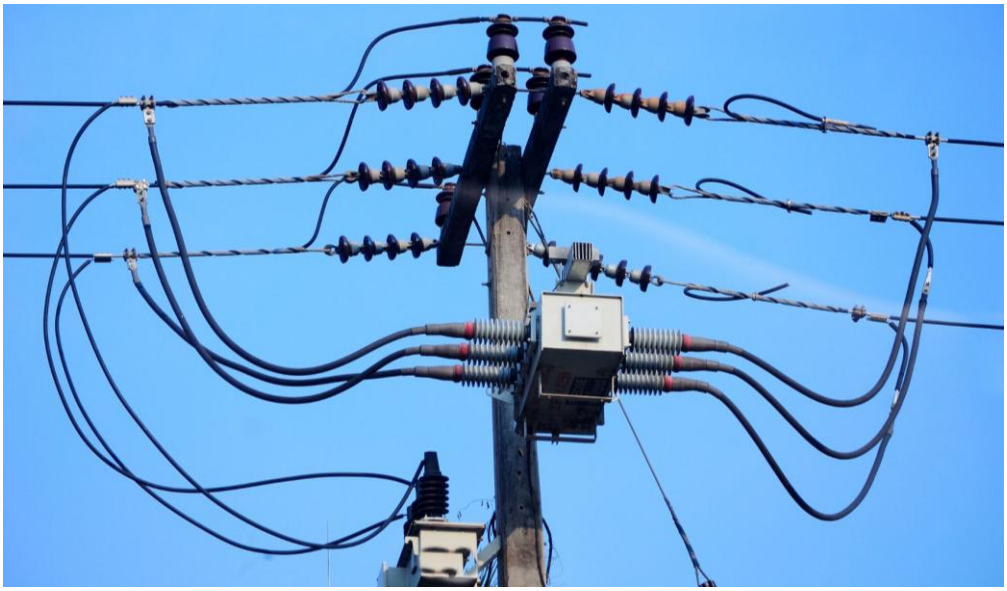
Prosumer paradox: How outdated grids undermine energy poverty efforts in central and eastern Europe



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Executive summary

Barriers to equitable energy access across central and eastern Europe, illustrated by examples from the Czech Republic, Poland and Romania, stem from outdated distribution grids that hinder prosumer integration and undermine programmes aimed at reducing energy poverty.

Households with photovoltaic panels often struggle to feed surplus energy into the grid due to insufficient capacity and congestion. A persistent lack of investment in grid modernisation has significantly weakened initiatives to alleviate energy poverty. For instance, the Casa Verde programme in Romania provides low-income households with renewable energy solutions.[1] However, the grid cannot handle the surplus energy, which means the programme fails to deliver its intended financial and environmental benefits.

[1] Managed by the Environmental Fund Administration (AFM) – Romania's state agency for environmental financing – the Casa Verde programme provides funding for the installation of renewable energy systems, such as photovoltaic panels, to reduce utility costs and protect the environment. See: Environmental Fund Administration, Casa Verde Fotovoltaice 2024, *Environmental Fund Administration*, accessed 29 August 2025.

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Drawing on comparative case studies, this briefing examines the shared challenges of underinvestment, capacity constraints and urban–rural disparities, and proposes solutions tailored to energy-poor communities, including participatory governance through energy cooperatives or low-cost smart grid technologies.

It advocates for future EU and national funding to prioritise low-voltage grid modernisation, aligning with the EU's climate and social equity goals. By addressing grid constraints, policymakers and distribution system operators (DSOs) can enhance the effectiveness of photovoltaic programmes, empower vulnerable populations, support energy community initiatives, and advance an inclusive energy transition in central and eastern Europe.

