed variables, including bond characteristics such as offering amount and state characteristics such as population and real GDP. Month-year fixed effects absorb time-series variation common to all issuers in a given month. County fixed effects absorb time-invariant differences across counties. We cluster standard errors by issuer and month. The sample includes observations for all 50 states. Table 2 presents the results, reporting coefficient estimates for all control variables for completeness; we suppress control variable estimates in subsequent tables.

[Insert Table 2 here.]

The results reveal a positive and statistically significant relationship between the implementation of renewable targets and local bond yields. In column (1), using tax-adjusted spreads over Treasury yields as the dependent variable, we estimate a 13.2 basis point increase for issuers after the state implements a renewable energy target. Column (2) adds a control for the adoption of a Clean Energy Standard. Consistent with Prediction 4 from Section 3, CES adoption is associated with a 5 basis point reduction in yields, suggesting that technology-neutral standards partially offset the cost of renewables-only mandates. Columns (3) and (4) benchmark spreads to the MMA curve. The estimates are somewhat smaller (approximately 10 basis points), suggesting that the AAA municipal benchmark may itself incorporate a portion of the RPS-induced yield increase. The qualitative pattern is unchanged: RPS raise yields, and CES moderate the effect.

The magnitude is economically meaningful. Goldsmith-Pinkham et al. (2023) find a 5.3 basis point effect of sea level rise on exposed coastal municipal debt and argue that even moderate yield increases correspond to large present-value losses for issuers. A back-of-the-envelope calculation, applying our baseline Treasury-spread

estimate of 13 basis points to the approximately \$4 trillion municipal bond market over the median bond maturity of 7 years, implies a present-value cost to local issuers of approximately \$36 billion.⁴

The effect increases monotonically with bond maturity (Table A4 in the Internet Appendix). This pattern is consistent with the long-run nature of RPS compliance costs: bonds maturing over longer horizons are more exposed to the decades-long trajectory of renewable mandates. Additional robustness tests in the Internet Appendix confirm that results are largely unchanged when we exclude callable bonds and measure yield to maturity rather than yield to worst (Table A1), when we compute spreads with equal rather than value weighting (Table A2), or when we condition on credit ratings (Table A3).⁵

Dynamic effects. To examine the timing of the yield response, we estimate an event-study specification:

$$\begin{aligned} Spread_{i(j,k),t(y)} = & \alpha + \beta_e \cdot Renewable\ Target_j \times Event\ Year_e + Clean\ Energy\ Law_{j,t} \\ & + Bond\ Controls_{i,t} + State\ Controls_{j,y} + Month-Year\ Fixed\ Effects_t \\ & + County\ Controls_{k,y} + \varepsilon_{i,t}. \end{aligned} \tag{6}$$

where i indexes bonds (j indexes states and k indexes counties), t indexes months (y indexes years), and e indexes event time. *Renewable Target* is an indicator for states that implement RPS after the start of the sample, and *Event Year* is a set of

⁴This calculation uses the notional value of the U.S. municipal bond market (approximately \$4 trillion), the baseline coefficient estimate from column (1) of Table 2 (approximately 13 basis points), and the median maturity of bonds in the sample (7 years, per Panel A of Table 1).

⁵We do not control for credit ratings in our main specifications. Credit ratings are themselves a function of the covariates in our model, and Iliev and Vitanova (2024) demonstrate the challenges of using endogenous variables as controls.

indicators for each year e relative to the year the renewable target becomes effective. The estimates for $e = -1$ are normalized to zero. Figure 4 presents the results.

[Insert Figure 4 here.]

Panel A aligns event time with the year the RPS law is first passed. We observe no discernible trend in yields prior to adoption: pre-period point estimates are small, statistically insignificant, and show no systematic pattern. This absence of differential pre-trends supports the identifying assumption that treatment and control states were on comparable yield trajectories before RPS passage. Following adoption, yields increase gradually, echoing findings by [Deschenes, Malloy, and McDonald \(2023\)](#) that most renewable energy capacity additions occur more than five years after legislation is passed.

Panel B aligns event time with the first year the RPS requires a positive renewable target, i.e., the year utilities must begin compliance. Consistent with the notion that actual implementation is when mandates become credible, the yield increase is sharper. Within two years of the first binding target, the 95% confidence interval no longer overlaps with the normalized $e = -1$ estimate.

5.2 Credit Ratings

Credit ratings from Moody's, Standard & Poor's, and Fitch measure long-term credit risk and update slowly by design, avoiding short-term fluctuations ([Cornaggia and Cornaggia, 2013](#); [Bruno, Cornaggia, and Cornaggia, 2016](#)). We re-estimate Equation (5) with *Credit Rating* as the dependent variable. Table 3 presents the results.

[Insert Table 3 here.]

In the pooled sample, credit ratings do not significantly respond to RPS implementation. This non-result likely reflects two features of the pooled specification. First, rating agencies intentionally “rate through the cycle,” incorporating long-run expectations while filtering out shorter-term policy shifts, particularly ones with significant political uncertainty, as RPS are frequently amended or repealed. Second, the pooled sample includes the 11 states that adopted RPS before our trading data begin in 2005; for these states, any rating adjustment would have occurred before the sample period, diluting the estimated effect. Consistent with this interpretation, we find significant rating reductions when we use a stacked approach that excludes pre-treated states (Section 5.3.1), and when we distinguish between aggressive and modest targets (Section 6).

5.3 Robustness

5.3.1 Stacked Difference-in-Differences

A concern with staggered difference-in-differences designs is that heterogeneous treatment effects across cohorts can bias two-way fixed effects estimates (Sun and Abraham, 2021). We address this by constructing a stacked sample following Cengiz et al. (2019). For each state that implements a renewable target during our sample, we create a cohort-specific dataset pairing that state’s bonds with all bonds in states that have not yet adopted a renewable mandate as of that month. We then stack these cohort-specific datasets and estimate:

$$\begin{aligned}
Spread_{i(j,k),t(y,c)} = & \alpha + \beta \cdot Renewable\ Target_{j,y} + Bond\ Controls_{i,t} \\
& + State\ Controls_{j,y} + County\ Controls_{k,y} + Month-Year\ Fixed\ Effects_t \\
& + County-Cohort\ Fixed\ Effects_{k,c} + \varepsilon_{i,t}.
\end{aligned} \tag{7}$$

where c indexes cohort. This approach constructs nine stacks corresponding to the nine states that implement RPS after 2005 and discards observations from the 11 states with pre-existing mandates. County-cohort fixed effects absorb time-invariant heterogeneity within each cohort. We cluster standard errors by bond and month. Table 5 presents the results.

[Insert Table 5 here.]

The results are broadly consistent with the pooled estimates and, if anything, larger in magnitude. The adoption of renewable targets increases *Spread Treasury* by approximately 17 basis points (column 1) and *Spread MMA* by approximately 8 basis points (column 2). In column (3), we find that, in contrast to the pooled non-result in Table 3, RPS implementation is associated with a statistically significant reduction in credit ratings. As discussed above, this difference is consistent with the stacked approach dropping pre-treated states whose rating adjustments predate our sample. Column (4) documents a large and significant yield increase in primary market issuance.

5.3.2 Legal Environment

A concern with our identification is that RPS may be passed concurrently with other state legislation that independently affects fiscal health. We test this directly

by controlling for the legislative environment. We download the universe of state laws passed since 2009 from LegiScan—over 500,000 bills—and classify each into one of the 18 legal themes identified by [Ash, Morelli, and Vannoni \(2025\)](#) using an embedding-based approach.⁶ We then create a set of fixed effects, one for each theme, taking a value of one in state-years where the theme is among the top five themes in laws passed that year. If RPS tend to be passed alongside particular types of legislation, including these fixed effects will subsume the explanatory power of *Renewable Target*. Table 6 presents the results.

[Insert Table 6 here.]

Controlling for states’ legislative trends does not meaningfully affect our results. Coefficient estimates attenuate somewhat but remain economically and statistically significant. The sample size decreases slightly because LegiScan coverage begins in 2009. We conclude that the yield effect reflects RPS implementation, not legislative activity that just so happens to correlate with it.

5.3.3 Results from New Bond Issues

We complement the secondary market analysis with primary market issuance data. Studying new issues is useful because offer yields capture the realized borrowing costs that municipalities face when raising capital. However, issuance is endogenous: municipalities may time offerings or forgo issuance entirely when borrowing costs are elevated. We re-estimate Equation (5) using primary market observations for local issuers from 2001 to 2024. Table 4 presents the results.

⁶We create embedding vectors for each theme from the keywords provided by [Ash, Morelli, and Vannoni \(2025\)](#), embed each bill’s text, compute cosine similarities between the bill embedding and all 18 topic embeddings, assign probabilities via softmax, and classify each bill into the highest-probability theme. Figure A2 in the Internet Appendix summarizes the results.

[Insert Table 4 here.]

The results are qualitatively similar to the secondary market findings, but magnitudes are smaller. This attenuation is consistent with strategic timing: municipalities that face the largest RPS-induced yield increases would be those most likely to delay or reduce issuance. Conditional on issuing, RPS still predict significantly higher offering yields. We do not find large yield reductions for states that have adopted clean energy laws, revealing that CES effects are not yet priced in the primary market during the years preceding implementation.

6 Mechanism

The conceptual framework in Section 3 generates predictions about how the yield effect of RPS varies with mandate aggressiveness (Predictions 1–2), local energy demand and renewable resource supply (Prediction 3), and the adoption of technology-neutral standards (Prediction 4, tested in Section 5). We test the remaining predictions in turn.

6.1 Aggressive vs. Modest Targets

Predictions 1 and 2 state that modest RPS should lower yields by resolving policy uncertainty (δ), while aggressive RPS should raise yields because electricity cost burdens (γ_i) exceed the uncertainty benefit. We test this prediction by adding *Aggressive Renewable Target* to our baseline specification. Figure 5 motivates the distinction by displaying the distribution of RPS targets in event time. The dispersion in targets widens substantially over time: states at the 90th percentile reach targets well in excess of 20% within a few years of implementation, while states at

the 10th percentile remain near zero for over a decade.

[Insert Figure 5 here.]

Table 7 presents the results. The yield effect documented in Table 2 is driven entirely by states with aggressive mandates. In columns (1) and (2), using *Spread Treasury*, the coefficient on *Aggressive Renewable Target* is 26.3 basis points, while the coefficient on *Renewable Target* is -6.5 basis points and statistically significant. The net effect for aggressive states is therefore approximately 19.8 basis points (the sum of the two coefficients). States with modest targets experience yield *reductions* relative to states without mandates, consistent with Prediction 1: modest commitments resolve policy uncertainty without imposing excessive costs. In columns (3) and (4), using *Spread MMA*, the coefficient on *Aggressive Renewable Target* remains large and positive, though the reduction for non-aggressive states is not statistically significant with this benchmark.

[Insert Table 7 here.]

Table 8 examines credit ratings. Aggressive mandates are associated with a reduction of more than half a rating notch, while modest mandates are associated with a significant rating *improvement*. This pattern mirrors the yield results and is consistent with Prediction 2: aggressive targets impose costs that outweigh the benefit of policy clarity, while modest targets occupy the favorable middle ground. Table A5 in the Internet Appendix confirms these patterns in primary market offer yields.

