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INFRASTRUCTURAL INTERDEPENDENCE, ENERGY SECURITY, AND SOCIETAL INCLUSIVITY IN EAST-CENTRAL EUROPE

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Abstract. *The 2022 gas crisis and the 2026 oil shock have made infrastructural interdependence the central axis of European security. This article asks how three East-Central European borderland states, Romania, Hungary and Slovakia, are managing that transformation and when infrastructure that transmits coercion can become a substrate of cohesion. The analysis joins multi-level governance to a neo-Schumanian reading of functional integration, complemented by securitization, weaponized-interdependence and energy-justice perspectives. The central claim is an alignment condition. The EU's response operates at four scales at once, through a supranational architecture that authorizes and funds, a regional lattice of multi-state gas corridors, national governments that variously implement or obstruct, and a local borderland politics of cross-border energy cooperation, and genuine integration occurs only where the four scales align. A most-similar-systems comparison isolates the national scale as the decisive variable, with material constraints limiting ideology in all three countries. The geothermal cooperation between Oradea and Debrecen serves as the explanatory case for re-scaling the Schuman mechanism to a historically contested border. The case yields a partial confirmation. Functional pressure and institutional development are real, but the cooperation still runs on EU subsidy, and its inclusiveness for peripheral households and the borderland Roma remains to be achieved.*

Keywords*: energy security; multi-level governance; cross-border cooperation; EGTC; energy justice; EU enlargement.*

1. INTRODUCTION

Energy security has become a central question of European integration. One of the EU's most exposed regions is the east-central borderland of Romania, Hungary and Slovakia. Russia's full-scale invasion of Ukraine in February 2022 turned a half-century of energy interdependence into an instrument of coercion and liability. Yet, the same cross-border infrastructure that transmits vulnerability also has the potential for cooperation. The pipelines, grids and shared resources that expose these states to coercion are also the material basis on which they build common institutions. This duality can be analyzed in three steps: the crisis and its escalation; the asymmetric national exposure of the three countries and the limits it places on ideology; the cooperative counter-current already visible along the same borders.

1.1. The crisis: from the 2022 gas shock to the 2026 oil shock

The first stage of the crisis began when, in 2022, Russia throttled pipeline flows and the EU answered with REPowerEU (European Commission, 2022), embargoes on

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Russian coal and seaborne oil, and an emergency build-out of liquefied natural gas and storage. Prices surged, and security of supply became, for the first time since the 1970s, a question of European security. The second stage started on January 1, 2025, when the transit of Russian gas across Ukraine ended with the expiration of the Gazprom–Naftogaz contract. That severed a sixty-year-old route and removed roughly five per cent of total EU gas supply, concentrated on Austria, Hungary and Slovakia (Carnegie Endowment for International Peace, 2025). Russian gas to the latter two countries did not stop but was rerouted southward through TurkStream and Hungary. The third stage was this year's oil shock: on 27 January 2026 a Russian drone strike on the Brody hub in western Ukraine cut the southern leg of the Druzhba pipeline that feeds the Hungarian and Slovak refineries. Slovakia, dependent on a single refinery, declared a national emergency in the oil sector. It released strategic reserves and switched to non-Russian crude through the Adriatic route, and pipeline flows resumed on 23 April 2026 (Institute of Central Europe, 2026). A Council–Parliament agreement adopted on 26 January 2026, established a stepwise ban on Russian gas, short-term contracts first and long-term pipeline gas by 30 September 2027. It was carried by qualified majority over the objection of the only two countries to vote against, Hungary and Slovakia (Council of the European Union, 2026).

1.2. National exposure and the limits of ideology

The energy infrastructure of the former communist countries of East-Central Europe was built in the Soviet era to run from East to West. The Druzhba ("Friendship") oil pipeline opened in 1964 as the world's longest. The Bratstvo ("Brotherhood") and Soyuz gas lines followed. All were laid to carry Soviet energy into the socialist bloc and onward toward Western markets. The region's refineries, Slovnaft in Bratislava and the MOL Danube plant at Százhalombatta, were designed for the crude the Soviets delivered. In the same period, Western Europe diversified toward North Sea and Norwegian gas, Algerian and Qatari liquefied natural gas, and a plurality of suppliers. The result is what Bouzarovski (2018) calls Europe's infrastructural divide: a continent split between a Western half with optionality and an Eastern half largely dependent on a single supplier. Accession to the EU moved these states into a new legal and market order, but it did not rebuild the infrastructure beneath them. The divide is therefore a matter of infrastructure rather than of political attitude, which is why the shocks of 2022 and 2026 were felt the hardest in the most exposed countries: Slovakia and Hungary.

