Ukraine's Energy Security 2026

Pre-winter assessment 2026-2027



International Energy Agency

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Key findings

As Ukraine enters its fifth winter since Russia's full-scale invasion, the country has worked to strengthen resilience, invest in passive protection measures for critical energy infrastructure and expand distributed energy resources, but the threat has grown faster. Russia's drone technology and attack patterns have also continued to evolve, presenting an ever-growing threat to Ukraine's energy system at a time when interception rates have declined. Ukraine's system is better equipped than it was going into last winter, but more advanced jet-powered drones have already begun to erode the summer's repair efforts. Air defence remains essential for maintaining the energy system.

Last winter confirmed the value of electricity imports and decentralisation, but neither was used to its full potential. Imports from Europe and decentralised supply have been two of Ukraine's main strategies to keep the lights on since the full-scale invasion. Imports covered a growing share of the deficit, and local cogeneration and boiler houses kept heat and water running, where they were deployed. Yet, connecting delivered equipment has often taken months, and few local generation units or batteries can operate in island mode when the grid is cut.

Since last winter, Ukraine has added around 0.4 GW of distributed gas-fired generation and more battery storage, and set up a strategic reserve of energy equipment, while its repair crews have gained another winter of experience. Repairs, however, remain constrained by a shortage of replacement equipment. Meanwhile, Ukraine's gas storage is at a six-year high going into the winter, despite repeated attacks on production.

Ukraine has learned from the past four winters, but significant risks remain:

- **Russia has begun using faster, jet-powered drone models** that have already weakened generation, networks, gas and fuel supply before the heating season.
- **Large-scale attacks on industry over the summer have lowered Ukraine's electricity demand but they are also reducing the flexibility of the system to manage winter peaks**. Industrial load was the first to be curtailed in shortages. A cold spell or damage to district heating could push evening peaks up again.
- **Power shortages are likely this winter, and their depth will depend on attacks and weather patterns**. Imports from Europe remain vital, but the import limit of 2 450 MW for the Ukraine-Moldova block cannot close the gap. Internal bottlenecks leave the eastern regions most exposed.

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The measures most likely to make a difference this winter rely on assets already in Ukraine. Connecting delivered equipment adds capacity within weeks. Letting batteries and consumers reduce the evening peak relieves pressure during the scarcest hours. Keeping district heating running prevents households from turning to electric heaters and aggravating the electricity gap. Co-ordination between cities lets crews and reserves move to where an attack hits.

Equipment for winter 2027-2028 must be secured now. Critical equipment such as small cogeneration units and substation equipment takes six to nine months to deliver. Pooled procurement and the establishment of pan-European strategic stocks of equipment and spare parts could shift preparation from reactive to proactive ahead of next winter.

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Lessons from winter 2025-2026

Large plants and grid bottlenecks remain weak points for the system

Last winter, Russian Federation (hereafter: Russia) strikes damaged or destroyed 8.5 GW of generation, leaving about 11.5 GW of dispatchable domestic capacity in January against peak demand of around 18 GW. The shortfall forced rolling outages across the country: average daily outages for households reached almost 12 hours on 8 February, before falling below two hours by early March.

Damage to the grid was often as disruptive as damage to generation assets. Strikes on high-voltage transmission substations cut supply to large areas even where generation was available: after the attack of 9 January, more than 500 000 consumers in Kyiv lost power. Within Ukraine, limited transmission capacity from the west, which had spare generation, to the east, where shortages were deepest, meant that national adequacy did not guarantee supply to consumers. Large combined heat and power plants (CHPs) proved doubly exposed, since each strike removed both electricity and heat for an entire city.

Electricity outages quickly cascaded across essential services

Electricity underpins every other service: heating and water supply depend on electric pumps and controls, and mobile and internet networks on power-based stations. In Kyiv in January and February, electricity demand exceeded the capacity available to supply the city by an estimated 35-45%. When strikes cut power to pumping stations, water pressure collapsed: after the attack of 20 January, the whole left bank (roughly 3 500 residential buildings) of the Dnipro river lost water supply. Where heating networks could not be drained in time, pipes froze and burst, damage that restoring power could not reverse. Keeping heat, water and communications running is therefore as important as restoring electricity.

Decentralised heat has proved its value where deployed

With over 30% of Ukrainian households reliant on district heating, the sector remains a deliberate target for Russian attacks. Attacks on district heating infrastructure have ramped up over the past two winters, with cities such as Kyiv, Kharkiv and Odesa as major targets. Decentralisation, with a larger number of smaller cogeneration units and modular boiler houses connected to district heating networks, remains a key pillar of local resilience plans. These units can also keep key municipal infrastructure running as "energy islands". In large cities, however,