[Insert Table 8 here.]

6.2 RPS and Electricity Prices

The conceptual framework identifies electricity costs as the channel through which aggressive mandates raise yields. We test this directly by estimating the effect of RPS on electricity prices, using state-month data from the U.S. Energy Information Administration. Table 9 presents the results with overall, industrial, commercial, and residential electricity prices as dependent variables.

[Insert Table 9 here.]

RPS have a robust, positive relationship with electricity prices. The coefficient on *Aggressive Renewable Target* is positive and large across all customer categories, consistent with aggressive mandates imposing broad-based energy cost increases. The pattern for modest mandates is more nuanced: *Renewable Target* in non-aggressive states is associated with increases in overall and residential electricity prices, but not with industrial or commercial prices. This distinction matters because municipal tax bases depend heavily on commercial and industrial activity. The absence of commercial and industrial price increases in non-aggressive states helps explain why modest mandates do not raise (and may even reduce) bond yields: they generate small household-level compliance costs without disrupting the economic activity that underpins local government revenues.

6.3 The Exacerbating Role of Local Energy Demand

Prediction 3 states that the yield effect should vary with local conditions that determine γ_i . We first examine variation through electricity demand. We interact *Renewable Target* with pre-treatment measures of county-level electricity consumption

and expenditures, as defined in Section 4.⁷ Because consumption and expenditures are measured as of 2016, before many RPS targets ratchet up to their most stringent levels, they capture baseline demand characteristics rather than equilibrium responses to the mandates. Table 10 presents the results.

[Insert Table 10 here.]

The positive relationship between RPS and yields is concentrated in counties with above-median electricity consumption or expenditures. In counties with below-median consumption or expenditures, the relationship between RPS and yields is economically small and statistically insignificant. These results are consistent with Prediction 3: areas with high baseline electricity demand face larger cost increases from renewable mandates, and these costs are reflected in higher borrowing costs.

6.4 The Mitigating Role of Local Renewable Energy Supply

We next examine the second source of variation in γ_i : the local supply of renewable energy resources. Where wind or solar resources are abundant, the infrastructure investment required for RPS compliance is less costly, reducing γ_i . We interact *Renewable Target* with indicators for counties with top quartile wind potential, top quartile solar potential, and top quartile potential in any of these resources, as defined in Section 4. Model (1) of Table 11 replicates the baseline specification for comparison. Models (2) through (4) report the interaction effects.

[Insert Table 11 here.]

The results are striking. In counties with above-median wind generation potential, the interaction term is -14.6 basis points, fully offsetting the baseline RPS

⁷For brevity, results in this subsection and the next use *Spread Treasury* as the dependent variable. Results are similar with *Spread MMA*.

effect of 15.0 basis points. The net effect in wind-rich counties is economically negligible and statistically insignificant. This finding is particularly important because wind is the largest source of renewable electricity generation in the United States, accounting for the majority of RPS compliance. Where the primary input to renewable generation is naturally abundant, mandates impose no measurable fiscal burden on local governments.

The interaction with combined wind and solar potential produces a similar pattern (model 2). The interaction with solar potential alone (model 4) is negative but not statistically significant. The weaker solar result may reflect differences in the cost structure of solar compliance, as utility-scale solar projects involve different siting, permitting, and transmission challenges than wind. Another possibility is that high solar potential correlates with high cooling demand, partially offsetting the cost advantage.

Taken together, the results in this section support the energy-cost channel identified in our conceptual framework. The yield effect of RPS is driven by aggressive mandates that raise electricity prices. It is amplified where electricity demand is high and eliminated where wind resources are abundant. The fiscal consequences of renewable mandates depend not only on policy design but also on local resource endowments.

7 Conclusion

This paper examines the financial consequences of state-level renewable energy mandates for local government borrowing costs. Exploiting the staggered implementation of Renewable Portfolio Standards across 32 U.S. states, we find that these mandates raise municipal bond yields by 10 to 13 basis points, representing approx-

imately \$36 billion in present value costs to local issuers, an effect that exceeds the documented impact of sea level rise on coastal municipal debt ([Goldsmith-Pinkham et al., 2023](#)). That the policy response to climate change currently imposes a larger fiscal burden on local governments than the physical risk itself underscores the importance of effective climate policy design.

The aggregate yield effect, however, masks the paper’s central finding: the fiscal consequences of decarbonization depend on how mandates are designed. Aggressive RPS (those requiring rapid increases to high renewable thresholds) drive the entire yield effect and are associated with significant credit rating reductions. States adopting modest targets experience yield *reductions*, suggesting that gradual mandates resolve policy uncertainty without imposing excessive compliance costs. Technology-neutral Clean Energy Standards, which broaden the set of eligible technologies to include nuclear power and carbon capture, are associated with lower borrowing costs. The cost burden we document is therefore specific to the technological constraints of renewables-only mandates, not to the commitment to decarbonize itself.

The mechanism operates through electricity prices. Aggressive RPS explain higher electricity costs, and the yield effects are strongest in areas with high energy demand. In counties with abundant wind resources, the primary source of U.S. renewable generation, the fiscal cost of RPS disappears. This result implies that mandates calibrated to local resource endowments could achieve renewable energy goals without the borrowing cost increases we document for the average adopting state.

Our analysis has natural limitations that suggest directions for future research. We focus on the United States, where the absence of federal clean energy legisla-

tion makes state-level mandates uniquely salient. Whether similar effects arise in countries with national renewable standards (such as those in the European Union) remains an open question. Our estimates also capture only the fiscal costs of RPS to local issuers; they do not account for the environmental and health benefits of reduced emissions, which may justify these costs from a welfare perspective. Future work that jointly estimates fiscal costs and environmental benefits would provide a more complete picture of the net welfare effects of renewable mandates. Some policymakers and voters may judge the increased cost of borrowing an appropriate price for the intended reductions in emissions.

More broadly, our results reveal a tension that is central to climate finance. Policies designed to accelerate decarbonization impose real costs on public sector balance sheets—costs that ultimately flow to taxpayers through higher borrowing rates. But these costs are not inevitable. The contrast between aggressive and moderate RPS, between renewables-only and technology-neutral standards, and between wind-rich and wind-poor regions all point to the same conclusion: the fiscal burden of the energy transition is a function of policy design and local conditions, not of ambition. As the political fragility of these mandates illustrates, with Kansas, Ohio, and Arizona repealing their RPS in recent years, designing policies that achieve environmental objectives without imposing unsustainable fiscal costs is not merely desirable but necessary for their long-term survival.

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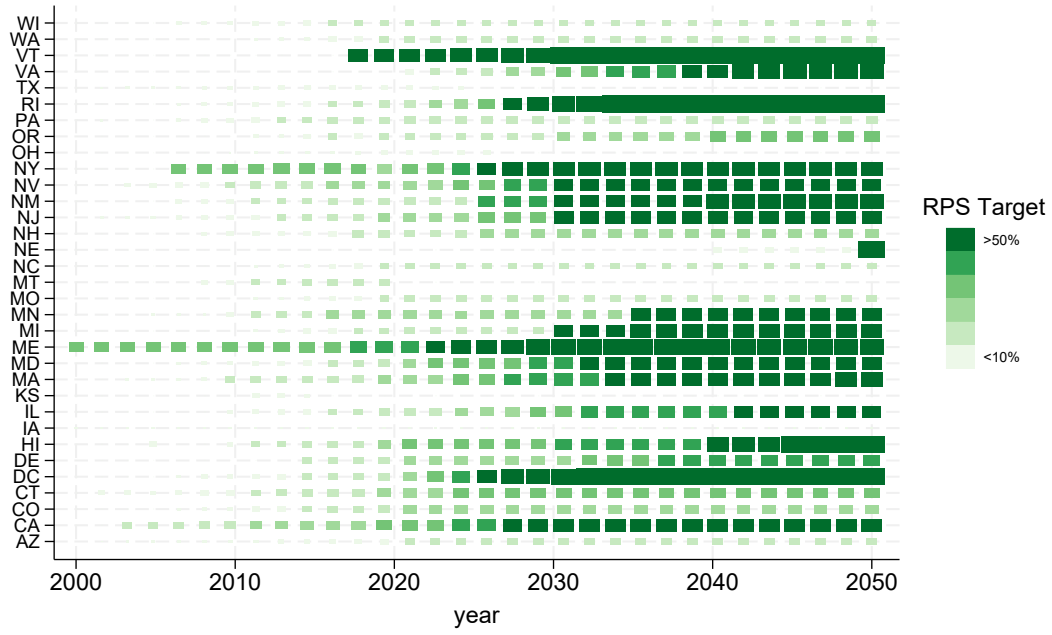


Figure 1: Renewable Portfolio Standards for Adopting States

This figure plots renewable percentages for the 32 states that implemented a renewable target at any point over the sample period. *Renewable Percentage* is the state-year target for the percentage of electricity to be sourced from renewable sources as reported by the Lawrence Berkeley National Laboratory and U.S. Department of Energy.

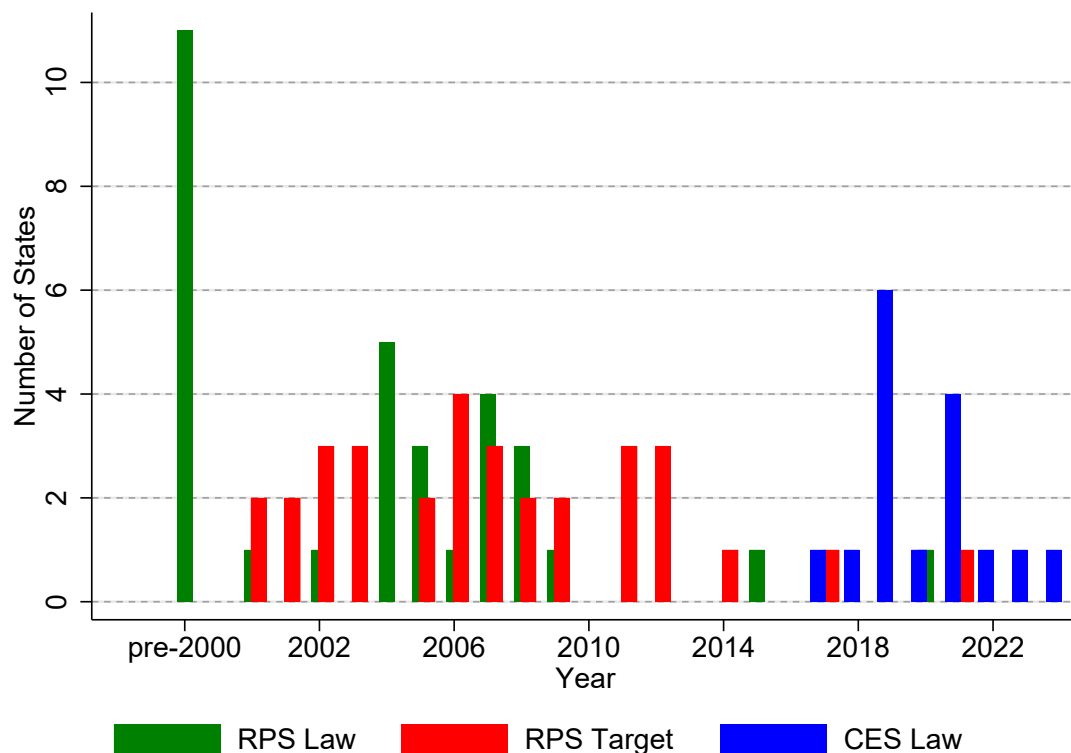


Figure 2: Renewable Portfolio Standard and Clean Energy Standard Adoptions over Time

This figure plots the number of states that have adopted Renewable Portfolio Standards (RPS) laws, implemented renewable targets (adoption refers to legislative passage, which often precedes the first binding target by several years), and adopted Clean Energy Standards (CES) laws over time. Data are from the Lawrence Berkeley National Laboratory and the U.S. Department of Energy.

