Romanian-Bulgarian Economic Cooperation for Addressing Energy Vulnerability [1]

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Introduction

The EU's ambition to achieve climate neutrality by 2050 has significantly accelerated renewable energy deployment across Europe. This objective has been reinforced by the growing role of renewables in energy security for this fossil fuel-dependent continent, with geoeconomic crises around global oil and gas adding further impetus to the energy transition. Within this transition, solar and wind energy have emerged not only as key instruments of decarbonisation but also as major drivers of economic growth and investment (EEA 2025).

Against this backdrop, Romania and Bulgaria stand out as countries with significant potential for the development of renewable energy infrastructures. This would reduce fossil fuel dependency for the decarbonization of industries and address the high levels of energy vulnerability they continue to face. This is particularly relevant for the Romanian-Bulgarian Lower Danube cross-border area, which figures among the poorest areas in the EU and hence some of the most vulnerable in the face of energy price volatility dependent on fossil fuels. In addition to experiencing some of the highest rates of household energy poverty in the European Union, both countries have also been severely affected by rising energy prices for non-household consumers. These increases have placed considerable pressure on industries and businesses, contributing in some cases to the suspension of operations or the relocation of economic activity abroad, further exacerbating broader patterns of poverty and socio-economic insecurity.

Indeed, addressing energy poverty in Europe, particularly acute in Southern and Central-Eastern Europe, increasingly depends on expanding access to renewable energy and supporting a just energy transition (Omic 2019). Energy poverty alleviation has therefore become closely associated with renewable energy systems aimed at improving energy access, affordability, and social inclusion (Bouzarovski 2018), an objective aligned with Europe's energy security and economic competitiveness aims. Furthermore, the European Central Bank (2025) identifies the expansion of cheaper and cleaner energy systems as essential for preserving industrial competitiveness and mitigating long-term employment losses, emphasizing the need to accelerate renewable energy deployment and cleantech development across Europe. Given the solar energy potential along the Danube borderland and that of offshore wind in the Black Sea, the Romanian-Bulgarian Lower Danube cross-border area emerges as one of the most promising areas for the development of renewable energy sources. Harnessing the potential of these sources would contribute to the alleviation of energy poverty in the area, increase

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economic competitiveness and therefore breaking the “lagging regions category” for the counties and districts of the Romanian-Bulgarian cross-border region (Interreg RO-BG, 2020).

This study argues that despite this growing recognition, Romania and Bulgaria continue to embody a profound structural contradiction at the heart of the green transition. While both countries increasingly frame renewable energy as central to their energy security, cost reduction and climate aims, they have simultaneously deepened their dependence on fossil fuel infrastructures using a petrostate's definition of energy security, economic competitiveness, and shared prosperity.

This contradiction is clearly reflected in the energy strategies of both states. Recent World Bank analyses underline the significant potential of Romania and Bulgaria to benefit from the expansion of clean technology sectors, particularly solar energy, battery storage, and wind power (World Bank 2024). Yet instead of pursuing such a decisive transition, both countries continue to invest heavily in new gas infrastructure alongside renewable energy deployment whilst undermining their renewable energy rollout capabilities. In Romania, the Neptun Deep gas project in the Black Sea is presented as a strategic pillar of national energy security and a major future source of state revenue. The project risks locking the country into long-term fossil fuel dependency whilst generating substantial greenhouse gas emissions, damaging marine ecosystems, and negatively affecting local communities and quality of life (Celmare et al. 2025; Greenpeace Romania 2025). Similarly, Bulgaria is advancing the Vertical Gas Corridor, an EU-supported and US-backed infrastructure initiative linking Greece, Bulgaria, Romania, Moldova, and Ukraine through Liquefied Natural Gas (LNG) imports and Caspian gas supplies (USEA 2025).

While gas is likely to remain a backup energy source for renewables and its expansion is not by itself a marker of contradiction, the hesitation to make solar and wind structurally central to the energy system is. A coordinated offshore wind strategy in the Black Sea could significantly reshape energy economics in Southeast Europe by unlocking economies of scale, lowering generation costs, and easing grid constraints. Both countries possess substantial solar energy potential with complementary geographic and infrastructural characteristics that could support diversified and regionally integrated solar energy systems. Regional cooperation on variable renewable energy sources (VRES) would turn both countries into net energy exporters and enable them to reduce the extremely high energy costs burdening households and firms, costs that undermine their capacity to protect industrial employment and reduce extreme social disparities.

Existing interconnectors, EU-supported infrastructure projects such as CARMEN, regional balancing mechanisms, and joint initiatives related to offshore wind and hydrogen development already point toward a growing shift to coordinated regional energy governance. Such cooperation could improve system flexibility, storage integration, balancing capacity, and grid resilience whilst reducing dependence on fossil fuels and limiting inefficiencies generated by fragmented national transitions. Both the National Energy and Climate Plans (NECP) of Romania and Bulgaria, as well as recent World Bank reports, emphasize regional cooperation as essential for achieving these objectives. However, the solar-wind ecosystem emerging from

current plans aims far below the potential these countries possess, tragically ensnaring them in a halfway energy house creating high social and economic costs.

Economic context: Two distinctive economic regime types

Few pairings in European political economy are as instinctively grouped, and as analytically misleading, as Bulgaria and Romania. Shared history as communist-era "laggards," simultaneous EU accession in 2007, and broadly similar levels of underdevelopment have made them a natural analytical couplet. Yet as a comparative study of euro accession in the two countries shows (Ban and Volintiru 2021), the surface resemblance conceals what are, at the level of growth regimes, two fundamentally different economic stories. The contrast goes well beyond convergence timelines or political will; it reaches into the structural architecture of how each country actually grows.

The most basic distinction is between demand profiles. Romania, by virtue of its larger domestic market, resembles Poland in maintaining a significant internal consumption component alongside its export sector. Bulgaria, despite a comparable export share of GDP on paper, operates closer to the small, open economy archetype typical of the Visegrad states, relying on external demand in ways that leave it with a much thinner domestic buffer, assuming that the domestic buffer is adequately financed, which in Romania’s case is not always true.

This structural difference translated into markedly different real-economy outcomes over the decade following the 2008 financial crisis. Romania's hybrid growth engine combining exports with consumption consistently outperformed Bulgaria's more rigid, export-dependent model at least until its fiscal crisis that started in 2025. By 2019, Romania's GDP per capita stood at €9,120, against Bulgaria's €6,140. Measured in purchasing power parity terms, the gap was even wider: Bulgaria had reached 53% of the EU average while Romania stood at 69%, a difference the authors describe as equivalent to seven years of growth. The crisis decade sharpened the divergence further. Between 2008 and 2018, Romania's GDP per capita in purchasing power parity (PPP) terms grew by 60%, while Bulgaria's grew by 54%. Employment gains told a similar story: Romania's employment rate rose by 15 percentage points between 2009 and 2019, Bulgaria's by just 6%.

Much of this differential performance traces back to a single institutional decision taken in 1997. Faced with a hyperinflationary shock of 2,040% in March of that year, Bulgaria adopted a currency board, pegging the lev first to the Deutsche Mark and then to the euro. Romania, where central bank economists vetoed the same solution, did not. That choice locked Bulgaria into a structurally orthodox macroeconomic regime for the following three decades and effectively pre-committed the country to euro accession as a logical sequel. Romania, by contrast, retained policy space that its political elites repeatedly used to sustain domestic consumption-led growth, often at the expense of nominal convergence criteria.