Introduction: Context of energy poverty and low-voltage grids

Across the EU, outdated energy infrastructure at both transmission and distribution levels poses a significant hurdle to achieving a sustainable and resilient energy future.[2] By 2030, an estimated 40 to 55 per cent of low-voltage lines will be more than 40 years old. Yet, their total length increased by only 0.8 per cent between 2021 and 2022.[3] The European Commission estimates that EUR 730 billion will be required for distribution and EUR 477 billion for transmission grid development by 2040.[4]

At the EU level, around 2,560 DSOs manage over 10 million kilometres (km) of distribution grids.[5] The situation in central and eastern Europe is unique. In most countries, grid operators are predominantly state-owned, with limited competition and insufficient regulatory oversight. In Poland, the Czech Republic, Hungary, Bulgaria, and Romania, the three largest DSOs collectively distribute 60 per cent or more of all electricity. State ownership prevails in the Czech Republic, Slovakia, Poland, and the Baltic States, whereas DSOs are privately owned in countries such as Romania and Hungary. This structure often restricts access to grid investments and diminishes incentives for improvement. As with all monopoly markets, there is little immediate impetus to enhance service quality.[6]

In addition to their historical role of owning, operating, and investing in distribution networks, DSOs are now required to provide equipment such as smart meters and local storage systems. These enable the

[2] European Commission, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions | Grids, the missing link - An EU Action Plan for Grids, *EUR-Lex*, 3, 28 November 2023.

[3] European Commission, Commission Notice on a guidance on anticipatory investments for developing forward-looking electricity networks, *European Commission*, 2, 2 June 2025.

[4] Ibid., 5.

[5] European Commission, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions | Grids, the missing link - An EU Action Plan for Grids, *EUR-Lex*, 8, 28 November 2023.

[6] Marta Anczewska, et al., Future-Proofing Central Eastern European Grids for Tomorrow's Energy System, *Climate Action Network Europe*, 14, February 2024.

management of electricity flows to and from consumers, who generate their own energy resources to store electricity and feed surplus power back into the grid.[7]

In addition to these challenges, energy poverty casts a long shadow over the central and eastern European region. According to a study published by EU Science Hub, almost half of the income-poorest 10 per cent of the EU population live in Romania, Poland, or Bulgaria.[8] Low-voltage distribution grids, essential for enabling decentralised renewable energy systems, are woefully outdated and underfunded.

Persistent underinvestment – driven primarily by the limited capacities of public authorities and the absence of adequate financial incentives for DSOs to modernise electricity infrastructure in certain regions – prevents vulnerable households from reducing energy poverty and accessing the opportunities offered by prosumer integration and energy community development.

Against this backdrop of insufficient investment, prosumers – households with photovoltaic panels seeking to feed surplus energy into the grid – encounter persistent barriers in both rural and urban areas. Connection backlogs within distribution grids are escalating rapidly. For instance, it is not uncommon for a single medium-size DSO to receive several thousand new requests each month.[9] Rural grids, burdened by ageing infrastructure and inadequate capacity, often struggle to accommodate new connections, while urban grids typically suffer from congestion driven by rising renewable energy inputs.

EU funding frameworks, often skewed towards large-scale transmission projects and urban infrastructure, have consistently overlooked the critical role of low-voltage grids in addressing energy poverty and fostering equitable energy access, a gap that risks perpetuating regional disparities. Although roughly two-thirds of the required investment is needed at the distribution level, EU funding instruments like the Connecting Europe Facility are limited to projects of common interest and do not cover the local needs of DSOs.[10]

This briefing, focusing on the Czech Republic, Poland and Romania, identifies shared challenges – such as underinvestment, capacity constraints, and the urban–rural divide – as well as opportunities like replicable, smart-grid pilot schemes. It calls for participatory governance models, low-cost smart technologies, and public–private partnerships to transform low-voltage grids into drivers of energy equity. Finally, it highlights the potential of renewable energy programmes and energy community initiatives to deliver tangible benefits for vulnerable communities in these countries.

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[7] Conall Heussaff, Georg Zachmann, Upgrading Europe's electricity grid is about more than just money, 3, *Bruegel*, February 2025.

[8] Sofia Maier, Ilda Dreoni, Who is "energy poor" in the EU? | JRC Working Papers on Taxation and Structural Reforms No 5/2024, *EU Science Hub*, 24, 7 December 2024.

[9] European Commission, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions | Grids, the missing link - An EU Action Plan for Grids, *EUR-Lex*, 3, 28 November 2023.

[10] Ibid., 5.