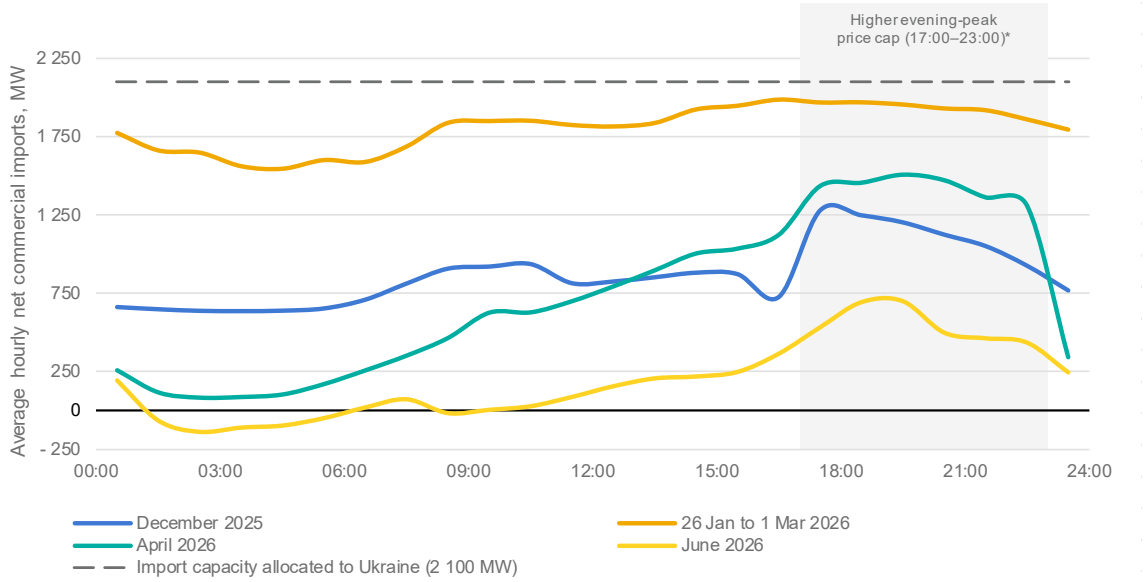
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integrating them requires more connections to the gas pipeline network and other network changes, which can make projects longer and more expensive. Last winter, cities that moved early to local heat generation fared better. Kharkiv shifted a large part of its heat supply to small cogeneration units and boiler houses, which kept residents warm despite repeated strikes. Kyiv still relies heavily on three large CHPs that supply 47% of its heat capacity. Russian attacks on 9 January left roughly 50% of Kyiv's apartment buildings without heating and restoration was uneven, with 15% still disconnected as late as 25 January.

Electricity interconnections filled part of the gap once market rules facilitated trading

Ukraine's interconnection with Europe proved vital again last winter, and market rules enabled better use of available capacity. The import limit for the Ukraine and Moldova block was raised to 2 450 MW in January 2026, with 2 100 MW allocated to Ukraine. Since 2023, an ENTSO-E agreement has allowed system operators across Continental Europe, beyond Ukraine's direct neighbours, to provide emergency assistance. Between late January and early March, imports averaged 1 800 MW. In the evening, when demand peaked, the allocated capacity was almost fully used: imports reached at least 95% of it in about two-thirds of the hours between 16:00 and 20:00. Some capacity remained unused at night.

Average net electricity imports of Ukraine by hour of day, December 2025 to June 2026



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Notes: Wholesale price caps were higher in the evening peak until 16 January and again in April. Caps were uniform across all hours from 17 January to 30 March, and since 1 May. Hours are set to Kyiv time.

Source: IEA analysis based on data from EnergyMap hourly import and export dataset; the National Energy and Utilities Regulatory Commission of Ukraine (NEURC) and the European Network of Transmission System Operators for Electricity (ENTSO-E).

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Month-ahead capacity auctions on interconnectors, in place since December 2025, let traders secure imports earlier and at lower and more predictable prices than in the day-ahead market alone; in January, requests exceeded the capacity on offer more than tenfold. Wholesale price caps in Ukraine, which limit the ability of prices to signal scarcity and attract imports, shaped how interconnectors were used.

NEURC sets maximum prices on the day-ahead, intraday and balancing markets. When prices in neighbouring EU markets rise above the Ukrainian cap, traders cannot import without incurring a loss. Until mid-January, caps were highest in the evening peak, so imports were concentrated in those hours. From 17 January, caps were set at the evening-peak level in all hours and state companies were required to import, and imports rose to close to the allocated capacity for several weeks. The measure increased supply but also raised costs for suppliers serving households and was introduced at short notice.

Price caps were made uniform throughout the day in May 2026 and are due to be abolished in May 2027. Until caps are abolished, their level should be reviewed against prices in neighbouring markets during scarcity, so that they protect consumers against extreme prices without blocking imports.

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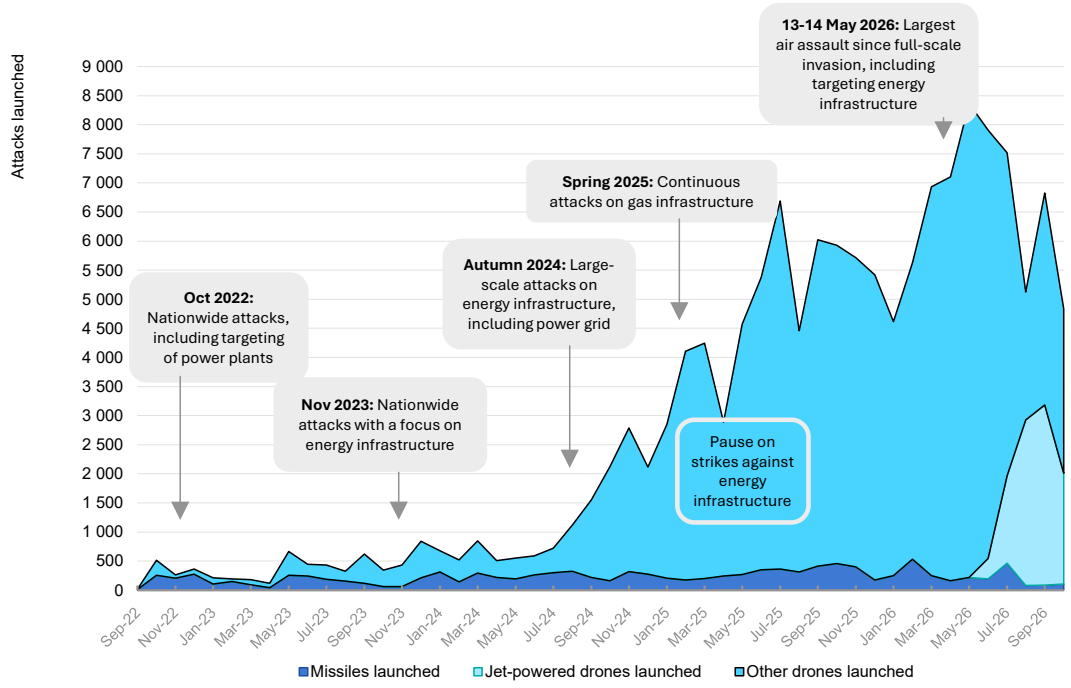
What has changed since last winter

