

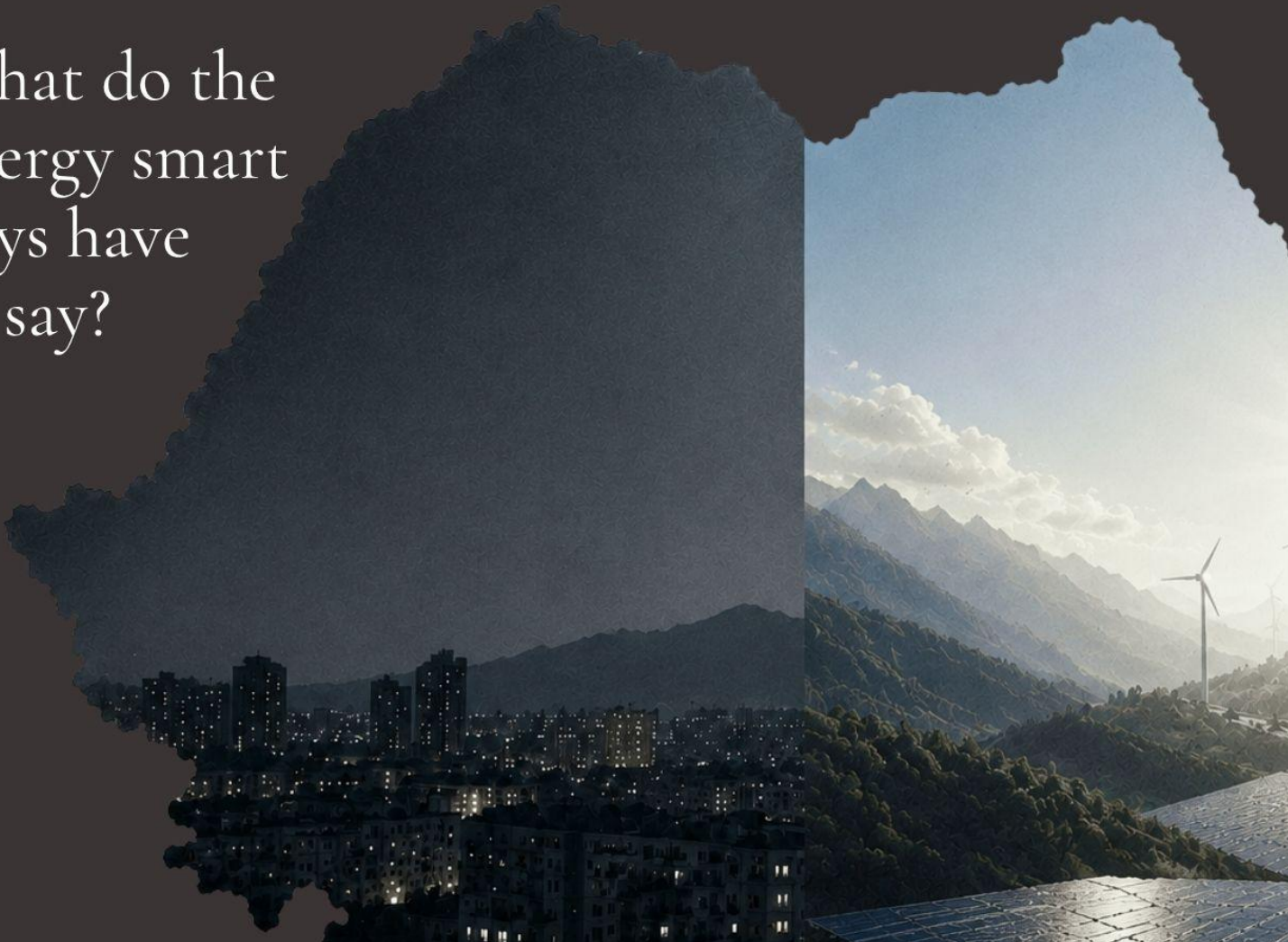
BLUE PAPER *by*

Top

September,
2026

The present is blacked-out The future is electric.

What do the
energy smart
guys have
to say?



EXECUTIVE SUMMARY

To argue that Romania may soon face a shortage of electricity demand might sound absurd. The public debate is dominated by fears of blackouts, costly energy imports and claims that misguided energy policies have pushed the country to the brink of disaster. Yet emotion is no substitute for rational policymaking. Turning energy into a battleground for political confrontation, exploiting public anxiety and reducing an entire industry to the caricature of the politically charged caricature of Romania's so-called "smart guys in energy" cannot replace either a coherent energy strategy or a strategy for economic competitiveness.

Romania is, in fact, confronting two apparently contradictory energy problems. For a few dozen, or perhaps a few hundred, hours each year, the system may run short of available capacity. During thousands of other hours, renewable generation could exceed the country's ability to absorb it. The first problem triggers alarm and sharp price spikes. The second more quietly erodes capture prices, producers' revenues and the bankability of new projects. One commands immediate attention. The other will shape the market through 2030.

"The numbers point to a wall that the public debate has yet to recognise. Romania is adding generating capacity faster than it is creating demand."

If the projects currently under construction come online, Romania will have substantially more renewable generation by 2028, enough storage to shift a significant share of the midday surplus into the evening, and additional gas-fired capacity for critical hours. But this will not automatically produce a balanced system. Batteries can move electricity from one part of the day to another. They cannot create demand, nor can they cost-effectively cover prolonged periods of weak renewable output.

New nuclear reactors cannot ease the pressures facing the system this decade, for the simple reason that they will not yet be operational. The case for them must be assessed against the architecture Romania will need after 2035. Until then, the urgent question is not what additional generating capacity the country can announce, but who will use the electricity it is already preparing to generate and what will keep the system running when sun, wind and water are all in short supply.

Much of the answer lies in electrifying the economy. Data centres, electric mobility, heating and cooling are among the largest emerging sources of demand in a modern economy. Agriculture and the food industry could follow. Fruit, vegetables and animal feed could, in effect, become part of the living battery of an electrified economy.

Cheap electricity does not have to be stored solely in batteries. It can be converted into pumped water, controlled temperatures, processed data, electric mobility or higher-value agricultural products. Greenhouses, controlled-environment agriculture, irrigation, cold storage and food processing can use electricity when the system produces it in abundance. These are not merely new sources of consumption. They are mechanisms through which surplus electricity can be converted into domestic production and economic value.

Without faster electrification across Europe, however, the advantage of cheap renewable power will not translate fully into greater competitiveness. Europe can build generating capacity, grids and batteries, but if electricity demand continues to lag behind, cheap green power risks remaining a promise rather than becoming an economic advantage.

Electricity currently accounts for only about 20% of global final energy consumption. By 2035, its share could rise to between 26 and 36 per cent, depending on the pace of the transition. This growth will not come from data centres alone. Transport, heating, cooling and industrial processes are gradually shifting energy consumption away from fuels and towards electricity.