The currency board's fiscal discipline came with real costs. Bulgaria became the EU's poorest country, burdened by an export profile dominated by low value-added products: refined oil, refined copper, raw copper. Romania developed a significantly more sophisticated export base

of vehicle parts, insulated wire and cars, reflecting a more mature industrial Foreign Direct Investment (FDI) relationship. Only 3% of Bulgaria's exports were generated by the automotive sector, compared to 18% for Romania. Romania also pulled substantially ahead on export growth post-crisis: the share of exports in GDP rose by 57% between 2008 and 2018 in Romania, compared to 26% in Bulgaria, a gap the study attributes in large part to Romania's ability to use managed currency depreciation as a competitiveness lever, an option Bulgaria surrendered with the currency board.

The regional dimension compounds the picture. Both countries are heavily weighted toward less-developed regions by EU standards, but Romania exhibits far greater internal variance. While Bucharest scores at 78% of the EU average, sub-regions elsewhere lag far behind, making national convergence averages potentially misleading. Bulgaria's internal disparities are more uniformly low, which paradoxically simplifies its convergence narrative even as it underscores the depth of the development challenge. Bulgaria's poverty and social exclusion rate before social transfers stood at 39% in 2019, higher than Romania's 35%, while inequality metrics showed a steeper upward trajectory in Bulgaria as well.

Export sophistication further separates the two. The data on goods and services exports as a share of GDP between 2002 and 2019 shows Bulgaria tracking closer to Hungary in export intensity, while Romania converges from a lower base but with structurally more complex goods. The nature of what each country sends abroad matters as much as how much, and here Romania's industrial FDI inheritance gives it a decisive edge.

The study's framework uses growth regimes precisely to capture this kind of structural differentiation that aggregate convergence statistics tend to flatten. Ban and Volintiru (2021) conclude that "from the perspective of the CEE export-led growth regime, Romania and Bulgaria are in fact very different sub-regimes, a fact that is side-tracked by analyses grouping them together simply because they joined the EU later." Bulgaria is a small, dependent market economy with constitutionalized austerity and a strong export orientation. Romania is a larger dependent market economy whose export sector coexists with a durable domestic demand engine.

The socio-economic costs of energy vulnerability

Energy vulnerability has emerged as one of the most pressing socio-economic challenges in Eastern Europe, particularly in Romania and Bulgaria. Both countries are facing mounting energy costs that strain household budgets and threaten industrial competitiveness. Rising electricity prices—driven by volatile wholesale markets, limited domestic energy resources, and delayed infrastructure modernization—have deepened existing inequalities and exposed structural weaknesses in energy systems.

In Romania, sharp increases in both household and non-household electricity prices have intensified concerns over affordability, with energy poverty affecting a substantial share of the population and further deepening disparities between rural and urban households. Bulgaria has likewise experienced rising energy costs for non-household consumers, while continuing to

record some of the highest levels of energy poverty in the European Union. Together, these developments illustrate the complex interplay between energy policy, market dynamics, and social welfare in the region—highlighting the high socio-economic costs of sustained energy vulnerability and the urgent need for coordinated action to ensure equitable access to affordable and sustainable energy.

Electricity prices in Romania have increased significantly compared to last year. According to EU Energy Live (2026), the average Romanian electricity price for the same month last year was around 0.453 lei/kWh, compared to approximately 0.587 lei /kWh this month. Broader Eurostat data indicate an even sharper increase for final household consumers. In the second half of 2025, household electricity prices in Romania increased by 58.6 per cent compared with the second half of 2024, the largest increase recorded in the EU (Eurostat 2026a). At the same time, Romania also recorded the highest electricity prices in the EU when adjusted for purchasing power standards (PPS), highlighting the disproportionate burden of electricity costs relative to household incomes (Eurostat 2026b).

The evolution of energy poverty in Romania suggests that the phenomenon remains widespread and structurally embedded despite recent support schemes and broader energy transition efforts. According to the 2025 report of the Romanian Energy Poverty Observatory (ORSE 2025), approximately 21.1 per cent of Romanian households fall below the poverty threshold after paying energy bills, indicating the persistent pressure of energy costs on living standards. The report highlights strong territorial and social inequalities, with energy poverty disproportionately affecting rural areas, low-income households, and individual houses with low energy efficiency. Moreover, Eurostat data for 2025 suggest that Romania remains among the countries with the highest percentage of population unable to keep homes adequately warm, at 11.9 per cent (Eurostat 2026c).

Electricity prices in Bulgaria have also increased compared to the same period last year, although the rise has been more moderate than in Romania. According to EU Energy Live (2026), Bulgaria's average wholesale electricity price for the current month reached approximately 0.179 BGN/kWh, compared to 0.169 BGN/kWh during the same month last year, reflecting the continued volatility of Southeast European electricity markets. At the same time, household electricity prices in Bulgaria remain relatively low compared to many EU member states due to regulated pricing mechanisms and continued state intervention in the retail market. Nevertheless, Bulgaria continues to experience severe levels of energy poverty, with 16.1 per cent of the population unable to keep their homes adequately warm in 2025 (Eurostat 2026c).

This persistence of energy vulnerability is further reinforced by deep-seated territorial economic inequalities. For Bulgaria, according to the Bulgarian National Statistical Institute data for 2024, regional economic activity remains highly concentrated, with the Yugozapaden region accounting for over half of national GDP, while Severozapaden contributes only around 6.5%. This persistent territorial imbalance is particularly significant for the northern border districts such as Vidin and Montana, which remain among the most economically deprived regions in Bulgaria, and hence with lower resilience capabilities in the face of electricity volatility (National Statistics Institute 2026). Similar territorial disparities are evident in

Romania, where economic activity remains concentrated in the Bucharest-Ilfov region, while the Lower Danube development regions of Sud-Vest Oltenia, Sud-Muntenia, and Sud-Est continue to record lower GDP per capita levels (Eurostat 2026d). This is consistent with how energy prices are felt at the level of households, with both the Northmost regions in Bulgaria and Romania's Southern regions ranking among the most vulnerable in terms of energy poverty both within each respective country and within the EU (Energy Poverty Advisory Hub 2026).

Aside from household consumers, the high price of electricity has also taken a toll on industrial and business consumers for both countries. Figure 1 illustrates the changes in electricity prices for non-household consumers in Romania and Bulgaria relative to the previous year during the second half of 2025. According to Eurostat (2026a), Romania recorded the largest increase in electricity prices for non-household consumers in the European Union during the second half of 2025, with prices rising by 15.4 per cent compared to the same period in 2024, while Bulgaria registered an increase of 6.8 per cent. At the same time, industrial producer prices in the EU increased by 3.2 per cent in March 2026 compared with the previous month, largely driven by rising energy prices. Romania and Bulgaria were among the EU countries recording the highest annual increases in industrial producer prices in early 2026, at 7.8 per cent and 7.5 per cent respectively (Eurostat 2026d).