EU funding for grid modernisation

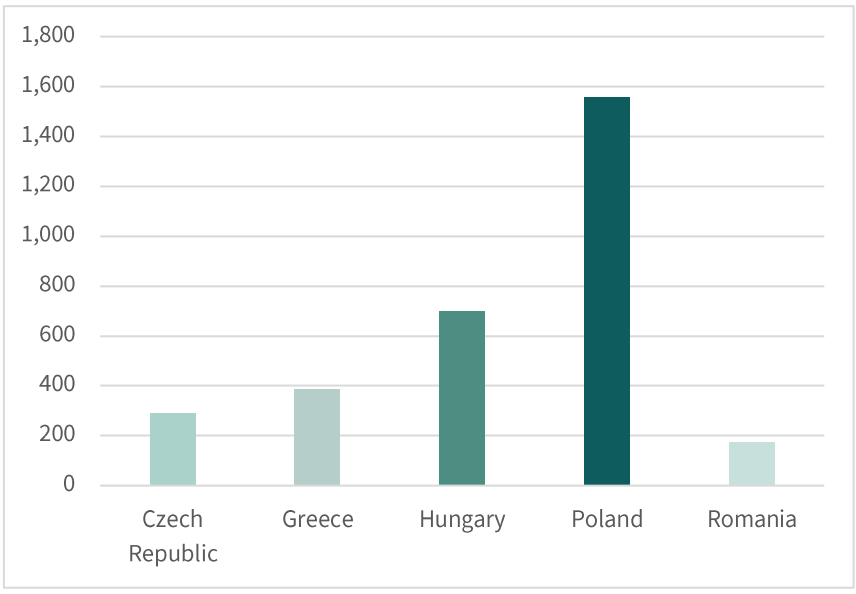
Power networks throughout the EU face significant challenges. By 2030, electricity consumption is expected to rise by around 60 per cent, while wind and solar generation capacity will need to increase from 400 gigawatts (GW) in 2022 to at least 1000 GW.[11] These trends necessitate rapid upgrades and network expansion, particularly at the distribution level.

The technological sophistication of distribution grids varies widely across countries. Some have completed smart-meter rollouts, while others remain in the early stages. In 2023, smart-meter deployment was slow to progress in the Czech Republic (3 per cent), Poland (27 per cent) and Romania (23 per cent).[12]

Modernising low-voltage distribution grids is essential for enabling prosumer integration and ensuring the success of energy poverty alleviation programmes. Yet EU funding continues to favour large-scale, urban-centric projects, leaving vulnerable communities at a disadvantage.

To examine grid investment patterns in the three countries covered in this briefing, we used a tool developed by Climate Action Network (CAN) Europe that analyses the distribution of funds from the current EU Multiannual Financial Framework for green investments.[13] Readers should note that the CAN Europe data focuses on a combination of storage and grid investments, and does not distinguish between investments in transmission and distribution networks.

Figure 1. Investments in storage and grids (in million EUR)[14]



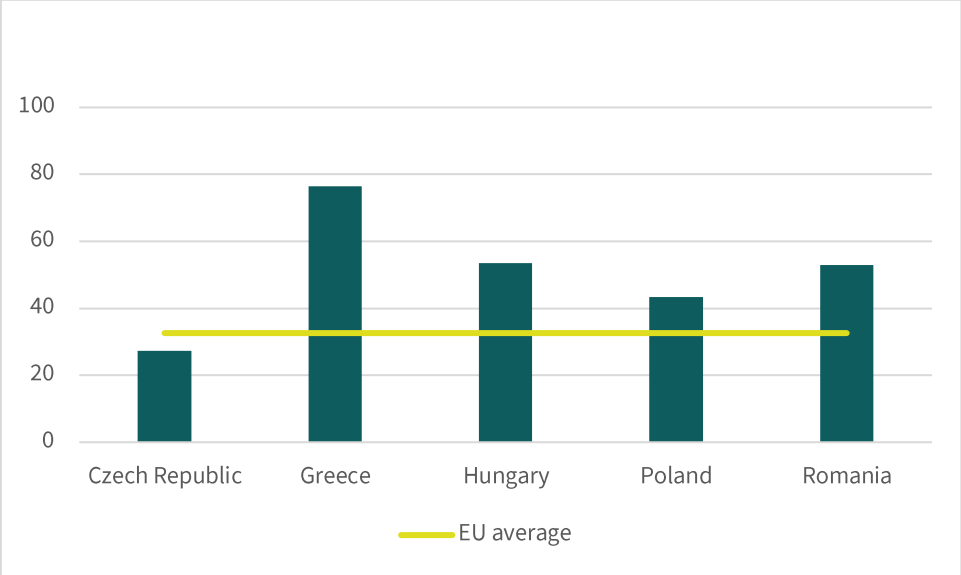
[11] Ibid., 2.