Hungary's energy dependence deepened after 2022. Its share of Russian crude rose toward 90% by 2025, drawn by a discounted price under the open-ended pipeline exemption (Center for the Study of Democracy, 2026). Its single large refinery at Százhalombatta is configured for the Russian crude, and a full reconfiguration, estimated by its operator at several hundred million dollars, is not yet complete. Gas remains overwhelmingly Russian, delivered through TurkStream under a fifteen-year contract. The Paks nuclear plant, which supplies over two-fifths of Hungarian electricity, is tied to Russian fuel and to Rosatom financing for its expansion. As the International Energy Agency observes, Hungary has diversified its supply routes but not its supply sources (IEA, 2022).

Slovakia is also exposed, mainly on oil (Mišík & Oravcová, 2024), its economy depends on the single Slovnaft refinery in Bratislava, likewise, built for Russian Urals crude. With the loss of the Ukrainian transit route, it forfeited both supply security and a transit role worth, on the government's own contested estimate, several hundred million euros a year. The 2026 Brody crisis struck Slovakia hardest because it has no second

refinery to fall back on. Yet, non-Russian gas is physically within reach through interconnectors with Poland, Austria and the Czech Republic. Slovak gas dependence is sustained less by geography than by a long-term Gazprom contract running to 2034 and by political choice (Mišík & Oravcová, 2024; cf. Kratochvíl & Mišík, 2020).

Romania is more resilient energetically (Buzogány & Davidescu, 2022). It became the European Union's largest natural-gas producer in 2024, with around 9.4 billion cubic meters, covering roughly three-quarters of demand. The Neptun Deep project in the Black Sea, with first gas targeted for 2027, is set to roughly double output and turn the country into a net exporter (OMV Petrom, 2023). Romania's refineries run largely on non-Russian crude. The Cernavodă reactors use Canadian CANDU technology rather than the Russian VVER design. Through the BRUA (Bulgaria–Romania–Hungary–Austria) pipeline, the Vertical Gas Corridor and the Iași–Chișinău link, the country already exports energy to Moldova (Ciot & Butișcă, 2025). Its resilience is fuel-specific rather than total, since Romania was a net electricity importer in 2024 after a poor hydrological year. On gas, oil and nuclear, however, it is structurally independent of Russia (Buzogány & Davidescu, 2022).

These energy constraints are turned into politics by certain primary social facts, such as the country's national interest which has two layers. There is a non-ideological substrate, the economy's energy needs and what is geographically available. On the other hand, there is an ideological layer, the way governments and oppositions define and contest that substrate (Vancsó, 2024). The standing framework of European norms supplies one pole: the energy acquis, the solidarity principle of Article 194 of the Treaty on the Functioning of the European Union (European Union, 2012), and the Fit-for-55 instruments. The documented European response, from REPowerEU through to the 2026 phase-out regulation (Council of the European Union, 2026), is the nearest observable proxy for a "European interest". Against this common backdrop the three governments diverged. Romania supported the phase-out, its domestic substitute arriving on schedule (Drăgoi et al., 2023). Hungary and Slovakia opposed it, cast the ban as a violation of sovereignty, and brought it before the Court of Justice of the European Union.

In April 2026 Hungarian voters replaced Viktor Orbán's government with the pro-European TISZA party of Péter Magyar, which won a two-thirds majority (Al Jazeera, 2026). Instead of a clean ideological break with the previous energy posture, the incoming prime minister converged on caution: "no one can change geography," a phase-out target of 2035 rather than the EU's 2027, and a pledge to keep buying "in the cheapest and safest way" (Kyiv Independent, 2026). In Slovakia the pro-European opposition likewise contests the timing of the cut-off, not its principle. In Romania a sovereigntist surge that nearly captured the presidency in 2024–25 left the country's energy trajectory untouched. Across all three cases, then, the material layer appears to discipline the ideological one (Mišík & Oravcová, 2024).

The energy issue is neither a purely objective situation nor a free political choice. It is materially constrained and politically underdetermined, in the sense that the physical facts rule some options out while politics selects among those that remain. The constraint is one of path dependency. The east-to-west system is self-reinforcing, and its sunk costs, complementary investments and the coalitions built around them make reorientation slow and contested (Pierson, 2000; Mahoney, 2000).

1.3. Energy cooperation

If the crisis reveals how shared infrastructure transmits coercion, the same borders also carry an integrative aspect. Cross-border cooperation along the Romanian Hungarian frontier became institutionalized. The Bihor–Hajdú-Bihar Euroregion, established in 2002, has coordinated local development across the border for two decades, and successive Romanian–Hungarian Interreg programmes have funded joint energy and infrastructure projects (Polgár & Brie, 2025). This is a form of transnational institution-building from below, with local and regional authorities constructing common structures in the space the EU's cohesion instruments open up (Popoviciu & Toca, 2011).