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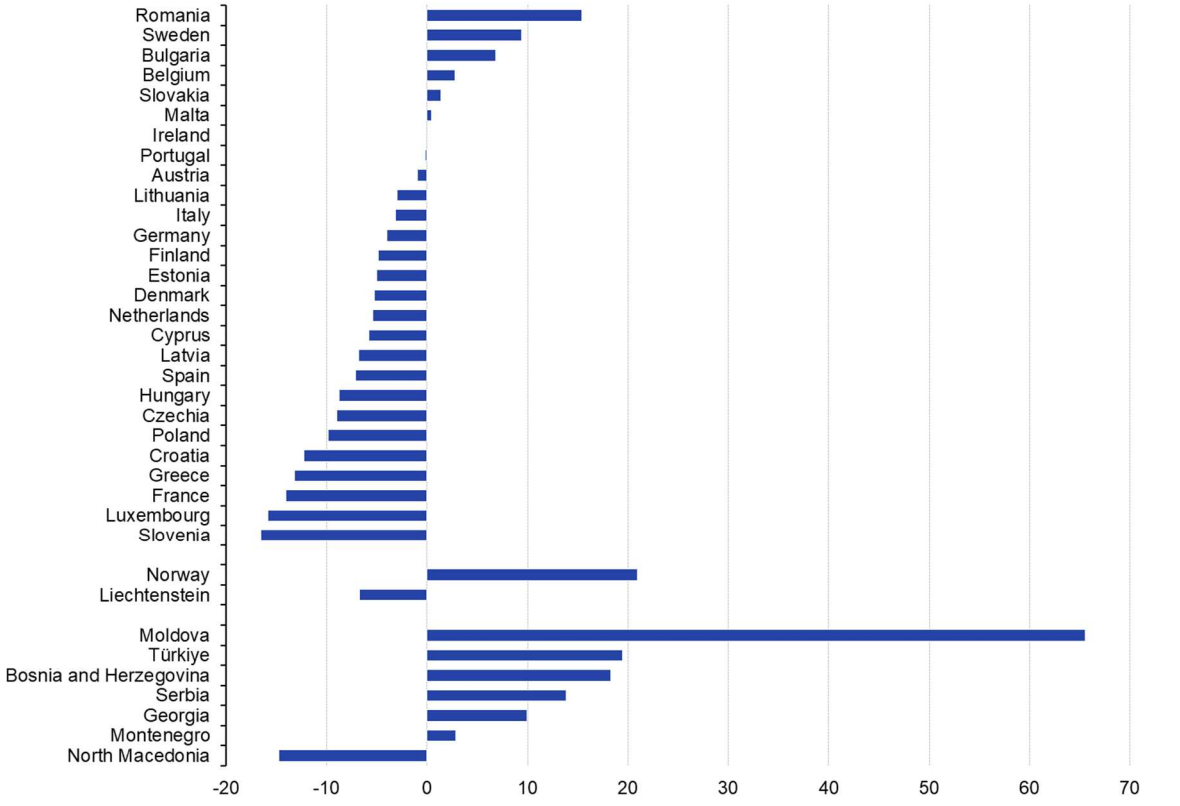
Change in electricity prices for non-household consumers compared with previous year, same semester, (National currency), second half 2025
(%)



Source: Eurostat (online data codes: nrg_pc_205)

eurostat

Figure 1. Change in electricity prices for non-household consumers compared with previous year, same semester, (National currency), second half of 2025.

These developments reflect broader pressures affecting industrial and commercial energy users throughout Europe. In 2024, industrial electricity prices in the EU reached €0.199 per kWh, compared to €0.082 in China and €0.075 in the United States, illustrating the substantially higher energy costs faced by European industries (Fig. 2). At the same time, Europe's relatively limited domestic energy resources increase dependence on imported energy, including liquefied natural gas (LNG), which remains considerably more expensive than pipeline gas and has further contributed to rising energy costs. Alongside regulatory pressures and labour availability, energy prices are increasingly identified as one of the principal challenges affecting the European industrial sector (Business Europe 2025).

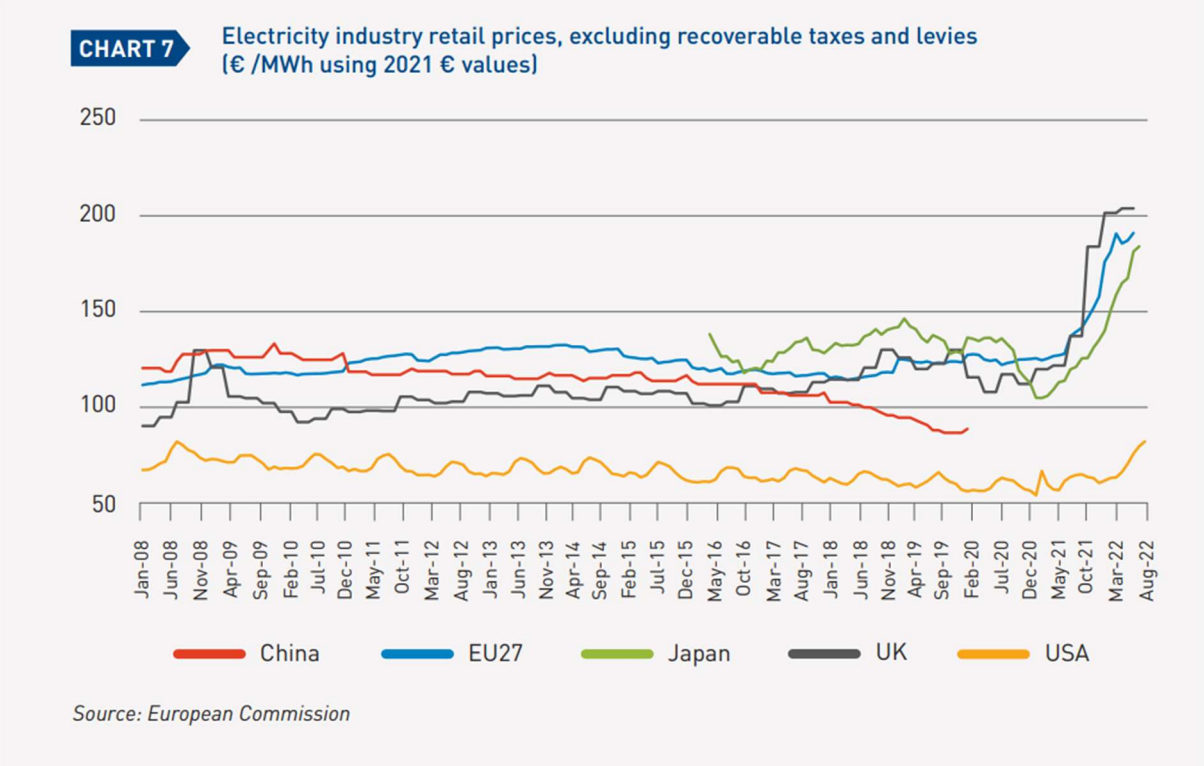


Figure 2. Electricity industry retail prices, excluding recoverable taxes and levies (€ /MWh using 2021 € values). Source: BusinessEurope (2025).

This reflects the continuing pressures exerted by rising energy costs on industrial and business consumers, as well as their broader implications for long-term socio-economic sustainability. According to a European Central Bank (ECB 2025) analysis, persistently high electricity prices are increasingly threatening the competitiveness of European industry and may generate substantial employment losses. The ECB estimates that a permanent 10 per cent increase in electricity prices could reduce employment in energy-intensive industries by between 1 and 2 per cent, while indirect effects could amplify these losses further through knock-on impacts on local services and regional economies. At the same time, the ECB identifies the expansion of cheaper and cleaner energy systems as a central solution for preserving industrial

competitiveness and mitigating long-term employment losses, highlighting the importance of accelerating renewable energy deployment and cleantech development across Europe.