Russia has stepped up its attacks with new drone technology

Russia continues to attack Ukraine's energy system with the aim of causing maximum damage. Strikes continued through the spring and summer, including the largest aerial attack of the war on 13-14 May 2026, with 1 567 drones and 56 missiles, and repeated strikes on generation, transmission and gas facilities. Over the summer, Russia began to scale up the production and deployment of new jet-powered drone models, from 350 launches in June to more than 3 100 in September. The Geran-4 and 5 models, which can reach speeds of up to 600 km/h, have been harder and more costly to intercept than earlier models, reducing interception rates from 90% to roughly 50-60%.

The pattern of attacks suggests that Russia is once again seeking to split Ukraine's power system by damaging key substations and transmission corridors and separating generation-rich areas in the west from regions in the east facing the greatest shortages. Air defence remains the most effective protection for energy infrastructure, and continued support from partners is essential.

Monthly Russian attacks on Ukraine per weapon type, 2022-2026



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Source: IEA analysis based on data from kaggle (2026), Massive Missile Attacks on Ukraine, compiled by Petro Ivaniuk, accessed Oct 2026 and publicly available statements on drone and missile attacks, including by the Ukrainian Ministry of Defence and the Ukrainian government.

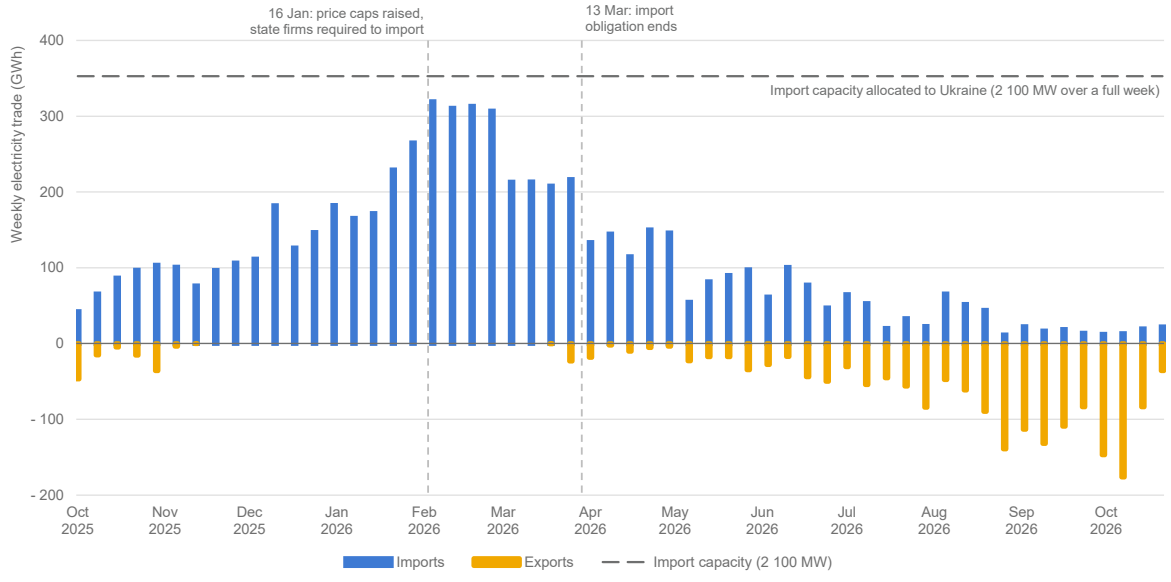
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Ukraine's energy system has strengthened, but remains under strain

Ukraine was a net electricity exporter over the summer, but import capacity remains unchanged for the winter

Since the spring, the balance has reversed. Imports fell steadily after March, and Ukraine was a net exporter from late June. Higher solar output, lower industrial demand and restored generation explain the surplus, which went mainly to Hungary and Moldova. Even so, Ukraine still imported up to 0.7 GW in the evening in June, a reminder that an average surplus does not mean the system can cover its own evening peak. The import/export balance follows a seasonal pattern, since solar output is highest and demand lowest in summer: Ukraine was also a net exporter in summer 2025, before returning to imports in the autumn. It is not guaranteed, however, as in 2024 the damage from spring attacks kept Ukraine importing throughout the summer. Since mid-October, renewed attacks have sharply reduced exports while imports have risen again.

Ukraine's weekly commercial imports and exports, October 2025 to October 2026



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Source: IEA analysis based on data from DiXi Group, EnergyMap (2026).

Electricity import capacity has not changed since January and remains insufficient to close the gap, particularly in the east. Further gains can come only from using existing infrastructure more intensively, for example through dynamic line ratings,

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and from market mechanisms. New cross-border lines will not add capacity before the end of 2028, when a 400 kV line between Ukraine and Romania is planned, and the reconstruction of the line to Slovakia is planned for 2030.

Ukraine now has a larger, but still insufficient, fleet of distributed and flexible resources

Ukraine has added distributed gas generation, batteries and wind capacity since last winter. These resources are less exposed to attack than large plants and can be deployed within months. Battery imports rose almost fourfold between January and May 2026, and a further 530 MW of distributed gas generation is under construction.

Deployment of distributed resources in Ukraine, 2025 to 2026

Resource	2025	Latest update (September 2026)
Distributed gas-fired generation	1.4 GW	1.8 GW
Utility-scale battery storage	0.5 GW/1 GWh	>0.6 GW/1.2 GWh
Behind-the-meter storage	0.45 GW/1.8 GWh	>0.45 GW/1.8 GWh
Solar	8.3 GW	9.4 GW
Wind	1.3 GW	1.7 GW

Note: Solar includes both utility-scale and rooftop solar.