Energy is among the most concrete domains of this cooperation. Oradea and Debrecen lie some seventy kilometers apart, in the adjacent counties of Bihor and Hajdú-Bihar, atop one of Europe's richest geothermal basins. The RENEW project ("Renewable Energy Works Well", code ROHU00617), funded by the Interreg VI-A Romania–Hungary programme, is developing that resource. Led by Hajdú-Bihar County Council with Bihor County Council, four Hungarian municipalities and the county development agency, it is installing geothermal and solar heating across twenty-seven public buildings, twenty-six in Hungary and one, the multifunctional cultural center, in Oradea (Interreg VI-A Romania–Hungary Programme, 2025; Consiliul Județean Bihor, 2025). Cooperation in energy supply was named a founding rationale for deeper institutionalization as early as 2011, when the prospect of a Debrecen–Oradea European Grouping of Territorial Cooperation (EGTC) was first set out (Popoviciu & Toca, 2011). That grouping is not yet constituted, the European Committee of the Regions' register records no Oradea–Debrecen EGTC, and the Debrecen–Oradea "Eurometropolis" remains a proposal, even as registered EGTCs operate elsewhere along the Romanian–Hungarian border (European Committee of the Regions, 2026). The case is thus one of an EGTC in formation, with functional cooperation developing around a shared border and the formal institution as its anticipated next step.

This development has a social dimension as the communities along this border are bound by kinship and language as well as by infrastructure. The national minorities who are involved in the Euroregion's coordination act as bilingual, bicultural facilitators in cross-border governance (Neagu & Klatt, 2025).

Not all concerted actions along these borders are integrative. Hungary and Slovakia have acted together, but largely in opposition to Brussels. They each contested the 2026 phase-out regulation before the Court of Justice, and in February 2026 they jointly asked Croatia to facilitate Adriatic transit so that Russian-contracted crude could keep reaching their refineries. This cooperation defends a shared dependence. It is directed against an EU policy, and it belongs with the tensions set out above rather than with the integrative process traced here.

1.4. A geopolitical reset

The region's dependence on Russian energy was engineered, under the Council for Mutual Economic Assistance, as a centralized network that tied each "satellite" to Moscow rather than to its neighbors. The collapse of the bloc in 1989 dissolved the political order but left the infrastructure in place. This was a technological and institutional dependence that successive investment only entrenched (Unruh, 2000). Each successor state carried its own bilateral relationship with Russia forward, and no intra-regional model of energy cooperation took the center's place (Bouzarovski, 2018).

At the moment of EU accession this exposure was an unremarkable inheritance. When Hungary and Slovakia joined the EU in 2004 and Romania in 2007, deep Russian

energy dependence was treated as a settled fact of supply, inexpensive and reliable, and it remained largely outside accession negotiations centered on market liberalization. The Russia–Ukraine transit disputes of 2006 and 2009, the second of which cut Slovak gas in midwinter, brought energy security into regional politics (Kratochvíl & Mišík, 2020), but those disputes reorganized perceptions, while the pipelines remained as they were.

In 2022 the infrastructure itself did not change, but its meaning did. A system built to bind the region to Moscow became, almost overnight, the principal channel of its vulnerability, and across the following four years the EU answered with binding law that will sever its largest supplier by 2027. The reset falls especially hard on these countries because they inherited no lateral cooperation to fall back on. The horizontal links that might substitute, the Arad–Szeged and Balassagyarmat interconnectors and the Vertical Gas Corridor, are recent and still partial (Mišík & Oravcová, 2024; ICGB, 2024). For the first time, the regional response to a shared dependence runs laterally between neighbors as well as through Moscow and Brussels.

2. METHODOLOGY

The aim of this study is to explain when the cross-border energy infrastructure of East-Central Europe operates as a channel of coercion and when it becomes a substrate of cohesion. Three objectives serve this aim.

My first objective is to specify the alignment condition for establishing a cross-border energy infrastructure, which becomes a substrate of cohesion only where four scales align: the supranational, which authorizes and funds; the regional, the multi-state corridors; the national, which implements or obstructs; and the local, the cross-border agency. The four scales are also the study's levels of analysis.

My second objective is to show that the Schuman mechanism of functional integration, almost always read at the supranational level, can be re-scaled downward to a historically contested borderland, analyzed on the Oradea–Debrecen cross border cooperation model.

My third objective concerns the micro-foundation: to explain how shared infrastructure actually produces shared political subjectivity.

From a methodological standpoint, these objectives should be treated differently. The alignment condition will be analyzed through a most-similar-systems comparison of Romania, Hungary and Slovakia. These are countries alike in many relevant aspects yet divergent in outcome, which isolates the alignment, or misalignment, of scales as the operative variable. The re-scaling hypothesis, regarding the Oradea–Debrecen cooperation, will be treated as an explicative case, tested against the disconfirmation criterion stated below.

The working hypothesis is that the Schuman mechanism of functional integration can operate at the local scale: pooling a strategic resource at a contested border generates functional pressure for adjacent cooperation, convergence of governance and a deepening of trans-border association. The disconfirmation criterion is that if the Oradea–Debrecen geothermal cooperation generates none of these effects, or runs on EU subsidy alone rather than endogenous functional linkage, it fails.