Cross-Border Renewable Energy Development for Tackling Energy Vulnerability

Given the pressing challenges posed by energy vulnerabilities in both countries—including persistent energy poverty, rising electricity costs for industrial consumers, and the resulting risks of job losses—greater attention should be directed towards the development of VRES (Variable Renewable Energy Sources) in the region, particularly wind and solar energy, which are increasingly recognized as key instruments for addressing these challenges. Solar energy potential is among the highest around the border regions and districts of both countries, with the Romanian regions bordering the Danube also possessing the highest potential for photovoltaic power in the country (Interreg RO-BG, 2020; World Bank Group 2019). In this context, Romania and Bulgaria are increasingly emerging as important solar energy hubs within Eastern Europe, one of the fastest-growing solar regions in the European Union. Recent analyses indicate that Eastern European solar capacity expanded rapidly between 2019 and 2024, with solar energy accounting for an increasing share of regional electricity generation (Reuters 2025). Romania has become one of Europe's fastest-growing solar markets, surpassing 7 GW of installed photovoltaic capacity by 2025, while Bulgaria's installed solar capacity approached 6 GW following several consecutive years of rapid expansion in photovoltaic deployment and battery storage infrastructure (PV Magazine 2026).

At the same time, the emergence of Romania and Bulgaria as prospective offshore wind hubs in the Black Sea reflects a broader reconfiguration of Europe's energy geography, where peripheral regions are being repositioned as strategic assets in the transition to renewables. This shift is driven by the layering of institutional validation, policy frameworks, and private capital. The World Bank has played a pivotal role in this process by transforming what was once a largely speculative resource into a quantified and investable opportunity. Its technical assessments as early as 2020 estimate that the Black Sea holds between 435 and 453 GW of offshore wind potential, a figure that places it among the most promising undeveloped offshore basins globally (World Bank 2020; CSD 2021).

Solar Energy Expansion in Romania and Bulgaria

Solar Photovoltaic has the potential to play a significantly larger role in Romania's national energy mix. With 210 sunny days per year and an annual solar energy flow ranging between 1,000 kWh/m²/year and 1,300 kWh/m²/year, it is among the countries in the South and South-East with the highest value recorded, reaching approximately 1,387 kWh/m²/year. In addition, Romania is well positioned for the development of large-scale Photovoltaic (PV) installations, as substantial areas of degraded land could be repurposed for solar infrastructure with relatively limited environmental impacts (EPG 2024: 5).

The policy framework is also increasingly oriented toward favouring the energy transition. Romania's updated NECP sets significantly more ambitious renewable energy targets than

previous versions, aiming for at least 38.3 per cent renewable energy in gross final energy consumption by 2030. Within this strategy, solar energy is expected to play a central role, with installed capacity projected to reach approximately 8.2 GW by 2030, increasing further to 21.4 GW by 2040 and 33.3 GW by 2050 (Government of Romania [NECP] 2024: 25, 65).

Recent investment developments further reflect this growing momentum. In 2026, the European Investment Bank (EIB) committed €34 million to support three Romanian solar companies owned 65 per cent by the Norway-based renewable energy developer Scatec ASA and 35 per cent by Defic Globe BV. The project supports the development of three solar parks in the Oltenia region in southwestern Romania, near the Bulgarian border, and is expected to become fully operational by September 2027 (EIB 2026).

In terms of industrial development, while the country currently possesses limited strengths within the solar value chain, there is considerable potential for developing competitiveness in related products that align with existing industrial capabilities. This is particularly evident in the case of solar subcomponents, such as machinery used in the manufacture of PV wafers. Both Romania's exports of these products and demand within the EU market have increased in recent years, suggesting opportunities for further industrial development within the renewable energy supply chain (World Bank 2023: 55).

Despite these developments, Romania continues to face significant infrastructural and institutional barriers to the effective integration of renewable energy sources into the national grid. The investment needs associated with grid modernization are substantial. According to EPG (2024: 9), approximately €6.8 billion will be required for the transmission grid and between €9.2 and €11.5 billion for the distribution grid by 2030 in order to expand, strengthen, and digitalize the system sufficiently to accommodate Romania's decarbonization targets and the increasing number of prosumers.

At the same time, the absence of sufficient storage infrastructure further exacerbates pressure on the grid. According to a study conducted by REKK with the support of EPG, an annual increase of 800 MW in prosumer-installed capacity combined with approximately 120 MW of battery storage would significantly reduce grid pressure by improving synchronization with demand patterns and increasing the capacity to inject electricity during peak demand periods (EPG 2024: 9). The limited deployment of storage technologies therefore remains an important barrier to the stabilization and efficiency of the system.

It is precisely within this limitation that the complementarities between Romania and Bulgaria become visible. While Romania possesses significant renewable generation potential but faces important storage and grid integration constraints, Bulgaria has increasingly positioned solar energy and especially battery energy storage systems (BESS) as central components of its long-term energy transition strategy. According to the updated National Energy and Climate Plan, the country aims to achieve a 34.96 per cent share of renewable energy in gross final energy consumption by 2030. This objective is expected to be achieved primarily through the deployment of approximately 7,160 MW of new renewable electricity capacity after 2022, largely based on solar and wind energy (Government of Bulgaria [NECP 2025]: 22). The Bulgarian strategy also emphasizes the importance of expanding and modernizing transmission

and distribution infrastructure in order to integrate increasing volumes of intermittent renewable electricity while maintaining grid stability. Particular importance is assigned to strengthening the North-South transmission corridor in Northern Bulgaria to facilitate the transfer of renewable electricity toward both domestic consumption centres and regional markets, especially Romania.

At the same time, PV installations have become a dominant feature of Bulgaria's energy landscape, with approximately 5,000 MW of operational solar capacity already installed (Jowett 2026). In 2025 alone, Bulgaria installed approximately 1.4 GW of new solar capacity, surpassing 1 GW of annual additions for the third consecutive year and bringing cumulative installed solar capacity close to 6 GW. This rapid expansion has positioned Bulgaria among the fastest-growing solar markets in Eastern Europe. This rapid growth has already begun to transform Bulgaria's electricity market. In June 2025, photovoltaic generation exceeded the country's total domestic electricity demand for several consecutive hours during midday for the first time, reaching between 2,935 MW and 3,230 MW, and allowing Bulgaria not only to satisfy domestic consumption but also to export surplus electricity (Todorović 2025).

Several factors have enabled Bulgaria's rapid renewable energy expansion. One of the most important has been the development of a highly supportive regulatory and financial environment for battery energy storage systems (BESS). In 2024, the Bulgarian Ministry of Energy launched multiple competitive tenders under the National Recovery and Resilience Plan (NRRP) to support renewable energy projects co-located with storage systems. Public subsidies covered up to 50 per cent of eligible storage-related costs. The programme supported both smaller distributed projects and large utility-scale developments. The first auction financed 200 projects combining 435 MW of renewable capacity with 176 MW of storage, while the second supported 49 large-scale projects expected to install approximately 2,660 MW of renewable energy and 1,000 MW of storage capacity. In parallel, Bulgaria launched dedicated tenders for standalone BESS projects, awarding 82 projects with a planned storage capacity of nearly 9.7 GWh (Kairakov and Iàcona 2026).

This rapid deployment has been facilitated not only by public subsidies, but also by simplified permitting procedures, the absence of double charging for grid use during charging and discharging cycles, and market rules allowing storage operators to participate directly in balancing and ancillary service markets. The rapid expansion of solar generation and declining daytime electricity prices have further increased the profitability of storage through electricity arbitrage and balancing services, positioning battery storage as a central component of Bulgaria's evolving energy strategy.