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20%

electricity in global final consumption, today

26–36%

share estimated by 2035

For Romania, the opportunity is not simply to generate more electricity. It is to attract and develop the activities capable of turning that electricity into products, services and greater competitiveness. In a market with a growing number of hours of abundant power, the winners will not necessarily be those that generate the most, but the economies that learn to use electricity intelligently when it is plentiful and cheap. Otherwise, Romania risks building the energy infrastructure of the future for an economy that has yet to learn how to use it.

Note on units. Throughout this paper, **MW and GW** refer to power, meaning the level of generation, consumption, imports or exports at a given point in time or averaged over a specified interval. **MWh and GWh** refer to the volume of energy generated, consumed, imported, exported or stored over a period of time. For an interval of exactly one hour, the numerical figures may be identical even though the units measure different quantities. An average power level of 1 GW sustained for one hour corresponds to 1 GWh of energy.

ROMANIA WILL PRODUCE MORE ENERGY. WHO WILL CONSUME IT?

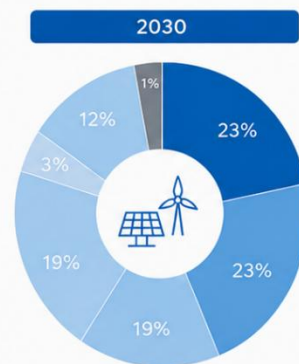
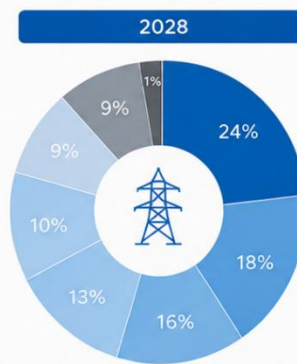
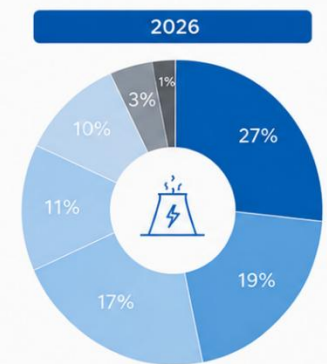
Romania has a relatively low-carbon power mix, built on hydropower, nuclear energy, natural gas, wind and, increasingly, solar. Over the coming years, sustained growth in solar and wind generation, alongside the expansion of storage, will allow more electricity to be shifted into periods of high demand. This should partly offset the temporary decline in nuclear generation between 2027 and 2029, as well as the volatility of hydropower output. Gas-fired generation will gradually decline in volume but retain an essential role in balancing the system and supplying electricity during periods of stress.

The cheaper and more abundant renewable power becomes, the more valuable flexibility will be.

Solar and wind drive down prices when they are generating, but they cannot replace the firm capacity required when they are not.

ENERGY AVAILABLE IN THE SYSTEM

Evolution 2026 – 2030



Source: Estimates TDP Partners

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CONSUMPTION AND PRODUCTION EVOLUTION

TWh (terawatt-hour) = billion kWh



PRODUCTION

2025–2030
+8.04 TWh
(+16.11%)



CONSUMPTION

2025–2030
+2.27 TWh
(+4.04%)



BALANCE

2025: -3.83 TWh
2030: +0.46 TWh
(production – consumption)



FINAL CONSUMPTION

2030: 57.42 TWh

TWh (terawatt-hour)



DIFFERENCE (Production – Consumption)	
TWh	
2025	-3.83
2026	-0.98
2027	-0.05
2028	-4.81
2029	-2.63
2030	+0.46

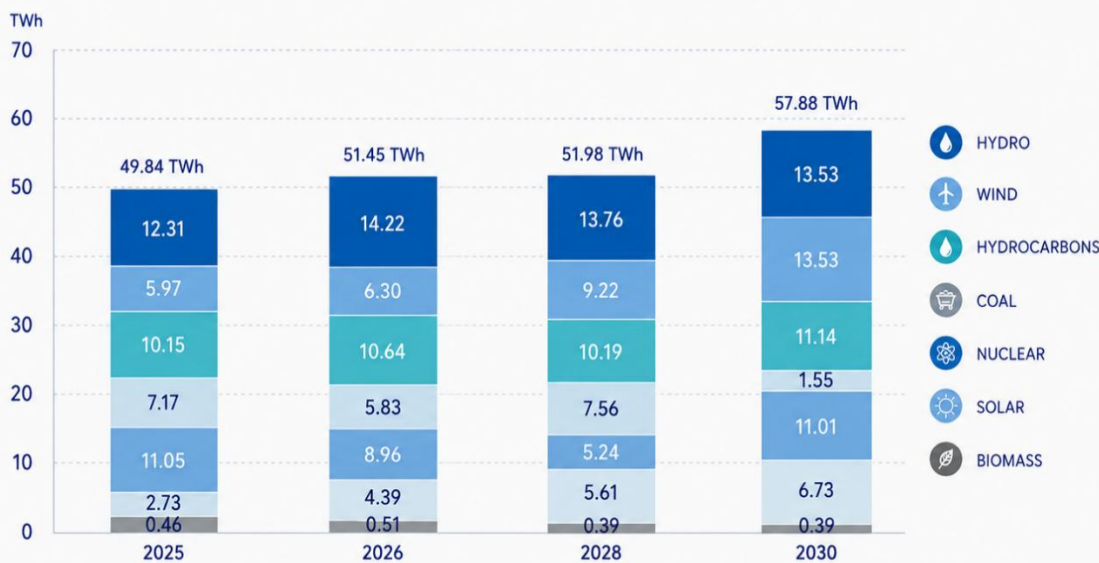
(-) = production lower than consumption
(+) = production higher than consumption

Source: Estimates TDP Partners

Note: differences of total sum due to rounding.

EVOLUTION OF PRODUCTION FROM MAIN ENERGY SOURCES

TWh (terawatt-hour) = billion kWh



CHANGES 2025 – 2030

TWh	Δ %
SOLAR 2.73 → 6.73 TWh	+146%
WIND 5.97 → 13.53 TWh	+126%
HYDRO 12.31 → 13.53 TWh	+10%
HYDROCARBONS 10.15 → 11.14 TWh	+10%
NUCLEAR 11.05 → 11.01 TWh	0%
COAL 7.17 → 1.55 TWh	-78%
BIOMASS 0.46 → 0.39 TWh	-14%



IMPORT/EXPORT BALANCE (TWh)

(+ net import / - net export)

2025: +3.83 TWh
(import)

2026: +0.98 TWh
(import)

2028: +4.81 TWh
(import)

2030: -0.46 TWh
(net export)

Source: Estimates TDP Partners

Note: differences of total sum due to rounding.

Even if the expansion of storage to **2–3 GW and 6,500 MWh by 2028**, and **4–5 GW and 11,000 MWh by 2030**, largely addresses Romania's intraday balancing challenge by shifting as much as 80 per cent of the daytime surplus into the evening, the system will still face two types of stress that batteries cannot resolve. Building enough storage to cover deficits lasting several weeks would be economically unviable.

