

Energy infrastructure attacks: updated outlook and impact during the 2024–2025 cold season

INTRODUCTION

In September 2024, ACAPS' Ukraine Analysis Hub published *Energy Infrastructure Attacks: Outlook and Impact During 2024–2025 Cold Season*. The report provided an overview of the energy and heat infrastructure in Ukraine, Russian attacks on the infrastructure since 2022, and how the country dealt with the significant energy deficit from the damage. The report also provided an anticipatory outlook for the cold season between October 2024 and April 2025 and described the anticipated impacts of the energy attacks that were highly likely to continue, with a focus on power outages particularly after very visible and widely covered combined missile and drone attacks. This report is a midterm update of the original outlook, with added highlights on other tactics, such as regular countrywide mass drone attacks and other more localised missile attacks on the energy infrastructure.

Contextual background: Russia has been targeting Ukraine's energy infrastructure as part of its full-scale invasion of Ukraine since 2022, with tactics that include launching combined missile and drone attacks to inflict higher damage. The last quarter of 2022 alone saw 11 of these combined attacks, leading to state-controlled stabilising power outages known as rolling blackouts across the country. 2023 saw five more such attacks, although these did not lead to similar blackouts. Between March–August 2024, nine combined attacks hit Ukraine, reintroducing countrywide rolling blackouts from May till mid-September 2024 and raising concerns about winter. After a temporary pause, five more attacks in the cold season, between November 2024 and January 2025, brought the total to 30 combined missile and drone attacks since 2022 (DiXi Group 02/01/2025; UA Energy 03/10/2024; OHCHR 19/09/2024; KSE 05/2024; IAEA accessed 30/01/2025; ISW accessed 31/01/2025). The trends for these attacks over the years indicate that they remain highly likely as the war continues. These combined attacks are not exclusive to the cold season and are likely to continue throughout the year.

ABOUT THE REPORT

Aim

this report aims to provide a midterm update on the outlook and impacts described in the [original report](#) on energy infrastructure attacks, covering the start of the cold season in mid-October 2024 until the end of January 2025. This report reassesses the likelihood of the original outlook based on the latest developments and publicly available information for the remaining months of the cold season from February–April 2025 to further inform response planning and preparedness.

Methodology

this report relies on secondary data, complemented by key informant interviews. The outlook and impact sections use ACAPS' internal anticipatory analysis methodology. A driver (energy infrastructure attacks) is the main cause of a crisis, while an aggravating factor is an event that does not trigger the crisis but can worsen its impacts. Outlooks rely on historical data and trends analysis to outline the most probable – or at least a highly probable – short-term future. Outlooks also highlight potential risks even if they are not likely.

Limitations

this report is not fully exhaustive and does not describe all the aggravating factors or mitigating measures that influence the situation, nor does it list all the impacts. Anticipatory analysis is not an exact science, as new and less likely futures can also develop. Triggers expected to drive a shift or change in the situation may not occur nor drive the expected change, or new factors may arise that prevent the projected change or shift from happening. Information and data gaps concerning potentially security-sensitive information on energy infrastructure, as well as a lack of consolidated data on the energy situation, limit the analysis.

Disclaimer

given the latest developments, a ceasefire scenario in which energy attacks are suspended has a low likelihood of materialising before the end of the current cold season in April 2025 and is not covered in this analysis (WSJ 22/01/2025). It will be covered in detail in our upcoming *Ukraine Scenarios in 2025* report.

INFORMATION GAPS

The Government of Ukraine considers information on the extent of energy infrastructure damage a matter of national security that can be used in future Russian attacks. This means publicly available and consolidated information for conducting analysis on the energy situation, including energy trading prices and state-controlled power outages, is limited and will remain so for years to come (MEV 13/08/2024; PHR 04/12/2024; OREE 30/12/2024; BBC 29/11/2024). Granular information that could help response preparedness and coordination also remains limited because of this sensitivity (KII 29/01/2025). A lack of consolidated data on the energy situation and information gaps limit the analysis. Although this analysis covers countrywide rolling blackouts, localised power loss and emergency power outages are not fully covered, limiting the analysis of their impact. The US funding suspension has also affected energy-related information and analysis (UA Energy 31/01/2025).