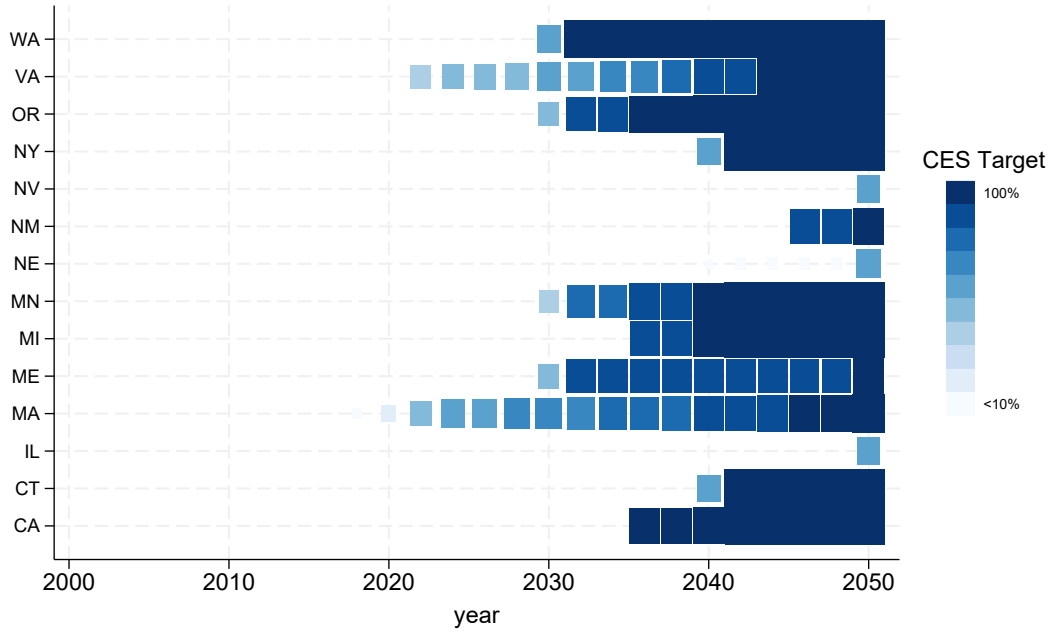
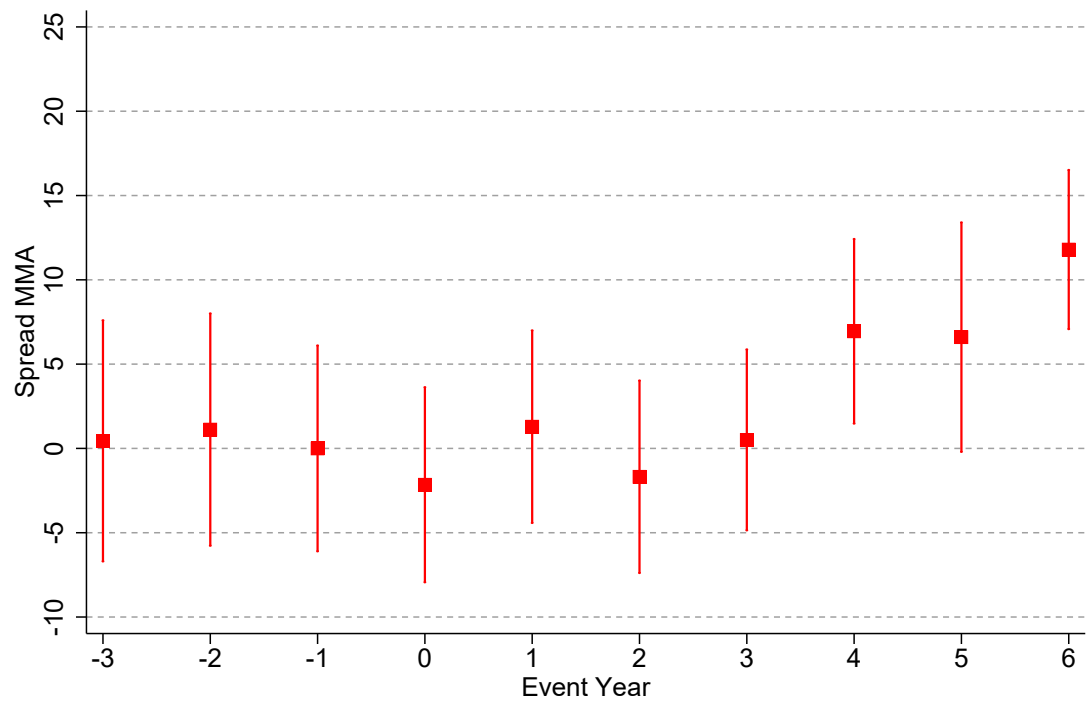
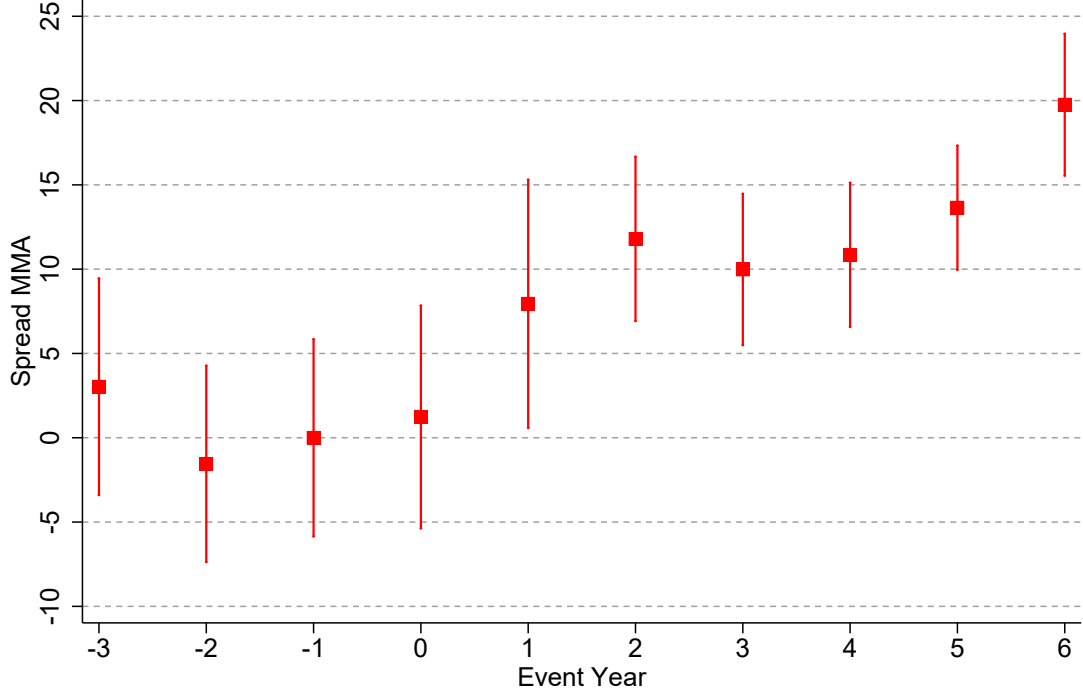


Figure 3: Clean Energy Standards for Adopting States

This figure plots clean energy targets for the 14 states that implemented a clean energy target at any point over the sample period. *Clean Energy Target* is the state-year target for the percentage of electricity to be sourced from technology-neutral clean energy sources including nuclear power or fossil fuels fitted with carbon capture technologies. We collect this information from the Lawrence Berkeley National Laboratory and the U.S. Department of Energy.



Panel A: Event: Renewable Target Law is Passed



Panel B: Event: Renewable Target becomes Effective

Figure 4: Issuers' Secondary Market Yields around Renewable Target Date

This figure plots estimates of β_{-5} through β_{+10} from the following OLS regression equation based on the sample of observations associated with issuers in Table 1 Panel A:

$$\begin{aligned}
 Spread_{i(j,k),t(y)} = & \alpha + \beta_e \cdot Renewable\ Target_j \times Event\ Year_e + Clean\ Energy\ Law_{j,t} \\
 & + Bond\ Controls_{i,t} + State\ Controls_{j,y} + Month-Year\ Fixed\ Effects_t \\
 & + County\ Controls_{k,y} + \varepsilon_{i,t}.
 \end{aligned}$$

where i indexes bonds (j indexes states and k indexes counties) and t indexes months (y indexes years). In Panel A, $EventYear_e$ represents a vector of indicator variables, one for each year e relative to the year in which a state's *Renewable Target* is passed for the first time. In Panel B, $EventYear_e$ represents a vector of indicator variables, one for each year e relative to the year in which a state's *Renewable Target* first becomes non-zero. The estimates for event times $e = -1$ are normalized to zero. Other variable definitions are provided in the legend of Table 1. Whiskers represent 95% confidence intervals.

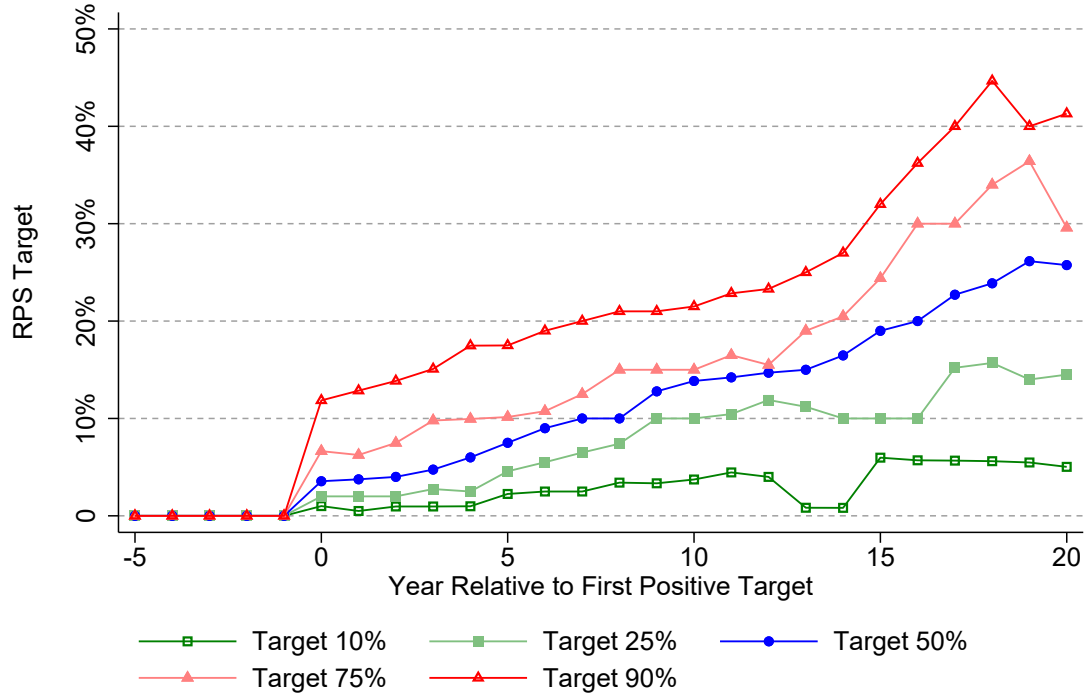


Figure 5: Renewable Portfolio Standards Targets over Time

This figure plots the distribution of implemented renewable portfolio standard targets in event time, relative to the first positive target year. Plotted lines represent percentiles (10th, 25th, 50th, 75th, and 90th) of the target distribution. Data are from the Lawrence Berkeley National Laboratory and the U.S. Department of Energy.