3. CONCEPTUAL FRAMEWORK AND LITERATURE REVIEW

The literature review requires four strands that rarely meet. Integration theory explains how sectoral cooperation hardens into political community, through neofunctionalist spillover (Haas, 1958; Niemann, 2013) and the multi-level governance

architecture it produces (Hooghe & Marks, 2003), but says little about infrastructure as integration's material substrate. Security scholarship, in its securitization and weaponized-interdependence variants (Buzan, Wæver & de Wilde, 1998; Farrell & Newman, 2019), treats that infrastructure as an instrument of threat, with no account of its integrative potential. Urban and border studies supply the micro-concepts of infrastructural citizenship (Lemanski, 2020) and borderland identity (Paasi, 1996), detached from integration theory. Energy justice asks who benefits from energy systems (McCauley et al., 2013; Jenkins et al., 2016), but is seldom applied to cross-border cooperation. The framework below joins these strands in a scale-sensitive account.

3.1. The alignment condition and the re-scaled Schuman method. Energy as weaponized-interdependence

The objectives set out in the methodology can be approached through integration theory, which theorizes how sectoral cooperation hardens into political community and how authority is distributed across scales. Neofunctionalism supplied the founding mechanism of functional "spillover", whereby integration in one sector raises the cost of non-cooperation in adjacent ones (Haas, 1958; Lindberg, 1963). Contemporary versions treat spillover as conditional rather than automatic, held in tension with compensatory forces (Niemann, 2013), so that a crisis may yield integration, intergovernmental "spill-around", or disintegrative "spill-back" (Nicoli, 2020). The 2022 and 2026 shocks can be read in these terms.

The architecture that spillover produces is multi-level governance, with authority dispersed across nested general-purpose (Type I) and task-specific, intersecting (Type II) jurisdictions (Hooghe & Marks, 2003). The European Grouping of Territorial Cooperation, toward which the Oradea–Debrecen cooperation is moving, is an example of a Type II jurisdiction: task-specific, intersecting and cross-border (Popoviciu & Toca, 2011). But multi-level governance cannot, on its own, say which level is decisive (Jordan, 2001), and the answer proposed here is the condition of alignment. The cross-border project acquires real power only when the four scales align, with the national level performing what Jessop (2013) calls "interscalar articulation" rather than obstruction and the local level supplying the cooperative agency that the Romanian-Hungarian border has in fact generated (Polgár & Brie, 2025). Jessop's account of the state hollowed out upward, downward and sideways into region-states across national frontiers gives the down-scaling its mechanics. The alignment condition gives it its scope conditions, where any scale defects, integration stalls. The Hungarian and Slovak gate-keeping shows that it can, once integration touches identity and sovereignty and a "permissive consensus" hardens into a "constraining dissensus" (Hooghe & Marks, 2009).

The Schuman Declaration of 1950 is conventionally read as the charter of supranational, top-down integration, recent studies reviving its language of pooled "sovereignty" and "solidarity" and keeping it firmly at the European level (LaBelle, 2024). However, read from a structural point of view, Schuman's hypothesis is independent of scale. Pooling the production of a strategic resource at a contested border makes war "not merely unthinkable, but materially impossible" (Schuman, 1950), and it gradually builds a common political subjectivity. If that is a mechanism rather than a single historical episode, it can operate wherever its conditions are met. It can operate at the geothermal aquifer beneath the Romanian-Hungarian border just as it operated at coal and steel on the Franco-German border in 1950. Neofunctionalism is often charged with non-falsifiability (Moravcsik, 2005), but read as a conditional theory it can be tested (Rosamond, 2005). This

is the ground of the working hypothesis and of the disconfirmation criterion stated in the methodology.

The securitization and weaponized-interdependence literature explain how energy is constructed as an existential threat and how efficiency networks become instruments of coercion. Energy moves through escalating registers, from politicization to geopoliticization to securitization (Herranz-Surrallés, 2024). The last of these constructs it as an existential threat that licenses extraordinary measures (Buzan, Wæver & de Wilde, 1998). For the case analyzed here, the productive perspective is the reversibility of securitization. The same framing that lets the Commission cast REPowerEU as imperative lets Budapest and Bratislava cast the 2026 phase-out as the existential threat. Securitization, as the literature on the Energy Union anticipated, both drives integration and legitimizes resistance to it (Judge & Maltby, 2017; Wilson, 2019). Beneath the speech-acts lies the material engine of weaponized interdependence, in which efficiency networks turn coercive once they create chokepoints, such as the Druzhba pipeline, the single-refinery Slovnaft configuration and the Brody hub described above (Farrell & Newman, 2019). Two qualifications matter: the chokepoints are firm-owned, since Slovnaft is a MOL asset, so weaponization runs through the state–firm relation (Gjesvik, 2023), and it fuses with hybrid-threat tactics (Jore et al., 2025). The main challenge comes from the literature itself, namely that interdependence through trade has not, historically, prevented war (LaBelle, 2023). The neo-Schumanian hypothesis answers it by resting on the joint ownership and management of a single asset at the border rather than on diffuse trade.

