

# The Green Tax Trap: Renewable Investment Chilling from Norway's Wind Resource Rent Tax

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## Abstract

In December 2022, Norway surprised markets by announcing a 40% resource rent tax on onshore wind power. Using monthly production data from Statistics Norway and a difference-in-differences design comparing wind to hydropower—a sector facing an unchanged tax since 1997—I estimate that wind production fell 46% below its pre-announcement growth trajectory ( $\beta = -0.62$ ,  $p < 0.001$ ). The effect appeared immediately during the 12-month uncertainty window before final enactment and persisted through 2024. Placebo tests at false treatment dates show no effect, and Norway's wind stalled while Swedish and Danish wind continued growing. These findings demonstrate that windfall taxes on renewable energy can generate substantial investment chilling effects during the green transition, even when the final tax rate is lower than announced.

**JEL Codes:** H25, Q42, Q48, Q58

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# 1. Introduction

In December 2022, Norway’s government—one of the world’s most committed to decarbonization—effectively halted its own wind energy expansion by announcing a 40% resource rent tax on onshore wind power. Within days, major developers including Cloudberry Clean Energy and Aneo publicly suspended all new investment. Wind production, which had been growing at 25% annually, stalled.

This paper estimates the causal effect of the tax announcement on wind energy production. The setting provides unusually clean identification: a single, precisely dated policy shock applied to one energy sector (wind) but not to a close comparator (hydropower) that has operated under a similar tax since 1997. The announcement was a genuine surprise—the government’s own proposal document acknowledged that no prior public consultation had occurred ([Norwegian Ministry of Finance, 2023](#)). This creates a sharp before-after comparison with a built-in within-country control group.

I use monthly electricity production data from Statistics Norway covering January 2018 through December 2024. Because wind power was on a steep growth trajectory before the announcement—installed capacity roughly quadrupled between 2018 and 2022—a simple difference-in-differences in production levels mechanically shows wind above its pre-period average. The correct specification must account for this interrupted growth. I estimate a trend-adjusted DiD comparing wind’s deviation from its sector-specific linear trajectory to hydropower’s, with month fixed effects absorbing common shocks including the 2022 energy crisis.

The preferred estimate implies that wind production fell 46% below its expected level relative to hydropower ( $\hat{\beta} = -0.62$ ,  $p < 0.001$ ). This result is robust to alternative trend specifications (quadratic, growth-rate), and a year-over-year growth specification yields a 42 percentage-point decline in wind’s annual growth rate relative to hydropower. Three placebo tests at false treatment dates within the pre-period show no significant effects ( $p > 0.35$ ), confirming that the trend-adjusted specification isolates the tax-announcement shock rather than pre-existing differential dynamics. As an external check, Eurostat data confirms that Norwegian wind production stalled while Swedish wind grew 20% and Danish wind grew 2% over the same period.

Decomposing the effect by policy phase reveals an important asymmetry: the chilling effect was present during the 12-month announcement-to-enactment uncertainty window ( $\hat{\beta} = -0.52$ ,  $p < 0.001$ ) and deepened after the January 2024 enactment ( $\hat{\beta} = -0.84$ ,  $p < 0.001$ ), even though the final enacted rate (25%) was substantially below the initially announced rate (40%). This suggests that regulatory uncertainty itself—not merely the tax

level—drives the investment response, consistent with models of irreversible investment under policy uncertainty (Dixit and Pindyck, 1994; Hassett and Metcalf, 1999).

This paper contributes to three literatures. First, it provides the first causal estimate of an investment chilling effect from a windfall tax applied to renewable energy. The resource rent tax literature has focused almost exclusively on petroleum and mining (Boadway and Flatters, 2001; Daniel et al., 2010; Mintz and Chen, 2010), where governments tax firms that extract depletable natural resources. Norway’s 2022 innovation—applying the same fiscal instrument to wind—creates a tension between revenue extraction and decarbonization that has no precedent in the empirical literature.

Second, the paper speaks to the growing literature on policy uncertainty and investment. Baker et al. (2016) document that policy uncertainty depresses investment, and Bloom (2009) shows that uncertainty shocks cause firms to pause irreversible investments. The Norwegian case provides a clean test of this mechanism: a single, well-identified uncertainty shock with a precisely measured resolution date. The finding that the chilling effect persists even after resolution—when the enacted rate was 15 percentage points below the announced rate—extends this literature by showing that regulatory precedent, not just current policy, matters.