[12] European Union Agency for the Cooperation of Energy Regulators, Country Sheets – Monitoring data 2023, *European Union Agency for the Cooperation of Energy Regulators*, 2024.

[13] Climate Action Network Europe, Interactive tool: Where do the Green Investments go in the EU's long-term budget?, *Climate Action Network Europe*, 3 July 2025.

[14] Ibid.

Figure 2. Percentage of investments in Storage and grids from the Renewable Energy Supply investments[15]



Without delving into the substantial disparities in total allocated amounts between Poland and the other two countries, an analysis of the percentages reveals that both Romania and Poland exceed the EU average of 32.6 percent, whereas the Czech Republic falls several percentage points below this benchmark.

There are also notable discrepancies with other countries in the region. For example, according to the CAN Europe data, Bulgaria allocates no funds for storage and grids, Hungary aligns with the percentages of the countries covered in this briefing (53.3 per centage), and Greece allocates a significant 76.5 per cent. In Greece's case, geographical factors and the large number of established energy communities likely account for the higher allocation. Therefore, these figures should be interpreted with caution, as reporting methods differ between countries.

While EU funding opportunities exist, a misalignment remains. The Connecting Europe Facility, for instance, focuses on projects of common interest which typically prioritise cross-border transmission infrastructure and overlook the local needs of DSOs. Other EU funding channels – such as the Cohesion Fund, the European Regional Development Fund, the Recovery and Resilience Facility, and the Modernisation Fund – are available for electricity grids but remain underutilised in certain cases.[16]

Future EU and national funding should prioritise the modernisation of low-voltage grids, integrate affordable, smart technologies like smart meters and demand-response systems, and introduce participatory governance models. This approach would enhance grid capacity, strengthen photovoltaic programmes, and promote equitable energy access in line with EU climate and social equity objectives.

[15] Ibid.

[16] European Commission, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions | Grids, the missing link - An EU Action Plan for Grids, *EUR-Lex*, 5, 28 November 2023.

Case study: Czech Republic

The Czech Republic's energy landscape, dominated by a centralised market, faces considerable challenges in integrating renewable energy and fostering energy communities. Although energy sharing has been legally recognised since 2024, progress remains sluggish due to outdated low-voltage grids, regulatory obstacles, and limited support for prosumers and low-income households. Additionally, grid capacity constraints have created significant bottlenecks for renewable energy integration. And while community energy initiatives show promise, they continue to encounter economic, technical and political barriers.

In the South Moravian town of Slavkov, near Brno, the local emergency medical services depot is part of a pioneering community energy project. Coordinated by the South Moravian Regional Procurement Agency (CEJIZA), the initiative shares electricity from solar panels installed on 12 different rooftops across the region. The energy is distributed among 24 emergency service bases, including the one in Slavkov, where it powers daily operations and charges electric ambulances. Since electricity sharing began in October 2024, the initiative has saved its participants roughly CZK 150 000 (EUR 6 000) within just seven months, with plans to expand to 250 members, including schools and hospitals.

However, the project has faced persistent grid congestion while real-time monitoring occurs via mandatory smart meters for larger photovoltaic systems, automation through remote piloting is not yet fully in place. Grid capacity shortages have left 25.8 GW of renewable energy, equivalent to 12 times the output of the Temelín nuclear plant, unconnected. Additionally, the Energy Data Centre, a national hub for electricity data established in August 2024, is only operating on an interim basis until at least July 2026. Its limited functionality has led to restricted data-driven grid management, stalling energy-sharing initiatives.