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WHEN DO THE ENERGY SYSTEM'S CRISIS MOMENTS OCCUR?

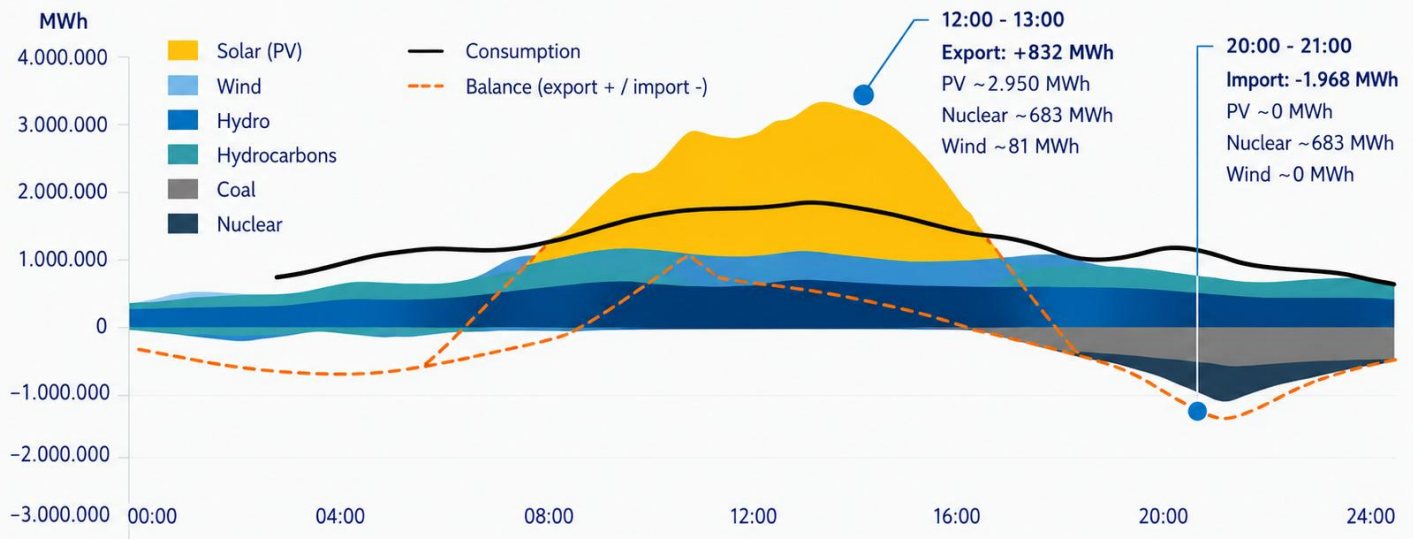
Romania does not face a permanent electricity shortage. Pressure is concentrated in a relatively small number of hours when high demand coincides with weak renewable output or outages at major generating assets. These episodes occur mainly in summer and winter, but for different reasons and with different implications for the investment the power system will require.

SUMMER

During summer, prolonged periods of extreme heat and drought create a difficult combination. Hydropower output declines, demand rises as industrial and residential cooling needs increase, and wind generation can remain weak for extended periods. If part of the nuclear fleet is also unavailable, the system can quickly lose a significant share of its firm generation. Cernavodă's two reactors have a combined capacity of about 1.4 GW, and there were periods in 2026 when both were offline simultaneously.

Summer also brings an important advantage. It is the season of peak solar generation, and Romania is already recording substantial midday surpluses. Nor is this phenomenon confined to the summer months. During one hour in April 2026, the surplus exceeded 1.6 GWh. In May, even with no nuclear generation, the system recorded a surplus of more than 700 MWh during one of the hours analysed. Surplus power is therefore no longer limited to ideal days when every source is generating simultaneously. It can emerge even when the wider system is under pressure.

Example: summer day (August 2026) – production and balance evolution (MWh)



Surplus of ~1 GW for 3–4 hours
= 3–4 GWh that needs to be stored, exported or reduced.



In the 2030 scenario (summer):

Surplus at noon ~2.7 GWh
Evening deficit ~1.8 GWh
Remaining reserve ~0.9 GWh

August 2026 illustrates how quickly the balance can shift within a single day. During the midday hour analysed, Romania exported 832 MWh even though Cernavodă generated only about 683 MWh and wind contributed just 81 MWh. Solar supplied almost 3 GWh. A few hours later, once solar generation had disappeared, Romania was importing almost 2 GWh. The swing between the two positions was approximately 2.8 GWh.

The scale of the evening imports is particularly significant because domestic flexible resources had already responded. Hydropower supplied about 1.62 GWh, gas-fired generation 1.38 GWh, coal more than 0.9 GWh and batteries almost 0.5 GWh. Even after this mobilisation, the remaining deficit was close to 2 GWh. Had Cernavodă's remaining 683 MWh also been unavailable, the import requirement would have approached 2.7 GWh.

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The summer of 2026 showed how easily the system can approach the import threshold of 3,000 MW, equivalent to 3,000 MWh over the hour analysed. With only one reactor operating, the import requirement came close to 2,000 MW. In the scenario in which both reactors were unavailable, it rose towards 2,300 MW. In the short term, the system can respond by increasing gas and coal generation, drawing on available strategic reserves and, during certain periods, benefiting from lower demand.

By 2030, the expansion of storage could alter this balance substantially. In the summer scenario, a midday surplus of about 2,700 MWh could cover an evening deficit of roughly 1,800 MWh, bringing imports close to zero and leaving approximately 900 MWh in reserve. Combined with the remaining import margin, this reserve would give the system enough room to absorb a major shock, including an outage at Cernavodă, without breaching the critical threshold.