Table 1: Summary Statistics

This table provides definitions and summary statistics for dependent and independent variables. Data sources are in parentheses. Panel A provides definitions and summarizes the secondary market variables measured at the time of the transaction, and Panel B summarizes the primary market observations at the time of issuance. *Renewable Target* is an indicator equal to one if the state has an active Renewable Portfolio Standard in place. *Aggressive Renewable Target* is an indicator equal to one if the state has an aggressive Renewable Portfolio Standard in place that mandates more than 5% renewable targets at 5 years, 10% at 10 years, and 15% at 15 years after the target implementation. *Renewable Percentage* is the state-year target for the percentage of electricity to be sourced from renewable sources as reported by the Lawrence Berkeley National Laboratory and U.S. Department of Energy. *Clean Energy Law* is an indicator of whether the state has adopted Clean Energy Standard laws. *Spread Treasury* is the local tax-adjusted spread between the bond yield and maturity-matched treasury yields. *Spread MMA* is the difference in basis points between the bond yield to maturity reported by the Municipal Securities Rulemaking Board (MSRB) and the maturity-matched Municipal Market Advisors MMA AAA-rated yield curve (Bloomberg). *Credit Rating* is the lowest numerical rating issued by Moody's, Standard & Poor's, and Fitch (Mergent). Ratings are scaled so that "AAA" is 21 and "D" is 1. *Coupon Rate* is the coupon rate of the bond in percentage (Mergent). *Log Offering Amount* is the natural logarithm of the bond offering amounts in \$ millions (Mergent). *Years to Maturity* is the number of years left until the bond matures (Mergent). *Bond Age* is the number of years since the bond was issued (Mergent). This variable does not apply to the issuance level sample. *Call Option* is an indicator equal to one if the bond has a call option (Mergent). *Insured* is an indicator equal to one if the bond is insured (Mergent). *Negotiated* is an indicator equal to one if the bond is a negotiated offering (Mergent). *State Population* is the state population in millions (U.S. Census Bureau). *State Income per Capita* is the state per capita personal income in a given year (U.S. Bureau of Economic Analysis). *State Real GDP* is the state GDP in 2012 trillion dollars, and *Real GDP Growth* is the state real GDP growth in percentages (both from the U.S. Bureau of Economic Analysis). *State Age Dependency* is the ratio of the state population above age 65 to the population between ages 15 and 64 (U.S. Census). *County Income per Capita* is the county average annual income per capita measured in thousands (Bureau of Economic Analysis), *County Unemployment Rate* is the county unemployment rate measured as a fraction of the labor force (Bureau of Labor Statistics), *County Population* is the total county population measured in millions (U.S. Census). *County Age Dependency* is the ratio of the county population above age 65 to the population between ages 15 and 64 (U.S. Census). *Overall Electricity Price* is the monthly overall price reported in the retail sales of electricity to ultimate customers database (U.S. Energy Information Administration). The *Industrial Electricity Price*, *Commercial Electricity Price*, and *Residential Electricity Price* are the prices further broken down by the sector of the customers.

Panel A: Secondary Market Sample

	Secondary Market (6,940,799 Obs.)		
	Mean	St. Dev.	Median
Renewable Target	0.849	0.358	1.000
Aggressive Renewable Target	0.411	0.492	0.000
Renewable Percentage	12.586	11.939	9.000
Clean Energy Law	0.138	0.345	0.000
Spread Treasury	160.182	163.407	138.499
Spread MMA	33.698	91.852	27.588
Credit Rating	18.063	2.030	18.000
Coupon Rate	3.899	1.349	4.000
Log Offering Amount	14.331	1.356	14.346
Years to Maturity	8.066	6.164	7.000
Bond Age	4.419	3.553	4.019
Call Option	0.533	0.499	1.000
Insured	0.396	0.489	0.000
Negotiated Offering	0.398	0.490	0.000
State Population	16.595	12.046	12.564
State Income per Capita	50.073	11.846	47.793
State Real GDP	1.045	0.832	0.665
State Real GDP Growth	2.106	2.588	2.200
State Age Dependency	0.151	0.025	0.149
County Income per Capita	51.935	18.585	48.072
County Unemployment Rate	0.061	0.026	0.054
County Population	1.272	1.995	0.592
County Age Dependency	0.148	0.042	0.143
Overall Electricity Price	11.747	4.012	10.290
Industrial Electricity Price	8.293	3.454	7.090
Commercial Electricity Price	11.512	3.882	10.220
Residential Electricity Price	14.300	4.456	13.200

Panel B: Issuance Level Sample (State Issuers)

	Primary Market (1,033,189 Obs.)		
	Mean	St. Dev.	Median
Renewable Target	0.718	0.450	1.000
Aggressive Renewable Target	0.269	0.443	0.000
Renewable Percentage	7.988	10.251	4.184
Clean Energy Law	0.038	0.191	0.000
Spread Treasury	159.022	93.012	151.150
Spread MMA	20.527	37.794	15.000
Credit Rating	17.914	2.094	18.000
Coupon Rate	3.548	1.233	4.000
Log Offering Amount	13.121	1.352	13.082
Years to Maturity	9.623	6.054	9.000
Call Option	0.454	0.498	0.000
Insured	0.423	0.494	0.000
Negotiated Offering	0.332	0.471	0.000
State Population	13.967	10.247	11.463
State Income per Capita	42.914	9.924	41.660
State Real GDP	0.819	0.648	0.581
State Real GDP Growth	2.106	2.306	2.200
State Age Dependency	0.147	0.022	0.148
County Income per Capita	43.251	14.391	40.583
County Unemployment Rate	0.059	0.022	0.054
County Population	0.835	1.488	0.326
County Age Dependency	0.149	0.044	0.145
Overall Electricity Price	10.208	3.134	9.490
Industrial Electricity Price	7.200	2.506	6.590
Commercial Electricity Price	10.207	3.034	9.400
Residential Electricity Price	12.411	3.468	11.910

Table 2: Renewable Commitments and Yields in Secondary Market Trading

This table reports results from panel regressions with *Spread Treasury* and *Spread MMA* as the dependent variables. The sample consists of monthly trading yields of bonds between 2005 and 2024. *Renewable Target* is an indicator equal to one if the state has an active Renewable Portfolio Standard in place. *Clean Energy Law* is an indicator of whether the state has adopted Clean Energy Standard laws. Variable definitions are in the legend of Table 1. We cluster standard errors at the issuer and month levels and report them below the coefficient estimates. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	(1) Spread Treasury	(2) Spread Treasury	(3) Spread MMA	(4) Spread MMA
Renewable Target	13.237*** (2.730)	13.604*** (2.741)	9.639*** (1.545)	9.869*** (1.554)
Clean Energy Law		-5.046** (2.422)		-3.170** (1.292)
Coupon Rate	-21.075*** (0.648)	-21.068*** (0.647)	-12.686*** (0.384)	-12.682*** (0.384)
Log Offering Amount	-6.253*** (0.494)	-6.256*** (0.494)	-3.492*** (0.302)	-3.493*** (0.301)
Years to Maturity	6.739*** (0.253)	6.740*** (0.253)	-0.951*** (0.105)	-0.950*** (0.105)
Bond Age	0.495* (0.255)	0.498* (0.255)	0.330** (0.152)	0.332** (0.152)
Call Option	-14.406*** (2.240)	-14.418*** (2.237)	-11.224*** (1.359)	-11.232*** (1.358)
Insured	16.066*** (1.976)	16.076*** (1.975)	10.629*** (1.200)	10.635*** (1.200)
Negotiated Offering	0.497 (1.440)	0.479 (1.440)	0.891 (0.884)	0.880 (0.883)
State Population	1.416 (1.163)	1.200 (1.178)	2.137*** (0.713)	2.001*** (0.721)
State Income per Capita	-0.739** (0.298)	-0.403 (0.357)	-1.014*** (0.162)	-0.802*** (0.178)
State Real GDP	-48.998*** (8.683)	-47.216*** (8.825)	-36.165*** (4.737)	-35.046*** (4.807)
State Real GDP Growth	-0.679** (0.281)	-0.709** (0.283)	0.044 (0.171)	0.025 (0.172)
State Age Dependency	-860.803*** (114.576)	-787.219*** (120.025)	-684.003*** (66.235)	-637.778*** (66.542)
County Income per Capita	0.330*** (0.083)	0.329*** (0.083)	0.168*** (0.049)	0.168*** (0.049)
County Unemployment Rate	792.929*** (80.948)	795.357*** (81.081)	541.731*** (47.854)	543.256*** (47.863)
County Population	-18.048*** (5.791)	-18.484*** (5.785)	-7.246** (3.188)	-7.520** (3.178)
County Age Dependency	-76.779* (43.615)	-79.662* (43.755)	-60.963** (26.237)	-62.775** (26.332)
Fixed Effects	County & Year-Month	County & Year-Month	County & Year-Month	County & Year-Month
Adj. R-squared	0.24	0.24	0.14	0.14
Observations	6,940,799	6,940,799	6,940,799	6,940,799

Table 3: Renewable Commitments and Credit Ratings

This table reports results from panel regressions with *Credit Rating* as the dependent variable. The sample consists of monthly ratings on traded state bonds between 2005 and 2024. *Renewable Target* is an indicator equal to one if the state has an active Renewable Portfolio Standard in place. *Clean Energy Law* is an indicator of whether the state has adopted Clean Energy Standard laws. Bond Controls include *Coupon Rate*, *Log Offering Amount*, *Years to Maturity*, *Bond Age*, *Call Option*, *General Obligation*, *Negotiated Offering*, and the *Insured* indicator. State Controls include *State Population*, *State Income per Capita*, *State Real GDP*, *Real GDP Growth*, and *State Age Dependency*. County Controls include *County Income per Capita*, *County Unemployment Rate*, *County Population*, and *County Age Dependency*. Variable definitions are in the legend of Table 1. We cluster standard errors at the issuer and month levels and report them below the coefficient estimates. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)
	Credit Rating	Credit Rating
Renewable Target	-0.078 (0.059)	-0.079 (0.060)
Clean Energy Law		0.013 (0.042)
Bond Controls	Yes	Yes
State Controls	Yes	Yes
County Controls	Yes	Yes
County Fixed Effects	Yes	Yes
Month-Year Fixed Effects	Yes	Yes
Adj. R-squared	0.38	0.38
Observations	6,940,799	6,940,799