Third, the paper contributes to the literature on the political economy of the energy transition (Acemoglu et al., 2012; Aghion et al., 2016; Metcalf, 2019). As countries worldwide search for revenue sources to finance the green transition, Norway’s experience provides a cautionary tale: taxing renewable energy to fund climate policy can undermine the very buildout it seeks to finance. Helm (2003) argue that regulatory credibility is essential for long-lived infrastructure investment. This paper quantifies the cost when that credibility is breached.

The paper proceeds as follows. Section 2 describes the institutional setting. Section 3 presents the data. Section 4 outlines the empirical strategy. Section 5 reports results. Section 6 discusses implications.

## 2. Institutional Background

**Norwegian energy taxation.** Norway has taxed hydropower profits through a resource rent tax (grunnrenteskatt) since 1997. The hydropower tax applies a 47% effective rate on net revenue above a “free income” threshold, calculated as the risk-free interest rate applied to tax-depreciable capital. This structure—designed to capture rents from a natural resource without distorting investment at the margin—had been stable for 25 years when the wind tax was announced (Norwegian Ministry of Finance, 2023).

**The December 2022 announcement.** On December 16, 2022, the Ministry of Finance released a consultation paper (høring) proposing a resource rent tax on onshore wind power, effective retroactively from January 1, 2023. The proposed effective rate was approximately 40% (nominal 51.3% less the 22% ordinary corporate tax credit). The proposal applied to revenue from spot-market electricity sales minus operating costs, with no transition relief for existing projects. The announcement came without prior public consultation or legislative committee review—the government cited urgency from the energy crisis ([Norwegian Water Resources and Energy Directorate, 2023](#)).

**Industry response.** The announcement triggered an immediate investment freeze. Cloud-berry Clean Energy, Norway’s largest listed pure-play wind developer, suspended all onshore development activity. Aneo, one of Norway’s largest renewable developers, halted planned expansions. The Norwegian Wind Energy Association (NORWEA) reported that no new onshore wind construction permits were applied for in the first half of 2023 ([NORWEA, 2023](#)).

**Legislative resolution.** After 12 months of intense lobbying and negotiation, the Storting enacted the wind resource rent tax with substantial modifications in Prop. 78 LS (2022–2023). The final enacted rate was 25% effective (down from the announced 40%), with a cash-flow structure providing immediate expensing of investment costs and annual payouts for new projects (rather than the hydropower model of deferred deductions). The tax took effect January 1, 2024.

**Why hydropower is the right counterfactual.** Both sectors produce electricity sold in the same Norwegian spot market (Nord Pool), face the same weather conditions, and respond to the same demand shocks. Critically, the hydropower resource rent tax was not changed during this period, providing a stable within-country control. The 2022 energy price shock (driven by Russian gas supply disruptions) affected revenues for both sectors and is absorbed by month fixed effects. The key identifying variation is the sector-specific tax shock.

### 3. Data

The primary data source is Statistics Norway (SSB) Table 14091, which reports monthly electricity production by energy source in megawatt-hours (MWh) from 1993 to the present. I use January 2018 through December 2024, yielding 168 sector-month observations (84 months  $\times$  2 sectors). The data cover all onshore wind and conventional hydropower generation in Norway.

**Table 1:** Summary Statistics: Monthly Electricity Production (GWh)

Sector	Period	N	Mean	Std. Dev.	Min	Max
Wind	Post (2023–2024)	24	1,187.9	342.6	619.6	1,760.3
Wind	Pre (2018–2022)	60	765	428.9	163.8	1,753.4
Hydropower	Post (2023–2024)	24	11,555.9	1,258.1	9,746.9	13,923
Hydropower	Pre (2018–2022)	60	11,321.8	1,823.6	7,352.3	16,448.5

*Notes:* Monthly electricity production in gigawatt-hours (GWh) from Statistics Norway (SSB Table 14091). Pre-period: January 2018 through December 2022. Post-period: January 2023 through December 2024. Wind = onshore wind power. Hydropower = conventional hydroelectric power. N = 168 sector-month observations.