Romania–Bulgaria Solar Energy Cooperation Through Shared Grid Infrastructure, Market Integration, Storage Systems, and Regional Clean-Energy Governance

Existing cooperation between Romania and Bulgaria in the energy sector has intensified significantly in recent years, particularly in relation to renewable energy integration, grid modernization, storage infrastructure, and regional electricity market coordination. Both countries increasingly recognize that the expansion of variable renewable energy sources,

especially solar and wind, depends not only on generation capacity, but also on deeper regional interconnection, system flexibility, and coordinated infrastructure development.

The growing interconnection between the Romanian and Bulgarian renewable energy sectors is reflected in the increasing presence of cross-border investment strategies and regionally integrated energy projects. A relevant example is the 229 MW "St. George" solar project located in northeastern Bulgaria, near the Romanian border, in the Silistra region. Developed by Rezolv Energy, the project is among the largest solar parks in Bulgaria and forms part of a broader wave of renewable energy expansion across the Lower Danube region (Rezolv Energy 2025). Its relevance extends beyond the Bulgarian national context, as the same developer is simultaneously investing in major renewable energy projects in Romania, including the large-scale Dama Solar project and wind energy developments (Rezolv Energy 2026). Such investments increasingly position Romania and Bulgaria as part of a shared regional renewable energy space, strengthening the logic of cross-border electricity integration, balancing mechanisms, and coordinated renewable energy governance in Southeast Europe.

At the infrastructural level, the Bulgarian electricity system is already strongly interconnected with Romania through four major 400 kV interconnectors linking Kozloduy, Varna, and Dobrudzha with the Romanian substations at Tuncareni and Mezzidia (NECP 2025: 96). These interconnections form part of the broader continental European electricity system and facilitate both cross-border electricity trade and the balancing of increasingly variable renewable generation. Bulgaria's NECP further emphasizes the strategic importance of strengthening North-South transmission corridors to facilitate the transfer of renewable electricity from Northern Bulgaria toward domestic and regional consumption centres, particularly Romania (NECP 2025: 99).

Regional cooperation has also increasingly focused on smart grid development and system digitalization. A central example is Project of Common Interest (PCI) 12.2 CARMEN/Carmen, included in the EU list of Projects of Common Interest under the trans-European energy infrastructure framework (CARMEN Smart Grid Project 2026). The project aims to modernize the legacy electricity infrastructure of Romania and Bulgaria through the implementation of smart grid standards across transmission and distribution systems, while also strengthening cooperation between transmission system operators (TSOs) and distribution system operators (DSOs). Beyond physical grid expansion, the project also emphasizes data sharing, grid flexibility, renewable integration, and improved system security (NECP 2025: 99). The broader CARMEN initiative similarly seeks to intensify cooperation along the Eastern EU border through both physical and non-physical interconnection measures, while fostering regional integration involving Romania, Bulgaria, Hungary, Moldova, and Ukraine through digitization and energy infrastructure upgrades.

Cooperation has also expanded through regional market coordination mechanisms. In 2020, the transmission system operators of Bulgaria (ESO EAD), Romania (Transelectrica), Greece (IPTO), and Italy (TERNA SpA) jointly established the Southeast Electricity Network Coordination Center (Selene CC) in Thessaloniki in order to strengthen regional electricity coordination, balancing, and system security (NECP 2025: 359). Bulgaria's broader interconnection strategy, including the development of a new double 400 kV interconnector

with Serbia, is likewise intended to accelerate electricity trade flows across the Western Balkans and strengthen the regional electricity market connecting Bulgaria and Romania to broader European corridors (NECP 2025: 109).

At the same time, Bulgaria's rapid expansion of BESS is already producing direct regional effects. The rapid deployment of storage infrastructure has also exposed emerging asymmetries in regional energy system preparedness. While Romania has rapidly expanded solar generation capacity, limitations in domestic storage infrastructure and system flexibility have increasingly enabled Bulgarian operators to benefit from regional electricity price volatility by storing surplus low-cost electricity, including electricity exported from Romania during periods of high solar production, and reselling it during peak demand periods at significantly higher prices (Economica 2025). This dynamic also illustrates how differences in storage deployment and grid flexibility can generate uneven economic advantages within increasingly interconnected regional electricity markets.

Romania and Bulgaria as prospective offshore wind hubs

Within the regional context, Romania has emerged as the more institutionally prepared actor for offshore wind development, even though actual deployment remains at an early stage. World Bank-supported analyses suggest that Romanian waters alone could host between 76 and 94 GW of offshore wind capacity, depending on technological and spatial constraints (World Bank 2020). The scale of required investment is substantial, with early-phase development costs estimated at around €19 billion, a figure that underscores the capital-intensive nature of offshore wind but also signals the size of the potential market (Energy Industry Review 2026). What distinguishes Romania is a partial alignment of enabling conditions. The port of Constanța, for instance, already possesses many of the logistical characteristics required to serve as an offshore wind hub, reducing the need for costly greenfield infrastructure (BSREC 2024). At the same time, Romania has taken initial steps toward regulatory clarification, including draft legislation aimed at defining concession regimes and grid connection rules. These developments create a degree of policy visibility that is often decisive in early-stage renewable sectors.

The scale of activity in 2024 reinforces this shift. Approximately 1,000 MW of new capacity were commissioned during the year, a figure that exceeds the combined additions of the previous two years. This expansion spans multiple technologies, including thermal, hydro, and renewables, and reflects a broader strategy of system stabilization rather than a narrow focus on decarbonization. Projects such as the 330 MW unit at Rovinari and the modernization of hydro capacity at Bicaz illustrate the continued reliance on dispatchable and legacy assets, even as new renewable capacity is brought online. This hybrid investment pattern is analytically important. It suggests that Romania's energy transition is being pursued not as a linear shift toward renewables, but as a layered process in which security of supply, price stability, and decarbonization are negotiated simultaneously.

Within this broader system transformation, offshore wind occupies a forward-looking but still preparatory position. The newly adopted offshore wind law establishes Romania as the first

Black Sea country with a dedicated legislative framework for such investments, a fact repeatedly emphasized by policymakers. According to statements by former Energy Minister Sebastian Burduja, the expectation is that the first offshore wind projects could become operational around 2032, with installed capacity reaching between 3 and 7 GW in line with World Bank projections. This timeline highlights a key tension. On the one hand, Romania is moving ahead institutionally faster than its regional peers. On the other hand, actual deployment remains at least a decade away, underscoring the long lead times and capital intensity associated with offshore wind development.

The adoption of the National Energy Strategy 2025 to 2035 to 2050 further consolidates this trajectory. Framed by the Ministry of Energy as a document of "pragmatism" and "intelligent investment," the strategy attempts to coordinate multiple streams of infrastructure development, from renewables to nuclear and gas. Offshore wind is embedded within this wider portfolio rather than treated as a standalone sector, which reflects a systemic approach to energy planning. At the same time, the strategy is closely aligned with European frameworks, including the submission of Romania's updated National Energy and Climate Plan to the European Commission. This alignment is not merely procedural. It enables access to EU funding mechanisms and situates Romania within a broader regional push to expand renewable capacity and reduce dependence on fossil fuels.