Table 4: Renewable Commitments and Offering Yields

This table reports results from panel regressions with *Spread Treasury* and *Spread MMA* as the dependent variables. The sample consists of offering yields of state bonds between 2001 and 2024. *Renewable Target* is an indicator equal to one if the state has an active Renewable Portfolio Standard in place. *Clean Energy Law* is an indicator of whether the state has adopted Clean Energy Standard laws. Bond Controls include *Coupon Rate*, *Log Offering Amount*, *Years to Maturity*, *Call Option*, *General Obligation*, *Negotiated Offering*, and the *Insured* indicator. State Controls include *State Population*, *State Income per Capita*, *State Real GDP*, *Real GDP Growth*, and *State Age Dependency*. County Controls include *County Income per Capita*, *County Unemployment Rate*, *County Population*, and *County Age Dependency*. Variable definitions are in the legend of Table 1. We cluster standard errors at the issuer and month levels and report them below the coefficient estimates. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)
	Spread Treasury	Spread Treasury	Spread MMA	Spread MMA
Renewable Target	4.467*** (1.238)	4.465*** (1.237)	3.218*** (0.742)	3.207*** (0.741)
Clean Energy Law		-0.160 (2.354)		-1.546 (1.378)
Bond Controls	Yes	Yes	Yes	Yes
State Controls	Yes	Yes	Yes	Yes
County Controls	Yes	Yes	Yes	Yes
County Fixed Effects	Yes	Yes	Yes	Yes
Month-Year Fixed Effects	Yes	Yes	Yes	Yes
Adj. R-squared	0.68	0.68	0.38	0.38
Observations	1,033,189	1,033,189	1,033,189	1,033,189

Table 5: Spreads and Credit Ratings in Secondary Market Trading with Stacked Sample

This table reports results from stacked panel regressions with *Spread* and *Credit Rating* as the dependent variables. In the first three models, the sample consists of monthly trading yields on the secondary market of municipal bonds between 2005 and 2024. In the last model, the sample consists of offering yields of local bonds between 2001 and 2024. We stack each treated cohort together with all untreated and not yet treated observations. *Renewable Target* is an indicator equal to one if the state has an active Renewable Portfolio Standard in place. Bond Controls include *Coupon Rate*, *Log Offering Amount*, *Years to Maturity*, *Bond Age*, *Call Option*, *General Obligation*, *Negotiated Offering*, and the *Insured* indicator. State Controls include *State Population*, *State Income per Capita*, *State Real GDP*, *Real GDP Growth*, and *State Age Dependency*. County Controls include *County Income per Capita*, *County Unemployment Rate*, *County Population*, and *County Age Dependency*. Variable definitions are in the legend of Table 1. We cluster standard errors at the issuer and month levels and report them below the coefficient estimates. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)
Market:	Secondary	Secondary	Secondary	Primary
Dependent Variable:	Spread Treasury	Spread MMA	Credit Rating	Spread Treasury
Renewable Target	17.047*** (2.786)	8.086*** (1.637)	-0.282*** (0.065)	13.073*** (1.295)
Bond Controls	Yes	Yes	Yes	Yes
State Controls	Yes	Yes	Yes	Yes
County Controls	Yes	Yes	Yes	Yes
County-Cohort Fixed Effects	Yes	Yes	Yes	Yes
Month-Year Fixed Effects	Yes	Yes	Yes	Yes
Adj. R-squared	0.22	0.13	0.49	0.69
Observations	10,315,090	10,315,090	10,315,090	3,215,680

Table 6: Renewable Commitments and Spreads Controlling for Legal Environment

This table reports results from panel regressions with *Spread Treasury* and *Spread MMA* as the dependent variables. The sample consists of monthly trading yields of bonds between 2005 and 2024. *Renewable Target* is an indicator equal to one if the state has an active Renewable Portfolio Standard in place. Bond Controls include *Coupon Rate*, *Log Offering Amount*, *Years to Maturity*, *Call Option*, *General Obligation*, *Negotiated Offering*, and the *Insured* indicator. State Controls include *State Population*, *State Income per Capita*, *State Real GDP*, *Real GDP Growth*, and *State Age Dependency*. County Controls include *County Income per Capita*, *County Unemployment Rate*, *County Population*, and *County Age Dependency*. *State Law Fixed Effects* is a set of indicators that control for the top five law theme in each state. Variable definitions are in the legend of Table 1. We cluster standard errors at the issuer and month levels and report them below the coefficient estimates. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)
	Spread Treasury	Spread Treasury	Spread MMA	Spread MMA
Renewable Target	12.602*** (2.856)	12.822*** (2.875)	8.856*** (1.727)	8.955*** (1.739)
Clean Energy Law		-1.487 (2.324)		-0.670 (1.253)
Bond Controls	Yes	Yes	Yes	Yes
State Controls	Yes	Yes	Yes	Yes
County Controls	Yes	Yes	Yes	Yes
County Fixed Effects	Yes	Yes	Yes	Yes
Month-Year Fixed Effects	Yes	Yes	Yes	Yes
State Law Fixed Effects	Yes	Yes	Yes	Yes
Adj. R-squared	0.23	0.23	0.14	0.14
Observations	5,997,217	5,997,217	5,997,217	5,997,217

Table 7: Aggressive Renewable Commitments and Yields in Secondary Market Trading

This table reports results from panel regressions with *Spread Treasury* and *Spread MMA* as the dependent variables. The sample consists of offering yields of state bonds between 2001 and 2024. *Renewable Target* is an indicator equal to one if the state has an active Renewable Portfolio Standard in place. *Aggressive Renewable Target* is an indicator equal to one if the state has an aggressive Renewable Portfolio Standard in place that mandates more than 5% renewable targets at 5 years, 10% at 10 years, and 15% at 15 years after the target implementation. *Clean Energy Law* is an indicator of whether the state has adopted Clean Energy Standard laws. Bond Controls include *Coupon Rate*, *Log Offering Amount*, *Years to Maturity*, *Call Option*, *General Obligation*, *Negotiated Offering*, and the *Insured* indicator. State Controls include *State Population*, *State Income per Capita*, *State Real GDP*, *Real GDP Growth*, and *State Age Dependency*. County Controls include *County Income per Capita*, *County Unemployment Rate*, *County Population*, and *County Age Dependency*. Variable definitions are in the legend of Table 1. We cluster standard errors at the issuer and month levels and report them below the coefficient estimates. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	(1) Spread Treasury	(2) Spread Treasury	(3) Spread MMA	(4) Spread MMA
Renewable Target	-6.526** (2.772)	-5.986** (2.795)	-2.254 (1.681)	-1.914 (1.694)
Aggressive Renewable Target	26.262*** (4.440)	25.996*** (4.451)	15.804*** (2.527)	15.637*** (2.533)
Clean Energy Law		-4.688* (2.446)		-2.954** (1.304)
Bond Controls	Yes	Yes	Yes	Yes
State Controls	Yes	Yes	Yes	Yes
County Controls	Yes	Yes	Yes	Yes
County Fixed Effects	Yes	Yes	Yes	Yes
Month-Year Fixed Effects	Yes	Yes	Yes	Yes
Adj. R-squared	0.24	0.24	0.14	0.14
Observations	6,940,799	6,940,799	6,940,799	6,940,799

Table 8: Aggressive Renewable Commitments and Credit Ratings

This table reports results from panel OLS regressions with *Credit Rating* as the dependent variable. The sample consists of monthly ratings on traded state bonds between 2005 and 2024. *Renewable Target* is an indicator equal to one if the state has an active Renewable Portfolio Standard in place. *Aggressive Renewable Target* is an indicator equal to one if the state has an aggressive Renewable Portfolio Standard in place that mandates more than 5% renewable targets at 5 years, 10% at 10 years, and 15% at 15 years after the target implementation. *Clean Energy Law* is an indicator of whether the state has adopted Clean Energy Standard laws. Bond Controls include *Coupon Rate*, *Log Offering Amount*, *Years to Maturity*, *Bond Age*, *Call Option*, *General Obligation*, *Negotiated Offering*, and the *Insured* indicator. State Controls include *State Population*, *State Income per Capita*, *State Real GDP*, *Real GDP Growth*, and *State Age Dependency*. County Controls include *County Income per Capita*, *County Unemployment Rate*, *County Population*, and *County Age Dependency*. Variable definitions are in the legend of Table 1. We cluster standard errors at the issuer and month levels and report them below the coefficient estimates. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	(1) Credit Rating	(2) Credit Rating
Renewable Target	0.308*** (0.059)	0.307*** (0.059)
Aggressive Renewable Target	-0.513*** (0.090)	-0.513*** (0.090)
Clean Energy Law		0.006 (0.041)
Bond Controls	Yes	Yes
State Controls	Yes	Yes
County Controls	Yes	Yes
County Fixed Effects	Yes	Yes
Month-Year Fixed Effects	Yes	Yes
Adj. R-squared	0.39	0.39
Observations	6,940,799	6,940,799

Table 9: RPS and Electricity Prices

This table reports results from OLS regressions with Electricity Price as the dependent variable. *Electricity Price* is the average price of electricity in the state for the month in cents (U.S. Energy Information Administration). The sample consists of monthly electricity prices between 2000 and 2024. *Renewable Target* is an indicator equal to one if the state has an active Renewable Portfolio Standard in place. *Aggressive Renewable Target* is an indicator equal to one if the state has an aggressive Renewable Portfolio Standard in place that mandates more than 5% renewable targets at 5 years, 10% at 10 years, and 15% at 15 years after the target implementation. We cluster standard errors at the state and month levels and report them below the coefficient estimates. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)
	Overall Price	Industrial Price	Commercial Price	Residential Price
Renewable Target	0.219*** (0.042)	-0.036 (0.046)	0.053 (0.048)	0.278*** (0.051)
Aggressive Renewable Target	0.533*** (0.059)	0.341*** (0.072)	0.543*** (0.067)	0.649*** (0.056)
State Fixed Effects	Yes	Yes	Yes	Yes
Month-Year Fixed Effects	Yes	Yes	Yes	Yes
Adj. R-squared	0.88	0.85	0.87	0.88
Observations	15,300	15,287	15,287	15,300