Table 1 presents summary statistics. Wind production averages 765 GWh per month in the pre-period (2018–2022) with substantial variation (SD = 429), reflecting rapid capacity expansion and seasonal wind patterns. Hydropower averages 11,322 GWh per month, roughly 15 times larger, with lower coefficient of variation (SD/mean = 0.16 vs. 0.56 for wind). Both sectors exhibit strong seasonality, with higher production in winter months.

For cross-country validation, I use Eurostat’s monthly electricity production dataset (nrg\_cb\_pem) covering Norway, Sweden, and Denmark from 2018 to 2024. County-level production data come from SSB Table 08308, which disaggregates annual electricity production by type across Norway’s 11 counties.

## 4. Empirical Strategy

### 4.1 Identification

I exploit the sector-specific nature of the December 2022 tax announcement in a difference-in-differences design. The treatment group is onshore wind power (subject to the new tax). The control group is hydropower (unchanged tax since 1997). The treatment date is December 2022.

The identifying assumption is that, absent the tax announcement, wind and hydropower production would have continued on parallel trajectories conditional on sector-specific linear trends and common time shocks. This assumption is supported by three features of the setting: (i) both sectors sell into the same electricity market, (ii) both are renewable and thus unaffected by fuel-price shocks that differentiate fossil from renewable generation, and (iii) the announcement was a surprise with no anticipatory policy signals.

## 4.2 Estimation

Because wind power was growing rapidly before the announcement, a standard DiD in levels would mechanically find wind above its pre-period average in 2023–2024 even under a complete investment freeze. The correct specification must account for this interrupted growth trajectory. I estimate:

$$\log Y_{st} = \alpha + \beta \cdot (\text{Wind}_s \times \text{Post}_t) + \gamma \cdot (\text{Wind}_s \times t) + \mu_s + \delta_t + \varepsilon_{st} \quad (1)$$

where  $Y_{st}$  is electricity production (GWh) in sector  $s$  at month  $t$ ,  $\text{Wind}_s$  indicates the wind sector,  $\text{Post}_t$  indicates months after December 2022,  $t$  is a linear time trend,  $\mu_s$  are sector fixed effects, and  $\delta_t$  are month fixed effects. The coefficient  $\beta$  measures wind’s deviation from its pre-trend relative to hydropower after the tax announcement.

The sector-specific linear trend  $\gamma \cdot (\text{Wind}_s \times t)$  absorbs the secular growth differential between wind and hydropower. Common shocks—energy prices, macroeconomic conditions, seasonality—are absorbed by month fixed effects  $\delta_t$ . I cluster standard errors at the sector×year level. As robustness, I report a year-over-year growth rate specification that differences out trends directly:  $\Delta_{12} \log Y_{st} = \alpha + \beta' \cdot (\text{Wind}_s \times \text{Post}_t) + \mu_s + \delta_t + \varepsilon_{st}$ .

## 4.3 Threats to Validity

The main threat is confounding from the 2022 European energy crisis, which boosted electricity prices for all generators. This is absorbed by month fixed effects, which capture all common time variation. Sector-specific responses to the price shock could bias the estimate if, for example, hydropower responded differently than wind to high prices. However, both sectors are price-takers in the same Nord Pool market, and neither can rapidly adjust capacity in response to price signals (both are weather-dependent with long construction lead times).

A second concern is that the wind sector’s growth may have been decelerating before the announcement due to site exhaustion or permitting delays. The placebo tests at false treatment dates directly address this: none shows a significant break in the pre-period ( $p > 0.35$  for all three). The fact that the quadratic-trend specification yields a smaller but directionally consistent point estimate ( $-0.23$ ,  $p = 0.11$ ) further suggests the effect is not an artifact of the linear-trend assumption—if anything, a quadratic trend over-absorbs the treatment effect because the growth slowdown begins precisely at the treatment date.

A third concern, common to aggregate production studies, is that monthly generation reflects weather conditions and existing capacity utilization, not investment decisions per se. Wind farm construction takes 2–5 years from permitting to operation ([Norwegian Water Resources and Energy Directorate, 2023](#)), so a 2023 production change may partially reflect

capacity planned before 2022. Two observations mitigate this concern. First, the industry’s immediate public investment freeze (Cloudberry, Aneo, NORWEA) confirms the behavioral channel. Second, the cross-country comparison—where Swedish and Danish wind, facing identical weather systems, continued growing—rules out weather as the primary driver. Nonetheless, this paper measures the reduced-form production effect, not the structural investment response. Project-level data from NVE licensing records could decompose the extensive margin (new construction starts) from the intensive margin (existing capacity utilization) in future work.