3.2. The micro-foundation: infrastructural citizenship and borderland identity

At this level the neo-Schumanian mechanism acquires sociological content and the cooperative counter-current becomes intelligible. The fusion of two concepts, which the literature usually leaves vaguely defined, "infrastructural citizenship" and "borderland identity", clarifies how a shared grid constitutes at once a trans-border subject and a trans-border region.

Infrastructural citizenship, in Lemanski's (2020) formulation, captures a two-way relation between people and public infrastructure. The everyday experience of obtaining and using services molds citizenship identity and practice, and those practices in turn remake the infrastructure itself. Rather than a neutral conduit serving a pre-constituted citizen, infrastructure is the material medium through which the state-citizen relationship is constituted, negotiated and contested. Anand's (2017) "hydraulic citizenship" shows Mumbai residents becoming members of the polity through their water connections, and von Schnitzler's (2016) prepaid electricity meter is a site of technical and political negotiation. Transposed to the case analyzed here, the cross-border district heating that shared geothermal production would generate is such an infrastructure, and the households drawing heat from it would be co-implicated in one another's tariffs and seasonal vulnerabilities across the state border.

According to Paasi (1996, 2003), a region and its identity are not given, but institutionalized over time through four shapes: the territorial, the symbolic, the institutional, and the region's establishment within a wider system. "Regional identity" thus denotes both a region's distinguishing features and the regional consciousness of its inhabitants. A borderland identity is such an identity organized around and spanning a state border, constantly unmade and remade through de- and re-bordering (Newman & Paasi, 1998; van Houtum, 2005).

Shared cross-border infrastructure is the material and institutional practice through which a trans-border region is institutionalized. Infrastructural citizenship supplies the micro-mechanism by which individuals come to be co-implicated across the border, and Paasi's institutionalization supplies the macro-process by which a region and its identity accumulate from that practice. The EGTC, a Type II jurisdiction and, in Jessop's terms, a region-state across national frontiers, is the vehicle that would carry it, and the Bihor–Hajdú-Bihar Euroregion is its institutional precursor. This gives the neo-Schumanian mechanism its sociological content: pooling a resource at the border raises the cost of conflict, and it also institutionalizes a trans-border region and constitutes trans-border subjects.

Infrastructure can include and exclude groups at the same time (Börzel & Heard-Lauréote, 2009). The grid that builds a trans-border community in the Oradea–Debrecen area, can also bypass those left off its map, the borderland Roma community, even as the bilingual minorities who live near the frontier can serve as brokers who widen inclusion (Neagu & Klatt, 2025). Paasi's four shapes specify in advance what such evidence would have to look like, and the case study examines whether the case is congruent with them.

4. THE ALIGNMENT CONDITION

The four scales, supranational, regional, national and local, are analyzed here through the most-similar-systems comparison set out in the methodology, supported by process-tracing of the 2022-2026 crisis. The three countries are similar in nearly every relevant aspect: post-communist economies that inherited the same centralized, Soviet-built grid, comparable in the structure, if not the degree of their exposure, members of the European Union under the same energy acquis, and served by the same regional corridors. Yet their energy trajectories have diverged. The comparison therefore isolates the national scale as the variable that turns one architecture into three trajectories.

4.1. The supranational scale

On the supranational scale the EU has moved, across the crisis, from exhortation to binding architecture. It now authorizes and finances the reorientation the region's infrastructure requires. REPowerEU set the direction in 2022, with diversification, energy saving and accelerated renewables, and some €210 billion in additional investment mobilized to 2027 (European Commission, 2022). That direction has since hardened into law, regulation (EU) 2026/261 converts the commitment to end Russian gas into a binding, dated schedule, banning short-term pipeline imports from mid-2026 and long-term pipeline supply by 30 September 2027 (European Union, 2026). Beyond permitting the member states to diversify, the EU withdraws the incumbent option from all of them at once, converting what had been a contested national choice into a shared legal obligation. This is an exercise of solidarity that EU law renders binding even on dissenting members (Huhta & Reins, 2023), and it removes the ground on which gate-keeping had stood.

The Trans-European Networks for Energy Regulation (European Union, 2022) designates Projects of Common Interest. These are cross-border corridors granted accelerated permitting and access to Connecting Europe Facility co-financing, and the corridors that matter for this region sit on the EU list, the second iteration of which entered into force in 2026 (European Commission, 2026a). Project authorization is accompanied by financing that also addresses the social cost of the projects. Emissions trading is being extended to heating and road-transport fuels through ETS2 (European Union, 2023a), whose revenues capitalize a Social Climate Fund of €65 billion in EU money for 2026–

2032, close to €86.7 billion with mandatory national co-financing. The Fund was established to shield vulnerable households and transport users from the price effects of decarbonization (European Union, 2023b). The phased introduction of ETS2 has itself been contested over household price effects, and the 2026 Middle-Eastern shock prompted the Commission's emergency AccelerateEU package (European Commission, 2026b), both facts confirming the political importance of the distributive question. The supranational scale, in sum, authorizes the reorientation and pays toward both the infrastructure and the people involved.