Table 10: The Exacerbating Role of Energy Demand

This table reports results from OLS regressions with *Spread Treasury* as the dependent variable. The sample consists of monthly trading yields of bonds between 2005 and 2024. *High Total MWH Usage* and *High Total Electricity Expenditure* are indicator variables taking a value of one for counties with above-median electricity consumption and expenditures, respectively. Electricity consumption and prices are measured as of 2016 from the City and County Energy Profiles data provided by the National Renewable Energy Laboratory (NREL). *Renewable Target* is an indicator equal to one if the state has an active Renewable Portfolio Standard in place. *Clean Energy Law* is an indicator of whether the state has adopted Clean Energy Standard laws. Bond Controls include *Coupon Rate*, *Log Offering Amount*, *Years to Maturity*, *Call Option*, *General Obligation*, *Negotiated Offering*, and the *Insured* indicator. State Controls include *State Population*, *State Income per Capita*, *State Real GDP*, *Real GDP Growth*, and *State Age Dependency*. County Controls include *County Income per Capita*, *County Unemployment Rate*, *County Population*, and *County Age Dependency*. Variable definitions are in the legend of Table 1. We cluster standard errors at the issuer and month levels and report them below the coefficient estimates. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	(1) Spread Treasury	(2) Spread Treasury	(3) Spread Treasury
Renewable Target $\times$ High Total MWH Usage		15.309*** (4.055)	
Renewable Target $\times$ High Total Electricity Exp			16.781*** (3.881)
Renewable Target	13.604*** (2.741)	-1.043 (3.357)	-2.573 (3.090)
Clean Energy Law	-5.046** (2.422)	-5.015** (2.422)	-5.005** (2.422)
Bond Controls	Yes	Yes	Yes
State Controls	Yes	Yes	Yes
County Controls	Yes	Yes	Yes
County Fixed Effects	Yes	Yes	Yes
Month-Year Fixed Effects	Yes	Yes	Yes
Adj. R-squared	0.24	0.24	0.24
Observations	6,940,799	6,940,799	6,940,799

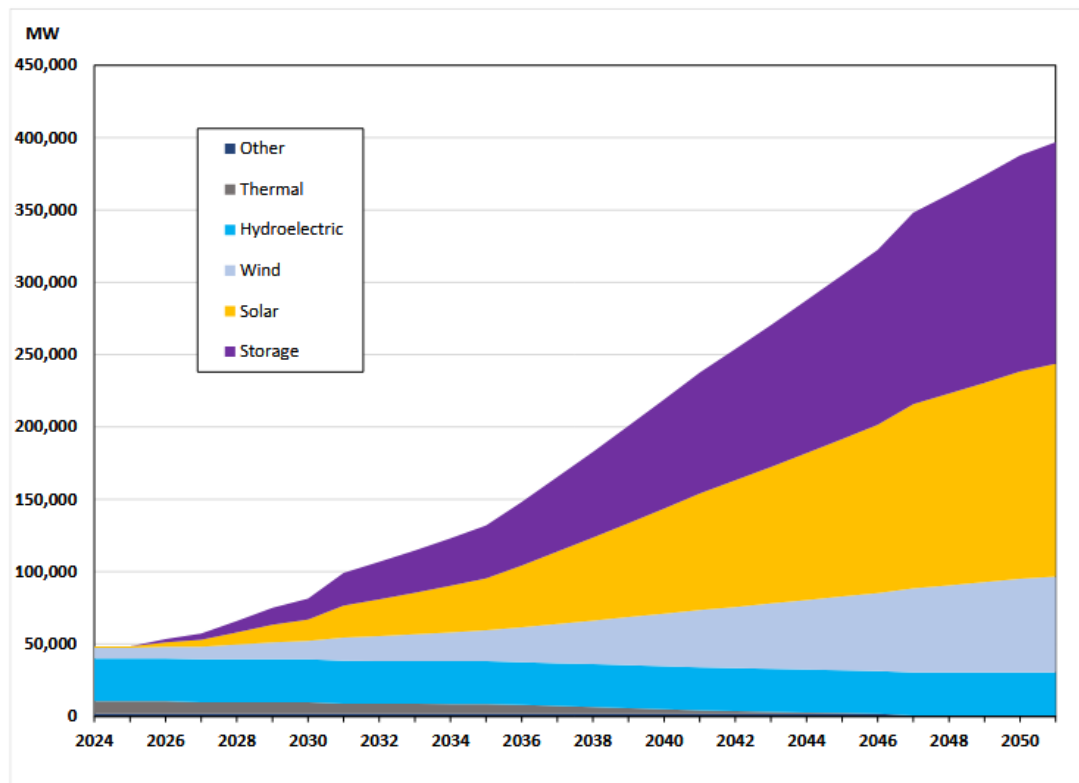
Table 11: The Mitigating Role of Renewable Energy Supply

The sample consists of monthly trading yields of bonds between 2005 and 2024. *Spread Treasury* is the local tax-adjusted spread between the bond yield and maturity-matched treasury yields. *Renewable Target* is an indicator equal to one if the state has an active Renewable Portfolio Standard in place. *High Renewable Potential* is a county that has either *High Wind Potential* or a *High Solar Potential*. *High Wind Potential* is a county in the top 25 percentile in terms of the wind speed (measured in meters per second) at 120 meters above the surface level in the zip code with the highest wind potential in a county (National Renewable Energy Laboratory). *High Solar Potential* is a county in the top 25th percentile in terms of the county's average sunlight potential measured in megajoules per square meter (Center for Disease Control and Prevention). *Clean Energy Law* is an indicator of whether the state has adopted Clean Energy Standard laws. Bond Controls include *Coupon Rate*, *Log Offering Amount*, *Years to Maturity*, *Call Option*, *General Obligation*, *Negotiated Offering*, and the *Insured* indicator. State Controls include *State Population*, *State Income per Capita*, *State Real GDP*, *Real GDP Growth*, and *State Age Dependency*. County Controls include *County Income per Capita*, *County Unemployment Rate*, *County Population*, and *County Age Dependency*. Variable definitions are in the legend of Table 1. We cluster standard errors at the issuer and month levels and report them below the coefficient estimates. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	(1) Spread Treasury	(2) Spread Treasury	(3) Spread Treasury	(4) Spread Treasury
Ren Target $\times$ High Renewable Pot		-15.144*** (3.870)		
Ren Target $\times$ High Wind Potential			-14.582*** (3.794)	
Ren Target $\times$ High Solar Potential				-17.856 (13.796)
Renewable Target	13.604*** (2.741)	15.202*** (2.997)	15.008*** (2.973)	13.907*** (2.765)
Clean Energy Law	-5.046** (2.422)	-5.118** (2.426)	-5.147** (2.427)	-4.446* (2.420)
Bond Controls	Yes	Yes	Yes	Yes
State Controls	Yes	Yes	Yes	Yes
County Controls	Yes	Yes	Yes	Yes
County Fixed Effects	Yes	Yes	Yes	Yes
Month-Year Fixed Effects	Yes	Yes	Yes	Yes
Adj. R-squared	0.24	0.24	0.24	0.24
Observations	6,940,799	6,940,799	6,940,799	6,891,541

Internet Appendix to The Cost of Net Zero

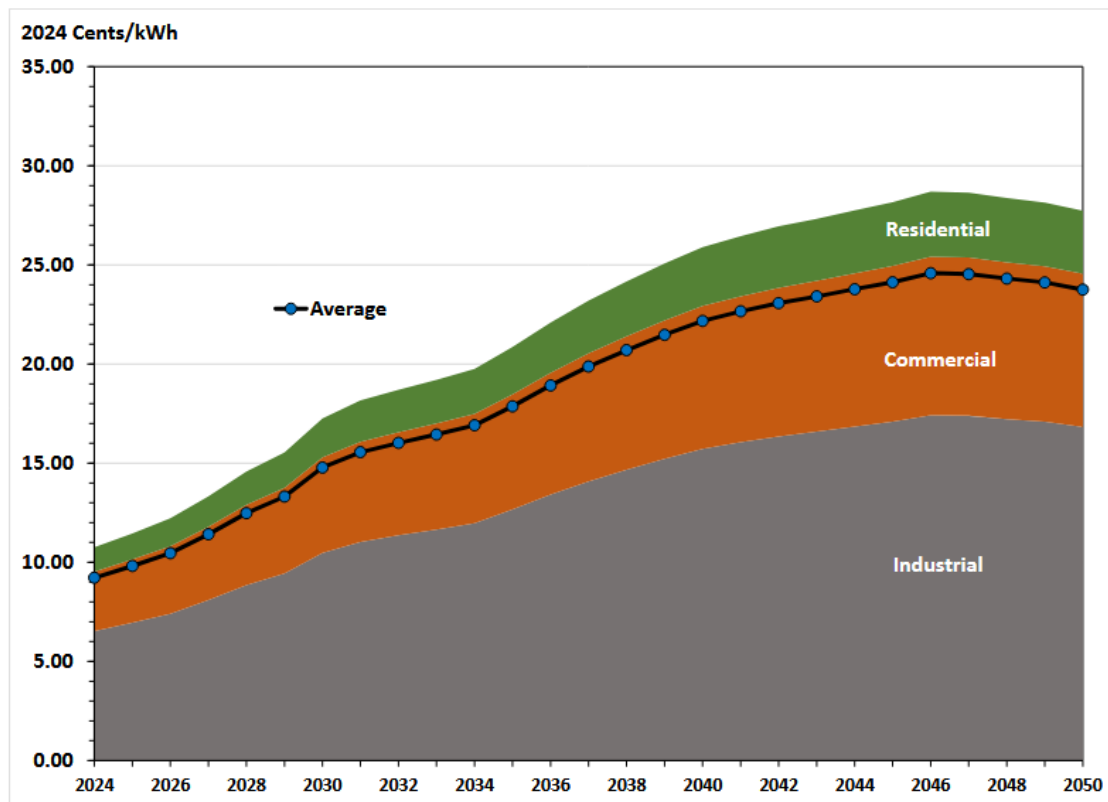
Figure 11: Annual Generating Capacity, RO Scenario



Source: authors' calculations.

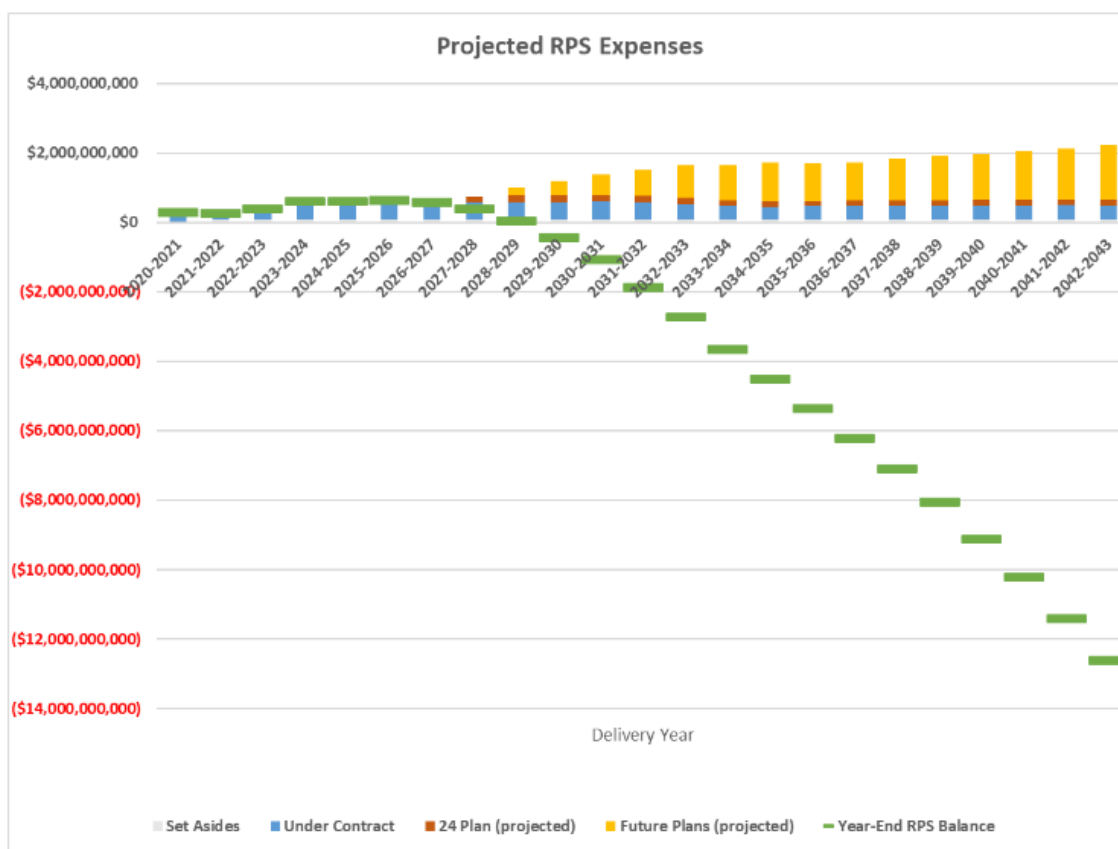
Panel A.1: Oregon and Washington Forecasted Annual Electricity Generation Capacity Needed

Figure 16: RO Scenario – Projected Retail Electric Rates, 2024 – 2050



Source: authors' calculations.