Prosumers typically encounter multiple obstacles when attempting to connect to the grid. DSOs often delay connections, citing reasons such as insufficient network capacity. For instance, the DUHA movement, a Czech cooperative launched in 2022, had to wait for over two years for the local distributor to build a substation, which delayed its solar panel deployment. Complicating matters, energy retailers frequently refuse to award contracts to energy-sharing participants or impose extra fees, as seen with CEJIZA. High initial costs, such as reconstructing fuse boxes to accommodate meters, which can cost up to CZK 30 000 (about EUR 1200), deter households from becoming prosumers, limiting the scalability of community energy models.

Efforts to combat energy poverty through photovoltaic programmes are undermined by grid constraints and an inadequate subsidy framework. The KOMUNERG programme, incorporated into the Modernisation Fund in December 2023, allocates 2.8 per cent of its resources (CZK 10–11 billion or EUR 400–440 million) to community energy projects. However, legislative delays have pushed the first call for proposals to autumn 2025, leaving projects like DUHA's cooperative without funding. Additionally, subsidies consistently favour municipalities and entrepreneurs over cooperatives, excluding many low-income households from benefits. And while initiatives like the South Moravian energy community show promise, they remain limited in reach without broader support, perpetuating energy poverty among vulnerable communities.

Grid modernisation efforts disproportionately prioritise urban areas, leaving rural regions reliant on outdated infrastructure. For example, in the municipality of Tábor in South Bohemia, the BYTES energy community, due to launch in late 2025, will focus on urban firms and organisations. It aims to generate a yearly output of 1,100 megawatt-hours (MWh), equivalent to one hour of generation from a single Temelín nuclear reactor. However, due to technical and scheduling constraints, the project has been unable to include rural households. Similarly, the Slavkov initiative, despite covering both urban and rural areas, faces limited grid capacity in rural areas, which continues to hinder photovoltaic integration. This urban–rural divide further widens energy access inequalities, as rural areas face greater delays in connecting renewable energy sources, a situation compounded by the reluctance of DSOs and insufficient investment in decentralised grid upgrades.

Despite the above challenges, these innovative energy community projects offer potential solutions to grid bottlenecks. Yet the difficulties they continue to encounter also underscore the need for streamlined regulations and infrastructure investment. By enabling local generation and sharing of renewable energy, these communities can reduce reliance on centralised fossil fuel plants, enhancing resilience of the Czech grid – particularly in rural areas with ageing infrastructure vulnerable to extreme weather events such as heatwaves and storms.

Case study: Poland

The low-voltage network in Poland is, on average, 50 to 60 years old, which means it is not designed to accommodate the dynamic growth of renewable energy sources or the increasing number of connections to the low-voltage system. This poses a significant barrier for homes equipped with photovoltaic panels and undermines programmes aimed at alleviating energy poverty.

Due to the inadequacy of the network infrastructure and low self-consumption during peak hours – caused by a lack of storage facilities – DSOs have difficulty balancing the network during times when prosumers generate high levels of renewable electricity. This increasingly leads to forced restrictions on energy production from micro-installations.

Other obstacles include frequent and significant delays in processing applications for grid connections and a lack of transparency in planning new connection capacity. Legal restrictions on connecting battery storage facilities present an additional challenge, as the capacity of these storage systems is treated as additional energy capacity, subject to the same rules as, for example, photovoltaic installations.

Additionally, DSOs follow different procedures and vary in their understanding and application of legal provisions, further prolonging procedures and hindering the development of renewable electricity at the low-voltage network level. Detailed reports on these challenges have been published by the Polish Power

Transmission and Distribution Association,[17] the Polish Agency for Enterprise Development,[18] and the Supreme Audit Office.[19]

The main difficulty is that inverters automatically disconnect installations when voltage in the local grid becomes too high, a consequence of the grid's weak infrastructure and limited flexibility. In addition, inadequate metering and automation prevents DSOs from monitoring and controlling the operation of micro-installations in real time.

Operators also respond too slowly to reports of problems with feeding energy into the grid. The development of energy storage facilities also lacks sufficient state support, whether through subsidies or regulatory adjustments. Furthermore, the regulatory environment for micro-installations is unstable due to factors such as changing billing systems, which erodes public confidence in renewable energy sources and discourages households from further investment. These regulatory gaps have led to an inability to establish energy cooperatives in urban municipalities and issues with interpretating regulations on internal settlements, excise duty, and VAT.