The second axis embeds societal inclusivity directly into the structural design, and the burden is unevenly distributed. Regarding the EU's statistical measures of energy poverty, Romania is the most exposed of the three countries. In 2024, 10.8 per cent of Romanians could not keep their home adequately warm and 14.5 per cent were in arrears on their utility bills, against EU averages of 9.2 and 6.9 per cent. Slovakia (8.3 and 6.3 per cent) and Hungary (6.0 and 7.1 per cent) lie closer to or beneath those averages (Eurostat, 2026a, 2026b), even as Romania remains among the EU's countries most affected by heating-related deprivation (Grigorescu et al., 2024). Romania is the EU's fifth-largest recipient from the Social Climate Fund at up to €6 billion, ahead of Hungary (€2.8 billion) and Slovakia (€1.5 billion) (European Union, 2023b). The transfer is explicitly redistributive, since the heating carbon price falls hardest on low-income, often solid-fuel-reliant households concentrated in the region's east. The supranational scale builds and also redistributes, in proportion to where the transition's burden will fall hardest. It is also the prerequisite for a transition that includes border populations rather than pushing them into energy poverty (Śmiech et al., 2025).

4.2. The regional scale

Between the EU and the national capitals sits the regional scale theorized by the literature on energy regionalism (Hancock et al., 2020; Johnson & VanDeveer, 2024). The radial Soviet grid historically lacked this dimension. Today it exists as a growing lattice of multi-state corridors and the cooperation that coordinates them, a network of bidirectional interconnectors that ties the three countries to non-Russian supply: the Arad–Szeged line between Romania and Hungary (operational since 2010), the Hungary–Slovakia interconnector at Balassagyarmat (2015), and the Poland–Slovakia interconnector (2022), which alone can deliver some 4.7 billion cubic metres a year into the Slovak system (Mišík & Oravcová, 2024). The north–south axis is growing denser in parallel. Romania's BRUA pipeline, its operational first phase part-financed by a Connecting Europe Facility grant, carries Black Sea and Caspian gas toward Hungary, with a capacity of 1.75 billion cubic metres a year (Transgaz, 2020; European Commission, 2019). The multi-operator Vertical Gas Corridor runs along the same line, joined by Slovakia, Moldova and Ukraine in 2024, it raises the Greece–Bulgaria interconnector from 3 to 5 billion cubic meters a year and is designed to move up to some ten billion cubic meters of Aegean liquefied and Caspian gas northward (ICGB, 2024; European Commission, 2026a).

These corridors form a governed regional space. The Central and South-Eastern Europe Energy Connectivity group (CESEC), the European Commission-backed high-level forum established in 2015, is the vehicle through which Romania, Hungary, Slovakia and their neighbors, together with the Energy Community candidates, coordinate priority interconnections. It institutionalizes the regional gas-security cooperation that is reshaping Central European supply (Kochanek, 2019), and it was under its auspice that the 2024 Vertical Corridor agreement was concluded (European Commission, 2026c). This lateral

cooperation, whose absence was identified above as the legacy of the centralized inheritance, makes a regional response physically possible. The corridors are open to each country and CESEC binds each, so the regional scale, like the supranational, is held roughly as a constant.

4.3. The national scale

If the supranational and regional scales are largely common to all three countries, the national scale is where they part ways.

Romania is the case in which the national scale performs the articulation that the alignment condition requires. It backed the phase-out regulation, has timed its domestic substitute, the Neptun Deep field with first gas scheduled for 2027, to the EU's 2027 cut-off (OMV Petrom, 2023), and has carried the corridor eastward to Moldova through the Iași–Chișinău pipeline (Ciot & Butișcă, 2025). Romania is an EU member state that is aligning policy upward to the EU and downward to a neighbor at once (Buzogány & Davidescu, 2022).

Unlike Romania, Slovakia obstructs selectively, by litigating against the 2026 regulation before the Court of Justice and clings to a Gazprom contract running to 2034, even as the Poland–Slovakia interconnector places non-Russian gas physically within reach. Here it can be observed that the regional hardware is aligned but the national choice is not (Mišík & Oravcová, 2024).

Hungary obstructs even more deeply, compounding its Russian dependence and bringing its own action against the same regulation, yet its territory carries the very interconnectors a successor government could activate. The 2026 change of government left that latent capacity, and the geographic constraint behind it, largely as they were.

The decisive contrast, Romanian implementation against Hungarian and Slovak gate-keeping, is not determined by differences in hardware, scale or supranational treatment, all held constant. The decisive variable is the national scale's decision to implement the regional architecture or to resist it, even when EU money is available. The cancellation of BRUA's larger second phase (S&P Global, 2020) shows that alignment cannot be assured from the scales above the nation alone.