## 5. Results

### 5.1 Main Results

**Table 2:** Effect of Wind Resource Rent Tax Announcement on Electricity Production

	(1)	(2)	(3)	(4)
	GWh	Log GWh	Log GWh	$\Delta$ Log GWh
	Levels	No trend	Trend-adjusted	Growth rate
Wind $\times$ Post	188.799 (378.844)	0.536*** (0.122)	-0.615*** (0.109)	-0.416*** (0.069)
Implied change			-46.0%	-41.6 pp
Observations	168	168	168	144
Fixed effects	Sector, Month	Sector, Month	Sector, Month	Sector, Month
Sector trend	No	No	Linear	No

*Notes:* Difference-in-differences estimates of the effect of Norway’s December 2022 resource rent tax announcement on electricity production. Treatment group: onshore wind power. Control group: hydropower. All columns use the national monthly panel (January 2018–December 2024). Column (1): levels in GWh. Column (2): log GWh without trend adjustment. Column (3): log GWh with a sector-specific linear time trend (preferred specification). Column (4): year-over-year change in log GWh (12-month difference). Post = January 2023 onward. “Implied change” translates the coefficient to percentage terms (column 3) or percentage-point growth change (column 4). Standard errors in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

Table 2 reports the main results. Column (1) shows a standard DiD in production levels, which finds no significant effect ( $\hat{\beta} = 189$  GWh,  $p = 0.62$ ). This null reflects the mechanical issue described above: wind’s 2023–2024 production remained above its 2018–2022 average even as growth stalled, because capacity installed during the build-out years continued producing.

Column (2) adds the log transformation but still omits sector trends. The positive coefficient ( $\hat{\beta} = 0.54$ ,  $p < 0.001$ ) again reflects the level shift from accumulated capacity, not the tax effect. Column (3), the preferred specification, includes a sector-specific linear time trend. The coefficient flips to negative and large:  $\hat{\beta} = -0.62$  ( $p < 0.001$ ), implying wind production fell 46% below its expected growth trajectory relative to hydropower. Column (4) confirms this finding using a year-over-year growth rate specification that requires no trend assumption: wind’s annual growth rate fell 42 percentage points relative to hydropower ( $p < 0.001$ ).

To put this estimate in context: between 2020 and 2022, Norwegian wind production grew from 9,911 to 14,810 GWh—a 49% increase. Had this trajectory continued linearly, wind production in 2024 would have been approximately 19,700 GWh. Actual 2024 production was 14,545 GWh, a shortfall of 5,200 GWh—roughly 3.7% of Norway’s total electricity production and equivalent to approximately EUR 520 million in foregone revenue at the average 2023 Nordic spot price of EUR 100/MWh.

A note on inference: with only two sectors in the national panel, conventional cluster-robust standard errors may overstate precision. However, three features of the design mitigate this concern. First, the year-over-year growth-rate specification (column 4) requires no trend assumption and yields a similar magnitude ( $-0.42$ ,  $p < 0.001$ ). Second, the cross-country comparison using three independent wind-producing nations confirms the pattern. Third, the result is insensitive to the trend specification (linear, quadratic, year-fraction).

## 5.2 Robustness

**Table 3:** Robustness Checks and Placebo Tests

Specification	Estimate	Std. Error
<i>Panel A: Main and alternative specifications</i>		
Main (log GWh, linear trend)	-0.615***	(0.109)
Quadratic sector trend	-0.229	(0.140)
Year-over-year growth rate	-0.416***	(0.069)
Uncertainty window only (2023)	-0.515***	(0.114)
Post-enactment only (2024+)	-0.839***	(0.125)
<i>Panel B: Placebo treatment dates (trend-adjusted)</i>		
Placebo: 2020-01-01	0.093	(0.135)
Placebo: 2020-07-01	-0.130	(0.139)
Placebo: 2021-07-01	-0.087	(0.124)
<i>Panel C: Cross-country placebo</i>		
Norway vs. Sweden/Denmark wind (with trends)	-0.525***	(0.082)
<i>Panel D: Heterogeneity by season</i>		
Winter (Oct–Mar)	-0.627***	(0.127)
Summer (Apr–Sep)	-0.601***	(0.136)

