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UKRAINE'S ENERGY AND CLIMATE POLICY

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INTRODUCTION BY THE SPECIAL EDITORS

Why Energy and Climate Policy Is the Foundation of Ukraine's Future Prosperity

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Ukraine's future is being shaped not only by the outcome of the war but also by the choices the country is already making while the war continues. Ukraine is rebuilding damaged infrastructure, advancing regulatory alignment with the European Union, and trying to preserve economic functioning. In this context, energy and climate policy cannot be treated as a secondary agenda deferred until after the war. Instead, it has become one of the central arenas in which Ukraine's future is being decided. Precisely because the strategic future horizon remains unsettled, the choices made now will shape whether wartime adaptation evolves into a more resilient and competitive development model.

Energy policy has become central to Ukraine's resilience. During the war, reliable electricity, heat, and basic energy services are part of the country's core security task, enabling households, industry, and the economy to function. Policy choices related to energy efficiency, decentralised generation, and storage have become practical instruments of resilience, helping to reduce vulnerability to targeted air strikes while supporting longer-term system transformation. In Ukraine's case, energy policy is also becoming part of the financial architecture, shaping how resources are mobilised and allocated.

The same logic applies to reconstruction. Ukraine's long-term prosperity will depend not on the simple replacement of destroyed assets, but on whether reconstruction is used to modernise the economy on more efficient, resilient, and lower-carbon foundations. Every major investment made now locks in a future system: either one that is more efficient, resilient, and compatible with European climate and market rules, or one that remains costlier, more fragile, and more difficult to modernise later. If Ukraine rebuilds inefficient infrastructure, it will not merely preserve old technical weaknesses, but also lock itself into higher operating costs, greater exposure to future shocks, and more expensive retrofits later.

EU integration reinforces this argument. Even amid the full-scale war, the country has taken important steps towards EU accession and has begun implementing the EU acquis, with the possibility of joining the EU as early as 2030, depending on progress (Politico 2025). However, EU accession is not only a political challenge but an institutional and infrastructural one, because it requires Ukraine not only to align with the acquis but to implement it. This means building administrative capacity, trustworthy institutions, and developing credible regulation rather than relying on the import of legislation. The European Commission notes that insufficient monitoring and weak alignment with the National Energy and Climate Plan (NECP) still hinder progress, and that Ukraine must build the institutional capacity needed to meet EU alignment requirements in practice (European Commission 2025)

In the longer run, competitiveness will depend on secure, efficient, and lower-carbon energy within a European market increasingly shaped by decarbonisation, industrial standards, and investor scrutiny. Recent modelling on the Carbon Border Adjustment Mechanism (CBAM) suggests that the mechanism alone will not be enough to drive deep decarbonisation in Ukraine (Chepeliev et al. 2025). Domestic policy quality, regulatory credibility, and implementation capacity will remain decisive. Countries that fail to modernise their energy systems and create credible investment conditions will face weaker investor confidence, higher adjustment costs, and a less favourable position in future industrial competition. For Ukraine, this is not an abstract debate about climate policy. It is part of the question of whether the country moves from survival mode to a path of resilient growth within the European economic space.

Yet none of these objectives can be achieved through finance and legislation alone. Sound choices require implementation capacity and domestic institutions. Human-capacity constraints continue to limit policy coherence and implementation in Ukraine right now. In parallel, recent academic work on Ukraine's energy transition shows that success depends not only on finance or technology, but on managerial effectiveness, understood as the interaction of institutional capacity, policy stability, and implementation efficiency.

This issue of the Ukraine Analytical Digest brings together a set of contributions that examine the transformation of Ukraine's energy system under conditions of war, reconstruction, climate policies, and European integration. The articles are structured along three interrelated dimensions: resilience and adaptation of the energy system under wartime conditions, market and infrastructure integration with the European Union and neighbouring countries, and the role of local energy systems and municipal capacity in implementing reforms. Across these perspectives, the contributions analyse how the system has maintained operation under sustained attacks, how cross-border cooperation and market integration are evolving, and how institutional and local capacities shape the effectiveness of recovery and reform. Taken together, they explore how Ukraine can rebuild and adapt its energy system to strengthen security of supply, improve efficiency, and anchor its future within the EU energy and climate acquis.

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ANALYSIS

Electricity Market Coupling between the EU and Ukraine: An Early Accession Measure for Efficiency and Security of Supply

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Abstract

Ukraine's electricity system has demonstrated remarkable resilience under wartime conditions; however, persistent inefficiencies in cross-border electricity trade continue to undermine both economic welfare and the security of supply. This article argues that early integration into the European Union's electricity market through market coupling is critical. Drawing on evidence from the winter of 2025/26, it demonstrates how imports played a decisive role in stabilising the system but were constrained by internal bottlenecks and inefficient market design, particularly distorted price signals caused by wholesale market price caps. By aligning price signals and optimising cross-border flows, market coupling offers a structural solution to these inefficiencies. However, despite recent legislative progress, Ukraine remains several steps away from implementation. Given existing procedural timelines, day-ahead market coupling is unlikely to be achieved before 2029. Accelerating regulatory alignment and addressing the remaining distortions are therefore essential not only for improving efficiency and resilience but also for securing a Carbon Border Adjustment Mechanism (CBAM) exemption for electricity trade.

Introduction

Since the emergency synchronisation of Ukraine's electricity system with the continental European grid in March 2022, the country has achieved a remarkable degree of technical integration under extreme wartime conditions. However, physical synchronisation alone does not guarantee efficient market outcomes. Ukraine's electricity market remains characterised by structural inefficiencies that prevent cross-border trade from delivering its full economic and security-related benefits.

This article contributes to the literature by examining how distortions in wholesale price formation, particularly the use of price caps, contribute to inefficient cross-border electricity flows under crisis conditions. Drawing on evidence from Ukraine during the winter of 2025/26, the article demonstrates how these distortions limited the effectiveness of electricity imports and argues that market coupling—by aligning price signals and optimising cross-border flows—offers a structural solution by restoring efficient price signals.

Electricity market coupling with the European Union offers a pathway to addressing these inefficiencies through the integration of cross-border capacity allocation and energy trading, thereby restoring efficient price signals. Beyond being a technical reform, market coupling represents an early accession measure with direct implications for system stability, price formation, and Ukraine's broader integration into EU energy and climate governance. Drawing on evidence from the winter of 2025/26, this article examines both the potential benefits of market coupling and the remaining barriers to its implementation.

Winter 2025/26: Imports as a Lifeline Under Structural Constraints

The winter of 2025/26 exposed both the resilience and the fragility of Ukraine's electricity system. Sustained Russian attacks on generation assets and grid infrastructure significantly reduced available capacity. Conventional generation fell to approximately 10.5–12 GW, while peak demand during cold periods reached approximately 18 GW, creating a persistent supply deficit (Stubbe et al., 2026).

These structural shortages translated into widespread outages. Survey-based evidence indicates that electricity outages peaked at approximately 11–12 hours per day in early February 2026, before declining sharply in March as system conditions improved (Carr and Meissner, 2026).

In this context, electricity imports from the European Union proved indispensable. On January 17, Ukrainian day-ahead market price caps were temporarily increased until the end of March 2026 from a level of approximately 110–300 EUR/MWh (5,600–15,000 UAH/MWh), depending on the hour of the day, to a uniform 300 EUR/MWh (15,000 UAH/MWh) for all hours. Following the adjustment of price caps in January 2026, imports increased markedly, rising from approximately 775 MW to more than 1,800 MW on average in February 2026 and frequently reaching technical limits (see Figure 1 on p. 5). The availability of cross-border electricity therefore played a crucial role in preventing even more severe stress on the system. However, the effectiveness of these imports was uneven. Regions in western Ukraine, which are better connected to EU interconnectors, benefited disproportionately, whereas central and eastern regions continued to experience higher outage levels. This asymmetry reflects a fundamental structural constraint: war-related internal transmission bottlenecks limit the ability to transmit imported electricity from west to east (Stubbe et al., 2026).

Beyond these physical constraints, the operational management of outages introduced additional inefficiencies. Planned outages systematically exceeded actual outages by an average of 1.7 hours per day, indicating a conservative but imprecise approach to load shedding. This mismatch created uncertainty for households and firms, leading to suboptimal behavioural adjustments and additional economic costs (Carr and Meissner, 2026).

Taken together, these observations illustrate a central tension. While cross-border trade has become essential to maintaining system stability, its economic efficiency remains constrained by both physical and institutional factors.

Structural Inefficiencies in Cross-Border Electricity Trade

Despite synchronisation with the European grid, Ukraine's cross-border electricity trade continues to operate within a fragmented framework based on explicit capacity allocation. This system separates the allocation of transmission capacity from electricity trading, creating coordination problems that lead to inefficient outcomes.

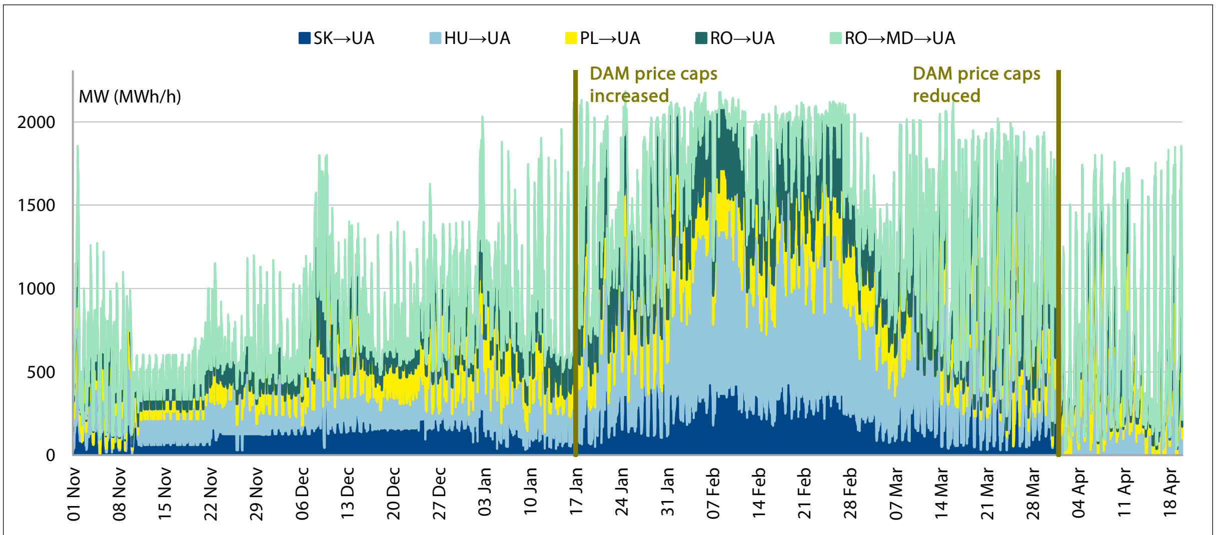
One of the most prominent distortions arises from price caps in the Ukrainian day-ahead market (Stubbe et al., 2025b). Electricity market price caps are generally problematic because they weaken incentives for investment in new generation capacity (Kahn, 2002; Joskow and Tirole, 2007), and in the hardening and winterisation of generation equipment (Biggar and Hesamzadeh, 2024).

Moreover, price caps affect cross-border electricity trade by distorting relative price signals between interconnected markets. When wholesale prices are artificially suppressed in one bidding zone, electricity may flow out of that market even under scarcity conditions, while import levels fail to reflect the true marginal value of electricity. In interconnected systems, such distortions can lead to inefficient trade patterns, including flows against price differentials and the underutilisation of available interconnector capacity (Lorenczik, 2019).

In the Ukrainian context, this weakens economic incentives for imports precisely during periods when they are most needed, thereby exacerbating system stress and increasing reliance on administrative measures such as load shedding (Nies et al., 2025). This highlights a central mechanism: when price signals are suppressed, cross-border electricity trade cannot respond efficiently to scarcity conditions, even when physical interconnection capacity is available.

This pattern is clearly illustrated by electricity import trends during the winter and spring of 2025/26. Ukrainian day-ahead market price caps were temporarily increased on 17 January 2026, until the end of March 2026, as damage from Russian attacks and outages approached critical levels. This enabled larger commercial imports, thereby somewhat reducing the need for load shedding. Although imports had already declined throughout March 2026, they fell further after price caps decreased to previous levels on 1 April 2026 (Figure 1). While other factors—such as seasonal changes

Figure 1: Commercial Electricity Imports to Ukraine by Import Route, November 2025–April 2026



Source: Green Deal Ukraïna, based on ENTSO-E (2026) and NEURC (2026).

in demand and the gradual restoration of generation capacity throughout March—also contributed to the observed dynamics, the timing of the price cap adjustments suggests that market design played a significant role in shaping import incentives.

This distortion is also reflected empirically in the prevalence of electricity flows against price differentials. A substantial share of cross-border flows occurs from higher-price areas to lower-price areas, indicating that electricity is not consistently flowing to where it is most valued. While some of these flows may be explained by operational constraints or security considerations, their frequency points to systemic inefficiencies in market design. More broadly, the Ukrainian electricity market is characterised by limited liquidity, high market concentration, and regulatory interventions such as public service obligations. These factors weaken price formation and reduce the reliability of market signals. The resulting inefficiencies are economically significant, with estimated welfare losses exceeding EUR 500 million annually (Nies et al., 2025).

The current system therefore fails to fully utilise available interconnection capacity and to ensure that electricity flows to where it is most needed. This is precisely the problem that market coupling is designed to address.

Market Coupling as a Structural Solution

Electricity market coupling represents a fundamental shift in the organisation of cross-border electricity trade. Instead of allocating transmission capacity separately from energy trading, market coupling integrates both processes into a single coordinated mechanism.

In the European model, market participants submit bids to national power exchanges, while transmission system operators provide information on available cross-border capacity. A central algorithm then simultaneously clears all participating markets, determining prices and electricity flows in a way that maximises overall welfare.

The key economic principle underlying market coupling is that electricity should flow from areas with lower marginal generation costs to those with higher costs. By aligning cross-border flows with price differentials, market coupling ensures that available transmission capacity is used efficiently.