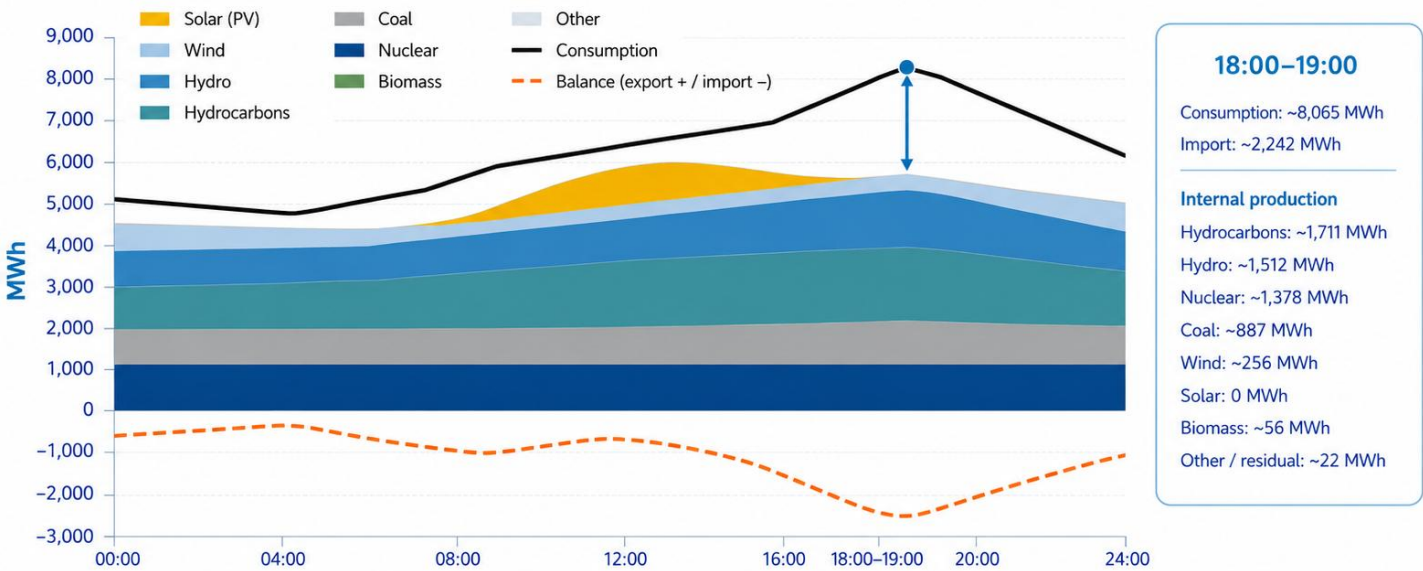
The constraint emerges when unfavourable conditions persist. Several consecutive days of low river flows, weak wind and very high demand can reduce the energy available to recharge batteries. Gas-fired generation will therefore retain a role in the system, even if it operates for progressively fewer hours as solar and storage capacity expand. The need for gas could decline substantially, but it will not disappear until Romania adds sufficient new firm generating capacity, particularly nuclear. Full analysis of the summer 2026 stress hours and the 2030 scenario is available in Appendix 1.

WINTER

Winter presents a different and, under certain conditions, more difficult challenge. Solar generation is much lower, while peak evening demand arrives after solar output has almost entirely disappeared. Wind conditions and river flows are generally more favourable than during a dry summer, but neither can be guaranteed. Several very cold, windless days can therefore leave the system facing high demand with far less renewable power available.

Example: winter evening (January 2025) – profile of a stress episode (MWh)

Illustrative intraday profile calibrated to the exact midday and 18:00–19:00 values reported in Appendix 1.



In the 2030 scenario (winter):

Surplus at noon ~0.85 GWh
(much less than in summer)



Batteries can reduce imports,
but cannot replace fossil energy
in long cold and low-wind episodes.



In the 2030 scenario (winter):

Surplus at noon ~0.85 GWh
Evening deficit ~0.66 GWh
The evening deficit can be covered from storage.

Free to grow

The winter of 2025–2026 provides a useful benchmark. During the stress hour analysed, demand reached 8.1 GW and Romania was importing about 2.24 GW. At the same time, gas-fired plants were generating roughly 1.7 GW, hydropower 1.5 GW, nuclear almost 1.4 GW and coal close to 0.9 GW. The deficit therefore emerged when much of the country’s dispatchable generation was already heavily mobilised. Nor was this an isolated event. There were 34 evening hours with a similar profile during the same month.

Electrification will intensify the pressure during precisely these hours. Heat pumps consume more electricity when temperatures are very low, while electric vehicles can add substantial demand during the evening. Data centres, by contrast, introduce a relatively constant load throughout the day. In our 2030 scenario, the three categories add about 960 MWh during the critical evening hour. Electric vehicle charging accounts for roughly 750 MWh, heat pumps for 120 MWh and data centres for 90 MWh. Applied to the system configuration observed in January 2025, this additional demand would raise the theoretical import requirement from approximately 2.24 GWh to 3.2 GWh.

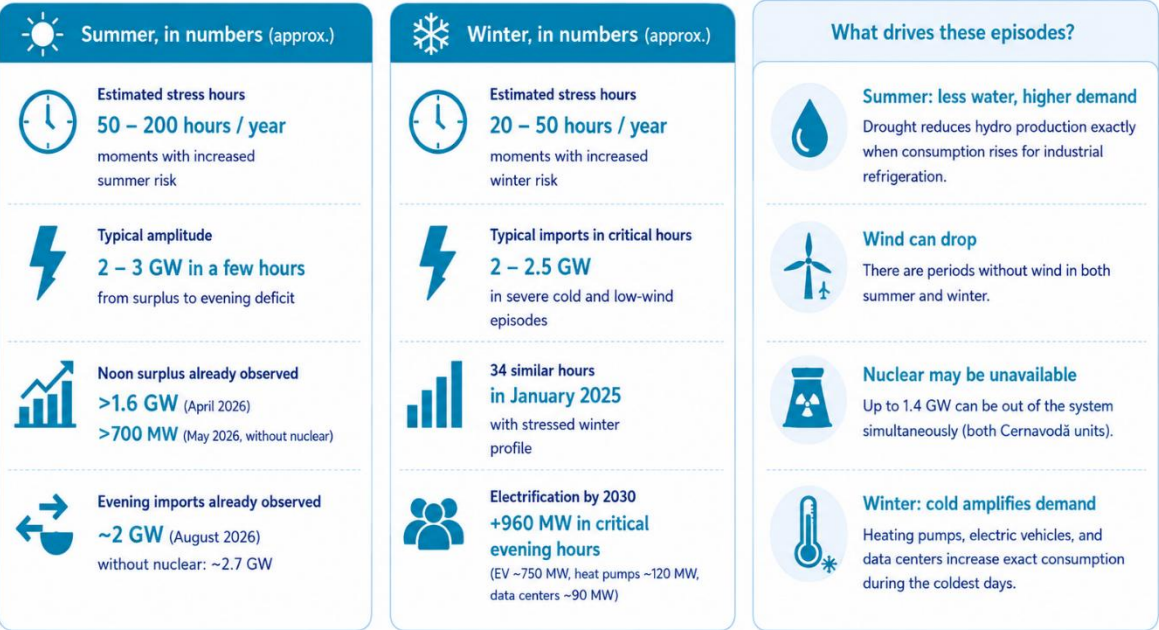
January 2025 revealed the same underlying pattern seen in summer. During the stress hour analysed, the import requirement reached approximately 2,240 MWh, close to the 3,000 MWh threshold. A similar system configuration occurred during 34 hours in January alone. By 2030, even after accounting for the additional demand from heat pumps, electric vehicles and data centres, investment in renewables and storage could reduce the evening import requirement to approximately 600–1,600 MWh, leaving a comfortable margin below the critical limit. TDP Partners’ analysis of the actual stress hours recorded in January 2025, together with the full 2030 scenario, is presented in Appendix 1.