Sources: IEA analysis based on data from IEA (2025) Database Renewable Energy Progress Tracker, and DiXi Group, collected from the Ukrainian Ministry of Energy of Ukraine, the Solar Energy Association of Ukraine, Ukrenergo, and the Ukrainian Wind Energy Association.

Grid connection has lagged behind delivery, although some progress has been made since the spring. Since 2024, grid operators have approved connection requests for nearly 6.8 GW of new generation, but only about 1.6 GW has been connected and put into operation, and a media investigation in March 2026 found that over 40% of donated cogeneration units were still sitting idle. Since then, connection rules have been simplified considerably, so the remaining obstacles are mostly practical: the cost of civil and electrical works, missing gas connections, a lack of specialists and, once units run, the cost of gas, delayed payments and the lack of a route to sell their output. Donor support usually covers delivery, while Ukrainian utilities and municipalities install the equipment so that they own, operate and maintain it themselves. The government funded the connection of 75 cogeneration units, and the new Ukraine Energy Installation Facility, set up with the United Nations Development Programme, finances the final steps of installation and commissioning.

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While decentralisation is having an impact on system balance, there is a missed opportunity to keep critical services running during widespread outages. Few of the distributed solar plants and batteries can yet operate in island mode: most inverters follow the grid and disconnect when it is lost, and distribution operators have little incentive to invest in networks able to form islands.

The Ukrainian government has also prepared the district heating sector for further attacks, after significant damage two winters in a row. These preparations were tested early: on 13 October, Russia struck all three of Kyiv's large CHPs, which supply 47% of the city's heat capacity. Backup generators, cogeneration units and mobile boilers kept the system running, but they cannot fully replace the large plants once winter temperatures set in, particularly where local heat sources are not yet connected to the gas distribution network.

Consistent equipment supply chains remain an issue

Critical equipment such as transformers, gas turbines and cogeneration units takes six to nine months to deliver, and competition from data centre projects, particularly in the United States, has tightened supply. Ukraine also depends heavily on a limited number of suppliers: over 92% of imported transformers and 88% of batteries in early 2026 came from the People's Republic of China. Partners have helped through the Energy Community's Ukraine Energy Support Fund, which delivered 380 transformers and 75 MW of gas turbines over the summer, and through a new strategic reserve of energy equipment set up in March 2026 within the Ukraine Energy Support Fund. However, a significant funding gap remains. As of August 2026, Ukraine still lacked EUR 650 million needed to prepare its energy sector for the upcoming heating season.

Regional resilience plans are empowering cities and regions, but implementation delays present a risk

Regional energy resilience plans have given cities and regions their own means to protect critical services. The plans finance protection, backup power and distributed generation, with UAH 40 billion (Ukrainian hryvnia)[1] in the 2026 budget, and around 40% of planned measures had been implemented, by June. However, implementation rates vary across regions. Governance, bureaucratic delays and financing remain significant issues. Plans set out lists of investments but are not binding. When failures cascade across power, heat and water, no single body has the mandate to allocate scarce resources such as fuel, generators and repair crews between sectors.

[1] Exchange rate: 1 Ukrainian hryvnia (UAH) = EUR 0.0196 = USD 0.0220 (as of 3 November 2026)..

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The next step is to link these plans with each other and with the operation of the national system. Neighbouring cities depend on the same networks, repair crews and equipment reserves, and a shared view of priorities would allow these resources to be moved quickly to where an attack has hit hardest.

Russia has continued to attack oil depots, and has also begun to target filling stations

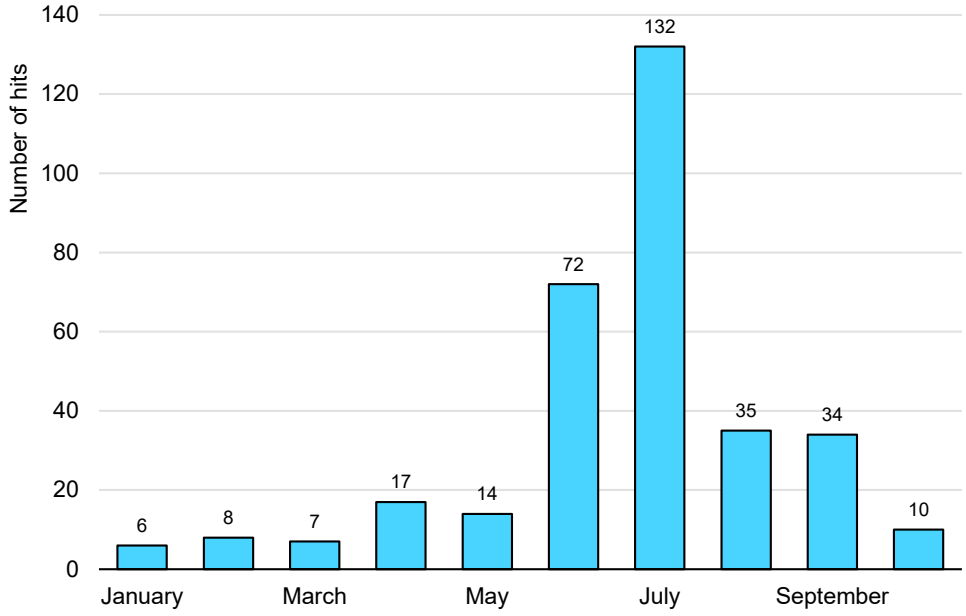
Ukraine's oil sector has been a target for Russian attacks since the very beginning of the full-scale invasion in 2022. Russia has systematically attacked oil refineries and oil depots, but attacks on filling stations were fairly sporadic throughout 2022-2025. Russia has carried out 43 attacks on oil depots since 2022, with over 50% (23 depots) hit in 2026. However, in the spring of 2026, Russia began ramping up its targeting of civilian filling stations, in what is largely seen as a tit-for-tat response to Ukraine's ongoing campaign against Russian oil infrastructure, with a particular focus on oil refineries.