This mechanism has several important implications. It reduces price differences between countries, improves market liquidity, and enhances competition. It also strengthens the security of supply by allowing countries to access regional resources during periods of stress (Stubbe et al., 2025b). In the Ukrainian context, this would translate into more effective use of imports during periods of shortage and a reduction in the need for costly and disruptive load shedding.

Importantly, market coupling does not eliminate physical constraints such as internal grid bottlenecks. However, it ensures that available cross-border capacity is used as efficiently as possible, thereby maximising the benefits of existing infrastructure.

Ukraine's Progress and Remaining Gaps

Ukraine has taken important steps towards market coupling, most notably through the adoption of the revised electricity market law (Law No. 4831-IX) in April 2026 (Verkhovna Rada of Ukraine, 2026). This law aims to transpose key elements of the EU's Electricity Integration Package and provides the legal foundation for participation in the European market coupling framework.

Nevertheless, significant gaps remain. The transposition of the Electricity Integration Package, consisting of nine legal acts, is not yet complete, particularly with regard to secondary legislation such as network codes and implementing regulations. In addition, the integration process requires the submission of a Market Coupling Operator Integration Plan, which must be jointly prepared with its European counterparts and approved by ACER, the EU Agency for the Cooperation of Energy Regulators. Progress in this area has been delayed, further postponing the practical steps towards integration.

These legal and procedural gaps indicate that, despite political momentum, Ukraine is still at an early stage of the market coupling integration process.

Procedural Timeline and Realistic Expectations

Integration into the EU's Single Day-Ahead Coupling (SDAC) follows a clearly defined sequence. Once the legal framework is fully transposed, Ukraine must formally notify the Energy Community Secretariat and the European Commission. This is followed by a verification process, which typically takes several months: three months for the Energy Community and a further five months for the European Commission.

Only after successful verification can Ukraine submit an official application to join the coupled market. At that stage, the Market Coupling Steering Committee initiates an implementation phase that typically lasts approximately 18 months.

When these steps are considered sequentially, a realistic timeline emerges. Even under optimistic assumptions, the verification process is unlikely to be completed before late 2026 or early 2027. This implies that a formal application could only be submitted thereafter, with implementation extending into mid-2028. There is a risk that full transposition of the secondary legislation—and hence also the verification and implementation process—could be further delayed due to limited administrative and bureaucratic capacities of Ukraine's authorities.

Consequently, Ukraine is likely to miss the first SDAC go-live window in Q1 2028. Under the current procedural timeline, the earliest realistic date for Ukraine's participation in day-ahead market coupling is therefore the second go-live window in Q1 2029. This timeline is significantly longer than is often assumed in policy discussions and underscores the need for accelerated action during the preparatory phase.

Market Coupling and CBAM: A Strategic Interdependence

The importance of market coupling extends beyond efficient cross-border trade. It is also closely linked to Ukraine's position within the EU's climate policy framework, particularly the Carbon Border Adjustment Mechanism (CBAM).

The definitive phase of the CBAM imposes a carbon price on imports of specific goods, including electricity, from third countries into the EU, unless certain conditions are met (Regulation (EU) 2023/956, Art. 2(7)). One such condition is the existence of an electricity market coupled with the EU. Another is the introduction, by 2030, of a carbon pricing mechanism for the electricity sector with an equivalent price to the EU Emissions Trading System (ETS). Conversely, the go-live of the SDAC cannot occur without securing a CBAM exemption for the electricity sector, since the CBAM cannot be effectively applied within coupled markets (Stubbe et al., 2025a; Nies et al., 2025).

This creates a strategic interdependence. Without market coupling, future Ukrainian electricity exports to the EU would face significant additional costs, reducing their competitiveness and limiting trade. However, to achieve SDAC integration, Ukraine must also secure a CBAM exemption for its electricity sector now, which requires additional conditions to be met, including the introduction of an equivalent carbon pricing mechanism.

As a result, market coupling becomes a prerequisite for securing a CBAM exemption for the electricity sector, and vice versa. Under the current regulatory framework, Ukraine is unlikely to achieve one without the other. This adds an additional layer of urgency to the integration process, as well as to the development of an ambitious carbon pricing framework, as delays in market coupling or carbon pricing could have direct economic and energy security consequences for Ukraine's electricity trade.

Conclusion

The experience of the winter of 2025/26 has demonstrated the critical role of cross-border electricity trade in maintaining Ukraine's energy security. At the same time, it has revealed the limitations of the current market framework, which fails to ensure the efficient use of available interconnection capacity. More broadly, the Ukrainian case illustrates that, in interconnected electricity systems, inefficient market design can be as significant a constraint as physical infrastructure.

Electricity market coupling offers a comprehensive solution to these challenges. By aligning price signals and coordinating cross-border flows, it can significantly improve efficiency, reduce outages, and strengthen system resilience. In addition, it represents a key step in Ukraine's integration into the EU's internal energy market and climate policy framework.

However, market coupling is not an immediate remedy. The procedural and regulatory requirements imply a timeline extending to the end of the decade. Crucially, alongside the legal and technical process of market coupling integration, Ukraine urgently needs to introduce a meaningful carbon price by piloting a national ETS with a clear pathway towards convergence with European carbon price levels. A national ETS will be central to securing a CBAM exemption for the electricity sector, which is a prerequisite for the go-live of electricity market coupling.

In this sense, market coupling should be understood not only as a long-term integration objective but also as an urgent policy priority. Its successful implementation will be central to Ukraine's economic recovery, energy security, and European future.

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ANALYSIS

State of Play and Prospects of the Electricity System of Ukraine in the Fourth Year of War

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Abstract

This paper examines the role of electricity networks in ensuring the resilience and sustainability of Ukraine's power system during the fourth year of the war. It analyses the evolution of the transmission system following synchronisation with the European grid and the gradual increase in cross-border capacity, which has been critical for supply security. Moreover, it highlights the need to reform and strengthen distribution system operators to enable decentralisation and support system resilience. This paper argues that a combined approach—reinforcing the central grid while developing a more flexible and decentralised distribution system—is essential for Ukraine's energy security, market integration, and long-term transition.

Introduction

Russia has changed its strategy several times: expecting a fast victory, in February 2022, it targeted the central electricity system. Being unsuccessful, it shifted towards a mix of attacks on the energy system across the country, progressively including gas infrastructure. With limited progress on the battlefield, Russia sought to provoke a humanitarian disaster in the winter of 2025/26 by simultaneously attacking centralised and local heat, power and gas systems, while temperatures were approximately –20 degrees Celsius. Kyiv, for example, with its 2.80 million inhabitants, is grouped with the Eastern part of the country for power distribution. The city lost most of its electricity, heating, and water supply, and still depends, at the time of writing, on imports after losing 2 gigawatts (GW) of local generation and heat supply capacity.

Ukraine faces massive energy and infrastructure challenges during the fourth year of the war. While the first years and winters of the conflict benefited from massive overbuilding in terms of both generation and transmission (38 GW installed capacity with a peak load of 24 GW in early 2022 (International Energy Agency (IEA) 2025)), repeated attacks have destroyed this initial advantage. Massive partner-country support, such as through the Energy Support Fund, has therefore remained crucial. Former Soviet-bloc countries, for example, could provide replacement transformers and other critical equipment from their stocks. (Energy Community Secretariat 2026). Overcentralisation, with large nuclear, coal, and gas blocks; combined heat and power plants; high-voltage transmission lines (up to 750 kV); and large substations, has recently been proven to be the critical point of failure of the system, as its major components are easy to target and have far-reaching impact.

Therefore, decentralisation in Ukraine is widely seen as an imperative that is driven primarily by supply security rather than by sustainability considerations, as is often the case in other countries. Nevertheless, decentralisation alone cannot provide a complete solution, as the synchronised system is essential for international exchanges, and the domestic grid is indispensable for managing internal bottlenecks. A combined approach—integrating both centralised elements—is needed. This approach includes reinforced resilience and air protection for large blocks, battery energy storage systems (BESSs), and modern grid technologies and much greater smartness and distribution system operator (DSO) capabilities, as well as renewables (RESs) plus batteries on the decentralised side. Such an integrated approach would help address the challenge of West−East transfers in Ukraine. Following the occupation of the 6 GW Zaporizhzhia nuclear power plant at the beginning of the war, electricity is generated and imported mainly from the West, while consumption is important in the East. In addition, the Ukrainian territories currently under Russian control form part of its infrastructure, including interconnection with Russia and Russian phone networks.

From Synchronisation to Integration

The Ukraine-EU power bridge was established four years ago. Although preparations had been underway since 2017, synchronisation was not expected until 2023, when the war clearly pushed it up by several years. When Russia invaded Ukraine on the morning of 24 February 2022, the country's power grid had already been operating in island mode for two days. Operating in island mode is a regulatory requirement under the synchronisation project's catalogue of measures (ENTSO-E 2023). The establishment of the power bridge, which also anticipated Ukraine's future EU accession, gained symbolic significance and became decisive for the war: innumerable lives were saved, and the front was maintained as electricity flowed from the West through eight cross-border power lines linking Ukraine/Moldova and their neighbours. Moldova was included because it forms a single power grid with Ukraine. The synchronisation and the following years benefited from the operational experience of the individual Transmission System Operators (TSOs), prior collaboration, and highly professional and standardised TSO coordination based on a common rulebook. Starting as an emergency support mechanism without trade, exports and imports evolved over time within the limits set by the European Network of Transmission System Operators for Electricity (ENTSO-E 2025), and later by Transmission System Operator Security and Cooperation Network (TSCNET, Europe's leading Regional Coordination Centres).

Changes in Export/Import Patterns Since 2022

Since synchronisation in March 2022, cross-border capacity limits between Ukraine/Moldova and the EU have gradually increased from emergency levels with no commercial exchanges to 2.45 GW by early 2026. Each stepwise increase reflected technical progress and system stabilisation under wartime conditions and played a critical role in the security of supply. The methodology for calculating available capacity was further updated in June 2025, shifting from ENTSO-E Board decisions to a coordinated process led by the Regional Coordination Centre TSCNET in the context of the planned Eastern Europe Capacity Calculation Region (CCR). The development of cross-border grid capacity is closely linked to electricity market integration, as available transmission capacity determines the scope for cross-border trade and market coupling.

From Low-Hanging Fruits to Eastern European CCR and Market Coupling in 2029

Several "low-hanging fruit" opportunities in high-voltage transmission grid optimisation and build-out are available for short-term security of supply and medium—and long-term decarbonisation and market integration.

These are

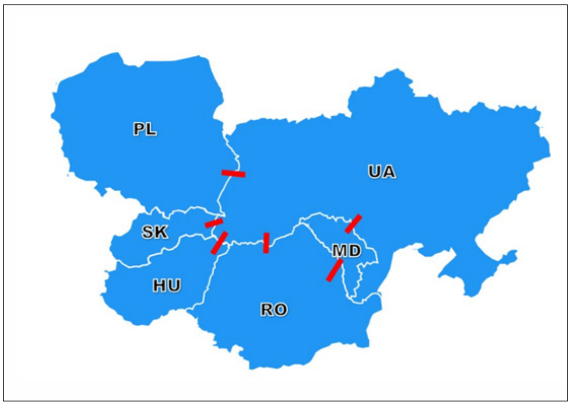
- the deployment of Flexible AC Transmission System Technologies (FACTS) devices, which improve the controllability and utilisation of existing transmission lines, for the Polish-Ukrainian Rzeszów–Khmelnytskyi cross-border line, translating into +500 MW import capacity for Ukraine, and could be operational by the end of 2026
- the use of Dynamic Line Rating Technologies (DLR), which can increase the transfer capacity on existing lines and interconnectors by 15% within three to six months, and improve West-East transfers.
- two strategic interconnection projects must be accelerated to dispose of 1600–2000 MW more capacity, including interconnections between Romania (Isaccea–Yuzhnoukrainsk) and between Slovakia and Ukraine (Mukachevo–Veľké Kapušany).
- The 110 kV network should be used for cross-border flows and improved internal flows. (Nies and Savitskyi 2024, Nies 2025).

All these projects could double the existing energy trading potential. Their implementation is also crucial for the eagerly awaited postwar future.

Importance of Market Coupling

According to the Decision of the Agency for the Cooperation of Energy Regulators (ACER) No. 10/2025 of 16 December 2025 (ACER 2025c), the Southeast Europe (SEE) CCR has been expanded to include eleven additional bidding zone borders. Furthermore, three new capacity calculation regions have been defined: East-Central Europe (ECE CCR), Italy Montenegro (ITME CCR), and Eastern Europe (EE CCR). The definition of these regions means for Ukraine that it is part of the Eastern Europe CCR.

Figure 1: Eastern Europe Capacity Calculation Region



Source: Green Deal Ukraïna 2026

The adoption of the new law by the Ukrainian Parliament on April 7, 2026 (Verkhovna Rada 2026b) represents a major milestone for the electricity market integration by 2029. This law transposes key elements of the EU's Electricity Integration Package. Market coupling will enhance competitive prices and increase security of supply.

While transmission is decisive for market coupling, the development of the so-far neglected Ukrainian distribution system is the basis for decentralisation. Both TSOs and DSOs underpin the electrification process, whereby electricity gains an increasing share of the energy mix.

Progress & Challenges in DSO Reform and Grid Modernisation

DSOs in Ukraine are set to undergo a fundamental transformation, like other clean energy transition countries, where the traditional one-way street from production to consumption made them the last step in distribution. With the rise of small and distributed generation (Renewables), as well as digitalisation, DSOs become active participants in the system and must interact with active customers, TSOs, and market players. EU accession also requires Ukraine to implement Chapter 15 on energy, which includes substantial provisions for DSOs.

State of Play in Ukraine

The Ukrainian distribution landscape varies regionally. DSOs in western and central parts of the country increasingly face challenges linked to load growth, business relocation, and the rapid integration of new distributed generation and storage assets, as population movements and industrial relocation continue to reshape demand patterns. In contrast, DSOs operating near the frontline and in partially occupied territories face fundamentally different conditions: physical destruction of infrastructure, disruptions in revenue collection, consumer outmigration, operational security risks, and, in some areas, the continued inability to fully access and maintain network assets. This regional divergence has become a defining feature of Ukraine's distribution sector and requires differentiated regulatory and investment approaches.