Despite adopting Law 121 on offshore wind energy in June 2024, the country has missed every major procedural deadline tied to offshore wind development. The government was supposed to approve, by March 2025, the list of offshore perimeters available for concession, based on a dedicated technical study. That process had not even properly started until May 2025, nearly a year after the law entered into force. Even more basic steps, such as approving the terms of reference for the study within three months, slipped well past their legal deadlines. This delay effectively pushes the entire offshore wind timeline back. According to the Ministry of Energy, the study identifying viable offshore zones is now expected only in 2026, with competitive concession procedures potentially launched in 2027–2028. That means that Romania’s first offshore wind projects, already expected only in the early 2030s, risk further slippage. In a sector where investor confidence depends heavily on regulatory predictability, such delays are costly signals. The Ministry itself acknowledges that multiple specialized entities have submitted expressions of interest for the foundational study, indicating that capital and expertise are available. Yet the bottleneck has shifted to something more basic: funding the study and completing preparatory regulation. This is a familiar pattern in emerging energy sectors, where political commitment at the level of strategy does not translate into administrative execution.

Equally telling is the political silence surrounding the issue. Offshore wind has largely disappeared from the discourse of both governing and opposition parties, despite being framed officially as a strategic priority and a commitment under EU-linked instruments such as the Recovery and Resilience Plan. The overall impression is that the political debate overwhelmingly favors fossil fuels and particularly Black Sea gas.

Bulgaria presents a more uneven trajectory, where resource abundance coexists with institutional lag. Estimates suggest that Bulgarian offshore zones could support up to 116 GW

of capacity, although only about 26 GW is currently feasible using bottom-fixed technology, with the remainder dependent on the commercialization of floating wind systems (CSD 2021). This technological split is important because it directly affects cost structures and investment timelines, making Bulgaria's potential more sensitive to global innovation cycles. According to analysis by Ember, Bulgaria could install around 1.8 GW of offshore wind capacity by 2030, which could reduce wholesale electricity prices by up to 45%, due to the low marginal cost of wind generation displacing more expensive fossil-based power (Ember 2024).

Bulgaria's offshore wind resource is geographically concentrated. The most suitable areas are located in the northern Black Sea zone, near the Romanian border, where wind speeds are higher and water depths allow for bottom-fixed turbines. Capacity factors in these are estimated at 40–48%, comparable to established European offshore markets. However, a large share of Bulgaria's overall offshore potential lies in deeper waters, which would require floating wind technology that is currently more expensive and less commercially mature.

Wind generation has effectively stagnated since 2012. This decade of inertia reflects governance failures, weak political commitment, and persistent grid access constraints. The government's draft Strategy for Sustainable Development targets the addition of 0.6 GW of onshore wind and 0.5 GW of offshore wind by 2030, but these ambitions are notably modest and would leave Bulgaria trailing most of Europe. These targets also underestimate Bulgaria's offshore wind potential. The most promising zone within its maritime exclusive economic zone, near the border with Romania, has an estimated technical potential of 4.3 to 5 GW, with capacity factors of 45 to 48 percent and a levelized cost of electricity in the range of €62 to €90 per MWh. This is already competitive with the operating costs of coal and gas, suggesting that offshore wind deployment could become viable as early as 2030 (Ember 2024).

Unfortunately, despite this resource base, Bulgaria lacks a fully developed regulatory framework for offshore wind. There is no comprehensive law equivalent to Romania's 2024 offshore wind legislation, and key elements such as concession rules, auction mechanisms, and grid connection procedures remain underdeveloped. This creates uncertainty for investors and slows project development. Draft legislation proposes offshore renewable energy auctions, with targets of at least 1 GW by 2027 and an additional 2 GW by 2030. Pilot initiatives are also underway, including small-scale floating wind demonstration projects supported by EU programs. The absence of clear maritime spatial planning rules, concession frameworks, and grid integration strategies creates a coordination problem that cannot be solved by market actors alone. Overall, however, Bulgaria is a case that combines strong technical potential with institutional gaps. The main barrier is not resource availability but the absence of a clear, stable policy framework needed to mobilize large-scale investments. In this sense, Bulgaria illustrates a recurring pattern in emerging renewable regions: high technical potential does not automatically translate into investment without a parallel development of governance capacity.

Cross border cooperation within a European framework for energy resilience

The European Union has intervened precisely at this juncture, reframing the Black Sea as part of its broader decarbonization and energy security agenda. Offshore wind features prominently

in EU strategies linked to the Green Deal, and financial instruments such as the Recovery and Resilience Facility and cohesion funds are explicitly designed to support infrastructure-heavy transitions in less developed member states (European Commission 2020). For Romania and Bulgaria, EU involvement serves a dual function. It provides access to capital under relatively favorable conditions, and it imposes a degree of regulatory harmonization that reduces transaction costs for cross-border investors. This is particularly relevant in a sector like offshore wind, where projects depend on long-term policy stability and coordinated grid planning. The EU's role, therefore, is not limited to subsidy provision; it acts as a structuring force that aligns national policies with a wider regional energy system.

The interaction between national policy and European integration becomes particularly visible in debates over electricity prices and market functioning. Romania, alongside Greece and Bulgaria, has argued that structural deficiencies in interconnection infrastructure create persistent price disparities between Eastern and Western Europe. The call for a more "functional energy union" reflects both economic and political concerns, linking domestic affordability to broader questions of market design and regional equity. In this context, offshore wind is not only a decarbonization tool but also part of a longer-term strategy to increase domestic generation capacity and reduce exposure to volatile cross-border dynamics.

Danish investors and firms have been among the most attentive external actors to these developments, reflecting Denmark's historical position as a pioneer in offshore wind. Companies such as Vestas, alongside institutional investors linked to Danish pension funds, bring a combination of technological expertise and patient capital that is particularly suited to offshore projects. Denmark's experience in building the North Sea offshore wind cluster provides a template for expansion into new basins, where early entry can secure strategic advantages in supply chains and project pipelines (Green Power Denmark 2022). From the perspective of Danish capital, the Black Sea offers a familiar but underdeveloped landscape: strong wind resources, proximity to EU electricity markets, and increasing policy support. The risks, especially around regulation and grid capacity, are higher than in mature markets, but so are the potential returns. This risk-return profile aligns well with infrastructure investment strategies that seek long-term, stable cash flows in sectors backed by public policy.

A further layer to this story is the emerging logic of regional integration. Offshore wind development in the Black Sea is unlikely to proceed as a purely national endeavor; instead, it will depend on coordinated infrastructure, including transmission networks and possibly shared offshore grids. Romania and Bulgaria have already engaged in joint maritime spatial planning initiatives, supported by international institutions, which represent early steps toward such coordination (World Bank 2023). The long-term vision, at least in policy discussions, involves a meshed offshore grid that could connect multiple countries and facilitate electricity trade across the region. If realized, this would transform the Black Sea from a peripheral energy space into a node within Europe's renewable energy system. Yet this vision also raises complex governance questions, particularly regarding cost-sharing, regulatory alignment, and geopolitical risk, given the Black Sea's proximity to non-EU actors. Structural constraints are non-trivial, however. Grid infrastructure remains underdeveloped, regulatory regimes are still evolving, and the capital intensity of offshore wind places a premium on policy credibility.