Support programmes that can play a role in tackling energy poverty include the Clean Air programme, which supports single-family home renovations with a component for renewable energy sources, and the My Electricity programme. Both are financed through the Recovery and Resilience Facility, the Modernisation Fund, and EU cohesion policy funding. However, support for low-income households remains insufficient. While Clean Air applies income thresholds, the funding available is low, while My Electricity lacks income thresholds entirely.

Grid limitations further reduce the benefits of these programmes. For instance, forced shutdowns of installations at the Żerków (registered 9 February 2023, 1 photovoltaic installation of 0.999 megawatt-electric (Mwe)) and Lądek energy cooperatives (registered 20 October 2023, 1 photovoltaic installation of 0.99954 MWe) have severely restricted operations and profitability. In Żerków, these service disruptions occurred more than 20 times in April 2025, reducing renewable energy coverage to about 15 per cent of local demand, compared to 40 to 70 per cent before the shutdowns began.

Grid modernisation efforts encounter significant challenges, particularly in rural areas, where tens of thousands of transformer stations need replacing to enable the integration of renewable electricity. Urban areas, in turn, require substantial digitalisation. The Recovery and Resilience Facility provides a key investment aimed at enhancing electricity grids (G1.2.4), allocating EUR 1 billion for the construction or modernisation of power lines, distribution infrastructure, remote reading meters, and communication

[17] Polish Power Transmission and Distribution Association, Dystrybucja i przesył energii elektrycznej w nowym raporcie branżowym PTPiREE, *Polish Power Transmission and Distribution Association*, accessed 3 September 2025.

[18] Łukasiewicz Research Network, et al., The Green Technology Sector in Poland, *Polish Agency for Enterprise Development*, 20 November 2024.

[19] Supreme Audit Office of Poland, Rozwój elektroenergetycznej sieci dystrybucyjnej, *Supreme Audit Office of Poland*, February 2024.

systems, aimed at optimising network operations and increasing the penetration of renewable energy sources.

Additional support is provided through two schemes under the Modernisation Fund: the smart energy infrastructure scheme (MF 2021-1 PL 0-003) aims to deploy 3.8 million smart meters, with EUR 222 million allocated for the 2022–2025 period; and the power grid development scheme (MF 2021-1 PL 0-006; supported by the European Investment Bank) will modernise 4,000 km of distribution lines and 800 substations to support the connection of approximately 6,000 public and 6,000 private electric-vehicle charging points, with EUR 222 million allocated for the 2022–2026 period.

Community-led initiatives include the Sąsiedzi (Neighbours) energy cooperative in Pieniężno, established through collaboration between the municipality and a local social cooperative, aiming to support energy-poor residents. Plans are also underway for a citizens' energy community in Łódź (MES Town), aimed at supporting households experiencing energy poverty. Additionally, Poland's draft social climate plan includes support for municipality-run energy communities, communal building renovations, and renewable energy installations. Partnerships with utilities include the Pomeranian Archipelago of Energy Islands project, [20] coordinated by the Pomeranian Marshal's Office, which seeks to create energy cooperatives operating on an island basis, balancing their own energy production and consumption as independently as possible.

According to a 2021 modular study, investments in Poland's distribution network need to rise significantly from a historical average of EUR 1.4 billion per year to EUR 2.7 billion per year by 2030, nearly doubling over the period.[21] However, available EU funding sources, including the European Regional Development Fund, the Cohesion Fund, the Recovery and Resilience Facility (including its REPowerEU component), and the Modernisation Fund, remain underutilised in supporting grid development.

Case study: Romania

Romania's low-voltage distribution grids face significant barriers that limit support for households equipped with photovoltaic panels. Many households, particularly in rural areas and smaller towns, struggle to connect their solar installations to the local electricity network, largely due to underdeveloped electricity systems originally designed for one-way power flow – from the grid to homes. Without smart equipment to monitor and automatically balance energy flows, areas with multiple rooftop installations can overload transformers or experience voltage swings.