Ukraine's distribution network is extensive, with 32 DSOs operating approximately 818,782 km of networks across voltage levels from 0.4 to 110 kV and, in some cases, up to 150 kV. The legacy of the Soviet-era system, often characterised as overbuilt, was developed for a different economic and technical reality: large Soviet-era industrial demand, centralised generation, high reserve margins, and extensive transmission and distribution infrastructure. This represents both a challenge and an opportunity. On one hand, parts of the network remain ageing and inefficient; on the other hand, the relatively dense physical infrastructure provides a stronger basis for reinforcement and modernisation than in many other countries, particularly in regions less affected by hostilities (see Figure 2 on p. 12).

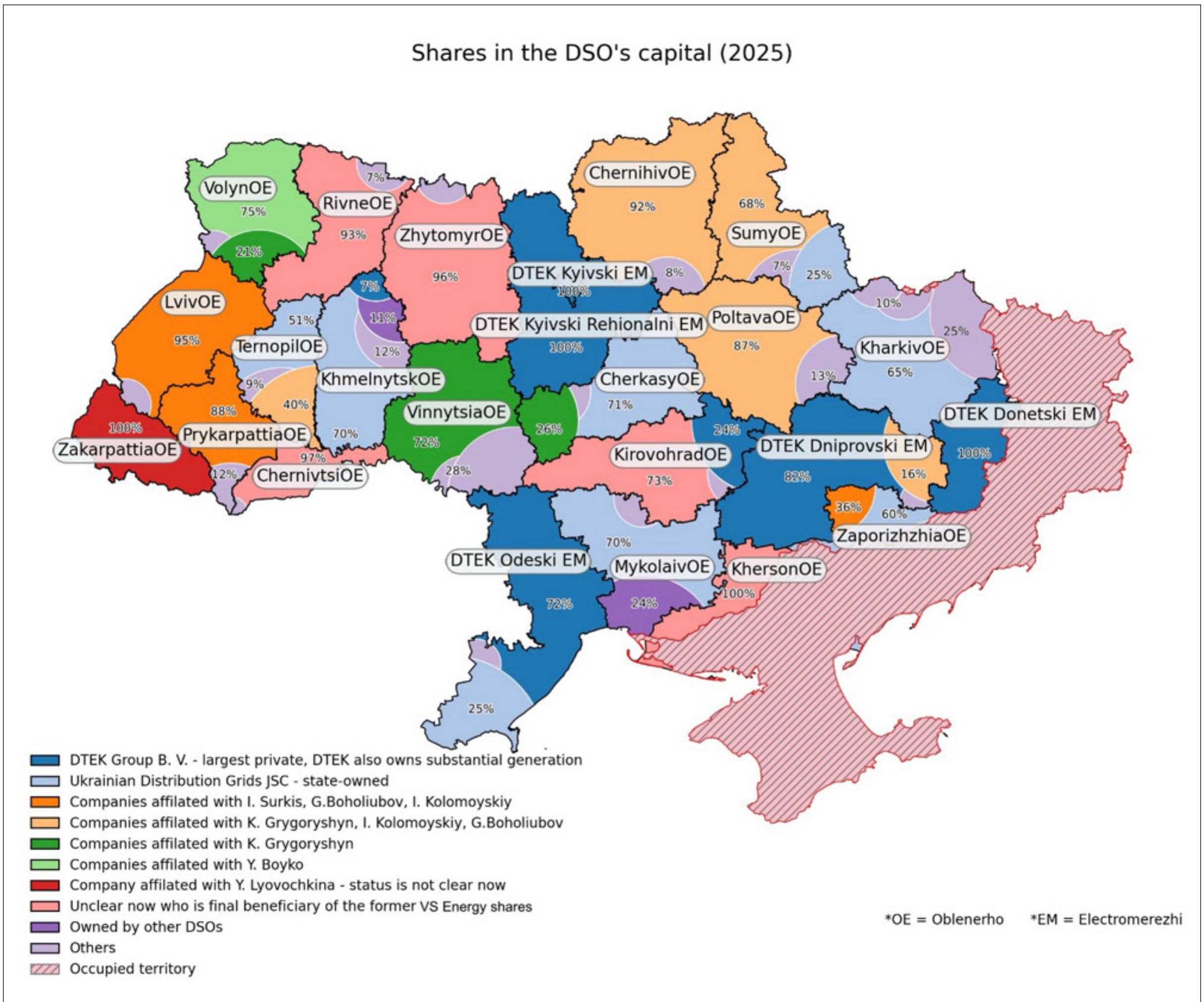
Moreover, wartime pressures have made resilience the central priority. Damage to Ukraine's electricity distribution infrastructure is estimated at approximately €0.6 billion on the basis of national assessments and the Ukraine Rapid Damage and Needs Assessment (World Bank 2026). Repeated attacks on critical energy infrastructure have required DSOs to shift from long-term optimisation to continuous emergency response and restoration cycles. In frontline and adjacent regions, grid operations increasingly include rapid repairs, temporary reconfiguration of network topology, management of emergency outages, and prioritisation of supply to critical infrastructure.

Regulatory and Legislative Developments

Regulatory reform has been a major area of progress. Here, regulation must frame the new role of DSOs in a more decentralised energy system. A particularly important legislative development is the adoption of Verkhovna Rada Law No. 4834-IX on the implementation of European energy market rules (Verkhovna Rada of Ukraine 2026b), aimed at strengthening supply security and enhancing competitiveness in the energy sector. The law aims to establish a comprehensive legal framework for the full integration of Ukraine's electricity market into the EU internal energy market. It introduces the legal basis for market coupling of the day-ahead and intraday markets with European bidding zones, thereby laying the foundation for deeper cross-border electricity trade and integration with the EU market architecture. It also transposes key elements of the European electricity risk preparedness model, including the introduction of risk preparedness plans, strengthened regional coordination, and alignment with ENTSO-E requirements. The law also introduces provisions on aggregation, demand-side response, active consumers, and energy communities, which support a more flexible and decentralised electricity system. In practice, consumers, storage operators, and distributed generators can increasingly participate in balancing the system and responding to grid conditions and price signals, reducing pressure on the network and facilitating the integration of distributed renewable energy sources. Following the adoption of the law, the regulator has already started implementing these new provisions and developing the corresponding secondary legislation.

Another legislative development is Law No. 4777-IX, adopted on 11 March 2026, on amendments to certain legislative acts of Ukraine regarding the development of distributed generation (Verkhovna Rada of Ukraine 2026a), which introduces several concrete measures with direct implications for DSO reform and grid modernisation. The law reforms the connection framework by introducing flexible connections, allowing installed capacity to exceed the permitted connection capacity and enabling hybrid connections, where generation, storage, and consumption assets may share a single connection point. It also extends cable pooling to include storage and consumers. In parallel, the law strengthens storage integration by simplifying colocation rules and applying network tariffs to net electricity flows. On the market side, the law introduces renewable energy auctions based on a market premium mechanism, where

Figure 2: Ukraine's Distribution Sector



Source: Bondarenko, Mikhnych, Zachmann (2025)

producers receive support linked to market electricity prices rather than fixed tariffs. It further aligns the Guarantees of Origin system with EU rules, helping Ukrainian renewable electricity become more compatible with European electricity and certification markets.

Another regulatory decision in Ukraine (President of Ukraine 2026) expands the mandate of DSOs to contribute directly to regional resilience planning by implementing measures associated with the protection of critical infrastructure and by enabling the rapid deployment of distributed generation, supported by targeted tariff adjustments for DSOs to finance resilience-related investments, complemented by allocations from the state budget.

EU Alignment

Table 1 on p. 13 compares key features of DSO regulation and investment frameworks in the EU and Ukraine to illustrate the current level of alignment, remaining gaps, and broader transformation required for decentralisation, resilience, and EU market integration. The table is based on EU legislation, ACER reports, and Ukrainian regulatory practices.

Conclusion

The resilience of Ukraine depends fundamentally on electricity networks. While the transmission system must be further developed through more cross-border connections, deployment of technologies, and development of HVDC links, the distribution system also requires profound reform on the basis of regulatory updates aligned with the implementation of the EU acquis. This process is expected to improve investability.

A combined central/local approach is therefore required: strengthening the resilience and performance of the central transmission system while simultaneously enabling a more decentralised and flexible distribution-level architecture. This integrated model is essential for ensuring the security of supply while supporting sustainability and electric-

Table 1: DSO Regulation and Investment Framework: EU vs. Ukraine

Aspect	European Union	Ukraine
DSO role and functions	DSOs act as active system operators, including integration of DERs, flexibility, data management and support to market functioning	Network operators; core system operation functions established; role expanding towards resilience, distributed generation and flexibility integration
Flexibility and demand-side integration	Market-based procurement of flexibility (demand response, storage, aggregation) increasingly required	Early-stage development; legal basis introduced, but market mechanisms still limited
Network planning	NDPs; increasing emphasis on transparent, forwards-looking planning, although practices vary across member states in terms of detail and coordination (analysed in ACER and CEER (2025)	Mandatory FYNDP and annual investment programmes are in place; however, challenges remain in forwards-looking planning, coordination, and integration of flexibility
Tariff and regulatory model	Incentive-based and TOTEX approaches to promote efficiency and innovation	Incentive-based, with cost+ for smaller DSOs. WACC, RoR, and depreciation are set by the regulator
Performance-based regulation	Widely applied (quality of supply, losses, innovation, efficiency incentives)	Limited development of performance-based incentives
Connection framework	Streamlined, with priority for RES and flexible connections	Reform underway: flexible connection, hybrid connection, cable pooling introduced
Digitalisation	Uneven progress across the MS, affecting the ability to deploy flexibility and optimise grid utilisation	Uneven progress; average 20% (NEURC, 2025) focus on physical resilience and restoration under war conditions
Investment environment	Stable regulatory frameworks, access to capital, increasing investment volumes: compared to 2021 (€23 billion), annual distribution grid investments increased by over 50% in 2024 (€35 billion) and are projected to double (from 2021) to 2027 (€47 billion), (ACER 2026). Anticipatory investments.	Constrained by war risks, tariff recovery challenges, and infrastructure damage. Investment programmes for 2025 ≈ €300 million. (NEURC 2025). Remaining significantly below estimated investment needs.
Resilience and security role	Increasing importance (cybersecurity, infrastructure protection), but not the primary driver	Central priority: emergency response, restoration, and protection of critical infrastructure
Transparency	Transparency requirements for DSOs are defined in EU electricity market legislation, which obliges system operators to publish relevant technical and commercial information and requires regulators to act transparently. In practice, DSOs must provide information on available capacity for new connections and existing and forecasted spare capacity; hosting capacity maps should be published and updated.	The regulator's draft tariff-setting decisions are subject to open discussion under the approved procedure. Due to martial law, the amount of information published on the official website of NEURC and DSOs' websites is currently limited.

Source: authors' compilation.

ity market integration. Ukraine's wartime experience may also provide important lessons for other countries facing growing security and resilience challenges in the energy sector. Ukraine could also become a pioneer beyond the country, very much like it pioneered drone technology.

Developing grids without developing markets—both domestic and across borders—will be a dead end. As highlighted in previous analyses (Nies et al. 2025)), issues such as incomplete market liberalisation, legacy regulatory provisions, and price distortions pose significant obstacles to short-term energy security and market coupling. The adoption of the revised electricity market law, transposing key elements of the Electricity Integration Package, therefore represents a major step forward, creating a pathway towards deeper market integration and greater decentralisation by 2029.

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ANALYSIS

Stronger Together: How Ukraine, Moldova and Romania Can Turn Shared Vulnerabilities into Strategic Advantage

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Abstract

Russia's invasion of Ukraine has reinforced the importance of strengthening cross-border interconnections with neighbouring EU countries to enable Kyiv to withstand the impact of attacks on critical energy infrastructure. Of all its regional partnerships, the Ukraine–Moldova–Romania energy triangle is arguably the most consequential, although its potential remains largely untapped. This paper examines two projects—a proposed electricity interconnection that builds on the three countries' complementary energy needs and the revival of the Trans-Balkan Pipeline as a south-to-north gas corridor—and argues that their completion could enable Ukraine, Moldova, and Romania to collectively reap significant economic and security dividends while contributing to broader regional stability, competitiveness and decarbonisation goals.

Introduction

Russia's full-scale invasion of Ukraine in February 2022 highlighted the importance of strengthening regional cooperation to help counter hybrid risks, build cross-border connectivity and consolidate military cooperation. Ukraine's electricity and natural gas interconnections with EU countries—Hungary, Poland, Romania, and Slovakia—have since supported Kyiv to withstand the impact of Russia's missile and drone attacks on critical infrastructure and preserve the overall stability of its energy system.

However, of all its EU neighbours, Ukraine's relationship with Romania is arguably the most complex and strategically important, but this partnership cannot be understood in isolation. In addition to Moldova, the three countries form an interdependent security and economic triangle, bound together not only by infrastructure but also by shared challenges and converging aspirations for functional energy markets, resilient infrastructure and decarbonisation.

As former Soviet states, Moldova and Ukraine retain deeply intertwined energy networks, which explains their decision to synchronise with the European power grid as a single bloc in 2022. While the benefits of synchronisation are indisputable, increasing infrastructure resilience and economic benefits, there are also risks that neither country can address alone.

Moldova and Ukraine are mutually dependent on each other for security. Despite its small size, Moldova serves as a buffer against Russian aggression, particularly on Ukraine's southeastern flank, while also depending itself on Ukrainian protection against the same threat.

Moldova's pro-EU orientation has been instrumental in helping to contain the risk of Russia opening a new southern front against Ukraine, while also constraining Moscow's ability to establish a land bridge to Transnsitria and transform it into an active military base. At the same time, Moldova has been able to absorb some of Russia's regional hybrid pressure, including political interference and energy coercion, diverting attention and resources that might otherwise be directed more fully towards Ukraine. Conversely, Ukraine has effectively sealed off Transnistria from the east, reducing the risk of regional escalation and providing Moldova with critical breathing space to advance its EU accession ambitions.

