EU INTEGRATION OR ENERGY SHOCK? COMPARATIVE EVIDENCE ON RENEWABLE ELECTRICITY DIFFUSION

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The diffusion of wind and solar electricity is commonly associated with European integration, yet what specifically drives it remains an open question. Two competing explanations can be identified. The first attributes diffusion to the form of a country's tie to the EU: the depth and enforceability of the rules in which it operates. The second attributes it to the triggering events themselves, such as membership prospects or an external energy shock. All countries in the sample are formally committed to expanding their renewable share under Sustainable Development Goal 7 (UN 2030 Agenda) [1], however, this global commitment is voluntary and lacks enforcement, in contrast to the binding targets of the EU.

Drivers of renewable electricity in the EU's neighbourhood have been studied in isolation and not in direct comparison. Case studies and qualitative reviews of the Renewable Energy Directive and the cohesion funds have documented the role of EU energy policy in the Baltic transition. The 2022 energy crisis has also been analysed from a pan-European perspective, with REPowerEU [2] and the diversification of gas imports [3] being pointed out as the dominant supply-side responses. What is missing is a single quantitative framework that puts these elements side-by-side. Such a framework would compare full EU membership against the lighter Energy Community framework, and the binding-target effect against the shock effect, measured on the same outcome across the same regional sample.

The present study examines whether the form of integration is more important than the triggering event in explaining renewable electricity diffusion and decomposes this proposition into three sub-hypotheses. (*H1*) Energy Community effects, where present, remain considerably smaller than those associated with EU membership. (*H2*) The 2022 energy shock conferred no differential advantage on the countries most dependent on russian gas. (*H3*) A pronounced country-level breakaway from the general trend is the exception, not the rule.

The empirical analysis draws on two panels. The first covers 13 countries across four post-Soviet regions, namely the Baltics, Eastern Europe, the South Caucasus, and Central Asia, for 1996–2021, using the World Bank series on the renewable electricity share excluding hydropower. Russia and Belarus are excluded on ethical grounds. Treated countries are concentrated in the first three regions, while Central Asia, together with Armenia and Azerbaijan, provides the never-treated control group. The second is a broader European panel for 2010–

2024, drawn from Ember/OWID, with the wind-and-solar share of electricity generation as the outcome. *H1* is tested using the staggered DiD estimator of Callaway and Sant'Anna [4], which remains valid under variation in treatment timing and heterogeneous treatment effects. Treatment is defined as the year of acquiring binding commitments: 2004 for the Baltic accession to the EU, 2010 for Moldova, 2011 for Ukraine, and 2017 for Georgia (Energy Community); the control group comprises seven never-treated states. *H2* is estimated as a common-date DiD/event study around the 2022 shock, with treatment defined as pre-war dependence on russian gas. *H3* is tested using the synthetic control method [5] with placebo inference, and the results are robust to a not-yet-treated control and to a doubly robust specification.

The first sub-hypothesis is supported (Table 1). On average, integration is associated with a marked increase in the renewable share, but almost all of this effect originates in the full-EU-membership cohort. The Energy Community cohorts show effects that are considerably smaller than those observed for full EU membership. The event-study analysis (Fig. 1) confirms the validity of the comparison. Before accession the cohorts trended in parallel, and the gap widens only afterwards, gradually reaching a substantial magnitude. This pattern is consistent with the argument that the Energy Community provides weaker enforcement incentives than the Renewable Energy Directive and associated EU funding mechanisms.

Table 1 – Estimates of the effect of the form of EU integration on the renewable share in electricity generation

Specification / cohort	**ATT (pp)**	**Std. error**	**Significance (95%)**
Overall effect (CS, never-treated)	9.40	3.90	yes
Cohort 2004 – EU membership (Baltics)	13.72	3.84	yes
Cohort 2010 – Moldova (EnC)	0.73	0.84	no
Cohort 2011 – Ukraine (EnC)	1.75	0.34	yes
Cohort 2017 – Georgia (EnC)	0.51	0.49	no
2×2 benchmark (Baltics, TWFE)	13.82	3.51	yes

Note: EnC – Energy Community; pp – percentage points. Significance is assessed by 95% simultaneous confidence bands.

Source: calculated by the author from World Bank data (EG.ELC.RNWX.ZS).