Annual reports from the National Energy Regulatory Agency highlight slow progress in digitalising the grid and persistent underinvestment in low-voltage infrastructure. These weaknesses make it harder to connect

[20] Emilia Kordek, Wyspa energetyczna – szansą na lokalną niezależność. Podsumowanie konferencji, *Marshal's Office of the Pomeranian Voivodeship*, 26 June 2024.

[21] Paweł Czyżak, Adrianna Wrona, Michał Borkowski, The missing element: Energy security considerations, *Instrat*, 50, December 2021.

new prosumers and safely manage the electricity they generate. Similarly, the energy component (C6) of the national recovery and resilience plan identifies grid upgrades and digital tools as key investment priorities, stating that outdated distribution networks are a barrier to renewable energy integration, especially in residential areas. The national energy and climate plan identifies low-voltage grid congestion in particular as a major obstacle to expanding rooftop solar installations, and proposes changes to streamline connection procedures.

Prosumer integration faces multiple challenges. In recent years, more Romanian households have installed solar panels and become prosumers – at the end of May 2025, a total of 228,350 prosumers were registered, representing an overall installed capacity of 2,725 megawatts.[22] However, feeding surplus solar energy into the grid is difficult due to outdated, undersized or poorly maintained infrastructure. Many transformers and cables cannot absorb additional input, leading to connection refusals, long delays or unstable system behaviour. In densely populated residential zones with numerous prosumers, overvoltage occurs when too much solar energy is injected, especially on sunny days with low local consumption, causing inverters to shut down and reducing household benefits.

The connection process remain time-consuming and inconsistent, requiring multi-step approvals that vary by DSO. Compensation for surplus energy is another issue, with cases of suppliers gradually lowering prices for injected electricity, discouraging households. Regulatory gaps persist: while the law allows grid connections, availability depends on local grid capacity, with no obligation for operators to upgrade infrastructure unless financially viable. This situation is made worse by a lack of tools, such as real-time maps (indicating existing grid capacity) and a 400-kilowatt (kW) capacity limit, which restricts the participation of schools, social housing, and energy communities.

Support programmes established to address energy poverty include the Casa Verde programme, managed by the Environmental Fund Administration (AFM), which offers grants of up to RON 30 000 for photovoltaic panels and battery storage at a minimum RON 3000 household contribution. The REPowerEU grant scheme targets vulnerable single-family homes with support for 3 kW photovoltaic systems (EUR 5 000), battery storage (EUR 5 000), and thermal renovations (EUR 14 000). Yet grid limitations dilute the benefits of these programmes, as households cannot feed surplus energy back into the grid, limiting financial savings and environmental impact. No specific community examples or quantitative data on affected households are available. However, the national recovery and resilience plan as well as reports issued by the National Energy Regulatory Agency confirm that outdated grids are holding these programmes back.

Grid modernisation efforts in Romania have focused on urban and industrial areas, where demand is higher and upgrades are seen as more economically viable. Unfortunately, rural and peri-urban areas are reliant on ageing infrastructure, limiting photovoltaic integration. In 2024 alone, the Romanian electricity

[22] National Energy Regulatory Agency, Situația privind promovarea energiei electrice produse de capacități electrice din surse regenerabile aparținând prosumatorilor la data de 31.05.2025, *National Energy Regulatory Agency*, 31 May 2025.

distribution company Rețele Electrice România[23] committed over RON 1.2 billion (EUR 236 million) to modernise the country's medium- and low-voltage networks, with a particular focus on areas previously underserved by older infrastructure. These efforts include upgrading transformer stations, extending underground cables, and installing smart meters to monitor electricity flows and manage photovoltaic injections. Grid operators have recently stepped up investments in local infrastructure, especially through EU funding instruments like the Modernisation Fund.

Community-led initiatives in Romania can play an important role in the energy transition by identifying technical needs and increasing public buy-in. One of the most notable examples is Cooperativa de Energie, Romania's first energy cooperative, which currently boasts nearly 1,000 members across the country.[24] Established in 2018, the cooperative supplies green electricity and is starting to develop member-owned solar installations. Despite not directly investing in grid infrastructure, the cooperative helps mobilise citizen participation and raise awareness about clean energy. This approach could set the stage for future joint projects with local authorities and DSOs in areas affected by energy poverty or grid bottlenecks.