The attacks had largely been focused on Ukraine's frontline regions, particularly on major roads linking cities and towns, using a mix of Shahed drones and missiles, but starting in late July, Russia began to send its newer Geran drones to targets as far west as the Rivne, Zhytomyr and Khmelnitsky oblasts, as well as Kyiv.

Over the summer, Russia continued to intensify its attacks on filling stations, with the total number of attacks in June-August reaching almost 240, in contrast with just over 50 recorded in January-May, according to open-source tracking from the Centre for Information Resilience. Attacks have continued into the autumn months, with the total number of filling stations destroyed or damaged in 2026 reaching roughly 330.

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Monthly Russian hits on Ukrainian filling stations in 2026



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Source: IEA analysis based on data from Centre for Information Resilience (2026), Eyes on Russia Map, data accessed on 23 October 2026.

In response, filling stations have introduced passive protection measures, including anti-drone netting and sandbags, and some are even installing concrete shelters. With filling stations a key supplier of motor fuel not only for transport but also for the growing number of generators in Ukraine, fuel companies are working to repair and rebuild as quickly as possible to make sure that access continues, but in some regions they are limiting opening hours, turning off outside lighting as a protection measure, and prohibiting refuelling during air-raid alerts.

Ukraine's gas storage levels have reached a six-year high, but attacks on gas production continue

Ukraine's natural gas sector remains a major target for Russian attacks. The number of attacks has increased substantially in 2026, with Naftogaz facilities attacked more than 400 times by mid-October, in contrast with a full-year total of 229 in 2025.

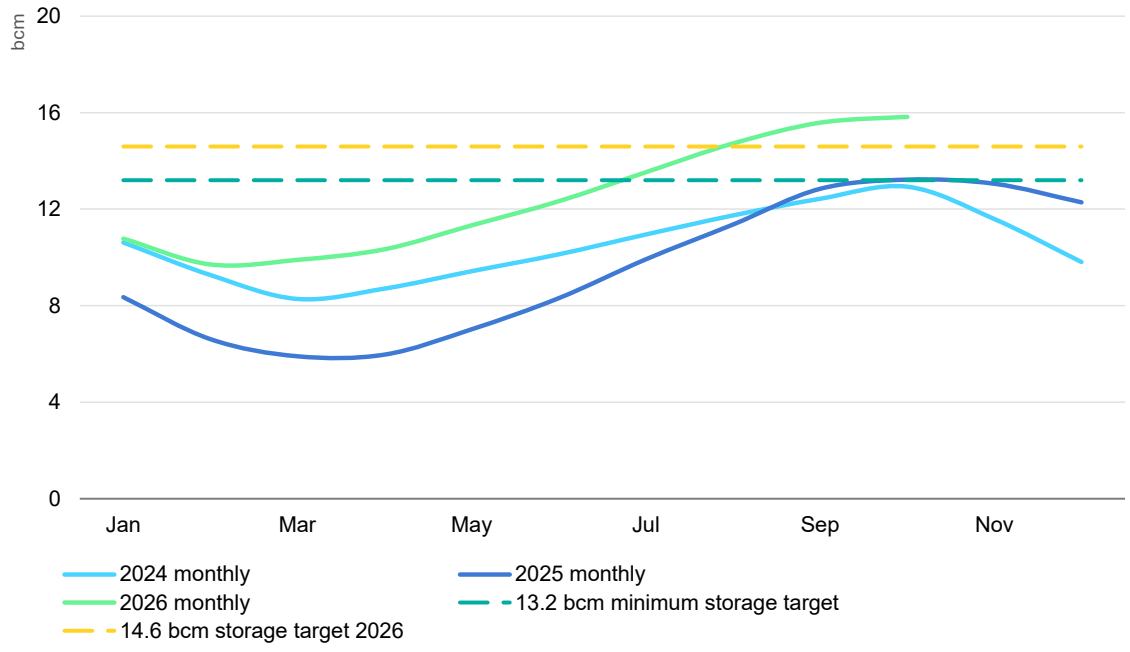
However, Ukraine's 2026 gas production appears to have been more resilient than in 2025, when attacks in the first quarter forced temporary production shutdowns and a need for higher gas imports to cover demand. Despite ongoing attacks, Ukraine only imported 400 million cubic metres (mcm) of natural gas over the summer, a significant drop from the 4.6 bcm that was imported throughout the summer of 2025.

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As a result, the bulk of Ukraine's gas in storage is domestically produced. Ukraine also reached its planned storage target of 14.6 bcm ahead of this winter on 28 August, weeks earlier than their 13.2 bcm target in 2025, having been injecting at a minimum rate of 38 mcm per day since May. By mid-October 2026, Naftogaz announced that it had accumulated Ukraine's largest gas reserves in six years ahead of winter, reaching 16 bcm.

On 7 October, the Ukrainian government passed a resolution allowing privately held gas producers to export 15% of their monthly gas output between 1 March and 30 November. Naftogaz and its subsidiaries remained banned from exporting natural gas. The move was a direct response to the August and September Russian attacks on Ukraine's steel sector, which affected over 90% of Ukraine's steel production. The ensuing loss of demand has given the government room to relax its export restrictions and generate revenues that can help repair and protect production facilities that are regularly targeted by Russia. Naftogaz estimates that total natural gas demand for 2026 will fall to roughly 20 bcm, from 21 bcm in 2025.