What stands out most clearly from recent technical and policy analysis is not the lack of potential in the Black Sea, but the scale of the missed opportunity for Romanian–Bulgarian cooperation in reducing energy costs through offshore wind. Both Romania and Bulgaria face structurally high electricity prices, driven by weak interconnections, fragmented markets, and limited access to low-cost generation. Offshore wind offers a rare solution that is simultaneously domestic, scalable, and increasingly cost-competitive. Yet, despite repeated recognition at the EU and analytical level, joint development remains largely unrealized.

The core economic argument for cooperation is straightforward. A coordinated Romanian–Bulgarian offshore wind buildout could unlock economies of scale that neither country can achieve alone. In a realistic 2030 scenario, fixed-bottom offshore wind in Romanian waters is estimated to reach a levelized cost of energy (LCOE) of around €71/MWh, while floating wind would remain higher at approximately €94/MWh. However, when modeled as a joint 3 GW Romanian–Bulgarian project, including shared grid infrastructure, the LCOE rises only moderately to around €79/MWh. Even when adding the cost of a shared offshore "energy island," the LCOE reaches approximately €85/MWh, still within a competitive range for large-scale clean generation in Europe. These figures suggest that cooperation does not undermine cost efficiency. On the contrary, it creates a pathway to scale that stabilizes costs while enabling much larger deployment.

The key bottleneck this cooperation could address is grid infrastructure. Both countries face constraints in integrating large volumes of new generation into their national systems. A jointly developed offshore "energy island," combined with high-voltage direct current (HVDC) connections, would provide a scalable solution to evacuate power, balance supply, and strengthen interconnection capacity across the region. Such infrastructure would not only connect Romania and Bulgaria but could extend to other Black Sea actors, including Turkey and Georgia, linking further into emerging corridors toward Azerbaijan. The recently announced HVDC cable involving Romania, Georgia, Azerbaijan, and Hungary illustrates that this regional integration logic is already underway, albeit without a fully coordinated offshore wind component.

The economic implications of such cooperation are substantial. A 3 GW offshore wind deployment in Romania alone could generate approximately €6.3 billion in economic activity, equivalent to around 2.6% of GDP, alongside the creation of roughly 22,000 jobs across construction and operations. Much of this activity would cluster around strategic infrastructure such as the Port of Constanța, with spillovers into manufacturing and services. A joint Romanian–Bulgarian project would likely amplify these effects by expanding supply chains and attracting larger-scale industrial investment, particularly in turbine components and installation services.

Discussions

The evidence presented above suggests that Romania and Bulgaria do not suffer from a lack of renewable energy potential, but from a failure to organize this potential into a coherent regional transition strategy. Both countries face high levels of energy vulnerability, reflected in

household energy poverty, rising electricity prices for industrial users, and broader risks to socio-economic stability. At the same time, both possess significant solar and offshore wind resources that could reduce exposure to volatile fossil fuel markets, lower electricity costs, and support new forms of industrial development. The central problem, therefore, is not resource scarcity, but the political and infrastructural organization of the energy transition.

A key finding is the coexistence of renewable energy expansion with continued fossil fuel lock-in. Romania and Bulgaria increasingly present solar, wind, storage, and grid modernization as strategic priorities, yet both continue to invest in gas infrastructure and frame energy security through the logic of fossil fuel availability. This produces a halfway transition: renewables are added to the system, but they are not yet made structurally central to energy security, industrial policy, or social protection. In this sense, energy vulnerability persists not simply because renewable deployment is insufficient, but because renewable energy is not yet treated as the backbone of a new economic and social model.

Solar energy already demonstrates the transformative potential of this shift. Romania and Bulgaria are emerging as important solar hubs in Eastern Europe, with rapid capacity growth and increasing private investment. Bulgaria's expansion of battery storage is especially significant, as it shows how storage can transform solar from an intermittent resource into a strategic market asset. However, it also reveals emerging asymmetries: where Romania has expanded solar capacity without sufficient storage, Bulgaria has been better positioned to benefit from regional price volatility. This points to the importance of coordinated planning rather than parallel national transitions.

Offshore wind offers an even stronger case for cross-border cooperation. The Black Sea has the potential to become a major renewable energy basin, but this potential cannot be fully realized through fragmented national strategies. A coordinated Romanian–Bulgarian offshore wind strategy could reduce costs through economies of scale, improve grid integration, support regional electricity balancing, and attract larger-scale industrial investment. Shared infrastructure, such as offshore grids or energy islands, would allow both countries to move beyond isolated project development and toward a genuinely regional clean-energy system.

The socio-economic implications are considerable. Renewable energy cooperation could contribute not only to decarbonisation, but also to energy affordability, employment protection, and regional industrial development. Lower-cost renewable electricity would help reduce pressure on households and energy-intensive industries, while large-scale offshore wind and solar supply chains could generate employment in ports, construction, manufacturing, maintenance, and grid services. In this sense, renewable cooperation should not be understood narrowly as an environmental objective, but as a strategy for tackling energy poverty, preserving industrial competitiveness, and reducing socio-economic disparities.

However, the main obstacles remain institutional and political. Romania has moved further in creating an offshore wind legal framework, but implementation delays undermine investor confidence. Bulgaria has strong technical potential, especially near the Romanian maritime border, but lacks a mature regulatory framework for offshore wind. Both countries therefore face a governance gap: they possess the resources and strategic rationale for cooperation, but

lack the administrative execution, regulatory clarity, and political prioritization needed to mobilize them at scale.

Overall, the Romanian–Bulgarian case illustrates a broader dilemma in the European green transition. Peripheral regions are increasingly recognized as central to Europe's renewable future, yet they remain constrained by fragmented infrastructure, uneven institutional capacity, and persistent fossil fuel imaginaries. The challenge is therefore not only to deploy more renewable energy, but to build the regional governance structures capable of turning renewable potential into social and economic resilience. For Romania and Bulgaria, cross-border cooperation on solar, storage, grids, and offshore wind could become a decisive pathway out of energy vulnerability—provided that it is treated not as a supplementary policy area, but as a central pillar of regional development.

References

4C Offshore. 2024. "Romania Unveils Roadmap for Offshore Wind Development in the Black Sea." https://www.4coffshore.com/news/romania-unveils-roadmap-for-offshore-wind-development-in-the-black-sea-nid30362.html.

Bouzarovski, Stefan. 2018. *Energy Poverty: (Dis)Assembling Europe's Infrastructural Divide*. Cham: Palgrave Macmillan.

Bursa. 2024. "World Bank: Offshore Wind Projects in Romania Will Create Tens of Thousands of Jobs." https://www.bursa.ro.

CARMEN Smart Grid. 2026. "CARMEN Smart Grid Project." https://carmen-smart-grid.eu/en/.

Celmare, I., M. Bugă, R. Joshi, and S. Cordes. 2025. "Romania at a Crossroads: Fossil Fuels or a Renewable Future?" https://eufactcheck.eu/blogpost/romania-at-a-crossroads-fossil-fuels-or-a-renewable-future/.

Constantin, M., A. Arsani, R. Cîrligeanu, and R. Dudău. 2024. "Harnessing Solar Power: A Key Driver for Romania's Decarbonisation Pathway." Energy Policy Group. https://www.enpg.ro/harnessing-solar-power-a-key-driver-for-romanias-decarbonisation-pathway/.