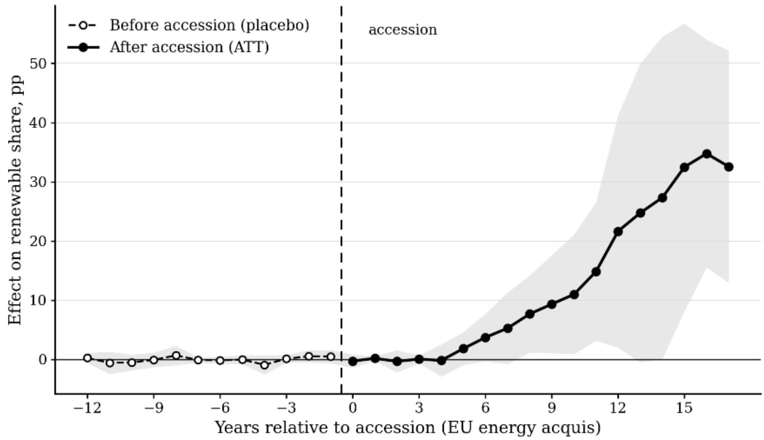

Figure 1 – Event-study analysis (Callaway–Sant'Anna): dynamics of the full-EU-membership effect relative to the year of accession

Source: calculated by the author from World Bank data (EG.ELC.RNWX.ZS).

The second sub-hypothesis is also supported (Fig. 2). The 2022 shock produced no differential effect for the most dependent countries: the differential estimate is close to zero (*p=0.80*), even though the build-out of renewables accelerated substantially across all countries. The likely mechanism is supply-side adjustment. The most dependent countries responded primarily through the diversification of energy imports, such as new suppliers and liquefied natural gas, while the expansion of renewables proceeded at a similar pace to the rest of Europe [3]. The acceleration of renewables is consistent with the broader policy response embodied in REPowerEU [2].

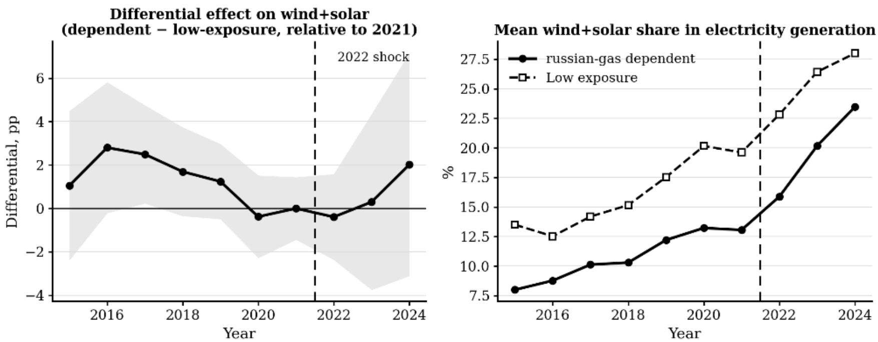

Figure 2 – The 2022 shock: absence of a differential effect (left) and similar post-shock acceleration across both groups (right)

Source: calculated by the author from Ember/OWID data.

The third sub-hypothesis adds detail to the picture at the country level. A clean breakaway from the general trend after 2022 passes the placebo test only for Latvia (and, more weakly, for Moldova), while Estonia and Lithuania are statistically indistinguishable from the general acceleration. The synthetic control method thus allows us to identify the rare country-specific cases that are averaged away in the aggregate DiD.

Conclusions: The findings suggest that the depth and enforceability of EU integration are more strongly associated with renewable electricity diffusion than the triggering events examined in this study. Full EU membership appears to provide a structural and lasting push through targets, funds and access to the common market, while the lighter Energy Community framework, which applies EU rules without effective enforcement, does not have a similar effect. The 2022 shock was associated with a broadly similar acceleration of renewables across Europe, rather than a disproportionate increase in the countries most dependent on russian gas. In these countries, adjustment primarily took the form of energy-import diversification. The results are robust in terms of direction, but their magnitude should be interpreted with caution, as full EU membership represents a bundle of institutional and economic advantages and therefore cannot be isolated as the sole driver of the transition. The findings are consistent with the argument that voluntary commitments alone may be insufficient to accelerate renewable diffusion without accompanying enforcement mechanisms.

References

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