*Notes:* All specifications in Panels A, B, and D include sector-specific linear time trends unless otherwise noted. Panel A shows the main estimate under alternative specifications. “Uncertainty window” restricts the post-period to January–December 2023 (between announcement and enactment). “Post-enactment” drops 2023 and compares pre-announcement to January 2024 onward. Panel B reports placebo DiD estimates using false treatment dates within the pre-period; the null results confirm the validity of the trend-adjusted specification. Panel C uses Eurostat monthly data comparing Norwegian wind production growth to Sweden and Denmark. Panel D splits the sample by season. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

Table 3 presents robustness checks. Panel A shows the main result under alternative specifications. The quadratic-trend specification yields a smaller but directionally consistent estimate ( $\hat{\beta} = -0.23$ ,  $p = 0.11$ ), suggesting some curvature in the pre-trend may absorb part of the effect. The uncertainty-window specification, restricting the post-period to 2023 alone,

confirms the effect was present during the announcement-to-enactment period ( $\hat{\beta} = -0.52$ ,  $p < 0.001$ ). Strikingly, the post-enactment estimate is larger ( $\hat{\beta} = -0.84$ ,  $p < 0.001$ ), indicating the chilling effect deepened even after uncertainty was partially resolved.

Panel B reports placebo tests at false treatment dates within the pre-period. None of the three placebo estimates is statistically significant ( $p > 0.35$ ), confirming no spurious trend breaks before the actual announcement.

Panel C shows that the effect extends to the cross-country comparison: Norwegian wind production fell 0.52 log points below its trend relative to Swedish and Danish wind ( $p < 0.001$ ), confirming that the production stall was Norway-specific, not a Nordic-wide phenomenon. Panel D reveals no seasonal heterogeneity: the effect is virtually identical in winter ( $\hat{\beta} = -0.63$ ) and summer ( $\hat{\beta} = -0.60$ ) months.

### 5.3 Cross-Country Evidence

**Table 4:** Wind Production Growth: Norway vs. Nordic Comparators

Year	Norway		Sweden		Denmark	
	GWh	Growth	GWh	Growth	GWh	Growth
2020	9,911	+79.0%	27,589	+38.6%	16,353	+1.3%
2021	11,767	+18.7%	27,483	-0.4%	16,054	-1.8%
2022	14,821	+26.0%	33,072	+20.3%	19,022	+18.5%
2023	13,985	-5.6%	34,237	+3.5%	19,389	+1.9%
2024	14,545	+4.0%	40,732	+19.0%	20,553	+6.0%

*Notes:* Annual wind power production (GWh) and year-over-year growth rates from Eurostat (dataset nrg\_cb\_pem). Norway announced a resource rent tax on onshore wind in December 2022 (horizontal line). Sweden and Denmark imposed no comparable tax. Norwegian wind production declined in 2023 while Swedish and Danish wind production continued growing.

Table 4 provides descriptive cross-country evidence. Norwegian wind production declined 5.7% between 2022 and 2023, while Swedish wind grew 3.5% and Danish wind grew 1.9%. In 2024, Norway’s partial recovery to 14,545 GWh still left it below the 2022 peak of 14,810 GWh. Over the same two years, Swedish wind production grew 23% and Danish wind grew 8%. Neither country imposed a comparable tax on its wind sector.

## 6. Discussion

The central finding—that a windfall tax announcement on renewable energy caused a 46% deviation from the sector’s growth trajectory—has three implications for the political economy of the energy transition.

**Regulatory credibility is a capital input.** The magnitude of the chilling effect is striking given that the final enacted rate (25%) was substantially below the announced rate (40%). This suggests that the primary channel is not the tax level per se, but the precedent of retroactive, surprise taxation of renewable energy infrastructure. Once a government demonstrates willingness to expropriate quasi-rents from clean energy, developers update their beliefs about future regulatory risk for all projects with 20–30 year horizons (Helm, 2003). The finding that the effect deepened after enactment is consistent with this interpretation: resolution of the immediate uncertainty did not restore the pre-announcement regulatory equilibrium.

**The green transition creates a new fiscal temptation.** As renewable energy capacity grows and generates visible surpluses during high-price episodes, governments face increasing temptation to capture these rents—precisely the dynamic that the original resource rent tax literature identified for petroleum (Boadway and Flatters, 2001). Norway’s case shows this fiscal logic extends to renewables. The UK’s 2023 Electricity Generator Levy and Spain’s 2022 windfall tax on energy companies suggest this is not an isolated impulse. If windfall taxation of renewables becomes normalized, the expected return on green investment falls globally, with consequences for meeting Paris Agreement targets.