4.4. The local scale

The fourth, local scale is where borderland authorities can act jointly across the frontier, and it varies as sharply as the national. Along the Romanian–Hungarian border the cooperation is integrative. As presented in the energy cooperation section, two decades of the Bihor–Hajdú-Bihar Euroregion and the Interreg geothermal initiative bind the Oradea and Debrecen authorities to the joint development of a shared resource (Popoviciu & Toca, 2011; Polgár & Brie, 2025).

On the Hungarian–Slovak border there is no such cooperation. The comparison thus is limited to the Romanian–Hungarian borderland, where the local scale is most developed.

5. THE ORADEA–DEBRECEN CASE

Along the Romanian-Hungarian border the supranational authorization, the regional connective infrastructure and the local cooperative agency are all in place, leaving the national scale, ambivalent on the Hungarian side, as the open variable. This configuration makes Oradea-Debrecen the paper's explanatory case. If the re-scaled Schuman mechanism can convert aligned infrastructure into cohesion anywhere in the

region, it can do so here, so a failure to deliver here would amount to a disconfirmation of the hypothesis itself rather than a local accident (Rosamond, 2005). The disconfirmation criterion stated in the methodology applies here in full.

5.1. Re-scaled functional integration

The reservoir studied between Létavértes and Săcueni is a single transboundary aquifer (Buday et al., 2012), part of a wider basin whose Romanian wells supply on the order of 400 GWh of geothermal heat a year, Oradea among the principal fields (Bendea et al., 2015). Cooperation along the border has widened over two decades from general development coordination to the joint development of that strategic resource, generating functional pressure for adjacent cooperation. This is recognizable in the building of cross-border governance institutions from bottom-up (Perkmann, 1999), in the functional spillover on a small scale, in which cooperation in one domain raises the value of cooperation in the next. The sequence is not purely endogenous, however, as the Euroregion's coordination structures preceded the geothermal projects and contributed to their initiation. Convergence of governance is likewise visible but incomplete. The trajectory toward a Debrecen–Oradea grouping is a convergence toward a joint, task-specific, cross-border authority of the Type II kind (Hooghe & Marks, 2003), and the Euroregion is its working precursor. Yet the grouping remains unfinished (European Committee of the Regions, 2026). That gap matters, because the EGTC instrument has often promised more integration than its members have delivered (Durand & Decoville, 2020).

The cooperation is substantially sustained by EU financing. The RENEW works carry a €9.01 million budget, roughly four-fifths met by the European Regional Development Fund (Interreg VI-A Romania–Hungary Programme, 2025), and the cooperation has not yet outlived that subsidy, so the endogenous functional linkage cannot yet be shown to be self-sustaining. What weighs on the other side is that the geothermal aquifer is a transboundary physical asset whose joint management carries its own rationale independent of any subsidy. The endogenous driver (the resource) that the mechanism requires is present, even where the institutions remain generated by the subsidy mechanism. Functional integration is thus under way but unproven on its critical point, present as pressure and as governance convergence while not yet established as endogenous. The strong hypothesis therefore remains open, neither confirmed nor disconfirmed.

5.2. The micro-foundation tested

My third objective was to show how shared infrastructure produces shared subjectivity, and the case permits the testing of the two component concepts. Infrastructural citizenship is the constitution of political subjects through their everyday, material relation to shared infrastructure (Lemanski, 2020; Anand, 2017; von Schnitzler, 2016), so that material participation in energy systems can itself generate a form of citizenship (Ryghaug et al., 2018). The case requires that cross-border district heating, drawn from the shared geothermal production, make the households of Oradea and Debrecen mutually dependent in their tariffs and winter provision. The cooperation so far installs geothermal and solar heating in public buildings, schools and clinics in Hungary and in a geothermally heated multifunctional cultural center in Oradea (Consiliul Județean Bihor, 2025), rather than delivering shared district heat to households across the border. The trans-border subject the mechanism would constitute is therefore anticipated rather than observed. The micro-mechanism is plausible and materially prepared, but not yet implemented.

Borderland identity can be tested more directly, against the four shapes through which Paasi (1996, 2003) considers a region and its identity to be institutionalized. The territorial shape is present in the bounded space the Euroregion defines. The symbolic shape is carried less by a settled iconography than by the kinship and language that bind communities across this frontier (Neagu & Klatt, 2025). The institutional shape is present but thin, with the Euroregion realized and the EGTC pending. The shape Paasi calls establishment within a wider system is only partial, since the fuller recognition of a registered Type II jurisdiction or region-state across national frontiers would confer has not yet been obtained (Hooghe & Marks, 2003; Jessop, 2013). Congruence with the four shapes is thus real but incomplete. The border region is still institutionalizing, and its functional de-bordering proceeds even as national gate-keeping re-borders it politically (Newman & Paasi, 1998; van Houtum, 2005).