Economica.net. 2024. "Circa 1.000 de MW Puşi în Funcţiune în 2024. România Are o Nouă Strategie Energetică şi Legea pentru Eoliene Offshore." December 20, 2024. https://www.economica.net/circa-1-000-de-mw-pusi-in-functiune-in-2024-romania-are-o-noua-strategie-energetica-si-legea-pentru-eoliene-offshore_797142.html

Economica.net. 2026. "Bateriile de stocare ale Bulgariei ajung să facă legea pe piața energei din zona noastră. Acumulează energia ieftină pe care și România o produce în exces și ne-o revând la preț mare, peste câteva ore". June 24, 2026. https://www.economica.net/bateriile-de-stocare-ale-bulgariei-ajung-sa-faca-legea-pe-piata-energei-din-zona-noastra-acumuleaza-energia-ieftina-pe-care-si-romania-o-produce-in-exces-si-ne-o-revand-la-pret-mare-peste-cateva-ore_938943.html.

Ember. 2024. "A Breath of Fresh Air: Offshore Wind in Bulgaria." February 20, 2024. https://ember-energy.org/latest-insights/a-breath-of-fresh-air-offshore-wind-in-bulgaria/.

Enerdata. 2024. "Romania's New Roadmap Considers 7 GW Offshore Wind Capacity by 2035." https://www.enerdata.net/publications/daily-energy-news/romanias-new-roadmap-considers-7-gw-offshore-wind-capacity-2035.html.

Energy Policy Group (EPG). 2023. *Offshore Wind – The Enabler of Romania's Decarbonisation*. https://www.epg-thinktank.org/wp-content/uploads/2023/01/EPG_Report_Offshore_wind-the-enabler-of-Romanias-decarbonisation.pdf.

Energy Poverty Advisory Hub. 2026. *Assessment of EU regions with higher vulnerability to severe energy poverty*. Luxembourg: Publications Office of the European Union.

EU Energy Live. 2026. "Electricity Prices Romania." Accessed May 11, 2026. https://euenergy.live/romania.

European Central Bank. 2025. "How Enduring High Energy Prices Could Affect Jobs." May 5, 2025. https://www.ecb.europa.eu/press/blog/date/2025/html/ecb.blog20250505~86c88d726c.en.html.

European Environment Agency. 2025. "Renewable Energy." https://www.eea.europa.eu/en/topics/in-depth/renewable-energy.

European Investment Bank. 2026. "Romania to Expand Solar-Power Production with €34 Million in Financing from EIB." https://www.eib.org/en/press/all/2026-058-romania-to-expand-solar-power-production-with-eur34-million-in-financing-from-eib.

Eurostat. 2026a. "Electricity Price Statistics." *Statistics Explained*. Accessed May 11, 2026. https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Electricity_price_statistics.

Eurostat. 2026b. "EU Household Electricity Prices Stable in 2025." May 5, 2026. https://ec.europa.eu/eurostat/web/products-eurostat-news/w/ddn-20260505-1.

Eurostat. 2026c. "Population Unable to Keep Home Adequately Warm by Poverty Status." Accessed May 11, 2026. https://ec.europa.eu/eurostat/databrowser/view/sdg_07_60/default/table.

Eurostat. 2026d. "Industrial Producer Prices Up by 3.2% in the Euro Area." May 6, 2026. https://ec.europa.eu/eurostat/web/products-euro-indicators/w/4-06052026-ap.

Eurostat. 2026e. "Gross domestic product (GDP) at current market prices by NUTS 2 region". June 23, 2026. https://ec.europa.eu/eurostat/databrowser/view/nama_10r_2gdp/default/map?lang=en

Government of Bulgaria. 2025. *Bulgaria – Final Updated National Energy and Climate Plan 2021–2030*. Sofia: Government of Bulgaria. https://commission.europa.eu/document/download/a3370b6f-98f5-4402-acee-df1f2e505437_en?filename=bulgaria-final-updated-necp-2021-2030-submitted-2025_en.pdf.

Government of Romania. 2024. *Romania – Final Updated National Energy and Climate Plan 2021–2030*. Bucharest: Government of Romania. https://commission.europa.eu/document/download/75df0ac2-ecf9-4212-89ac-2a603bd43e36_en?filename=RO_FINAL%20UPDATED%20NECP%202021-2030%20%28English%29.pdf.

Interreg VI-A Romania–Bulgaria Programme (2020) *Territorial analysis of the Romanian-Bulgarian cross-border area*. Available at: https://interregviarobg.eu/assets/2020/08/200618-territorial-analysis-updated.pdf

Jowett, Patrick. 2026. "Bulgaria Installs 1.4 GW of Solar in 2025." *pv magazine*, February 2, 2026. https://www.pv-magazine.com/2026/02/02/bulgaria-installs-1-4-gw-of-solar-in-2025/.

Kairakov, D., and D. Iàcona. 2026. "Bulgaria: Accelerating the Energy Transition Through Renewables, Storage and Next-Generation Nuclear." Schoenherr. https://www.schoenherr.eu/content/bulgaria-accelerating-the-energy-transition-through-renewables-storage-and-next-generation-nuclear.

National Statistics Institute. 2026. "Gross domestic product (GDP) - regional level NUTS 2 - 2024". https://www.nsi.bg/en/announcement/gross-domestic-product-gdp-regional-level-nuts-2-8921.

Observatorul Român al Sărăciei Energetice (ORSE). 2026. *Raport ORSE 2025*. https://www.saracie-energetica.ro/wp-content/uploads/2026/03/Raport-ORSE-2025.pdf.

OffshoreWind.biz. 2025. “Romania Launches Call to Identify Offshore Wind Areas in the Black Sea.” https://www.offshorewind.biz.

Omic, Edo. 2019. *Energy Poverty in Europe: How Energy Efficiency and Renewables Can Help*. Paris: Council of Europe Development Bank.

PVknowhow.com. 2026. “Romania Solar Energy: Impressive 229 MW Project Unveiled.” https://www.pvknowhow.com/news/romania-solar-energy-impressive-229-mw-project-unveiled/.

Rezolv Energy. 2025. “St. George Solar Plant.” https://stgeorge.energy/.

Rezolv Energy. 2026. “Dama Solar.” https://rezolv.energy/ro/project/dama-solar/.

Todorović, Igor. 2025. “Solar Power Exceeds Bulgaria’s Entire Electricity Demand for First Time.” *Balkan Green Energy News*, June 25, 2025. https://balkangreenenergynews.com/solar-power-exceeds-bulgarias-entire-electricity-demand-for-first-time/.

United States Energy Association (USEA). 2025. *The Vertical Gas Corridor*. https://usea.org/sites/default/files/The%20Vertical%20Gas%20Corridor_0.pdf.

World Bank. 2023. *Romania Country Climate and Development Report*. Washington, DC: World Bank Group. https://openknowledge.worldbank.org/server/api/core/bitstreams/9693d7f2-e4b9-45c9-ac1c-ca28146e0248/content.

World Bank. 2024. “Roadmap for Romania: Building a New Offshore Wind Industry in the Black Sea.” https://www.worldbank.org/en/news/press-release/2024/09/27/roadmap-for-romania-building-a-new-offshore-wind-industry-in-the-black-sea.

World Bank, and ESMAP. 2020. *Technical Potential for Offshore Wind in Romania: Map*. Washington, DC: World Bank Group. https://documents1.worldbank.org/curated/en/141221587050442759/pdf/Technical-Potential-for-Offshore-Wind-in-Romania-Map.pdf.

Global Solar Atlas. 2026. *Global Solar Atlas 2.0: Solar Resource Data and Maps*. World Bank Group / ESMAP / Solargis. https://globalsolaratlas.info/map