Nevertheless, since the start of the Russian invasion, Moldova's own security has been repeatedly threatened because Russian strikes on Ukraine's electricity grid sent shockwaves through its electricity network, triggering power blackouts on several occasions (Oleniak, 2026) or because successive Russian cuts to gas exports during peak winter demand led to major crises (Kieff, 2025). To keep afloat, Moldova turned to Romania for electricity and gas imports, deepening its dependence on its EU neighbour while also elevating Romania's strategic value in the region.

The three countries have already recognised the need to strengthen their collaboration, establishing the Odesa triangle, a platform for dialogue established in September 2022 to coordinate responses to Russian aggression (Pleșca, Burcea, 2025). Nevertheless, the case for deeper trilateral cooperation extends beyond security objectives and needs to go much further to build on shared objectives for infrastructure resilience, EU market integration and energy transition.

The following discussion focuses on two projects in the electricity and natural gas sectors that meet exactly those goals and shows how building on the three countries' complementarity will yield long-term dividends for Ukraine, Moldova and Romania as well as for the wider region.

The first concerns electricity and examines how deeper grid integration could stabilise infrastructure, enhance resilience, advance market integration and support decarbonisation. The second focuses on natural gas and explores how alignment with EU market rules could open access to competitively priced imports, generate transit revenues and contribute to security across the Black Sea region.

From Synchronisation to Integration

Since the start of Russia's full-scale invasion, Ukraine's and Moldova's energy priorities have focused on two elements—expanding or upgrading electricity capacity and taking steps to harmonise with EU rules in anticipation of accession towards the end of the decade.

Russia's relentless strikes on the electricity infrastructure prompted Kyiv to work fast to increase the transfer capacity of the synchronous Ukraine–Moldova bloc by no less than 24 times since 2022 from 100 megawatts in 2022 to more than 2,400 MW currently according to data by ENTSO-E, and the goal is to add another 1,500 MW over the next two years (Odessa Journal, 2026).

In that context, Ukraine has been in active talks with neighbouring countries to build new high-voltage power lines or upgrade local antennae to help expand cross-border transfer capacity (Nies, 2025), At the beginning of 2026, the presidents of Romania and Ukraine, Nicușor Dan and Volodymyr Zelenskyy discussed the construction of a 400 kV line linking Suceava to Chernivtsi and another 110 kV antenna between Siret and Porubne, both linking northern Romania to southwestern Ukraine. The interconnectors are expected to help raise Ukraine's transfer capacity with continental European Network of Transmission System Operators for Electricity (ENTSO-E) and boost grid resilience.

Meanwhile, Ukraine has been exploring the possibility of upgrading five existing 110 kV interconnections with Moldova which would provide a cheap solution to ensure grid stability and align with goals to scale up Ukraine's decentralised renewable capacity (Nies, Savytskyi, 2024).

Moldova has also been pursuing its own interconnection projects to increase security and expand cross-border capacity. Its legacy arrangements dating back to Soviet times mean that the electricity grid on the right bank of the River Nistru, also known as Moldova proper, and that on the left bank, also known as Transnistria, are intertwined. Historically, Moldova imported Russian gas, which it partially transferred to the left bank in exchange for electricity generated at the Russian-operated 2.5 GW Moldovaskaya GRES (MGRES, also CERS Moldovenească) power plant.

The arrangement stopped in January 2025, when Russia cut all the gas supplies to Transnistria, but Moldova's vulnerability did not completely disappear because the high-voltage Isaccea-Vulcănești power line, which connects to the European grid via Romania, is also linked with the MGRES plant (see Figure 1 on p. 20).

The interconnector is not only a safety net for Moldova, as it allows it to obtain up to 60% of electricity imports from Romania but also a point of vulnerability because by connecting to the MGRES power plant in Transnistria it exposes the country to Russian-controlled infrastructure in Transnistria.

To limit risks, Moldova is now working to remove the Transnistrian bypass by linking the Isaccea–Vulcănești high-voltage link through a new line directly connected to the capital Chișinău. While the upgrade has a pure security function, helping the right bank disentangle itself from MGRES, it does not result in additional transfer capacity (see Figure 1 on p. 20).

For that reason, Moldova has been in talks with Romania for the construction of two other 400 kV lines, the Strășeni-Gutinaș and Suceava-Bălți interconnectors, which are expected to be completed before the end of the decade (see Figure 1 on p. 20).

Altogether, the three lines are critical for the security of supply and are likely to open important commercial opportunities on both sides of the border, but they do not simultaneously capture the objectives shared by Ukraine, Moldova and Romania—infrastructure security, regional stability and decarbonisation.

One project could tick all three boxes, providing there is sufficient political will in Kyiv, Chișinău and Bucharest to drive it through. The Pivdennoukrainska nuclear power plant (Ukraine)—Isaccea (Romania) overhead line was first pitched in the late 1980s to enable electricity exchanges between Ukraine, Romania and Bulgaria. The 750 kV line was built at the time, but for technical reasons, it was switched off in the late 1990s before being brought in commercial operation. In 2007, attempts were made by the Ukrainian and regional stakeholders to resurrect it, but a source close to the electricity grid operator Ukrenergo interviewed for this research said that after 10 years of inaction, the company had filed a lawsuit against the Southern Energy Company Consortium, seeking termination of the agreement and the return of transferred assets and liability claims for failure to fulfil contractual obligations.

The source said Ukraine was no longer pursuing 750 kV line and that a new 400 kV interconnector between Ukraine and Romania was being considered. According to ENTSOE's publicly available list of transmission projects included in its 2026 TenYear Network Development Plan (TYNDP), the project has already been incorporated among the approved investments coordinated at the European level.

Ukraine has one of the world's largest 750 kV networks but these lines are not used for standard synchronous operations with ENTSO-E.

Although the old infrastructure is no longer thought to be in place, a new line could be built from the Pivdennoukrainska nuclear power plant (NPP) in Ukraine's Mykolaiv Oblast to the Isaccea nodal point in Romania and include a spur to Moldova along the route (see Figure 1 on p. 20).

The importance of the project lies not only in the fact that, if built, the line would add another 1.2 GW of interconnection capacity, boosting current levels by a third but also in the physical complementarity of the Romanian southeastern grid with the Ukrainian-Moldovan grid.

Romania has an abundance of clean electricity capacity, including nuclear and wind power plants, in the southeastern region of Dobrogea close to the Ukrainian border, which has created grid congestion and left the country struggling to evacuate the excess output to other parts of the country. The natural flow of the electric current from this region is eastwards towards Ukraine and Moldova, which means that the two countries could plug their supply deficit by importing the clean energy generated in Dobrogea.

The merits of this project are manifold. On the one hand, it would allow the three countries to stabilise the regional infrastructure by building on the natural flow of electric output, while on the other hand, it would contribute to the security of supply, particularly in the Odesa region and southern Moldova, deepen market integration and serve decarbonisation goals.

The natural eastwards flow of current from Romania to Ukraine and Moldova means that the line would also encourage trade along the path of least resistance, incentivising prices to converge across the three markets just as Ukraine and Moldova have now transposed the required legal frameworks in preparation for market coupling with the EU.

The project has enlisted international support and is currently in the preparatory phase, with construction scheduled to begin in 2026. However, much depends on the political will of Bucharest, Chisinau and Kyiv to advance and fast track the commissioning scheduled for 2028.

North Flows

Although Ukraine, Moldova and Romania have been taking steps to scale up their renewable capacity, natural gas remains a critical transition fuel for all three countries. Romania is expecting to add at least 3 GW of gas-fired capacity (Petcu, 2024) to replace coal generation, which it has pledged to phase out before the end of the decade, while Moldova and Ukraine are scrambling to build small-scale gas generators as an intermediary backup for peak consumption.

In summary, all three countries will continue to rely on natural gas for the foreseeable future and will require access to competitively priced volumes even as the global gas market is facing increasing risks linked to geopolitical volatility.

Unlike other European countries, which remain dependent on gas imports but do not have resources of their own, Romania and Ukraine sit on some of the continent's largest on- and offshore reserves, estimated at a combined 1.2 trillion cubic metres, (Sabadus, 2021) and benefit from strategic infrastructure, including a well-developed transmission network.

The two countries are also critical to wider southeastern Europe, as they boast some of the region's largest gas markets and offer access to storage capacity, particularly Ukraine's vast underground facilities, which could provide a security dividend to the entire eastern flank.

Projected demand growth in Romania linked to the energy transition as well as reconstruction efforts in Ukraine in a postwar scenario are incentivising regional LNG and gas grid operators in southern Europe to invest in infrastructure expansion that would facilitate access to new sources of supplies for northwards exports. These changes come at a time when the region is preparing to fully diversify away from Russian gas imports.

All of these factors help to build momentum to resurrect flows along the Trans-Balkan pipeline and establish a corridor for south-to-north supplies (see Figure 2 on p. 21).

The Trans-Balkan pipeline was established in the 1980s to ship Russian gas to the Balkan countries and Turkey via Ukraine, Moldova and Romania but is now shaping up as the backbone of an integrating south-east European gas market which would link importing facilities in southern Europe to Ukraine's vast storage capacity in the north.

The corridor has been largely idle since 2020, when the Russian producer and exporter Gazprom decided to divert supplies via the new TurkStream corridor across the Black Sea, but with technical upgrades and regulatory alignment, it could enable clear economic and security dividends.

Reversing the flow direction would enable north-bound exports from Romania's Black Sea offshore production to Moldova and Ukraine. Conversely, maintaining the original northtosouth configuration would allow Ukraine to export gas from its domestic system, including its storage facilities, to neighbouring countries in the south.

Nevertheless, the viability of the route, estimated to unlock €92 m in additional annual revenue for gas grid operators if fully utilised, (WECOM, 2025) hinges on the ability of the operators along the route to collaborate towards streamlining operations and slashing transmission tariffs.

While Bulgaria and Greece charge competitive tariffs and are aligned in their application of EU rules, there are several complications associated with the Ukraine–Moldova–Romania segment that need to be addressed. The greatest roadblocks thus far have been related to high tariffs charged by Romania and Moldova, which discouraged companies from using the route and, potentially, accessing Ukrainian storage facilities. See Figure 3 on p. 21 for the current and proposed tariff structure.

As with electricity, the three countries had already been working bilaterally on most of the issues under discussion. For example, Moldova had already adopted regulations closely mirroring those in Ukraine's gas transmission code, indicating deliberate regulatory convergence (WECOM, 2024)

Moreover, Moldova had also been closely aligning with Romania on a number of issues. Following comprehensive reform in recent years, its transmission operations have been placed under the control of a company majority owned by the Romanian gas grid operator (Derewenda, 2023)

Nevertheless, the three countries could take their collaboration a step further to establish a unified tariff zone and potentially an integrated natural gas market, following the model of Finland, Estonia and Latvia, which removed internal cross-border tariffs through an inter-transmission system operators (TSO) compensation mechanism that preceded full regulatory alignment. An interTSO compensation mechanism is a framework used in EU electricity and natural gas markets to allocate fairly the costs and benefits of cross-border flows between transmission system operators.

The benefits cannot be understated. A fully integrated market underpinned by Romanian and Ukrainian gas reserves, a well-developed transmission network and access to Ukraine's vast underground storage capacity—the largest in Europe—would deliver significant dividends across multiple dimensions.

For market participants, the removal of internal tariff barriers would reduce transaction costs, improve price transparency and encourage competition, driving down prices for consumers across the region.

For grid operators, a unified tariff zone would increase utilisation rates along the Trans-Balkan corridor, whereas for the broader region, linking LNG import terminals in Greece and possibly Turkey to Ukrainian storage in the north would create a credible, liquid alternative to Russian supply for the region.

Conclusion

The Ukraine–Moldova–Romania triangle represents one of the most consequential but thus far underappreciated axes of European energy security. Although bound by geography and legacy infrastructure dating back to Soviet times, the three countries are only now beginning to grasp the importance of aligning economic, political and security goals to face shared risks and reap converging benefits.

Russia's war in Ukraine has accelerated the need to diversify away from Russian energy resources, while decarbonisation challenges are driving home the importance of market integration to ensure that clean energy can flow freely across borders.

Although by setting up the Odesa Triangle, a forum for security dialogue, the three countries have acknowledged the strategic value of working as an integrated unit rather than as three separate bilateral relationships, the process is still far from complete, particularly with regard to energy.

Ukraine is fighting to rebuild its war-torn energy system while also increasing its security. Moldova is offering a critical buffer to Ukraine's southeastern flank, but with its own energy system vulnerable to Russian attacks and supply blackmail, it has increasingly relied on neighbouring Romania to keep its lights on and the heating running.

Romania itself benefits from the security provided by Ukraine and could position itself as the strategic anchor of this energy triangle through the two projects examined in this paper.

The proposed Pivdennoukrainska–Isaccea–Moldova electricity interconnector would not only add 1.2 GW of transfer capacity among the three countries but also build on the complementarity of the three countries' energy systems, allowing Ukraine and Moldova to advance market coupling goals, support regional decarbonisation and strengthen the security of supply.

With respect to natural gas, the revival of the Trans-Balkan corridor as a south-to-north corridor offers an equally significant prize. Linking LNG import terminals in southern Europe or Romania's Black Sea gas production to Ukraine's vast underground storage capacity, the corridor could provide the region with a credible alternative to Russian supply and generate substantial transit revenues for operators. Building on that potential, however, requires the three countries to resolve outstanding regulatory misalignments by harmonising technical specifications, reducing transmission tariffs and ensuring full compliance with EU market rules.

About the Author
Aura Sabadus works as a senior journalist specialising in energy markets with London-based Independent Commodity Intelligence Services (ICIS), a global energy and petrochemicals news and market data publisher. She is also an Associate Fellow of the Royal United Services Institute and a Nonresident Senior Fellow with the Democratic Resilience Programme at the Center for European Policy Analysis. In her position as a journalist and researcher, she has written extensively on energy security and political risk and is particularly interested in energy supply dynamics in the Black Sea region. She has a PhD in international relations from King's College London and occasionally teaches at universities in the UK and EU.