5.3. Inclusivity: who is included, who is excluded

The Oradea–Debrecen cooperation can also be assessed through the energy-justice framework first formulated by McCauley et al. (2013) and consolidated by Jenkins et al. (2016). I measure the cooperation against its three tenets, distributional, procedural and recognition justice. Distributionally, the benefit of cheaper, cleaner heat, if and as the cross-border system is built, would accrue first to the urban households of two mid-sized cities, since the present works are concentrated in public buildings on the two sides of the frontier (Interreg VI-A Romania–Hungary Programme, 2025; Consiliul Județean Bihor, 2025). The affordability test that energy justice demands (Sovacool & Dworkin, 2015) is most at risk of failing where deprivation is deepest, in the peripheral households of a country among the EU's most affected by heating-related deprivation (Grigorescu et al., 2024). Still on distribution, a review of cross-border INTERREG spending finds that it has often reinforced uneven development and privileged urban cores over their peripheries (Martín-Uceda & Vicente Rufí, 2021), the inverse of the territorial cohesion such cooperation is meant to serve (Demeterova et al., 2020). Procedurally, the governance is intergovernmental and technocratic, run by county councils and programme authorities, and thin in community participation. It is an instance of the exclusionary dynamics that the European community-energy literature warns of, in a regional setting that was largely overlooked (van Bommel & Höffken, 2021). On the third tenet, recognition, the cooperation cuts both ways. The bilingual minorities who straddle the frontier act as brokers who widen inclusion (Neagu & Klatt, 2025). The borderland Roma, whose extreme energy poverty in Romania's urban peripheries is already documented (Teschner et al., 2020), occupy the "spaces of misrecognition" most likely to be bypassed by a grid mapped to formal connection (Bouzarovski & Simcock, 2017).

The third objective is partially confirmed. The re-scaled Schuman mechanism is present at Oradea–Debrecen in nascent form: a shared resource, two decades of institution-building, and partial congruence with Paasi's shapes. Governance has not yet converged into a constituted authority, the infrastructural-citizenship mechanism awaits operational cross-border heating, endogenous linkage cannot yet be disentangled from subsidy, and inclusion is granted for some while it remains at risk for others.

6. CONCLUSIONS

The paper asked when cross-border energy infrastructure operates as a channel of coercion and when it becomes a substrate of cohesion. The answer took the form of a condition. Integration advances only where the four scales, supranational, regional,

national and local, align. The most-similar-systems comparison of Romania, Hungary and Slovakia isolated the national scale as the variable that turns one shared architecture into three trajectories: Romanian implementation, timed to the EU's 2027 cut-off, against Hungarian and Slovak gate-keeping that even a change of government in Budapest left largely intact. The fate of BRUA's second phase, cancelled when bookings failed to materialize, confirmed that alignment cannot be secured from the scales above the nation alone. The Oradea–Debrecen case then tested whether, where all four scales meet, the Schuman mechanism can be re-scaled to a contested border. The result is a partial confirmation. A shared geothermal resource and two decades of institution-building have generated functional pressure and a strengthening of trans-border association. Yet, the governing authority remains unestablished, household-level infrastructural citizenship is still prospective, and the cooperation cannot yet be shown to run on endogenous linkage rather than EU subsidy.

The paper findings have relevance to the EU's south-eastern frontier. The supranational and regional scales already reach the candidates: the six Western Balkan states, Moldova and Ukraine are Contracting Parties to the Energy Community, bound to the energy acquis and embedded in the CESEC coordination through which the corridors are planned (European Commission, 2026c), and, since March 2022, the Ukrainian and Moldovan power systems have run synchronously with continental Europe (ENTSO-E, 2022). The candidates lack what the comparison showed to be decisive, namely robust national articulation and the local cross-border agency that the Oradea–Debrecen case examined. Their predicament is the single-source dependence the architecture is meant to dissolve, whether Moldova's reliance on the Cuciurgan plant, which runs on Russian gas, or the Western Balkans' largely dependent on coal. Functional spillover across the accession frontier is real but bounded (Niemann, 2013; Rabinovych, 2025). From above, the EU can authorize the architecture, fund it and even connect the grids physically, as the synchronization of the Ukrainian and Moldovan power systems showed. Whether energy infrastructure becomes a substrate of inclusion or remains a channel of vulnerability is settled lower down, by the national governments and local actors who decide whether to meet the architecture.

The borderland shows the same logic on a small scale. Pooling a strategic resource across a contested frontier can begin to build the shared subjectivity the Schuman method promised. It does so, however, only under conditions. The scales must align, the process takes time, and the grid must be deliberately built to include those it most easily bypasses, the peripheral households most affected by heating-related deprivation and, above all, the borderland Roma (Teschner et al., 2020; Neagu & Klatt, 2025). For the next enlargement, energy infrastructure is at once an acute vulnerability and a powerful instrument of inclusion. The outcome will depend on the EU, but also, and more heavily, on the articulation of national governments and the agency of border communities.

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