Romania's electricity grid is taking steady steps towards modernisation, progress that may inform similar efforts in other countries in central and eastern Europe. Initiatives such as the rollout of smart meters or targeted enhancements to low-voltage infrastructure in areas with increasing prosumer activity illustrate how public investment and coordinated utility strategies can gradually lay the groundwork for integrating solar energy more effectively.

Extreme weather events, such as storms and floods, have resulted in outages and damage to Romania's low-voltage grids, a situation that highlights rural infrastructure vulnerabilities. Efforts to improve resilience have involved the installation of underground cabling and smart grid technologies to isolate faults and restore power faster. Integrating photovoltaic systems with battery storage and demand-response mechanisms can enhance grid stability under climate stresses. To support photovoltaic programmes, grids need increased capacity, digitalised monitoring, and flexibility to handle variable renewable generation and extreme climate events.

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[23] Petre Barac, 'Rețele Electrice companies attract new European funding for investments in distribution infrastructure', *The Diplomat*, 2 August 2024.

[24] Cooperativa de Energie, Home page, *Cooperativa de Energie*, accessed 3 September 2025.

Perspectives and recommendations

By the end of 2025, the European Commission is set to unveil the European Grids Package – a key component of the EU's Competitiveness Compass – aimed at integrating affordable renewable energy and accelerating electrification. It also complements the parallel Clean Industrial Deal, which focuses on decarbonising industry and boosting competitiveness. Given the current state of the bloc's transmission and distribution systems, the European Grids Package is urgently needed to modernise the grid and adapt it swiftly to today's needs.

In addition to the European Grids Package, European institutions and Member States must quickly identify new ways to finance the modernisation process. With NextGenerationEU funding for grids coming to an end in 2026, the next Multiannual Financial Framework must include dedicated funding for electricity grids, including at the distribution level. Low-interest loans from the European Investment Bank along with targeted State aid could prove important for reducing overall grid costs and providing greater certainty for private co-investors looking to participate in such projects.

Most renewable energy connections will be deployed at the distribution grid level. However, current EU funding remains fragmented and insufficient. In this context, establishing a centralised one-stop shop at the EU level, along with increased and better-coordinated funding at local and national levels, would help prevent delays and bottlenecks in implementation.

Conclusions

The above case studies from the Czech Republic, Poland and Romania reveal shared challenges in central and eastern Europe that continue to hinder the integration of renewable energy sources and perpetuate energy poverty. Outdated low-voltage grids, designed for unidirectional power flow, struggle to accommodate the dynamic growth of photovoltaic systems, leading to congestion, voltage instability and forced disconnections.

In Poland, ageing infrastructure and inadequate metering limit prosumer integration. The Żerków cooperative experienced shutdowns that reduced its renewable energy coverage from between 40 and 70 per cent to 15 per cent. In the Czech Republic, around 26 GW of renewable energy projects are currently awaiting grid connection – roughly double the 2030 target set in the national energy and climate plan for renewables – as grid capacity remains insufficient. The South Moravian energy community, like many others, continues to be impeded by a misguided first-come, first-served queue system that allows speculative 'ghost' projects to occupy capacity without ever being realised. DSOs lack legal protection against lawsuits when cancelling such contracts, while no priority is given to strategic projects such as energy communities, battery storage systems, or schemes benefitting vulnerable groups. Romania's 228,350 prosumers face similar issues, with overloaded transformers and inconsistent connection processes undermining programmes like Casa Verde. These grid constraints disproportionately affect rural areas, where modernisation lags behind urban centres, deepening energy access inequalities across all

three countries. These grid constraints disproportionately affect rural areas, where modernisation lags behind urban centres, deepening energy access inequalities across all three countries.

To address these issues, these countries and others in central and eastern Europe must prioritise low-voltage grid modernisation through targeted EU, national, and private funding. Investments should focus on rural infrastructure, smart technologies and transparent grid planning to support prosumer integration. Regulatory reforms, including streamlined connection processes and support for energy cooperatives in urban and rural areas, are vital for supporting renewable energy deployment and reducing energy poverty.

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