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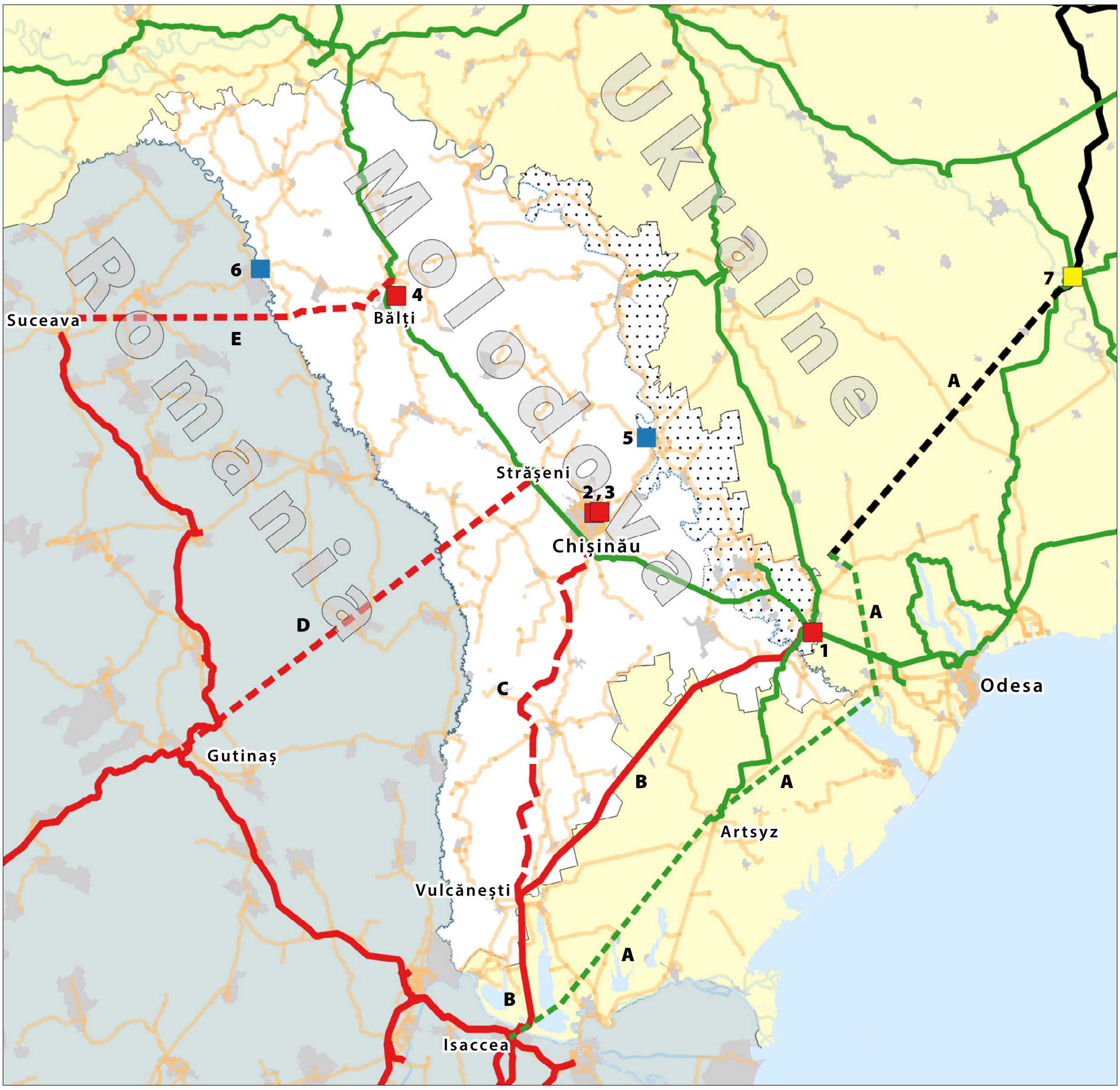
Figure 1: The Moldovan Electricity Transmission Network, Including Power Lines under Construction and in Planning



750 kV power lines
400kV power lines
330kV power lines
110kV power lines
Power line under construction
Power lines in planning
Transnistria

Power stations:

- Natural gas, fuel oil, coal
- Hydro
- Nuclear

1. Moldavskaya gosudarstvennaya rai-onnaya electrostantsiya (MGRES) or CERS Moldovenească or Cuciurgan or Kuchurgan Power Station
2. Combined Heat and Power CET Source 2
3. Combined Heat and Power CET Source 1
4. Combined Heat and Power CET-Nord
5. Dubăsari Hydroelectric Plant
6. Stânca-Costești Hydroelectric Plant
7. Pivdennoukrainsk NPP

Power lines:

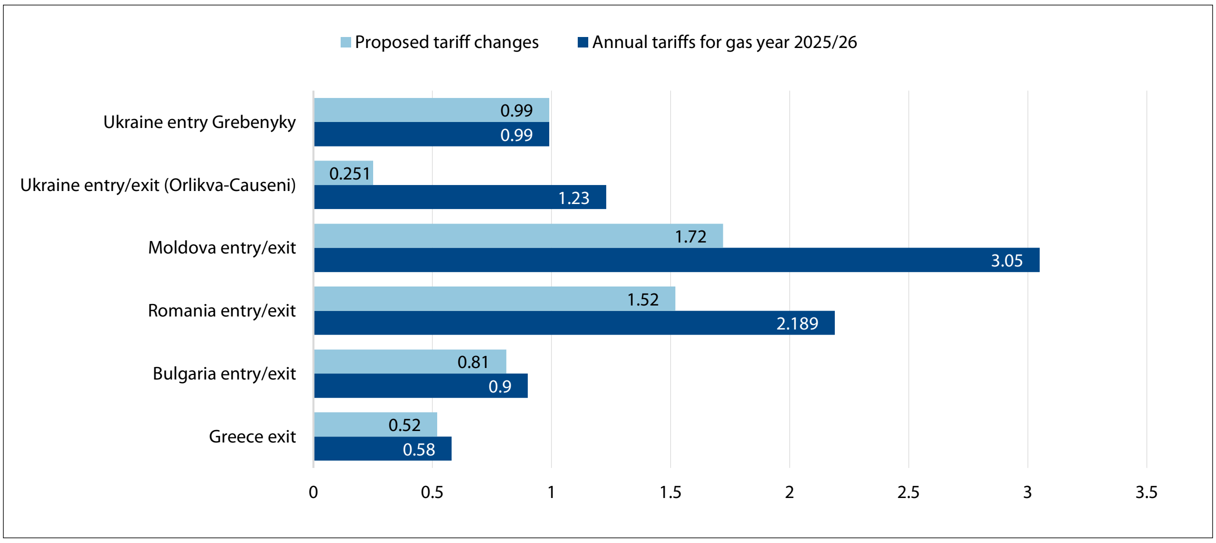
A Proposed Isaccea–Pivdennoukrainsk NPP High-Voltage Line
B Isaccea–Vulcănești–MGRES Interconnecting Line
C Chișinău–Vulcănești, to be completed in 2026
D Strășeni–Gutinaș, to be completed in 2030
E Bălți–Suceava, to be completed in 2027

Source: map created by the Research Centre for East European Studies with geodata from OpenStreetMap (© OpenStreetMap contributors)

Figure 2: The Trans-Balkan Pipeline

Source: GIE publication 2025 (https://www.gie.eu/publications/maps/trans-balkan-pipeline-map/). The author thanks GIE for the permission to reproduce this map.

Figure 3: Gas Transmission Tariffs along the Trans-Balkan Corridor for Gas Year (in Euro/MWh)



*Notes: *Bulgarian entry/exit tariffs include volume-based commodity fee, **Romania exit includes volume-based commodity fee*

Source: Regional gas grid operators

ANALYSIS

Planned versus Actual Power Outages in Ukraine: Evidence from Subnational Survey Data, January to April 2026

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Abstract

Electricity systems operating in crisis conditions, as is the case in Ukraine, often rely on planned outages for grid stability. However, the extent to which these schedules align with actual consumer experiences is poorly understood. The current research investigates the gap between planned and actual daily power outages in Ukraine between January and April 2026. Using original, subnational household survey data from 20 Ukrainian regions and a total of 2,677 observations, we analyse the temporal dynamics, regional disparities, and predictability of electricity supply. The outage burden appears to be highly time-concentrated over the observed period, peaking in the beginning of February before declining through March and rising slightly again in early April. Across the full sample, planned outages systematically exceed actual outages by 1.7 hours on average per day, indicating that schedules serve as upper limits rather than precise forecasts. Planned outages appear to be relatively evenly distributed across subqueues (groups of consumers who are disconnected or connected in blocks) within a region. However, the actual daily outage hours significantly differ between the intra- and inter-regional, with the eastern and southern regions experiencing higher outage frequency. Mismatches between planned and actual outages impose hidden costs on households and firms, including inefficient resource allocation, disrupted routines, and reduced trust in system operators and communications. Furthermore, unreliable scheduling may induce suboptimal load-shifting, adding unnecessary additional stress to a grid already pushed to its limits. These findings suggest that the resilience of power systems during crises should be measured not only in terms of outage duration but also in terms of spatial equity and predictability.

Introduction

Electricity systems under crisis conditions are often subject to managed (planned) outages and supply constraints. Such crises include conflicts, extreme weather events, and fuel shortages, which sometimes occur simultaneously. In these circumstances, managed outages, or load shedding, are used to protect the power infrastructure from cascading failures (a chain reaction of component outages that can lead to widespread blackouts) and maintain the system's frequency to ensure that the supply can still reliably reach as many consumers as possible (Kundur *et al.*, 2004).

Traditional assessments of system performance, particularly in times of crisis, focus on the availability of generation capacity, system balance, and total outage duration (Billinton and Allan, 1996). While these metrics are critical for understanding the dynamics of electricity provision at the system level, they do not necessarily capture consumer-level experiences. As reliability is increasingly understood as multidimensional (Hashemi, 2021), the predictability aspect for end consumers becomes an important determinant of the socioeconomic consequences of outages. Load shedding introduces a key distinction between planned (announced) outages and actual (experienced) outages. In addition to welfare losses from the simple lack of power supply, gaps between notified and experienced outages can create additional costs as businesses over- or underadjust, households misallocate resources, and trust in system communication erodes. Much of the literature focuses on system adequacy and blackout events (Kundur, 1994; Wu, Chang and Hu, 2017; Alhelou *et al.*, 2019), but less attention is given to how accurately planned outages reflect real experiences and how the resulting uncertainty affects households and firms.

Ukraine provides a unique setting to explore this gap further for several reasons. First, the country experienced large-scale damage to energy infrastructure dating back to the start of the Russian invasion in early 2022. As a result, there has been a heavy reliance on scheduled rolling outages. This strategy is underpinned by a complex web of rapidly changing rules and regulations that dictate when, where, and how much load needs to be shed, as well as how disconnections should be communicated (Uebele *et al.*, 2026). There have been rapid shifts between periods of system stress and recovery, resulting in large swings in daily outage durations over the course of a few weeks and across regions. In summary, the electricity supply in Ukraine since February 2022 has been relatively scarce, regionally uneven, and operationally uncertain, making Ukraine a valuable case for studying how outage systems function in practice under extreme conditions.

Using original survey data reported by households in all nonoccupied Ukrainian regions between January and April 2026, we explore here the temporal and spatial dynamics of announced vs. experienced power outages as well as the associated predictability gap.

Data Collection and Sample

A household survey was conducted in which forty consumers from twenty subnational regions (two from each) were asked to report the number of hours of scheduled and actual power outages each day between the 27th of January and the 10th of April 2026 (a total of 71 days). The survey was commissioned by *Green Deal Ukraïna* and carried out by the *Center for Applied Research*, a Ukrainian social research firm.

To provide some background on current outage planning in Ukraine, in each region, end-consumers are divided into six main queues and a further twelve subqueues (1.1, 1.2, 2.1, 2.2, and so forth up to 6.2) of roughly equal electricity consumption (based on a recent reference measurement day). The outage schedules announced by a region's distribution system operator (DSO) indicate which subqueues are to be disconnected and for how long. The overall goal is to keep outage durations balanced across subqueues when assessed at the weekly scale. In other words, at the end of a given week in which scheduled outages take place, all subqueues should have experienced roughly the same number of scheduled hours without power. Planned outages are typically announced the day prior (Uebele *et al.*, 2026).

Despite the assumption that all subqueues within one region experience equal hours of outages, we still collected reported data from two subqueues per region to detect any intraregional variation.

The sample of respondents consisted of residents from all of oblasts except the (partially) occupied regions of Luhansk, Donetsk, Zaporizhzhia, Kherson, and Crimea. The total number of observations in the survey is 2,677. A small number of consumers failed to report on some days. The key questions to be answered daily were as follows:

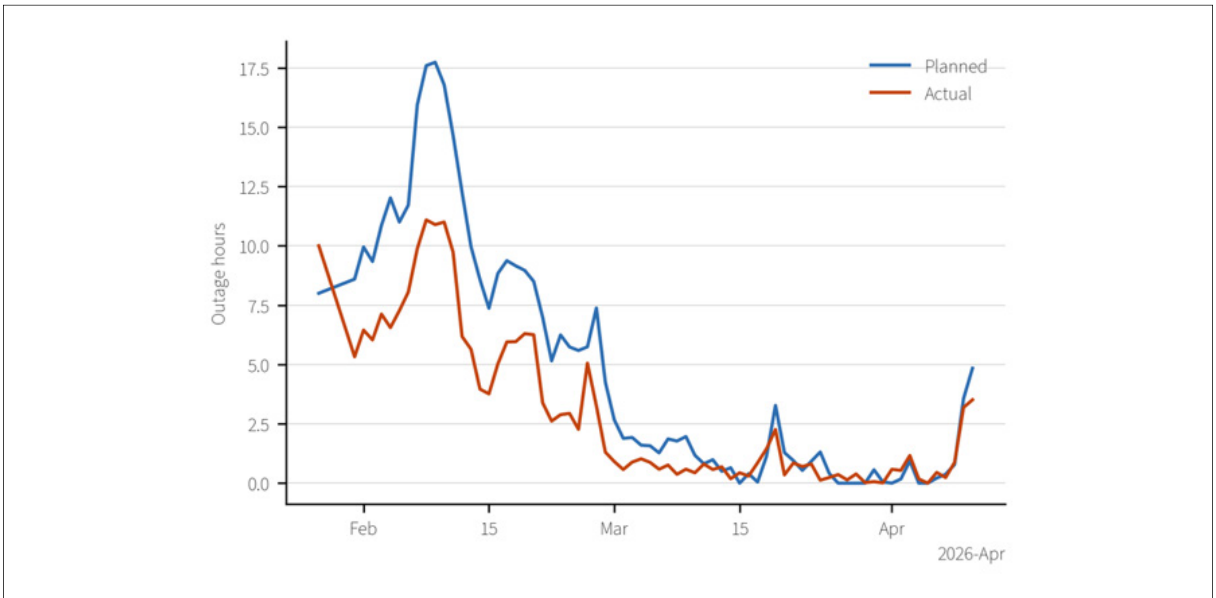
1. How many hours of scheduled outages were planned for today in your subqueue?
2. How many hours of actual outages occurred today in your subqueue?