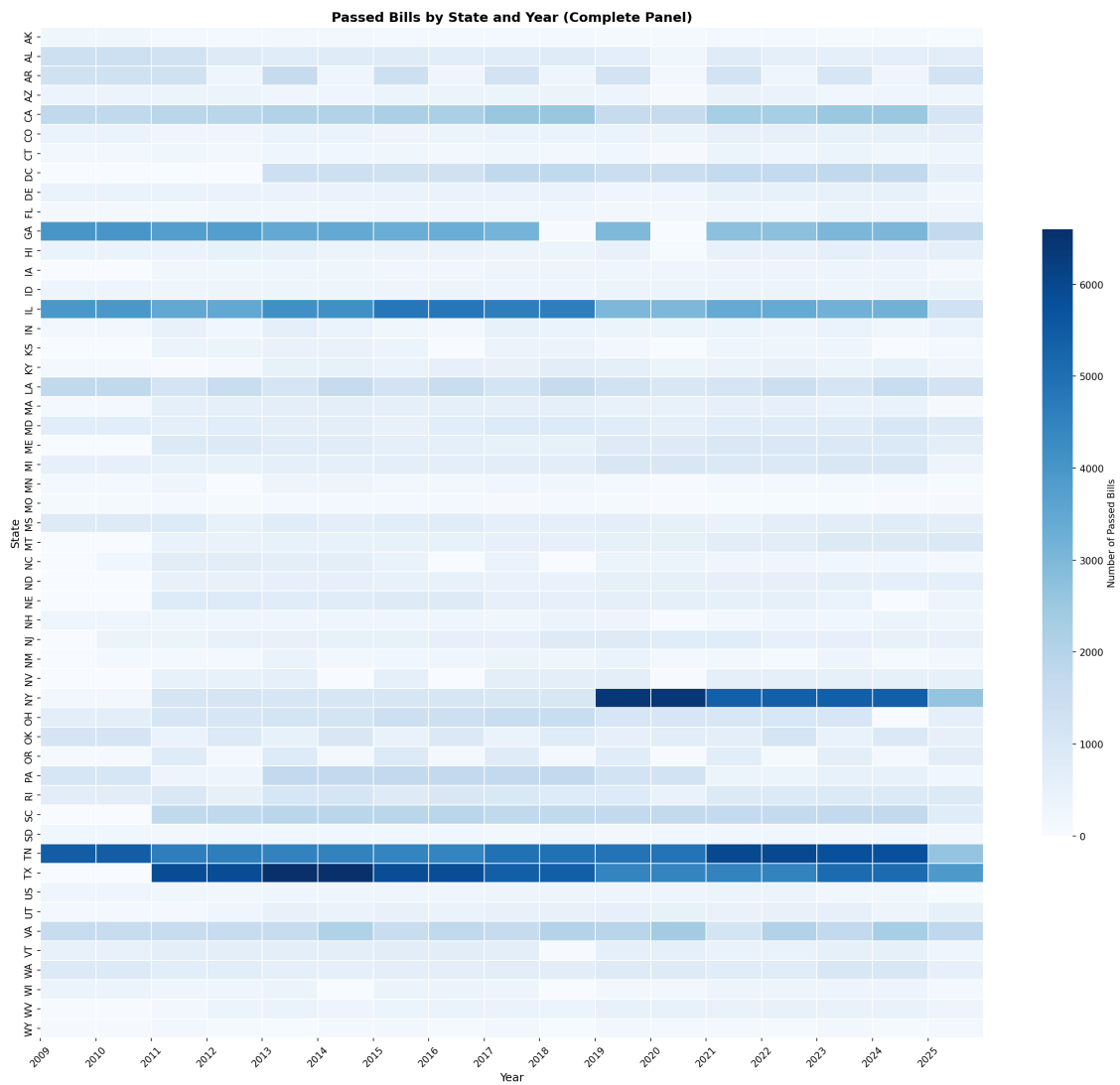
Panel A.2: Oregon and Washington Forecasted Retail Electric Rates



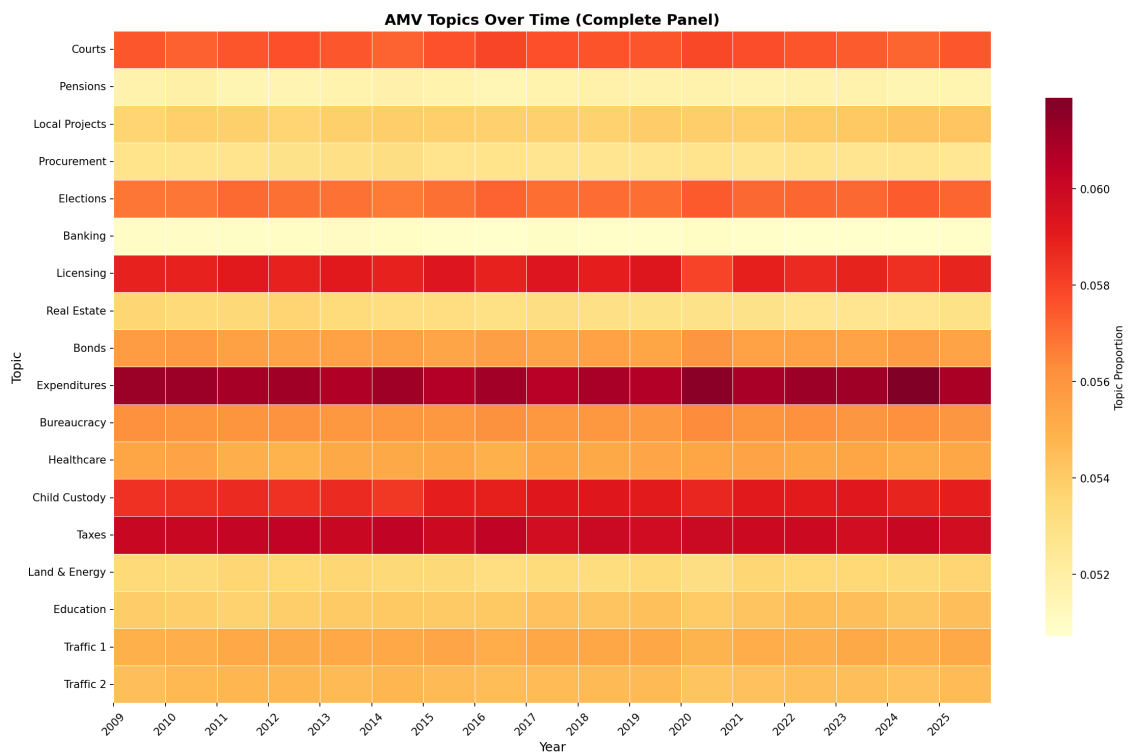
Panel B: Illinois Forecasted Cost of Renewable Portfolio Standard Renewable Energy Credits (RECs)

Figure A1: Examples of Forecasted Costs of Meeting RPS

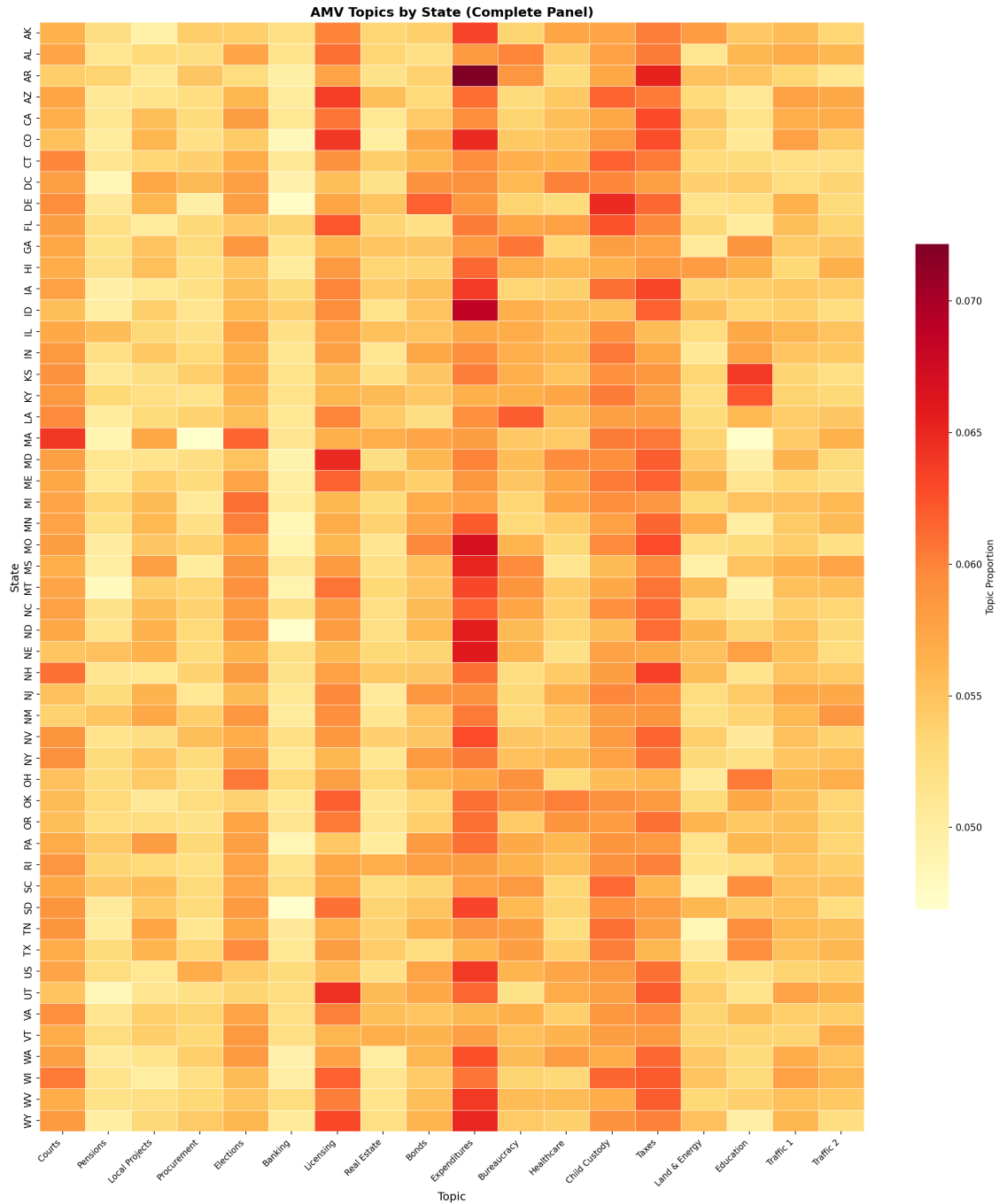
This figure displays two examples of the types of cost increases that policymakers project RPS to incur. Panels A.1 and A.2 show an example from Oregon and Washington, where RPS are predicted to increase the cost of electricity by 450% by 2050 under a “renewables only” (RO) scenario. Panel A.1 shows projected annual generation capacity needed to meet the states’ RPS. Panel A.2 shows projected retail electric rates. Source: Pages 24 and 33 from “The Crippling Cost of Electrification and Net Zero Energy Policies in the Pacific Northwest” (Lesser and Rolling, 2024). Panel B shows the projected budget shortfall in Illinois for renewable energy credits needed to satisfy the state’s RPS. Source: Illinois Power Agency, Renewable Portfolio Standard REC and Budget Forecast, February 2025.