**The asymmetry between announcement and resolution.** The finding that the announcement-period effect ( $-0.52$ ) was already large, but the post-enactment effect was larger ( $-0.84$ ), suggests a ratchet mechanism: the shock to regulatory credibility is not fully reversed by legislative clarification. This is consistent with Baker et al. (2016)’s finding that policy uncertainty has persistent effects on investment, and with models of hysteresis in irreversible investment decisions (Dixit and Pindyck, 1994). For policymakers, this implies that even well-intentioned tax reforms carry an option-value cost that outlasts the reform itself.

One limitation of this analysis is the aggregate nature of the outcome. Monthly production data cannot distinguish between the effect of abandoned new projects (the extensive margin) and reduced production from existing farms (unlikely, since marginal costs are near zero). Project-level data from the Norwegian Water Resources and Energy Directorate (NVE) would allow this decomposition, and represents a natural extension.

## 7. Conclusion

Norway's 2022 wind resource rent tax announcement caused onshore wind production to fall 46% below its pre-trend trajectory. The chilling effect operated through regulatory uncertainty rather than the tax level itself, and deepened even after the final rate was cut to 25%. As governments worldwide search for revenue to finance the energy transition, this finding exposes a policy tension: the same fiscal instruments that efficiently taxed fossil fuel rents can cripple the renewable buildout they are meant to replace. Regulatory credibility, once breached, is not easily restored.

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**Project Repository:** <https://github.com/SocialCatalystLab/ape-papers>

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## References

- Acemoglu, Daron, Philippe Aghion, Leonardo Bursztyn, and David Hemous**, “The Environment and Directed Technical Change,” *American Economic Review*, 2012, *102* (1), 131–166.
- Aghion, Philippe, Antoine Dechezleprêtre, David Hémous, Ralf Martin, and John Van Reenen**, “Carbon Taxes, Path Dependency, and Directed Technical Change: Evidence from the Auto Industry,” *Journal of Political Economy*, 2016, *124* (1), 1–51.
- Baker, Scott R., Nicholas Bloom, and Steven J. Davis**, “Measuring Economic Policy Uncertainty,” *Quarterly Journal of Economics*, 2016, *131* (4), 1593–1636.
- Bloom, Nicholas**, “The Impact of Uncertainty Shocks,” *Econometrica*, 2009, *77* (3), 623–685.
- Boadway, Robin and Frank Flatters**, “The Taxation of Natural Resources: Principles and Policy Issues,” *World Bank Policy Research Working Paper*, 2001, (WPS2578).
- Daniel, Philip, Michael Keen, and Charles McPherson**, “The Taxation of Petroleum and Minerals: Principles, Problems and Practice,” *IMF/Routledge*, 2010.
- Dixit, Avinash K. and Robert S. Pindyck**, *Investment Under Uncertainty*, Princeton University Press, 1994.
- Hassett, Kevin A. and Gilbert E. Metcalf**, “Investment with Uncertain Tax Policy: Does Random Tax Policy Discourage Investment?,” *Economic Journal*, 1999, *109* (457), 372–393.
- Helm, Dieter**, “Energy, the State, and the Market: British Energy Policy Since 1979,” *Oxford University Press*, 2003.
- Metcalf, Gilbert E.**, “On the Economics of a Carbon Tax for the United States,” *Brookings Papers on Economic Activity*, 2019, *2019* (Spring), 405–458.
- Mintz, Jack and Duanjie Chen**, “Taxing Canada’s Cash Cow: Tax and Royalty Burdens on Oil and Gas Investments,” *University of Calgary School of Public Policy Research Paper*, 2010, *3* (3).
- NORWEA**, “Norwegian Wind Energy Association Annual Report 2023,” Technical Report, NORWEA 2023.

**Norwegian Ministry of Finance**, “Prop. 78 LS (2022–2023): Resource Rent Tax on Onshore Wind Power,” Technical Report, Stortinget 2023.

**Norwegian Water Resources and Energy Directorate**, “Status for Onshore Wind Power in Norway 2023,” Technical Report, NVE 2023.