Temporal Dynamics of Outages

Temporally, the outage burden appears to be highly time concentrated. Severe blackouts in early February were followed by rapid improvements over the subsequent weeks, with only a mild relapse in early April (Figure 1).

The national pattern is sharply front-loaded with respect to the observed period. The average actual outage hours across responses were approximately 11–11.5 hours per day, peaking on 8–10 February, then decreasing steadily through late February, decreasing below 1 hour on average by early March, and remaining very low throughout most of March before a modest increase on 9–10 April. The substantial reduction in outages throughout March aligns with the report that

Figure 1: National Trend of Reported Planned vs. Actual Outages by Day



Source: GDU Household Survey

Ukraine began electricity exports again around this period (briefly) for the first time in four months (Shcherbak, 2026b). In weekly terms, the average actual outage time decreased from 8.6 hours during the week starting on 2 February to 0.53 hours during the week starting on 9 March.

In general, over the sampled period, more daily outages were planned than experienced by consumers by an average of 1.76 hours. There were 54 days with more planned outages than actual outages, 16 days with more actual outages than planned, and only 1 day with no planned outages or actual outages. Among the 71 days with reported data, the gap between the scheduled and actual outages was between –1 and 1 hour on 33 of the days, or 46% of the time.

The lowering of the electricity price cap may have played a role in the increased outages observed in early April. While there was a uniform price cap of 15,000 UAH on the day-ahead market (DAM) since January 17,2026, as of April 1, the cap ranged from 5,600 to 15,000 UAH depending on the hour (Shcherbak, 2026a), effectively representing a decrease. The main short-term consequence here was a sharp reduction in electricity imports (ExPro Electricity, 2026) as commercial imports became financially unattractive in more hours. The uniform 15,000 UAH price-cap was re-instated on May 1 (National Commission for State Regulation in the Energy and Utilities Sector, 2026).

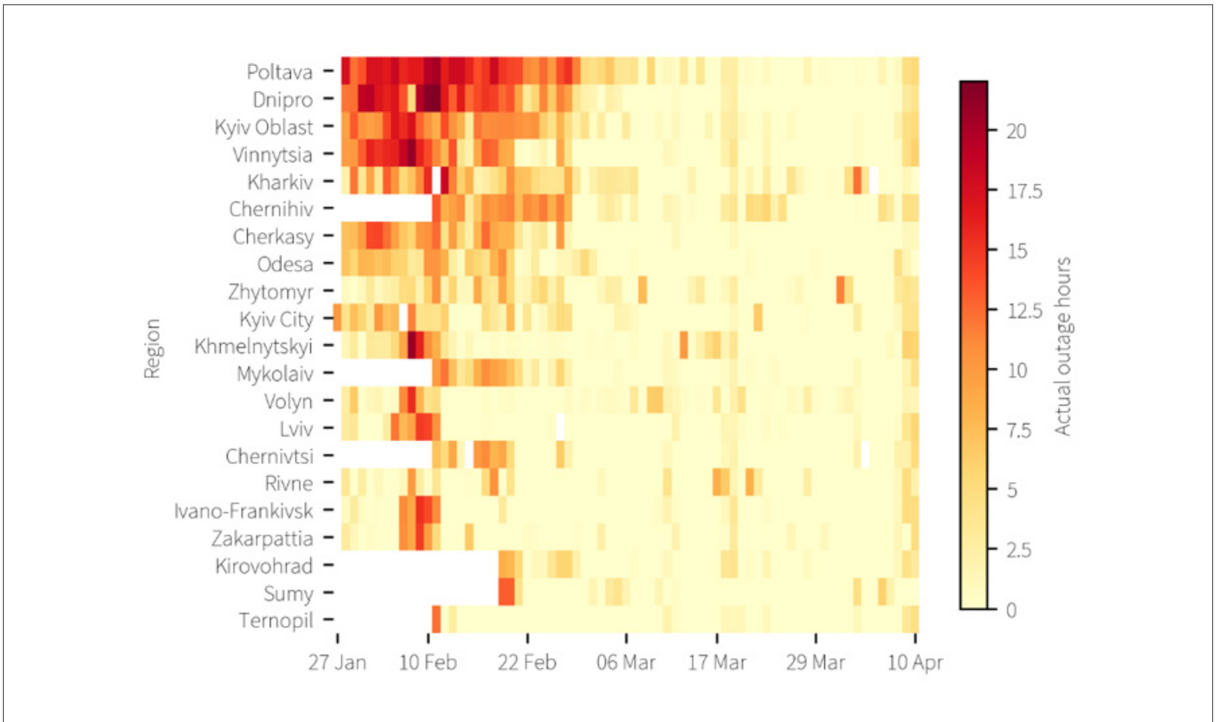
Inter- and Intraregional Inequality in Outage Burden

Differences across and within regions can be observed in the reported data. At the regional level, recovery appears to be geographically uneven, with some oblasts bearing more of the actual outage burden than others do (Figure 2).

The highest average actual outage hours were in places such as Poltava (7.15 h) and Dnipro (6.48 h), while many western oblasts were much lower: Ternopil (0.51 h), Zakarpattia (1.10 h), Ivano-Frankivsk (1.21 h), and Volyn (1.18 h). Poltava and Dnipro experienced 10+ hours of daily outages deep into February despite most other regions being relatively unaffected. Kyiv Oblast (the area surrounding but not including the capital city) also appears to have been hit much harder by outages than the capital itself, particularly towards the middle and end of February. At a broader level, when grouped into rough macroregions, the east/south averaged markedly more actual outage hours than the west did. Supply was much more reliable across the board in March and early April, with only a few isolated incidents in the Kharkiv and Zhytomyr regions.

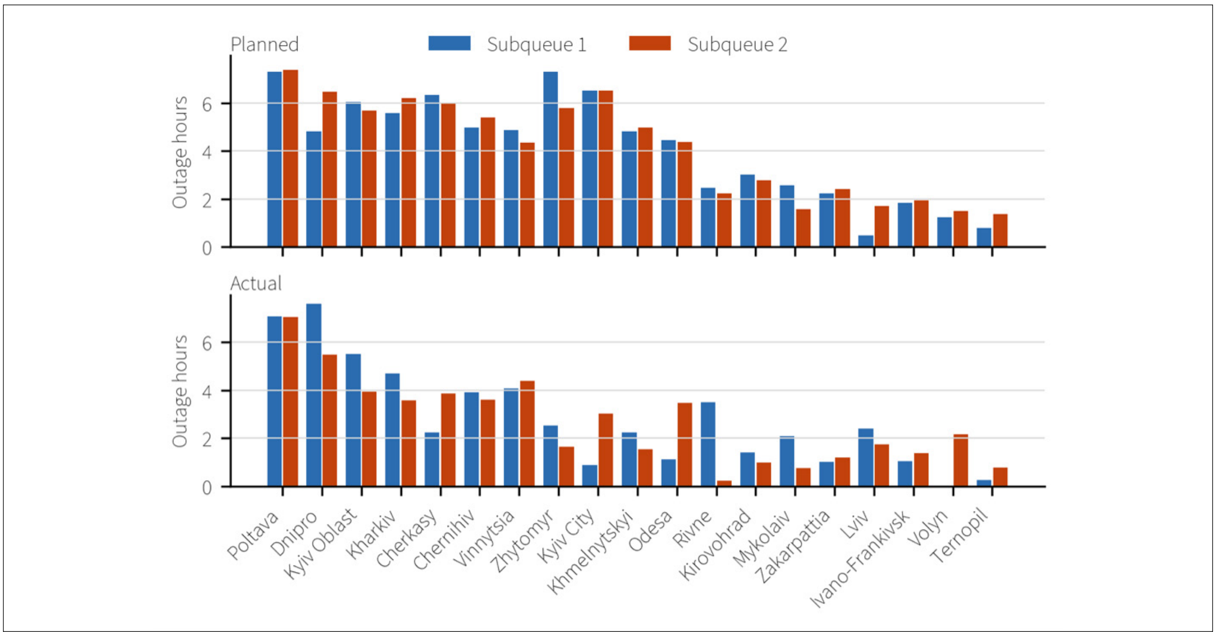
According to the rules for load shedding in Ukraine (Uebele *et al.*, 2026), scheduled outages across subqueues within a region should be roughly equal when averaged over longer periods of time. We can test this claim using our survey data (see Figure 3 on p. 26).

Figure 2: Reported Actual Outage Hours by Day and Region



Source: GDU Household Survey

Figure 3: Average Planned and Actual Daily Outages by Region and Subqueue (Jan–Apr 2026)



Source: GDU Household Survey

Indeed, it is clear that the average daily planned outage hours are quite similar within most regions between the two subqueues surveyed. Regions with slightly larger differences between subqueues tend to have the lowest number of scheduled outage hours (less than two hours); thus, perhaps in these cases, there is less emphasis on perfectly equalising both subqueues, as shorter outages are likely to reduce the perceived unfairness associated with unequal schedules.

In terms of actual outages, however, greater differences both within and across regions exist. In terms of within, there is a (more or less) two-hour difference in actual outage time across subqueues in Dnipro, Cherkasy, Kyiv City, Kyiv Oblast, Odesa, Rivne, and Volyn. Across regions, actual outage hours are systematically less than planned, except for those of Dnipro and Lviv. Kyiv city and Zhytomyr are the two regions with the greatest difference between planned and actual outages (4.5–4.7 hours less than planned).

Planned vs. Realised Outages

Building on some of the observations made above, one can safely argue that planned outages are generally a conservative ceiling and not a precise forecast of the actual experiences of households.

Looking at the distribution of planned vs. actual outage hours across the entire sample of observations (see Figure 4 on p. 27), the larger concentration of points below the 1:1 reference line indicates that actual outages were typically shorter than planned. The overall trend line being less than 45° supports this.

More specifically, the mean gap is approximately –1.66 hours overall, and in February, the gap widens to approximately –3.86 hours. In other words, communicated schedules often overstate the duration of outage that people ultimately experience.

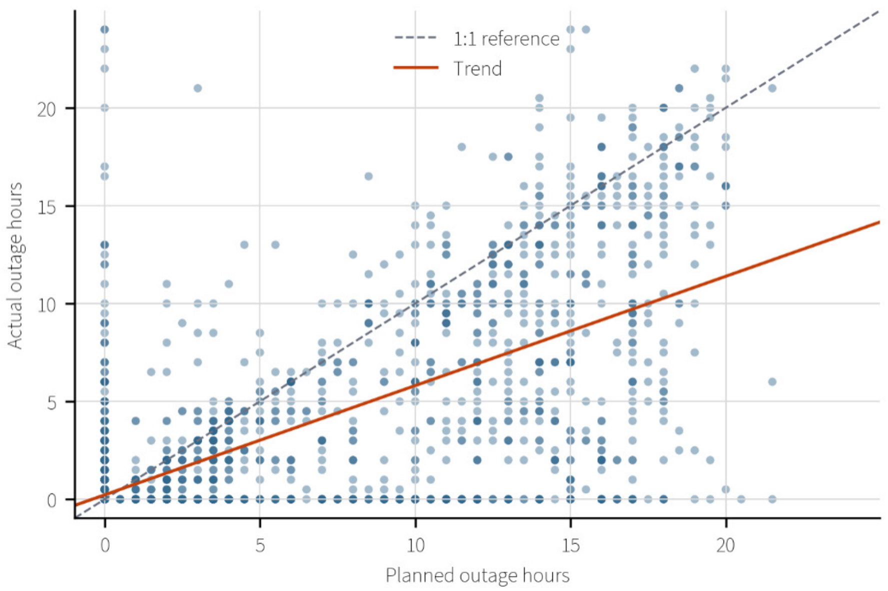
The substantial spread of observations around the trendline also highlights a significant degree of variability in how planned outages translate into actual experiences. For any given level of scheduled outages, the actual outages span quite a large range, indicating that operational constraints and real-time adjustments play a big role and cannot easily be accounted for in the provided schedules.

Finally, the cluster of observations along the zero points of either axis indicates that many instances where planned outages either never materialised (reflecting improved system balancing or overly conservative planning) or were not planned but then suddenly occurred (reflecting the opposite). Together, these patterns suggest that in addition to outage duration and frequency, uncertainty was also a key feature of electricity supply conditions during the survey period.

Consequences of Unpredictable Outages

Uncertainty in how outage schedules are reflected in realised consumer experiences can have a variety of negative consequences. From the perspective of consumers, particularly households and small businesses, the misallocation of resources (in anticipation of an outage that either does not occur or is shorter than expected) leads to hidden costs resulting, for example, from productivity

Figure 4: Reported Planned vs. Actual Daily Outages (All Observations)



Source: GDU Household Survey

losses or the inefficient use of backup solutions such as batteries and generators. Daily routines could be interrupted unnecessarily, increasing time costs because more waiting and rescheduling activities are needed. Conversely, if actual outages occur that were not properly announced or take much longer than stipulated in the schedules, consumers could be caught unprepared, and critical activities that require electricity may be suddenly interrupted or forced to be postponed indefinitely.

There is also the element of perceived inequality, which could create social tension. As observed in the lower panel of Figure 3, different experiences of actual daily outages across subqueues within a region may lead to one group of consumers questioning why they are being supplied with less electricity than another group is. These sentiments, along with the welfare losses mentioned in the paragraph above, undermine the legitimacy of system management and may erode consumer trust in official communication.