The two seasons therefore require different responses. In summer, Romania primarily needs flexibility to shift growing volumes of solar power from midday into the evening. During the most difficult winter periods, the challenge can become one of system adequacy, meaning whether sufficient firm capacity is available regardless of weather conditions.

We currently estimate that periods of system stress could total approximately 50–200 hours during a difficult summer and 20–50 hours during winter.

Imports can generally cover these episodes, making the problem appear manageable. From an economic perspective, however, it is precisely their limited duration that makes them difficult to address.

Energy crisis moments in Romania



As renewable and battery capacity expands, conventional power plants will be called upon to generate less frequently. Yet the system may need them during the few dozen hours when renewable output is weak, batteries have insufficient energy and imports are either constrained or expensive. Their value to security of supply may therefore remain high even as the revenue they earn from selling electricity declines.

This is one of the unresolved economic challenges of the coming decade. The market primarily rewards electricity delivered, while the system also depends on capacity being available when required. Romania may have enough energy over the course of a normal year and still lack sufficient power during the hours that matter most.

WHAT HAPPENS WHEN GENERATION EXCEEDS DEMAND?

Europe has already entered a phase in which the growth of renewable generation no longer lowers prices evenly, but redistributes them across the day. In 2025, renewables supplied 50% of the European Union's electricity, while solar generation increased by a further 41 TWh. At the same time, the daily range in wholesale power prices widened to roughly five times its 2020 level. Solar compresses prices during daylight hours, but as output falls at sunset, gas-fired generation and other flexible capacity return to the market.

Negative prices occurred during approximately 6% of the year's hours in France, Germany, the Netherlands and Spain. Their frequency doubled in Spain, increased by 45% in France and rose by about 25% in Germany and the Netherlands. The trend was not uniform, however. Finland and Sweden reduced the number of negative-price hours through a combination of storage, stronger cross-border integration, more price-responsive generation and flexible demand. In Finland, the electrification of district heating increased the sector's electricity consumption from 1.5 TWh to 2.6 TWh in a single year.

Romania is beginning to experience the same dynamic. During one hour in April 2026, the system surplus exceeded 1.6 GW, while 15 hours that month reached or surpassed the same level. In May, even with no nuclear generation and weak wind output, the system still recorded a surplus of approximately 700 MW. Surpluses no longer occur only when every source is generating simultaneously. They can also emerge when significant parts of the system are already under pressure. A surplus of 1 GW sustained for three or four hours represents 3–4 GWh that must be exported, curtailed or shifted into other periods.

Overproduction is not an inevitable consequence of investing in renewable energy. It occurs when generation expands faster than the grid, storage and flexible demand. The same volume of solar capacity can erode producers' revenues in an inflexible market or supply competitively priced power to industry in a market capable of shifting demand into hours of abundant generation.

Romania's ability to absorb surplus power could increase rapidly over the coming years. In our scenario, adjusted storage capacity rises from approximately 3.4 GWh in 2026 to more than 11 GWh by 2030. Assuming an average four-hour charging window, the theoretical average charging capacity would increase from about 0.8 GWh to almost 2.8 GWh.

3.4 → 11 GWh

adjusted storage capacity, 2026 → 2030

0.8 → 2.8 GWh

theoretical hourly absorption capacity

This trend is also gradually changing battery economics. The wide spreads between midday and evening hours create today's arbitrage opportunity, but the very investments these differences attract will start to narrow them. As more and more energy is shifted between hours, the very low daytime prices and the high evening prices will tend to converge. For developers, projects directly exposed to the market must be assessed by the effective price captured by the given technology and its ratio to the market's average price, not just by a general annual forecast. A solar project can operate in a market with an apparently attractive average price while, at the same time, selling most of its output exactly in the hours with the lowest prices.

For batteries, price spreads between hours remain the principal source of value, but they cannot be treated as permanent. For lenders and investors, project quality will increasingly depend on location, the generation profile, the route-to-market strategy

Who pays for 1 GW that may be needed for only a few dozen hours a year, but must remain available for all 8,760?

and the contractual allocation of price, shape and imbalance risks. As the market matures, the question is no longer simply how much renewable electricity Romania can generate, but how much of it the system can absorb and shift without cannibalising its value.

WHY ARE WE CONFIDENT THAT GENERATION WILL INCREASE?

Confidence does not come from capacity announcements, but from the steps that connect projects directly to revenues, financing and construction. Beyond the scale of the announced pipeline, four signals suggest that a meaningful share is already advancing towards deliverable capacity.

1. The CfD mechanism

The first is the CfD mechanism, which reduces one of the most significant risks in financing renewable energy projects, namely revenue volatility. Romania's first two auctions awarded approximately 4.2 GW of wind and solar capacity under 15-year contracts, exceeding the initial target of 3.5 GW. For lenders and investors, this matters. A project backed by a CfD benefits from far greater revenue visibility and a price benchmark against which the share of generation that remains exposed to the market can also be assessed. A meaningful portion of Romania's new capacity has therefore moved beyond investment intent and into a contractual framework capable of supporting long-term financing.

2. Projects are reaching financial and administrative maturity

The second signal is the progress projects are making through permitting and financing. The distinction between holding an ATR, Romania's grid connection permit, and advancing towards full authorisation and construction is becoming increasingly important in a market where simply reserving grid capacity is no longer enough. New guarantee requirements impose a real cost on keeping projects in the development pipeline and should accelerate the separation of bankable projects from those unlikely to reach construction. We expect this process to reduce the volume of active grid connection permits by approximately 15 GW a year in both 2027 and 2028, as projects without sufficient capital or credible prospects of implementation fall out of the pipeline.

3. Projects are moving into the hands of well-capitalised investors

The third signal is the transfer of projects to investors capable of financing their construction. Transaction activity is intensifying, with approximately 5 GW of wind, standalone storage and hybrid projects currently moving through acquisition processes or being transferred to utilities and better-capitalised developers. These transactions do not guarantee that every megawatt will be built, but they increase the likelihood that mature projects will reach construction. At the same time, the growing availability of construction finance is helping to bridge the gap between project development and access to long-term funding.

4. Storage

The fourth signal is storage. Dedicated support schemes could deliver approximately 2 GWh of battery capacity co-located with renewable generation and a further 4 GWh of standalone storage. The financing market for batteries is also beginning to mature. Grants are gradually being complemented by debt and risk-sharing instruments, while lenders are paying closer attention to revenue diversification, downside protection and operating assumptions. A battery will no longer be judged solely by the returns of the standalone project, but also by its ability to strengthen the revenue profile and bankability of a wider portfolio.

Taken together, CfDs, stricter permitting and guarantee requirements, the transfer of projects to investors with the capital to build them and the expansion of storage suggest that the maturation of Romania's project pipeline is no longer merely a

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hypothesis. Not all the capacity announced will be built, and a substantial share will disappear as projects are filtered out. Yet it is precisely this process of selection that makes the remaining pipeline more credible. The nature of the risk is therefore beginning to shift.