Gas storage levels reached ahead of the heating season by Ukraine, 2024-2026



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Notes: Including 5.1 bcm cushion gas in storage.
Source: IEA analysis based on data from AGSI(2026), Gas Infrastructure Europe.

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Power system outlook for winter 2026-2027

Ukraine may have sufficient generation and import availability to cover demand under mild temperature conditions, but the system has little operational margin

2026 saw a drop in industrial consumption, which was down by 23% year-on-year in August 2026, due to large-scale Russian attacks focusing on industrial sites. By September, 90% of Ukraine's steel production had been mothballed or damaged, following attacks on two Metinvest plants in Zaporizhzhia and Dnipro and an ArcelorMittal plant in Kryvyi Rih. The attacks on Ukraine's industrial capacity have translated into a 1.5 GW reduction in industrial electricity consumption, which could increase further if targeted attacks continue.

While lower-than-average demand heading into the heating season may create the appearance of a less stressed energy balance, it does not remove the underlying supply risk for Ukraine. The risk of lower-than-average winter temperatures in addition to further Russian attacks on Ukraine's district heating infrastructure could sharply increase household electricity use and push evening peaks higher. The loss of industrial demand for Ukraine has reduced an important source of demand-side flexibility. When load shedding is necessary, Ukrenergo first curtails industrial consumers, and without that capacity, there are fewer alternative sources to regulate demand in a system that is already lacking balancing sources. Last winter, peak demand during cold snaps was estimated at around 18 GW. With industrial consumption about 1.5 GW lower, peak demand this winter could still reach around 17 GW if temperatures remain mild.

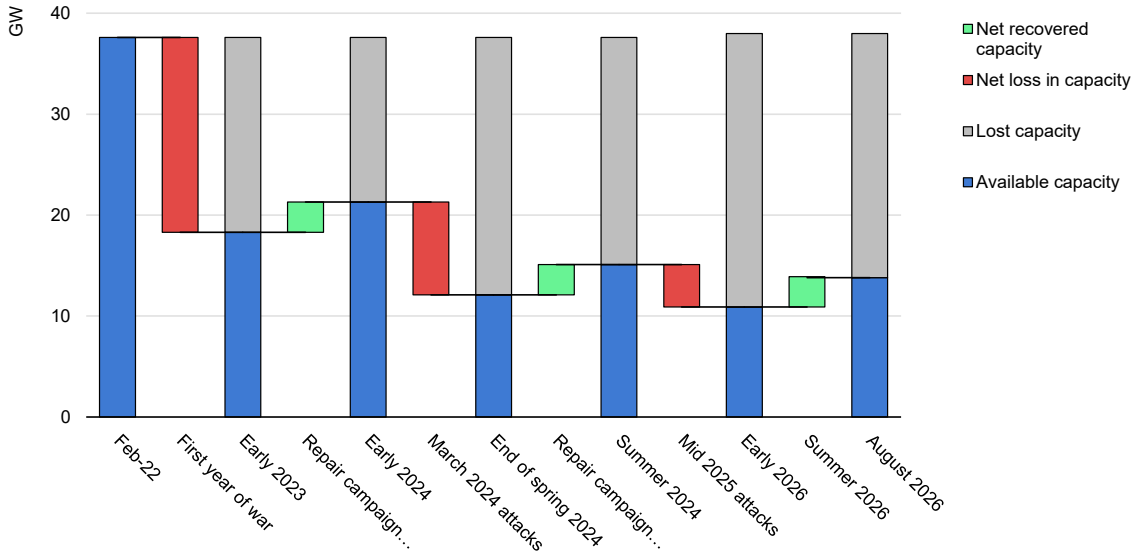
Last winter, 8.5 GW of dispatchable generation was damaged or destroyed. Even with further repairs this winter, a net loss of similar size would bring domestic capacity back to around 11 GW, leaving a gap of several gigawatts during peak hours, even with the full use of imports. The latest attacks on thermal power plants in October 2026 underline Russia's continuing tactic of targeting Ukraine's remaining generation capacity ahead of the heating season.

Interconnection with Continental Europe remains vital, as the 20-minute separation of Moldova and Ukraine from continental Europe on 31 January showed, but the main bottlenecks remain inside Ukraine: power imported at the western border cannot always reach the east, so the eastern regions are likely to

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face deeper shortages. Even when the system sees fewer attacks, there is still a power deficit in the eastern regions of Ukraine, compared with the west.

Available installed capacity of dispatchable power generation in Ukraine, 2022-2026



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Sources: IEA analysis based on data from DiXi Group, ENTSO-E, the European Commission, Green Deal Ukrainaska, the Kyiv School of Economics; UNDP (2023), Update on the Energy Damage Assessment June 2023, Towards a green transition of the energy sector in Ukraine; Ukrainska Pravda (2024), Russia has destroyed 9.2 GW of Ukrainian power generation, EU ambassador says; EnergoReforma (2024), Енергетикам на початок ОЗП вдалося відновити приблизно 3 ГВт пошкодженої РФ генерації – радник прем'єра; DiXi Group (2025), Summer Outlook on Electricity and Interfax-Ukraine (2025), Ukraine to restore 3.2 GW of damaged energy facilities by year end - Energy Minister.

Russia's recent tactical shift to launch waves of drones throughout the day, rather than mainly at night, has placed Ukraine's cities under sustained pressure. In September alone, Kyiv experienced over 200 hours of air-raid alarms, which led to delays in repairing generation assets and the overall preparation for the heating season. In September and October, Russia's jet-powered drones have focused on attacking transmission lines and substations, resulting in widespread rolling blackouts in Kyiv, despite an overall generation surplus in the system.

As during previous winters, shortages in electricity supply can be anticipated, especially during peak evening hours. The depth of shortages will depend mainly on the intensity of attacks and the ability of Ukraine to restore service. Restriction schedules for industry have applied since 6 October following new attacks. Moldova, which received about a third of Ukraine's exports over the summer, would be among the first affected if attacks force Ukraine back to imports, at a time when supply from Romania is reduced by the Danube drought (box).