Moreover, unpredictability can impose additional strain on the energy infrastructure itself. When outage schedules are announced, one would expect that a certain amount of load shifting takes place in which daily activities are more concentrated in hours where no outages have been scheduled. This naturally puts more pressure on the grid during those hours. However, if scheduled outages poorly reflect the actual outage hours, then the shifted loads add stress to an already strained grid when it is not necessary. In general, poor alignment between signals (planned outages) and reality (actual outages) leads to suboptimal system-wide decision-making.

Conclusion

Electricity outage schedules in Ukraine serve as conservative system management tools rather than accurate predictors of household experience. Therefore, resilience should be measured not only by planned outage intensity but also by actual consumer experience, geographic distribution and predictability. On the basis of the differences across regions, resilience appears to be territorial, meaning that targeted regional policies could be more effective than general policies established at the national level are. Predictability is a particularly relevant component that deserves more emphasis in policymaking discussions. The costs of an unpredictable electricity supply are not only difficult to measure (over- or underprepared businesses and residential actors, erosion of trust in critical system communications from the relevant authorities) but also diffuse across time and actors, complicating both private adaptation strategies and public policy responses. More stable day-ahead outage schedules, clearer communication of uncertainty ranges, and real-time digital updates regarding deviations from outage schedules are a few options to improve predictability. At the same time, some operational flexibility remains important as system operators may be able to restore supply earlier than anticipated. Taken together, these findings highlight the need for greater emphasis on the accuracy and transparency of outage scheduling in future policy frameworks.

Please see overleaf for about the authors and bibliography.

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Robert Carr is a Data and Modelling Officer at Green Deal Ukraïna. His work focuses on modelling the Ukrainian and wider European power systems to support policy advice across topics such as load shedding, carbon pricing, interconnection capacity, and tariff reforms. In addition, he also collects, analyses, and visualises various energy- and economic-related data.

Frank Meissner is the Data and Modelling Lead at Green Deal Ukraïna. His work focuses on developing the modelling infrastructure for the GDU's Ukrainian and European power system model as well as conducting a variety of economic analyses of energy efficiency, tariff reforms, and other current policies. He is also in charge of commissioning primary survey data on the topics of buildings and daily power outages.

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ANALYSIS

Public Building Renovation in Ukraine: Municipal Delivery as a Growing Bottleneck

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Abstract
Municipal public buildings in Ukraine sit at the intersection of wartime resilience, local service delivery, and EU-oriented energy reform. Ukraine has already adopted important strategic and regulatory measures to improve the energy performance of public buildings. Yet these steps have not produced a scalable municipal renovation system. This article argues that a major bottleneck lies not only in financing constraints, but in the weak link between planning, baseline data, project preparation, and access to funding. Ukraine's next task is to build a delivery architecture that different types of municipalities can actually use.

Introduction: A Large Renovation Challenge

Municipal public buildings in Ukraine are no longer only part of social infrastructure. In wartime, they are also part of the country's resilience infrastructure. Hospitals, educational facilities, and administrative buildings must continue functioning despite destruction, repeated energy disruptions, strained local budgets, and growing reconstruction needs. In this context, renovation matters not only because it can reduce energy use, but also because it can strengthen the continuity of essential public services under wartime conditions. In this article, public-building renovation refers primarily to energy-performance renovation of existing municipal public buildings. It covers both individual measures and more comprehensive deep-renovation packages intended to reduce energy demand and improve the energy performance of buildings. These may include thermal insulation of the building envelope, window replacement, modernisation of heating and ventilation systems, and related metering, control and energy-monitoring systems where they support or form part of an energy-performance package.

The scale of the challenge is substantial. Already in 2020, the European Investment Bank (EIB) estimated investment needs for renovation of Ukraine's public buildings at a minimum of 2 billion Euros and designed its flagship programme around deep renovation rather than partial upgrades (EIB, 2020). Yet scale alone does not explain the current bottleneck. According to the State Agency on Energy Efficiency and Energy Saving of Ukraine (SAEE)—data available as of January 2026—baseline energy performance was calculated for only 7,792 out of 18,268 state- or municipally owned buildings in 18 regions, with an average specific energy consumption of around 171 kWh/m²/year (SAEE, 2026). These figures do not fully reflect the condition of the entire stock. More importantly, they point to a situation in which baseline information remains incomplete and uneven.

This matters because Ukraine has already adopted important strategic and regulatory measures in the buildings sector, including the Long-term Strategy for Thermal Modernisation of Buildings until 2050, the national database of energy and operational characteristics of buildings, and the development of nearly-zero energy buildings (NZEB)-related regulation (CMU, 2023; CMU, 2024; MinDev, 2025a).

Public-building renovation in Ukraine is not driven by energy efficiency alone. In wartime Ukraine, rehabilitation of public buildings is increasingly framed as part of a broader recovery task rather than as a standalone energy-efficiency exercise. The Rapid Damage and Needs Assessment defines "build back better" as integrating improved functionality, energy efficiency, universal access, disaster and climate resilience, and critical modernisation measures into reconstruction (World Bank, 2025). At the same time, the "energy efficiency first" principle offers a useful way to frame reconstruction choices: in the buildings sector, its benefits go beyond lower energy consumption alone, since it can reduce pressure on the wider energy system, improve indoor conditions and wellbeing, lower operating costs, and strengthen energy security (DiXi Group and BPIE, 2025).

The energy-efficiency dimension deserves specific attention because Ukraine's legislation is broadly aligned with the EU acquis (European Commission, 2025). Yet this formal progress has not produced a fully operational renovation system for public buildings.

EU Approximation Strengthens Municipal Responsibilities, But Delivery Challenges Remain

Ukraine's approach to public-building renovation is increasingly shaped by approximation to the EU. The policy direction is visible in the National Energy and Climate Plan (NECP), which sets ambitious targets for the buildings sector by 2030, including functioning energy-management systems in at least 90% of municipalities, at least 36% of residential and public buildings meeting minimum energy-efficiency requirements and at least 10% of public buildings reaching NZEB (nearly zero-energy building) standard (Ministry of Economy, 2024). Ukraine has since expanded the formal regulatory framework through technical NZEB requirements, that entered into force in April 2025, although these currently serve as voluntary criteria for design and certification rather than a mandatory standard (IEA, 2025).

At the same time, EU alignment increases delivery pressure at the local level. The revised Energy Efficiency Directive extends public-sector obligations more clearly to the local, regional and national level, including a 1.9% annual public-sector energy-consumption reduction target and a 3% annual renovation obligation for relevant public buildings above 250 m² (European Union, 2023). In parallel, the recast Energy Performance of Buildings Directive requires all new buildings owned by public bodies to be zero-emission from 2028 onwards (European Union, 2024). Once reflected in Ukrainian legislation, this will increase delivery pressure on municipalities and strengthen the importance of energy management as a practical tool for local planning, building prioritisation, project preparation, and monitoring.

This is where the current gap becomes visible. Ukraine has already created many of the elements associated with an EU building renovation framework. However, the practical ability of municipalities to translate those obligations into a pipeline of renovation projects remains highly uneven. The issue is increasingly also one of implementation capacity rather than policy direction alone. In that sense, alignment with the EU sharpens this issue. It makes municipal readiness more important.

Instruments Available, Not Yet Forming a System

The main existing instrument is the EIB-backed Ukraine Public Buildings Energy Efficiency programme. The original framework loan, signed in 2020, amounted to EUR 300 million and was intended to support the renovation of around 1,000 public buildings (EIB, 2020). After Russia's full-scale invasion, EUR 200 million of that framework loan was redirected in 2022 to urgent support (MinDev, 2025b). Even so, it remains the flagship channel for municipal public-building renovation.

This programme favours deeper renovation, but also raises entry requirements because access depends on audits, technical design, procurement readiness, and municipal administrative capacity (UNDP, n.d.). By March 2026, the fourth competitive stage of the programme had selected 19 municipalities in 12 oblasts, while 76 projects are in the process of implementation in 38 municipalities from the first three stages (MinDev, 2026).

Meanwhile, five municipalities withdrew from earlier rounds due to their inability to secure loan approvals from the Ministry of Finance, shifts in budget projections, or war-related building damage (UDEPP, 2025). This shows that the programme is functioning and that municipalities are able to move projects forward, but the evidence also suggests that the preparation and approval chain remains difficult for weaker municipalities to complete.

A similar pattern is visible in other instruments such as ESCOs—energy service companies. In principle, under an ESCO/energy performance contracting model, a private company can implement and sometimes finance or arrange financing for energy-efficiency measures in a public building, with repayment linked to verified or guaranteed savings (IEA, 2018).

In the 2019 pilot projects cohort reviewed and supported by the United Nations Development Program (UNDP), 52 of 53 contracts focused mainly on heating-system modernisation and remote energy monitoring (UNDP, 2023). By the end of 2024, 26 contracts had been completed, 15 remained active, while others were suspended because of hostilities or legal disputes (UNDP, 2025). Underperformance often reflected preexisting problems at facilities, imperfect implementation schedules, and incomplete fulfilment of obligations by local authorities in advanced-partnership contracts, where energy-efficiency measures were to be implemented by both parties (a city and an ESCO company) (UNDP, 2023).

At the same time, more recent UNDP evidence suggests a more dynamic second wave of building renovation, with 95 contracts concluded, including 46 ESCO thermal modernisation projects launched in 2024 with expected energy savings of 17–70% (UNDP, 2025). This points to the continued relevance of ESCO, but as part of a broader delivery system rather than a stand-alone solution.

Beyond the EIB programme, Ukraine's financing landscape is also widening through the Decarbonisation Fund of Ukraine. Official data show 72 funded energy-efficiency and decarbonisation projects across 17 regions by late 2025. But the portfolio remains industry-oriented, while only 5% of end beneficiaries via the energy service company (ESCO) mechanism were local authorities, water utilities, hospitals and kindergartens, with only 1 thermo-modernisation project (Decarbonisation Fund of Ukraine, 2025).

Taken together, these instruments show that Ukraine does have mechanisms and financing channels. What it still lacks is a system that can reliably convert municipal needs into a broad pipeline of technically mature, implementation-ready projects.

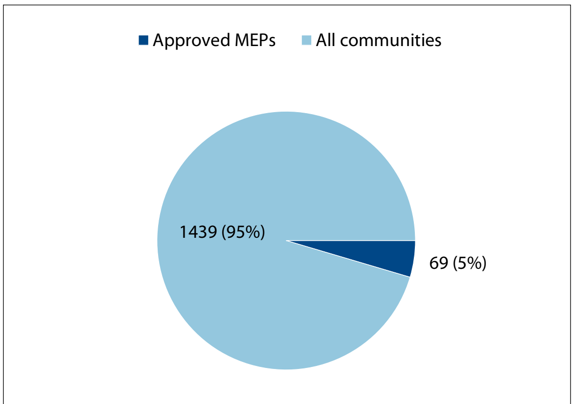
The Missing Link Between Strategy and Implementation

In practice, municipalities do not decide on energy-performance renovation of public-buildings in isolation: renovation often competes with, or must be combined with, structural repair, replacement of other outdated building systems, accessibility upgrades, and measures needed to maintain continuity of essential public services during energy disruptions. This makes project-preparation capacity and the ability to combine different objectives especially important.

This bottleneck becomes visible in three areas: planning, baseline data, and operational energy management.

The first weak link is planning. On 1 January 2026, an approved municipal energy plan (MEP) became a condition for access to state support for energy-efficiency measures (SAEE, 2025). In principle, this creates a sensible connection between public funding and local prioritisation. In practice, uptake remains limited: by 1 January 2026, only 69 such plans had been approved (Figure 1) (SAEE, 2026). This indicates that the planning requirement exists formally, but has not yet translated into broad municipal readiness. Available survey evidence suggests that the bottleneck is partly administrative and partly technical: municipalities report shortages of qualified staff, funding, baseline data, time and technical resources needed to prepare usable municipal energy plans (DiXi Group, 2025).

Figure 1: Municipalities with Approved MEPs by 1 Jan 2026 (SAEE, 2026)



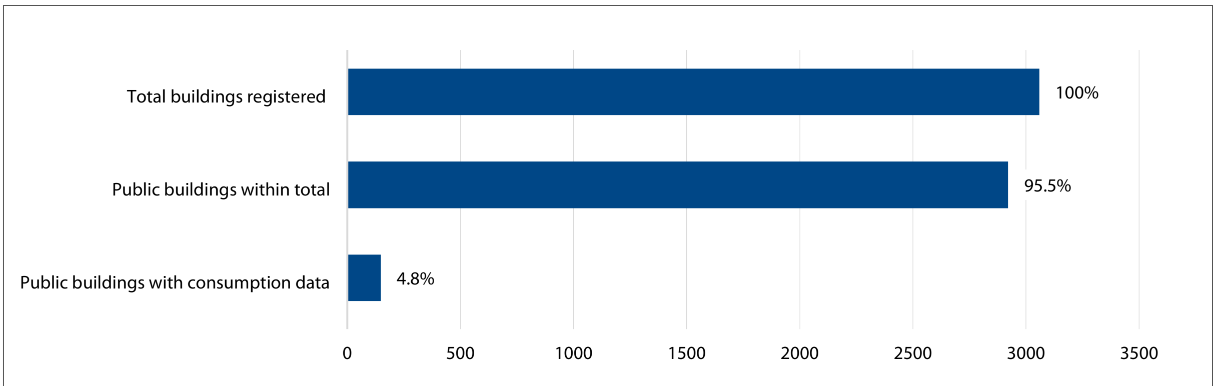
Source: https://saee.gov.ua/static-objects/saee/sites/1/publicnii-zvit-golovi-2025-final-4-26022026.pdf

Some practical support tools for municipalities are beginning to emerge. For example, the Association of Energy Efficient Cities of Ukraine's benchmark platform can help organise local data and generate part of the documentation needed for MEPs (EECU, n.d.). In addition, DiXi Group, a Ukrainian energy policy think tank, has developed methodological recommendations and analytical approaches to support local energy planning, particularly where municipalities cannot obtain complete energy-consumption data from suppliers (DiXi Group, 2026).