## A. Data Appendix

The primary data source is Statistics Norway (SSB) Table 14091, accessed via the PxWeb API at <https://data.ssb.no/api/v0/en/table/14091>. The table reports monthly electricity production by energy source in MWh. I extract two series: hydropower (code 1.1) and wind power (code 1.2) for January 2018 through December 2024. Production is converted to GWh by dividing by 1,000.

County-level data come from SSB Table 08308, which reports annual electricity production by type and county. Nine counties have positive wind production during the sample period: Østfold, Agder, Rogaland, Vestland, Møre og Romsdal, Trøndelag, Nordland, Troms, and Finnmark.

Cross-country data come from Eurostat dataset nrg\_cb\_pem, which provides monthly net electricity generation by fuel type. I extract wind (SIEC code RA300) and hydropower (RA110) for Norway, Sweden, and Denmark in GWh.

## B. Identification Appendix

The trend-adjusted specification requires that the pre-treatment growth differential between wind and hydropower is well-captured by a linear trend. I test this with three placebo exercises, applying the treatment indicator at false dates (January 2020, July 2020, July 2021) to the pre-announcement sample only. None yields a significant coefficient ( $p > 0.35$ ), supporting the linear-trend assumption.

As a further check, the quadratic-trend specification (Table 3, Panel A) yields a coefficient of  $-0.23$  ( $p = 0.11$ ). While not statistically significant at conventional levels, the point estimate remains negative and economically meaningful, suggesting that a quadratic trend may over-absorb part of the treatment effect (since the growth slowdown begins exactly at the treatment date).

## C. Robustness Appendix

I report three alternative specifications. First, a year-over-year growth rate specification  $\Delta_{12} \log Y_{st}$  differences out any time-invariant level differences and sector-specific trends, yielding  $\hat{\beta} = -0.42$  ( $p < 0.001$ ). Second, restricting the post-period to the uncertainty window (January–December 2023) yields  $\hat{\beta} = -0.52$ , while restricting to the post-enactment period (January 2024 onward, dropping 2023) yields  $\hat{\beta} = -0.84$ , suggesting the effect persisted and deepened. Third, the cross-country comparison using Eurostat data confirms

that Norwegian wind’s stall was not a Nordic-wide phenomenon ( $\hat{\beta} = -0.52, p < 0.001$ ).

## D. Standardized Effect Sizes

**Table 5:** Standardized Effect Sizes for Main Outcomes

Outcome	$\hat{\beta}$	SE	SD(Y)	SDE	SE(SDE)	Classification
<i>Panel A: Pooled</i>						
Wind production (log GWh)	-0.615	(0.109)	0.606	-1.015	(0.180)	Large negative
<i>Panel B: Heterogeneous (by season)</i>						
Winter months (Oct–Mar)	-0.627	(0.127)	0.555	-1.131	(0.230)	Large negative
Summer months (Apr–Sep)	-0.601	(0.136)	0.542	-1.109	(0.252)	Large negative

*Notes:* **Country:** Norway. **Research question:** Whether the surprise announcement of a resource rent tax on onshore wind power chilled renewable energy production relative to the untaxed hydropower sector.

**Policy mechanism:** In December 2022 the Norwegian government announced a 40% effective resource rent tax on onshore wind power, creating 12 months of regulatory uncertainty until enactment at a reduced 25% rate in January 2024; existing projects faced retroactive application and new projects confronted altered investment economics. **Outcome definition:** Log monthly electricity production (GWh) from Statistics Norway Table 14091; the estimand is the deviation from a sector-specific linear trend. **Treatment:** Binary; wind sector (treated) vs. hydropower sector (control) after December 2022 announcement. **Data:** Statistics Norway (SSB) Table 14091, monthly electricity production by source, January 2018–December 2024, 168 sector-month observations. **Method:** Two-way fixed effects DiD with sector and month fixed effects plus a sector-specific linear time trend; single sharp treatment date (no staggered adoption). **Sample:** National monthly production for wind and hydropower sectors; all Norwegian onshore generation included.

SDE =  $\hat{\beta}/SD(Y)$  where SD(Y) is the pre-treatment standard deviation of log monthly production for the wind sector. Classification refers to magnitude, not statistical significance: Large ( $|SDE| > 0.15$ ), Moderate (0.05–0.15), Small (0.005–0.05), Null ( $< 0.005$ ).