Conclusion

Romania risks a demand crisis before a supply crisis

At the current pace of growth in generating capacity, Romania may face a demand crisis before a supply crisis by 2030. The problem will not be a shortage of energy over the course of the year, but whether demand is large and flexible enough to absorb electricity when it is available. Increasing electricity consumption must therefore become a priority for both national and European policy.

The analysis of stress hours shows, however, that this does not eliminate adequacy risks. The summer of 2026 demonstrated how easily the system can approach the 3,000 MW import threshold. With only one reactor operating, the import requirement came close to 2,000 MW. During the interval analysed with both reactors unavailable, it rose towards 2,300 MW. In the short term, the system can respond by increasing gas and coal generation, drawing on available strategic reserves and, during certain periods, benefiting from lower demand.

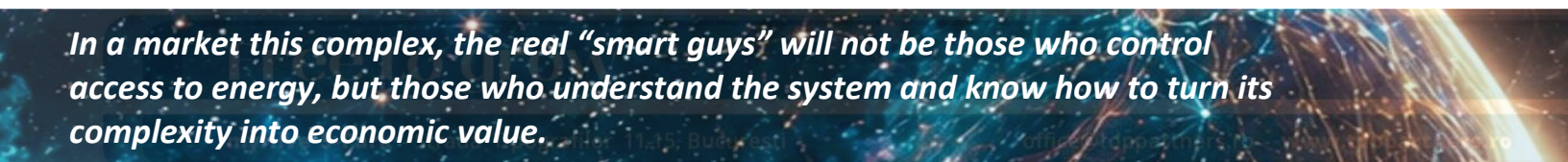
By 2030, the expansion of storage could alter this balance substantially. In the summer scenario, approximately 2,700 MWh available at midday could cover an evening deficit of about 1,800 MWh, bringing imports close to zero and leaving roughly 900 MWh in reserve. Combined with the remaining import margin, this reserve would strengthen the system's ability to withstand major generation outages.

Winter reveals the same vulnerability in a different configuration. During the stress hour analysed in January 2025, the import requirement reached approximately 2,200 MWh. A similar profile occurred during 34 evening hours in the same month. By 2030, even after accounting for the additional demand from heat pumps, electric vehicles and data centres, investment in renewables and storage could reduce the evening import requirement to about 1,600 MWh before stored energy is deployed and to approximately 600–700 MWh when the midday surplus is shifted into the peak hour. This would leave the system with a substantially larger safety margin below the critical threshold.

The two scenarios point to the same structural shift from opposite directions. Romania could simultaneously experience hours when available capacity is critically tight and others when it generates more electricity than it can absorb efficiently. The answer is therefore not simply to build more generating capacity, but to develop flexibility and demand capable of tracking the generation profile more closely.

The electrification of heating and transport, data centres, electrified greenhouses and industrial processes, together with the production of hydrogen and electricity-derived fuels, can create this demand. What matters is not only how much new consumption emerges, but also when it occurs. Demand that can be shifted into hours of abundant generation directly supports system balancing and makes productive use of electricity that would otherwise be exported at a discount or curtailed.

Romania also benefits from the diversity of its generation mix. Nuclear, hydropower, gas, wind and solar can together provide a more resilient energy base than that of many markets dependent on only one or two technologies. If the development of new industrial sectors is aligned with this generation profile, energy can become a source of competitive advantage rather than simply another commodity. This is the larger opportunity for the years ahead. At a time when industrial structures and global capital flows are being reshaped, Romania can use its available power to attract activities that require competitively priced



In a market this complex, the real “smart guys” will not be those who control access to energy, but those who understand the system and know how to turn its complexity into economic value.

electricity and can adapt their consumption to the needs of the system. Aligning the demand curve with the generation curve can achieve two objectives that have so far been treated separately. It can help balance the power system while creating new, competitive industries.

Appendix 1

TDP Partners analysis of the energy system's stress hours *Real data 2025–2026 and 2030 scenarios*

1. Stress hours and the summer scenario

Romania’s power system can be assessed against two relevant summer stress scenarios. The first could become relatively common over the coming years, with only one reactor available at Cernavodă. The second is more severe and, in theory, less frequent, with nuclear generation entirely unavailable.

The examples below are not purely theoretical constructs. They are based on actual hours of system operation in August 2026 and on observed combinations of demand, renewable generation, hydropower, gas, coal, storage and cross-border flows. This is precisely what makes them useful as benchmarks. They do not describe impossible conditions or artificially constructed extremes, but system configurations that have already occurred and could readily recur under similar circumstances.

The analysis examines how the system balance shifts from a midday surplus to an evening deficit, including during nuclear outages and periods of highly variable renewable generation.

Midday surplus vs. evening gap — one-reactor scenario

Scenario analysed: Romania, August 2026, in an actual midday hour, under a system stress scenario: Cernavodă is operating at only half capacity, and wind output is almost nonexistent. Even so, the system remains in surplus and exports energy.

Interval	Unit	Cons.	Prod.	Nuclear	Wind	Hydro	Gas	Coal	Solar	Biom.	Stor.	Export
August – midday (13:00–14:00)	MWh	5,325	6,157	683	81	633	863	788	2,948	54	43	832

Note: values are expressed in MWh, for the hourly interval indicated.

Wind generation is virtually absent at just 81 MWh, making the scenario more severe. The surplus does not occur on an exceptional day when every renewable source is producing simultaneously, but when wind contributes almost nothing. Exports of 832 MWh even exceed the 683 MWh of available nuclear generation. This is significant because it shows that, had the remaining nuclear output also been lost during that hour, the system would still have been broadly balanced, with a small surplus. In other words, neither operating Cernavodă with only one reactor nor having almost no wind generation eliminates the midday surplus.

The batteries’ observed absorption capacity remains far too limited, however, to capture this electricity and shift it into the evening. Between 13:00 and 14:00, batteries absorbed only 43 MWh from a surplus of approximately 875 MWh before storage. This represented less than 5% of the available surplus, while the remaining 832 MWh was exported. The conclusion is that a midday surplus already exists even under system stress, but Romania still lacks sufficient storage capacity to shift it into the evening. The problem is not the absence of surplus electricity, but the system’s very limited ability to move it across time.

Evening gap

Situation analysed: Romania, August 2026, in an actual evening hour, after solar output disappears. Compared to midday, the system balance shifts dramatically, the surplus vanishes and Romania reaches a significant import requirement even with half of Cernavodă operating.

Interval	Unit	Cons.	Prod.	Nuclear	Wind	Hydro	Gas	Coal	Solar	Biom.	Stor.	Import
August – evening (20:00–21:00)	MWh	7,249	5,255	683	99	1,622	1,380	921	-	57	493	1,994

The disappearance of solar generation completely reverses the system balance. At midday, solar supplied almost 2,950 MWh and the system recorded a surplus of more than 800 MWh. By the evening, once solar output had fallen away, the position had shifted to a deficit of almost 2,000 MWh. Within only a few hours, Romania moved from exporting electricity to requiring substantial imports.