Moreover, according to the Ministry of Energy, Russia is also planning to target municipal water and waste treatment sites, particularly in large cities such as Kyiv,

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Kharkiv and Odesa. These services rely fully on electricity, and large-scale power outages increase the risk of a public health crisis, particularly if wastewater systems fail.

Regional supply risk from the Danube drought

A drought in the Danube basin has reduced supply in the region from which Ukraine and Moldova import. According to Volue, Romanian hydro reservoirs were below the 10th percentile at the end of September, at 1.55 TWh against a normal 2.32 TWh, and inflows were expected to remain well below normal in October. Low river levels have shut down both units of Romania's Cernavoda nuclear plant (about 1 300 MW) since the summer and reduced output at Hungary's Paks nuclear plant, while unit°6 of Bulgaria's Kozloduy nuclear plant (1 040 MW) is offline until 20 November.

If attacks on Ukraine intensify before the situation improves, Ukraine, Moldova and Romania could face stress at the same time, which calls for close co-ordination on shared capacity.

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Priority actions for winter 2026-2027

The actions below are selected for their contribution to one goal: maintaining or quickly restoring supply during attacks and outages this winter. Each can be advanced by Ukrainian authorities with the support of partners. Without effective, timely and innovative resilience measures that are backed by large-scale financing, in addition to adequate air defences, Ukraine risks losing critical infrastructure in the coming months that could take years to rebuild.

Action 1: Protect critical assets

Physical protection should continue to be built into every repair and new project: Level 1 includes netting, gabions and sandbags, which protect against debris and drone fragments; Level 2 includes reinforced-concrete structures that are able to withstand direct drone hits. A National Security and Defence Council decision of 31 August requires more backup power, at least two weeks of fuel reserves and stronger engineering protection for critical infrastructure; partners can help by financing standard protection solutions and early-warning systems at key substations. According to the Ministry of Energy, roughly 200 Level 2 protection structures for a variety of energy facilities were installed by the end of August 2026, with a further 280 in progress. Ukrenergo further identified 18 priority substations critical for nuclear generation output, cross-border trade and black-start capability which will be, or already are, equipped with active and passive defence mechanisms. However, given the complexity and cost of retrofitting passive protection, many assets remain partially or fully unprotected. Cyber protection of control centres and market systems deserves the same attention, since major strikes have often been accompanied by cyberattacks.

Action 2: Keep equipment flowing and reserves ready

Strategic stocks of transformers, switchgear and generation units, held in Ukraine and neighbouring countries, shorten repair times. Dispersing them across several sites and standardising specifications would make them more useful and harder to destroy in a single strike. Partners can prioritise items that can be installed quickly or that come with funding for installation, taking into account manufacturing lead times for equipment that is in demand globally.

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Action 3: Support the people who keep the system running

Ukraine's energy workforce has carried the system through four winters of attacks, and its capacity now limits how fast equipment can be installed and repaired. Prioritising technicians for critical infrastructure can allow them to be exempted from army duty, while attracting and training new staff, including women for maintenance and service roles, and supporting staff wellbeing are key aspects of winter preparedness. With the severe reduction in industrial capacity from recent attacks, workers could be retrained and deployed to help install and maintain key energy equipment. The list of urgent workforce needs prepared by the Ministry of Energy and the Energy Community Secretariat offers a basis for targeted support. Arrangements agreed in advance to mobilise contractors and specialists from other sectors and regions would add surge capacity for repairs as well as for installing passive defence solutions.

Action 4: Connect and run the distributed fleet

Delivered units should be connected before the peak of winter. Preparing sites in parallel with procurement, by sizing units to the load, completing civil and electrical works and checking network and gas capacity before delivery, removes most delays. Funding for site preparation and installation, now available through the new installation facility, should be used to clear the backlog. Once connected, units need affordable gas and a route to sell their electricity, so that they run when the system needs them and not only as emergency backup. Particularly in energy-deficit and frontline regions, new distributed inverter-based units and batteries should be specified as grid-forming, so that they can keep supply running in island mode when part of the network is cut off.

Action 5: Let batteries and consumers support the system at peak

Batteries and active consumers can reduce the evening peak if rules allow it. Ukrenergo has contracted up to 810 MW of new generation and storage for ancillary services, but rules do not yet let this capacity serve other system needs. The large fleet of batteries installed behind the meter by households and businesses could also support the system at peak. Fast adoption of the draft rules on dynamic tariffs for the 4.1 million households with smart meters, allowing small batteries to sell electricity to the grid, and a communication campaign explaining the benefits would unlock part of this resource. Paying large consumers to reduce demand at specific hours offers more predictable results than curtailment.

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Action 6: Make full use of interconnections

With no new physical capacity expected before 2028, gains must come from operations and markets. More granular capacity calculation, such as distinguishing day and night values, and software-based line ratings accounting for ambient weather conditions (wind and temperature) on congested lines could release additional capacity. Price caps should be set at levels high enough to allow imports during scarcity, as was done from January to March 2026. Co-ordination with Moldova and Romania on shared capacity is all the more important given the drought. Making full use of the ENTSO-E emergency assistance framework, which already covers system operators beyond Ukraine's direct neighbours, would increase support after sudden losses.

Action 7: Strengthen local resilience across cities and sectors

Each region should be able to keep critical services running if it is cut off from the rest of the system. Lessons can be learned from frontline region experience, as this requires batteries and inverters able to operate in island mode, tested in selected areas, as well as backup power for heat, water and communications designed for winter conditions: standby generators can lose about 30% of their output at -10°C. Joint winter plans covering electricity, heat, gas and water, agreed between cities and national authorities, with clear roles and a shared picture of network conditions, would allow faster responses and spread good practices such as Kharkiv's. As of mid-October 2026, the implementation of resilience plans for cities and regions in frontline and border regions is outpacing that of Kyiv. Strengthening co-ordination with relevant institutions, establishing clear and consistent governance measures and introducing a systemic approach to resilience planning will allow for faster and more integrated implementation. Timely and predictable disbursement of funds would also help accelerate implementation.