The second weak link is baseline data (Figure 2). The national building database is an important institutional step, but it still cannot function as a strong planning tool. According to SAEE, by December 2025 the registry contained 3,059 buildings, including 2,921 public buildings, while energy-resource consumption indicators had been entered for only 148 (SAEE, 2026). Without this baseline, municipalities cannot easily prioritise buildings, prepare credible investment cases, aggregate project pipelines, or later verify energy savings achieved through renovation measures.

Third, energy management is becoming a more important part of the municipal implementation chain, but its rollout remains partial and uneven. By January 2026 SAEE had collected information about implementation of energy management systems from 286 municipalities, or 19.5% of all municipalities, covering 18,268 state- or municipally owned buildings (SAEE, 2026). However, the system often appears only partly operational: only 37.3% of those buildings had approved

Figure 2: National Building Database Coverage vs Energy Consumption Data by Dec 2025, (SAEE, 2026)



Source: https://saee.gov.ua/static-objects/saee/sites/1/publicnii-zvit-golovi-2025-final-4-26022026.pdf energy-management activity plans and 36.8% were covered by automated energy monitoring (SAEE, 2026). This suggests that energy management is no longer marginal, but in many municipalities it has not yet matured into a fully functioning tool for prioritisation, implementation, and monitoring.

Finally, the certified subset of public buildings also points to a persistent performance problem: among 1,117 certified buildings, 606 were classified in the lowest energy-efficiency class, G (SAEE, 2026).

Taken together, these patterns suggest that Ukraine's problem is not a lack of policy ambition or instruments alone. A major missing element appears to be a sufficiently broad municipal delivery architecture that links planning, usable baseline data, documentation, project preparation, and finance. Until that missing middle is strengthened, progress will likely remain slow, uneven, and difficult to scale.

Recommendations

For better implementation of renovation measures in municipal public buildings in Ukraine, three changes appear particularly important.

First, Ukraine needs to strengthen project-preparation capacity for municipal public-building renovation. Municipalities struggle with turning general renovation needs into implementation-ready projects. Stronger early-stage support is needed for baseline data collection, feasibility work, technical design, procurement preparation, and project structuring. Where municipal capacity is weakest, this support could be organised through stronger regional or intermediary institutions. Existing support structures, including the Offices of Decarbonisation and Energy Efficiency, could become part of this support layer. However, their current coverage needs to be expanded, as such offices are operating in only eight regions (SAEE, 2026).

Second, the national building database and municipal energy-management systems should become practical tools for prioritisation rather than largely formal reporting mechanisms. Municipalities need usable data to identify the worst-performing buildings, compare options, prepare investment cases, and monitor results. Denmark's Energy and Building Analysis platform offers a useful reference, as it integrates building registry data, energy certification, heating infrastructure maps, and ownership records into a single analytical tool used by municipal planners to identify underperforming buildings and prioritise renovation (UDEPP, 2025). Ukraine's system should move in a similar direction, with stronger data coverage, clearer responsibilities, more stable institutional support and incentives for local energy management.

Third, Ukraine needs differentiated access tracks for different municipalities, combined with greater aggregation of projects. Larger municipalities may be able to use complex, credit-backed deep-renovation schemes, while smaller or more constrained municipalities may need simpler entry routes based on phased renovation packages, standardised technical solutions, and lighter procedural requirements. At the same time, similar public buildings under one authority could be grouped into larger batches where possible, in order to reduce transaction costs and make audits, procurement, and contracting more manageable.

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ANALYSIS

Rebuild, Resist, Decarbonise: Governing Ukraine's Green Transition in Times of War

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Abstract

Thinking about decarbonisation in the midst of a full-scale war may seem counter-intuitive. This article shows why addressing decarbonisation and war simultaneously is complex but necessary. One of the most significant economic transformations associated with Ukraine's EU integration will be its inclusion in the EU emissions trading system. A sudden shift to EU carbon pricing levels could destabilise key industries and undermine political support for Ukraine's EU integration; therefore, gradual preparation is critical. This article shows that governing decarbonisation in Ukraine requires reconciling competing temporalities: immediate wartime needs and mid- and long-term transformation. While carbon pricing is the most efficient instrument for emission reduction, its rapid implementation in a war-affected economy entails significant risks. To address this tension, the article proposes the creation of a jointly funded Ukrainian–European Decarbonisation Fund, which is based on a one-to-one matching of domestic carbon revenues and EU contributions. Such a mechanism could enable a gradual increase in carbon prices during hostilities while preserving national ownership and ensuring economic and political feasibility. The article concludes that Ukraine's green transition should not be treated as a standard accession requirement but as a strategic joint project between Ukraine and the European Union.

Ukraine's Wartime Green Transition: The Simultaneity of Being

The year 2025 stood out as the most intense period of Russia's drone campaign against Ukrainian cities (AOAV, 2026), with civilian casualties reaching unprecedented levels (Reuters, 2026) and accelerated attacks on energy infrastructure (Janowski, 2026). Moreover, Ukraine's economy continued its fragile recovery, even though its output remains approximately one-third below pre-invasion levels (Matuszak, 2026). The present situation of Ukraine could hardly be more costly than it already is—and there is little indication that it will become easier in the immediate future.

Unfolding at present, Ukraine's war of defence against Russia is essentially a fight against its past. However, as the country made clear with its application to become an EU candidate country just four days after the beginning of Russia's full-scale invasion, the war is also a fight for its future—a European one.

Access to that future is structured through 35 negotiation chapters (European Commission, 2026). Among them, Chapter 27 on Environment and Climate stands out as one of the most demanding, requiring vast financial resources, strong institutional capacity, and profound shifts in how citizens and industries operate. Meeting EU decarbonisation goals, establishing a functioning carbon market, and aligning legal and investment frameworks with the Green Deal are pillars of Ukraine's transformation and path toward the European Union.

Thinking about decarbonisation in Ukraine in the midst of war introduces competing policy temporalities. On the one hand, policy-makers must respond to acute wartime needs to ensure immediate survival. On the other hand, they must implement forwards-oriented policies to prepare the country for EU accession. The war, together with Ukraine's ambition to join the European Union as quickly as possible requires both logics to be integrated.

One of the most significant economic transformations accompanying Ukraine's EU integration will be the inclusion of the country in the EU Emissions Trading System, which is currently producing a carbon price between €70 and €90 per tonne of CO_2 (Trading Economics, 2026). Ukraine's current carbon price is less than €1 (Ukrainian Parliament, 2026). A sudden increase to EU carbon pricing levels could destabilise key industries and undermine political support for Ukraine's EU integration. Gradual preparation is therefore essential.

This text elaborates on why decarbonisation in Ukraine matters and what economic theory suggests about its organisation. However, as Ukraine is not a textbook case of an EU accession candidate, the European Union should not treat it as one. As a pragmatic solution, the text proposes the implementation of a shared Ukrainian–European decarbonisation fund financed equally through Ukrainian carbon pricing revenues and financial contributions from the European Union.

Why Decarbonisation of Ukraine Matters…

… For Ukraine

Decarbonisation is a policy that imposes costs in the present while yielding benefits mostly in the future. Thus, considering Ukraine's decarbonisation amid full-scale war may seem misplaced. However, fighting for the end of the war is, in essence, a fight for Ukraine's future. Equally so, few policy fields are as inherently future oriented as decarbonisation and climate policy.

Ukraine will need to reconstruct a significant portion of its industrial infrastructure after the war. Investment decisions made during this period will shape the country's economy for decades—either laying the foundation for a decarbonised future within the European Union or locking it into a carbon-intensive trajectory.

Investing in low-carbon technologies can strengthen Ukraine's industrial competitiveness, reduce its energy intensity, consequently lower its dependence on imported fossil fuels, and strengthen the country's long-term integration into the European market.

Recognising this makes clear why decarbonisation matters now: the transformation will be central in shaping the country that emerges from the war.

… For the European Union

Ukraine's green transition is not only Ukraine's concern: it is Europe's strategic interest—one that goes beyond the global fight against climate change. The entry of Ukrainian industry into the Single Market with carbon-intensive production processes, stranded assets, and misaligned incentive structures can generate adjustment costs that European institutions, including the EU Emissions Trading System (EU ETS), would ultimately have to absorb. A structured pre-accession decarbonisation pathway can therefore be understood as a form of anticipatory burden-sharing: it reduces the risk that these costs are suddenly internalised within EU climate and market governance upon accession.

Moreover, Ukraine's successful decarbonisation can create economic opportunities across the continent. European companies can engage in technology deployment, grid integration, and energy efficiency projects, fostering cross-border industrial cooperation. Furthermore, lower-cost abatement potential in Ukraine can reduce the overall relative cost of achieving European CO_2 reduction targets.

Thus, supporting Ukraine's decarbonisation is not merely aid but a matter of strategic economic interest.

How to Decarbonise…

…Efficiently

Given the severe constraints on public and private resources, decarbonisation in Ukraine must be organised as efficiently as possible. Carbon pricing is generally considered the most efficient instrument for reducing emissions because it concentrates abatement where it is least expensive. In the European Union, this logic is institutionalised through the EU ETS: Policy-makers set an overall cap on emissions, and companies buy and trade emission allowances on the market. The resulting CO_2 price incentivises firms to reduce emissions, where it is cheaper to cut them than to pay for emitting it. As of 2026, EU carbon prices fluctuate around €70–€90 per tonne of CO_2.

From a climate-economic perspective, integrating Ukraine into the EU ETS would constitute another step towards a more cost-efficient European decarbonisation pathway, as lower-cost emission reductions in Ukraine could substitute for more expensive ones elsewhere in Europe.

Efficient Decarbonisation and Its Pitfalls in Ukraine

However, efficiency is not an end in itself. Efficiency gains at the aggregate level do not automatically translate into equitable outcomes across countries. In an integrated carbon market, the CO_2 price is shaped by the marginal abatement costs across the system as a whole—including the significantly higher costs tolerated in wealthier economies. For Ukraine—currently the poorest country in Europe—this can increase production costs, energy prices, and inflation.

This is especially problematic in a war-torn economy with high reconstruction needs. "[T]he feasibility of green transformations hinges on acceptance, not only by policy-makers but also by enterprises, consumers, and voters" (Altenburg et al., 2024). Thus, ignoring these realities risks undermining public support for EU integration and creating political space for populist actors in Ukraine.

How to Decarbonise Realistically

Therefore, rather than matching its carbon price immediately with EU levels, Ukraine should gradually increase its carbon price—even if this is difficult to implement. Ukraine's wartime economy is structurally shaped by short-termism, with households, firms, and policy-makers prioritising immediate survival over long-term investment. Development economics has long shown that economic stress narrows planning horizons and weakens the capacity of actors to absorb short-term costs for future gains (Banerjee and Duflo, 2011).

This creates a sequencing problem between (i) rapid regulatory convergence required by EU accession and (ii) domestic absorptive capacity under wartime conditions.

However, rather than leaving Ukraine stuck in the present, Europe should nudge the country in the right direction: EU financial transfers could help bridge the gap between Ukraine's constrained economic situation and higher European carbon prices, making a gradual increase in carbon pricing socially and economically feasible.

Towards a Ukrainian–European Decarbonisation Fund

This is the first time since the 1990s that Western policy-makers have exercised such substantial influence over Ukraine's political trajectory. However, the legacy of the 1990s underscores the ambivalence of external guidance: while such guidance was intended to foster transition and reform, it also coincided with a deep recession, soaring unemployment, the entrenchment of oligarchic structures rather than social market institutions, and the emergence of a fragile democracy. These past experiences must not be repeated today. Therefore, while financial streams from Europe will be essential to support Ukraine's transformation, Ukraine must not lose ownership over its own transition.

At present, there is no stable domestic political coalition in favour of ambitious decarbonisation. The government has strong incentives to postpone politically costly carbon pricing until after the war and after the next electoral cycle, when EU accession will likely become more immediate. Industry, too, is reluctant to support carbon pricing. However, the introduction of CBAM has the potential to shift these political economy dynamics. For many export-oriented industries, carbon pricing can no longer be avoided in trade with the EU, whereas the associated revenues accrue to the EU rather than to Ukraine.

One way to turn this situation into a domestic reform incentive could be the creation of a jointly governed and jointly financed Ukrainian–European Decarbonisation Fund with clearly defined investment windows. Such a fund could channel financial contributions from the EU and recycle revenues from Ukraine's domestic carbon pricing. To prevent the fund from becoming an external instrument in Ukraine, European contributions should not exceed Ukrainian contributions from carbon pricing. Moreover, European policy-makers could commit to linking their contributions to revenues from Ukrainian carbon price recycling: a one-to-one matching mechanism, whereby each euro raised domestically is complemented by one euro from the EU, could be organised through earmarked investment windows that ensure that the carbon pricing revenues are proportionally recycled into pre-agreed decarbonisation categories. The window structure would make the reinvestment logic transparent, since the carbon price the firms pay would be visibly and predictably returned to the economy. In this way, the instrument could

1. create strong incentives for Ukraine to gradually increase its carbon price
2. bridge the gap between high EU ETS prices and Ukraine's constrained economic situation.

By linking carbon pricing to reduced CBAM exposure and a visible source of sustainability support for domestic firms, such a design could help build a broader coalition in support of decarbonisation.

To function effectively, the fund would require a robust governance structure. A jointly governed board comprising Ukrainian and EU representatives could safeguard transparency and accountability. Its role would be to decide the broad allocation across the different investment windows, not to micromanage individual projects. Project selection within each window should then follow predefined eligibility criteria and multiyear programming cycles, which would reduce ad hoc political bargaining and help protect the Fund from short-term electoral shifts. Over time, trust in the instrument could grow both domestically and internationally, transforming it into a cornerstone of Ukraine's green transition.

Conclusion: Rebuilding the Future

No country before has ever sought EU membership while simultaneously defending itself in a full-scale war. How Europe approaches Ukraine's decarbonisation will ultimately test whether EU enlargement policy can adapt to geopolitical realities rather than merely extend technocratic conditionality. If pursued in partnership, Ukraine's green transition can become the cornerstone of the country's path into the European Union built on shared responsibility, autonomy, and the courage to act for the future even in times of war.

About the Author

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ABOUT THE UKRAINIAN ANALYTICAL DIGEST

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