The system was already responding aggressively through hydropower, gas and coal. Hydropower generation rose to 1,622 MWh, gas-fired output to 1,380 MWh and coal to 921 MWh. The import requirement of almost 2,000 MWh therefore did not emerge in a system with spare domestic capacity, but when conventional and flexible resources were already heavily mobilised.

This response has both physical and economic limits. Hydropower is constrained by water availability, particularly during droughts. Gas and coal can support the evening peak, but at higher generation costs and with additional emissions. Cernavodă therefore becomes critical to the evening balance. Even with 683 MWh of nuclear generation available, imports reached 1,994 MWh. Without that remaining output, the import requirement would have approached 2,700 MWh, leaving little room below the 3,000 MW threshold, equivalent to 3,000 MWh over one hour. Battery storage supplied 493 MWh, but was unable to shift enough of the midday surplus into the evening. A significant share of the electricity available at midday had already been exported, only for Romania to require imports again a few hours later.

The evening deficit therefore emerges even after the system has heavily mobilised hydropower, gas, coal and storage. The problem is not simply a shortage of generation at a particular moment, but the system's inability to transfer enough of the midday surplus into the evening peak.

Midday surplus vs. evening gap — no reactors available

The situation analysed represents a severe system stress scenario, in which Cernavodă is completely unavailable. This configuration is rarer than operation with a single reactor, but entirely possible and relevant for assessing the system's resilience. The values used come from actual hours in August 2026, when nuclear output was zero. The analysis tracks how the system manages the same day at two very different moments: midday, when solar can sustain a surplus, and evening, when solar output disappears and import pressure rises sharply.

Interval	Unit	Cons.	Prod.	Nuclear	Wind	Hydro	Gas	Coal	Solar	Biom.	Stor.	Imp/Exp
August – midday (12:15–13:15)	MWh	4,176	4,663	0	195	322	941	585	2,544	54	19	487
August – evening (18:58–19:58)	MWh	6,529	4,308	0	328	1,703	1,242	633	186	56	157	2,220

Even under these conditions, the system can remain in surplus at the height of daytime solar generation. This shows that the absence of nuclear power does not automatically eliminate the midday surplus.

The balance also benefits from lower demand, a plausible pattern in August, when holidays, industrial maintenance and other seasonal factors can reduce electricity consumption compared with other periods of the year. Wind generation provides

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additional support in this scenario, but cannot be treated as guaranteed. It may strengthen the balance during a particular hour, yet its variability means the system must remain resilient under conditions of much weaker output.

Hydropower is also deliberately conserved during the day, preserving water in reservoirs for the evening, when solar generation disappears and the need for flexible output rises sharply. Most of the remaining operating reserve comes from coal generation, which can be increased if the system balance deteriorates. Even so, the scenario shows that the system is already operating relatively close to the import threshold considered critical. This leaves only a limited margin if several additional problems occur at the same time.

Theoretical surplus

The analysis compares two actual hours from spring 2026 under markedly different system conditions. April represents a relatively favourable period for generation, while May captures a stress scenario in which Cernavodă was entirely offline. In both cases, however, the system still recorded a surplus.

Interval	No. hours	Unit	Cons.	Prod.	Nuclear	Wind	Hydro	Gas	Coal	Solar	Biom.	Export
April – 13:00–14:00	15	MWh	5,133	6,737	1,396	400	744	1,356	1,344	1,444	46	1,604
May – 13:00–14:00	37	MWh	4,177	4,909	-	296	999	585	494	2,468	42	732

April shows the scale that system surpluses can already reach. During the hour analysed, generation totalled approximately 6,737 MWh against demand of about 5,133 MWh, producing a surplus of roughly 1,604 MWh. There were 15 hours in April when the surplus reached or exceeded this level. Yet this was not simply the result of unusually favourable conditions. May 2026 provides a more revealing test of system resilience. Cernavodă was producing no electricity, while wind generation contributed only 296 MWh during the hour analysed. Even so, total generation reached 4,909 MWh, exceeding demand of 4,177 MWh and leaving a surplus of approximately 732 MWh.

This materially changes the case for storage. Surpluses are not limited to exceptional periods when every source is generating simultaneously. They also emerge when the system is under pressure, including when nuclear generation is entirely unavailable. Romania's hourly surplus can already exceed 1,600 MWh. Even if this is not treated as a permanent level, a surplus of about 1,000 MWh sustained over several consecutive hours is entirely plausible.

If such a surplus persists for three or four hours, between 3,000 and 4,000 MWh must either be exported or stored. Allowing for a reasonable operating reserve, a storage requirement of about 5,000 MWh already appears closer to a baseline need than a distant scenario. The April and May data therefore show that Romania already has a physical need for storage. April demonstrates how large the surplus can become. May shows that it can persist even under system stress and without Cernavodă. The question is not whether Romania will have electricity available to store, but how quickly it can build the capacity required to absorb and shift these surpluses.

Available batteries

The table shows the theoretical absorption capacity of batteries, based on an estimated average 4-hour daytime surplus window.

Indicator	Unit	2024	2025	2026	2027	2028	2029	2030
Total adjusted capacity – availability	MWh	19	1,711	3,371	4,998	6,592	9,000	11,358
Available hours, August	Hours	4	4	4	4	4	4	4

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Indicator	Unit	2024	2025	2026	2027	2028	2029	2030
Theoretical average absorption power	MW	4	427	842	1,249	1,648	2,250	2,839

This analysis should be read as an indicative estimate rather than a precise forecast. The four-hour window is an average assumption used for the scenario, not a fixed rule governing system operation. The table therefore does not show how much electricity batteries will charge on any given day, but how much they could absorb on average if the surplus persisted for about four hours and the entire storage fleet were available for charging.

The central point is that as total storage capacity expands, so does the system's theoretical ability to capture midday surpluses and shift them into other periods of the day.

Forecasts – 2030 (summer scenario)

The table presents the estimated scenario for a summer day in 2030, comparing midday (13:00–14:00), when solar output is very high and the system reaches a surplus, with evening (20:00–21:00), when solar output disappears and the system swings into deficit. Coal has almost disappeared from the generation mix, leaving the system dependent primarily on nuclear, hydropower, gas, wind and solar. This makes flexibility considerably more important.

Interval	Unit	Cons.	Prod.	Nuclear	Wind	Hydro	Gas	Coal	Solar	Biom.	Imp/Exp	Stor.
August – midday (13:00–14:00)	MWh	6,143	7,475	1,252	933	1,053	1,098	164	4,339	36	(2,736)	2,736
August – evening (20:00–21:00)	MWh	7,291	5,466	1,257	1,056	1,654	1,281	182	-	38	1,824	(1,824)

In the base case, the system produces a midday surplus of approximately 2,700 MWh that is available for storage. Even without Cernavodă, it would remain in surplus, although at a lower level. By the evening, the position reverses. Even under relatively favourable conditions, with wind contributing more than 1,000 MWh and hydropower more than 1,600 MWh, the loss of Cernavodă would once again push the import requirement towards the critical threshold of 3,000 MW, equivalent to 3,000 MWh over the hour.