Action 8: Protect heat supply and reduce peak demand

Keeping district heating running is one of the most effective ways of protecting the power system, because every interruption pushes households onto electric heaters at peak. Decentralised cogeneration does both, supplying heat and adding generation close to demand. Backup heating for households and public buildings should avoid electric resistance heating wherever possible. Energy efficiency comes first: radiator controls and bypasses, supported by the July law on district heating modernisation, cut heat demand quickly and cheaply in buildings where occupants now regulate temperature by opening windows. Almost 80% of the housing stock is energy inefficient, and the LED programme, which cut peak demand by up to 1 GW, shows how fast targeted measures can work.

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Starting now for winter 2027-2028

Support for Ukraine's energy system should move from winter-by-winter programmes to multi-year resilience planning. A multi-year framework would give municipalities, utilities and investors the planning security needed for equipment reserves, storage and local resilience projects. It would also allow funding to cover the whole chain from delivery to commissioning.

Equipment for next winter should be ordered now. With delivery times of key equipment now reaching an average of six to nine months, agreeing indicative volumes of critical equipment early in the year and pooling procurement across partners would let Ukraine reserve manufacturing capacity ahead of other buyers. This could be complemented by a pan-European stock of critical energy equipment, which could be rapidly deployed to Ukraine following attacks and provide a buffer against increasingly tight global supply chains. Mobile gas turbines are especially scarce at the moment given the strong global demand driven by AI. Meanwhile, attacks on Ukraine's industrial base risk slowing energy infrastructure repairs and fortification works. With much of domestic steel production offline, constraints on steel supply, alongside limited availability of specialised contractors, could extend project timelines.

New risk-sharing models can help bring in private capital to strengthen Ukraine's energy system. Traditional financing models for energy infrastructure appear to be increasingly inadequate in the face of repeated precision strikes on Ukraine's energy generation assets. Innovative financing models are needed to address both direct damage and wider economic losses while improving investor confidence. Public and partner support should combine grants, guarantees, concessional finance and war-risk insurance to help viable investment in critical energy projects move forward. Where possible, insurance should consider not only the asset itself but also enabling infrastructure, such as grid connections, substations and storage. Ukraine and its partners should expand risk-sharing to help address gaps, using public finance for risks that private insurers cannot absorb. The RAMP UP Programme, a joint initiative by the World Bank and the European Bank for Reconstruction and Development, is one example, using 15-year guarantees to unlock up to EUR 1.5 billion in private investment for 1 GW of new renewable capacity in Ukraine. This helps developers secure more predictable revenues, making it easier to secure financing and make informed investment decisions.

New flexible capacity and market reform should proceed together. The tender for 1 505 MW of flexible generation, protected against air attack, is a first

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step against an estimated need of about 9.5 GW of new generation. Abolishing wholesale price caps, adopting rules for aggregation and storage, and moving from broad price regulation to support targeted at vulnerable households would strengthen investment signals. Wind, which is distributed, quick to build and valuable in winter, attracted bids well above the 2026 quota and deserves a larger role. Progress on the planned lines with Romania and Slovakia, and on the reinforcement between Romania and Moldova, should continue.

Resilience should be the guiding principle for winter preparations. Four winters of sustained attacks on Ukraine's energy system have yielded clear lessons on what enables a system to withstand and recover from repeated disruption, many of which are set out in the IEA's report on energy system resilience. Embedding these lessons in investment and procurement decisions now, from passive protection to standardised equipment and strategic reserves, could help maintain essential services for this winter and strengthen preparedness for 2027-2028.

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Annex

Abbreviations and acronyms

AGSI	Aggregated Gas Storage Inventory
AI	artificial intelligence
CHPs	combined heat and power plants
ENTSO-E	European Network of Transmission System Operators for Electricity
EU	European Union
IEA	International Energy Agency
LED	light-emitting diode
NEURC	National Energy and Utilities Regulatory Commission of Ukraine
RAMP UP	Renewable Acceleration and Market Development for Ukraine Programme
UNDP	United Nations Development Programme

Glossary

bcm	billion cubic metres
°C	degrees Celsius
EUR	euro
GW	gigawatt
GWh	gigawatt hour
km/h	kilometres per hour
kV	kilovolt
mcm	million cubic metres
MW	megawatt
TWh	terawatt hour
UAH	Ukrainian hryvnia

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Acknowledgements, contributors and credits

This report was designed and directed by Talya Vatman, Caspian and Black Sea Programme Manager. The lead authors were Theresa Gebhardt, Talya Vatman and Jacques Warichet, with contributions from Craig Hart.

Valuable comments and feedback were provided by IEA senior management and other colleagues within the IEA, in particular by Mary Warlick, Tim Gould, Dennis Hesseling, Ali Saffar, Ronan Graham and Leonardo Paoli.

Several experts and organisations from outside of the IEA provided valuable insights, inputs and comments to ensure report accuracy and quality. They include: Borys Dodonov (Kyiv School of Economics), Susanne Nies (Green Deal Ukraina) and Olena Pavlenko (Dixi Group).

This report was edited by Oliver Joy.

Thanks go to the IEA Communications and Digital Office for their help in producing the report and website materials. Particular thanks go to Maria Ahmad, Oliver Joy, Julia Horowitz, Jethro Mullen, Astrid Dumond, Poeli Bojorquez and Grace Gordon.

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Typeset in France by IEA - November 2026
Cover design: IEA
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