Panel A: Number of Passed Bills by State and Year



Panel B: Topic Proportions by Year



Panel C: Topic Proportions by State

Figure A2: Summary Information for Laws Assigned to AMV Themes

Panel A of this figure displays the number of bills passed in each state and year. We assign each bill to one of the 18 themes identified by [Ash, Morelli, and Vannoni \(2025\)](#). Panel B shows the proportion of bills by topic and year, averaged across states. Panel C displays the proportion of bills by topic and state, averaged across years. We obtain the text of each bill from LegiScan.

Table A1: Excluding Callable Bonds

This table reports results from panel regressions with *Spread Treasury* and *Spread MMA* as the dependent variables. The sample consists of monthly trading yields of bonds without a call option between 2005 and 2024. *Renewable Target* is an indicator equal to one if the state has an active Renewable Portfolio Standard in place. *Clean Energy Law* is an indicator of whether the state has adopted Clean Energy Standard laws. Bond Controls include *Coupon Rate*, *Log Offering Amount*, *Years to Maturity*, *Negotiated Offering*, and the *Insured* indicator. State Controls include *State Population*, *State Income per Capita*, *State Real GDP*, *Real GDP Growth*, and *State Age Dependency*. County Controls include *County Income per Capita*, *County Unemployment Rate*, *County Population*, and *County Age Dependency*. Variable definitions are in the legend of Table 1. We cluster standard errors at the issuer and month levels and report them below the coefficient estimates. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)
	Spread Treasury	Spread Treasury	Spread MMA	Spread MMA
Renewable Target	5.259** (2.111)	5.341** (2.147)	3.939*** (1.144)	3.961*** (1.171)
Clean Energy Law		-1.010 (2.337)		-0.268 (1.349)
Bond Controls	Yes	Yes	Yes	Yes
State Controls	Yes	Yes	Yes	Yes
County Controls	Yes	Yes	Yes	Yes
County Fixed Effects	Yes	Yes	Yes	Yes
Month-Year Fixed Effects	Yes	Yes	Yes	Yes
Adj. R-squared	0.32	0.32	0.17	0.17
Observations	3,242,805	3,242,805	3,242,805	3,242,805

Table A2: Robustness with Spreads Computed with Equal- or Value-Weighting

This table reports results from OLS regressions with alternative yield definitions for state yields as the dependent variable. Model (1) and (3) reports results with *Spread Treasury* and *Spread MMA* from Table 2. Model (2) and (4) reports results with equal-weighted spreads as the dependent variables. This dependent variable uses average equally weighted yield spreads relative to the treasury (or MMA) instead of weighting by transaction amount. *Renewable Target* is an indicator equal to one if the state has an active Renewable Portfolio Standard in place. *Clean Energy Law* is an indicator of whether the state has adopted Clean Energy Standard laws. Bond Controls include *Coupon Rate*, *Log Offering Amount*, *Years to Maturity*, *Bond Age*, *Call Option*, *General Obligation*, *Negotiated Offering*, and the *Insured* indicator. State Controls include *State Population*, *State Income per Capita*, *State Real GDP*, *Real GDP Growth*, and *State Age Dependency*. County Controls include *County Income per Capita*, *County Unemployment Rate*, *County Population*, and *County Age Dependency*. Variable definitions are in the legend of Table 1. We cluster standard errors at the issuer and month levels and report them below the coefficient estimates. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	(1) VW Spread Treasury	(2) EW Spread Treasury	(3) VW Spread MMA	(4) EW Spread MMA
Renewable Target	13.604*** (2.741)	13.480*** (2.749)	9.869*** (1.554)	9.799*** (1.561)
Clean Energy Law	-5.046** (2.422)	-5.020** (2.434)	-3.170** (1.292)	-3.152** (1.297)
Bond Controls	Yes	Yes	Yes	Yes
State Controls	Yes	Yes	Yes	Yes
County Controls	Yes	Yes	Yes	Yes
County Fixed Effects	Yes	Yes	Yes	Yes
Month-Year Fixed Effects	Yes	Yes	Yes	Yes
Adj. R-squared	0.24	0.24	0.14	0.14
Observations	6,940,799	6,940,799	6,940,799	6,940,799

Table A3: Renewable Commitments and Yields in Secondary Market Trading Conditional on Credit Ratings

This table reports results from panel regressions with *Spread Treasury* and *Spread MMA* as the dependent variables. The sample consists of monthly trading yields of bonds between 2005 and 2024. *Renewable Target* is an indicator equal to one if the state has an active Renewable Portfolio Standard in place. *Clean Energy Law* is an indicator of whether the state has adopted Clean Energy Standard laws. *Credit Rating* is the lowest numerical rating issued by Moody's, Standard & Poor's, and Fitch. Bond Controls include *Coupon Rate*, *Log Offering Amount*, *Years to Maturity*, *Bond Age*, *Call Option*, *General Obligation*, *Negotiated Offering*, and the *Insured* indicator. State Controls include *State Population*, *State Income per Capita*, *State Real GDP*, *Real GDP Growth*, and *State Age Dependency*. County Controls include *County Income per Capita*, *County Unemployment Rate*, *County Population*, and *County Age Dependency*. Variable definitions are in the legend of Table 1. We cluster standard errors at the issuer and month levels and report them below the coefficient estimates. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)
	Spread Treasury	Spread Treasury	Spread MMA	Spread MMA
Renewable Target	12.159*** (2.345)	12.512*** (2.353)	8.981*** (1.345)	9.203*** (1.354)
Clean Energy Law		-4.871** (2.443)		-3.063** (1.286)
Credit Rating	-13.765*** (1.557)	-13.764*** (1.557)	-8.398*** (0.938)	-8.397*** (0.938)
Bond Controls	Yes	Yes	Yes	Yes
State Controls	Yes	Yes	Yes	Yes
County Controls	Yes	Yes	Yes	Yes
County Fixed Effects	Yes	Yes	Yes	Yes
Month-Year Fixed Effects	Yes	Yes	Yes	Yes
Adj. R-squared	0.26	0.26	0.16	0.16
Observations	6,940,799	6,940,799	6,940,799	6,940,799

Table A4: Baseline Results Interacted with Bond Maturity

This table reports results from panel regressions with *Spread Treasury* and *Spread MMA* as the dependent variables. The sample consists of monthly trading yields of bonds between 2005 and 2024. *Renewable Target* is an indicator equal to one if the state has an active Renewable Portfolio Standard in place. *Maturity 0-10 years* (*Maturity 10-20 years*, *Maturity 20+ years*) is an indicator variable taking a value of one if the bond's maturity is less than ten years (between ten and twenty years, more than twenty years). *Clean Energy Law* is an indicator of whether the state has adopted Clean Energy Standard laws. Bond Controls include *Coupon Rate*, *Log Offering Amount*, *Years to Maturity*, *Bond Age*, *Call Option*, *General Obligation*, *Negotiated Offering*, and the *Insured* indicator. State Controls include *State Population*, *State Income per Capita*, *State Real GDP*, *Real GDP Growth*, and *State Age Dependency*. County Controls include *County Income per Capita*, *County Unemployment Rate*, *County Population*, and *County Age Dependency*. Variable definitions are in the legend of Table 1. We cluster standard errors at the issuer and month levels and report them below the coefficient estimates. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	(1) Spread Treasury	(2) Spread MMA
Renewable Target $\times$ Maturity 0-10 years	6.020** (2.627)	6.899*** (1.497)
Renewable Target $\times$ Maturity 10-20 years	28.162*** (3.048)	13.357*** (1.720)
Renewable Target $\times$ Maturity 20+ years	48.704*** (4.757)	41.627*** (2.619)
Clean Energy Law	-4.821** (2.412)	-3.096** (1.290)
Bond Controls	Yes	Yes
State Controls	Yes	Yes
County Controls	Yes	Yes
County Fixed Effects	Yes	Yes
Month-Year Fixed Effects	Yes	Yes
Adj. R-squared	0.24	0.15
Observations	6,940,799	6,940,799

Table A5: Aggressive Renewable Commitments and Offering Yields

This table reports results from panel regressions with *Spread Treasury* and *Spread MMA* as the dependent variables. The sample consists of offering yields of state bonds between 2001 and 2024. *Renewable Target* is an indicator equal to one if the state has an active Renewable Portfolio Standard in place. *Aggressive Renewable Target* is an indicator equal to one if the state has an aggressive Renewable Portfolio Standard in place that mandates more than 5% renewable targets at 5 years, 10% at 10 years, and 15% at 15 years after the target implementation. *Clean Energy Law* is an indicator of whether the state has adopted Clean Energy Standard laws. Bond Controls include *Coupon Rate*, *Log Offering Amount*, *Years to Maturity*, *Call Option*, *General Obligation*, *Negotiated Offering*, and the *Insured* indicator. State Controls include *State Population*, *State Income per Capita*, *State Real GDP*, *Real GDP Growth*, and *State Age Dependency*. County Controls include *County Income per Capita*, *County Unemployment Rate*, *County Population*, and *County Age Dependency*. Variable definitions are in the legend of Table 1. We cluster standard errors at the issuer and month levels and report them below the coefficient estimates. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)
	Spread Treasury	Spread Treasury	Spread MMA	Spread MMA
Renewable Target	-1.971 (1.473)	-1.987 (1.475)	-2.240** (0.921)	-2.216** (0.922)
Aggressive Renewable Target	9.797*** (1.616)	9.829*** (1.620)	8.307*** (0.981)	8.260*** (0.979)
Clean Energy Law		0.614 (2.352)		-0.894 (1.361)
Bond Controls	Yes	Yes	Yes	Yes
State Controls	Yes	Yes	Yes	Yes
County Controls	Yes	Yes	Yes	Yes
County Fixed Effects	Yes	Yes	Yes	Yes
Month-Year Fixed Effects	Yes	Yes	Yes	Yes
Adj. R-squared	0.68	0.68	0.39	0.39
Observations	1,033,189	1,033,189	1,033,240	1,033,240