Batteries fundamentally alter this balance. Approximately 2,700 MWh can be stored at midday, while only about 1,800 MWh is needed to cover the evening deficit. In the base scenario, this would reduce imports to zero and leave around 900 MWh in reserve. That reserve could almost entirely offset the loss of wind generation assumed in the evening scenario. Even if Cernavodă were also unavailable, the system could accommodate an additional 1,200 MWh of imports to replace the lost nuclear output while remaining below the 3,000 MWh limit.

In the base 2030 scenario, storage therefore does more than reduce imports. It effectively creates a system reserve. Surplus electricity generated at midday can eliminate the evening import requirement while preserving enough flexibility to absorb additional shocks, including weak wind generation, a nuclear outage or fluctuations in demand.

2. Stress hours / winter scenario

Scenario analysed: January 2025, one of the periods of maximum stress for the system, characterised by high consumption, low solar contribution, and heavy dependence on dispatchable sources. The evening hour presented is not an isolated peak: during January there are 34 evening hours with a similar balance structure, indicating a recurring operating pattern rather than an exceptional situation.

Period	Similar hours	Unit	Cons.	Prod.	Hydro	Wind	Gas	Coal	Nuclear	Solar	Biom.	Imp/Exp
January 2025 midday	62	MWh	6,603	6,031	1,068	348	1,580	790	1,335	838	58	570
January 2025 evening	34	MWh	8,065	5,822	1,511	256	1,710	886	1,378	-	56	2,241

The hour analysed represents a point of maximum system stress, with imports exceeding 2,200 MW, already close to the 3,000 MW threshold and leaving a relatively narrow safety margin. Domestic dispatchable generation is heavily mobilised. Hydropower is producing about 1,500 MW and gas-fired plants more than 1,700 MW, alongside substantial contributions from nuclear and coal.

Storage cannot provide meaningful relief under this winter profile because there is no daytime generation surplus available to charge batteries for the evening peak. The underlying problem is the limited contribution from renewables under these conditions. Wind is one of the few variables that could improve the balance naturally, but at only about 250 MW its contribution remains modest. During such periods, the system cannot afford to lose a major source such as Cernavodă or suffer a significant reduction in hydropower availability. Coal remains critical to security of supply and cannot be phased down rapidly without increasing system risk.

The evening peak is the point of maximum stress for the winter system, combining high demand, weak wind generation, heavily mobilised conventional and hydropower capacity, and an import requirement exceeding 2.2 GW. Under this configuration, security of supply depends on the simultaneous availability of domestic generation and imports.

Forecasts for the winter scenario

The consumption forecast for the winter scenario starts from the stress hour observed in January 2025 and adds only a few additional sources of consumption, in a relatively conservative scenario: heat pumps, data centres, and electric vehicles.

Category	Unit	2030 – midday hour	2030 – evening hour
Heat pumps – additional power	MW	150	150
Heat pumps – simultaneous utilisation rate	%	60%	80%
Heat pumps – simultaneous requirement	MW	90	120
Data centres – additional power	MW	100	100
Data centres – simultaneous utilisation rate	%	90%	90%
Data centres – simultaneous requirement	MW	90	90
New electric vehicles	no.	150,000	150,000
Charging power / vehicle	kW	50	50
Theoretical total EV charging power	MW	7,500	7,500
Electric vehicles – simultaneous charging in the stress hour	%	8%	10%
Electric vehicles – simultaneous requirement	MW	600	750
TOTAL SIMULTANEOUS REQUIREMENT	MW	780	960

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Category	Unit	2030 – midday hour	2030 – evening hour
TOTAL SIMULTANEOUS REQUIREMENT – ONE HOUR	MWh	780	960

The increase in demand is gradual rather than extreme. In the scenario presented, the three categories add approximately 780 MWh during daytime hours and 960 MWh in the evening, precisely when the system is under the greatest pressure. Electric mobility accounts for the largest share. Even if only 10% of new electric vehicles charge simultaneously during the critical hour, the additional demand reaches about 750 MWh. Heat pumps contribute a further 120 MWh and data centres another 90 MWh.

Applied to the system configuration observed in January 2025, this increase would be sufficient to push the import requirement beyond the 3,000 MWh threshold. The hour analysed already recorded a deficit of approximately 2,242 MWh. Adding the 960 MWh assumed in the 2030 scenario would raise the theoretical import requirement to about 3,200 MWh if the generation mix remained broadly unchanged.

This is the particular challenge of winter. Stress occurs during the evening, when solar no longer contributes and the system cannot draw on the large midday surplus characteristic of summer. Under a reasonable demand scenario with no extreme assumptions, the January stress hour could require almost 1,000 MW of additional power by 2030. Unless available generation increases accordingly, storage and other sources of flexibility will be needed to prevent the evening deficit from exceeding the system's safe import capacity.

Forecasts – 2030 (winter scenario)

Scenario analysed: The 2030 outlook is based on the winter system profile and incorporates assumptions for demand growth and additional investment in solar, wind and storage capacity. The table shows how the power balance could change over the course of a winter day in 2030, both at midday, when new renewable capacity can generate a surplus, and in the evening, when solar output disappears while demand remains high.

Interval	Unit	Cons.	Prod.	Hydro	Wind	Gas	Coal	Nuclear	Solar	Biom.	Imp/Exp	Stor.
January 2030 midday	MWh	7,383	8,336	1,651	1,930	1,814	182	1,351	1,356	49	(953)	953
January 2030 evening	MWh	9,025	7,384	1,757	2,139	1,871	190	1,363	0	51	1,641	953

Additional wind and solar investment transforms the midday balance. In the 2030 scenario, renewable generation is high enough to move the system from deficit into surplus and allow a substantial reduction in coal-fired output, even as demand rises in line with the assumptions outlined above. The result is a midday surplus of almost 1,000 MWh. Under reasonable operating assumptions, this electricity could be stored and deployed during the evening, providing the system with an additional margin of flexibility.

The stress hour

During the hour of maximum stress, pressure on the system declines despite demand rising in line with the forecast. The import requirement falls to approximately 1,600 MW, well below the critical level observed in the 2025 scenario. The margin below the 3,000 MW import threshold increases from about 800 MW in 2025 to roughly 1,400 MW in 2030. Deploying the almost 1,000 MWh stored at midday could reduce the effective evening import requirement further, to approximately 600 MW. This lower dependence on imports creates meaningful operational flexibility.

With only about 600 MW required from neighbouring markets, the system can conserve gas-fired generation and water held in reservoirs, preserving these resources for more difficult periods. The additional reserve would also improve Romania's ability to withstand a nuclear outage without the system immediately coming under severe pressure.

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