TABLE OF CONTENTS

| | |
|---|----|
| Outlook update | 3 |
| Energy outlook | 3 |
| Driver: energy attacks..... | 4 |
| Aggravating factors..... | 6 |
| Ukraine’s defence capacity | 6 |
| Cold weather conditions..... | 7 |
| New aggravating factor: us foreign aid suspension | 7 |
| Anticipated impacts | 8 |
| Impact on essential needs | 9 |
| Impact on humanitarian operations | 10 |
| Socioeconomic impacts..... | 10 |

SUMMARY

As previously anticipated in the [original outlook](#), Russian forces have continued to target Ukraine’s energy infrastructure during the 2024–2025 cold season, including by launching countrywide combined missile and drone attacks frequently targeting Ivano-Frankivska, Kharkivska, Kyivska, and Lvivska oblasts. Rolling blackouts were reintroduced across the country the day after these combined attacks resumed, lasting from mid-November 2024 until the energy situation stabilised in late December. The daily sessions ranged between 4–12 hours in total. The combined attacks resulted in additional localised emergency power outages, most frequently affecting Kyivska, Dnipropetrovska, and then Donetsk oblast. The worst-case scenario of prolonged 20-hour countrywide daily blackouts did not materialise and is no longer anticipated, mainly thanks to energy production capacity improving by 3GW mitigated by factors such as a mild winter between December 2024 and January 2025 and governmental and international mitigation efforts to reduce energy demand and counter the impact of the attacks.

Russian missile and drone production capacity remains significant. As such, attacks targeting all types of energy infrastructure remain highly likely in the remaining months of the cold season, mainly through regular countrywide mass drone attacks followed by countrywide combined missile and drone attacks, as well as more localised missile attacks. Countrywide rolling blackouts remain likely, but if reintroduced, their length will depend mainly on the extent of the damage from direct hits and the tactics used. A somewhat improved air defence capacity will help Ukraine mitigate the impact of these attacks, but gaps remain and will continue exposing the energy infrastructure to potential damage. Freezing temperatures in the remaining winter period will continue to be a potential aggravating factor, while a warmer-than-usual spring forecast will reduce the energy demand. The US funding suspension, however, adds additional setbacks for improving the resilience of the energy system against future attacks and could delay annual infrastructure repairs.

Heavily populated cities and urban areas will continue to be exposed to unplanned large-scale power disruptions when directly targeted in attacks on energy infrastructure. Gaps in power back-up support will continue to affect water supply and heating facilities, IDP shelters, geriatric care centres, schools, and hospitals and smaller medical facilities. Despite significant support to the health sector, power outages will continue to affect medical procedures. Sumska oblast will be the most at risk in the remaining winter period compared to other assessed cold spots owing to persisting response gaps. Power outages will compound the impacts of war on older people, IDPs, people with disabilities, and those in frontline areas. The attacks and ensuing power disruptions will continue to result in negative socioeconomic impacts in the remaining cold season, particularly affecting small and micro businesses and households. Despite the gaps and challenges, various governmental mitigation measures and international and humanitarian support will help mitigate the negative impacts of the attacks.

OUTLOOK UPDATE

Energy outlook

The previous outlook was based on a 50% reduction in energy generation capacity by mid-2024. With international support, however, the Government of Ukraine managed to restore an additional 3GW by installing more energy generation equipment and conducting repairs, mainly of thermal power plant units (KII 05/02/2025 a; Kyiv24 17/08/2024; Topor 25/01/2025). The energy peak demand between October 2024 and January 2025 reached up to 16GW, which was lower than the previously anticipated 18GW, in part thanks to a mild winter so far into the cold season (see 1.4 Aggravating Factor 2: Cold Weather Conditions) (KII 05/02/2025 a; CPD 04/09/2024; Oil & Gas of Ukraine 25/11/2024). Consumers, mainly businesses that installed distributed generation facilities across the country – mostly gas engines, gas turbines, and cogeneration facilities – generated almost 1GW by the end of 2024 for their own use, in turn reducing the demand on the energy system (KII 05/02/2025 a; Topor 25/01/2025). Power-curtailling measures for industries, businesses, and average consumers have also been applied to manage energy consumption (DiXi Group 06/01/2025 and 20/01/2025; IMF 20/12/2024; Hromadske 17/01/2025). Calls for conserving energy by users have continued even on days with stable electricity supply (TSN 15/12/2024; Ukrinform 14/01/2025; UA energy 24/01/2025). Electricity import capacity from the EU had increased from 1.7GW to 2.1GW by 1 December 2024, as requested by Ukraine, enabling more import when needed (EC 29/10/2024; Ukrainska Pravda 29/10/2024). These efforts were built upon the experiences of the two previous cold seasons and are part of a broader resiliency strategy comprising various administrative, legislative, and responsive measures to lessen the impact of the attacks. The passive protection of substations, the facilitation of energy equipment importation, and the development of a decentralised energy strategy are a few such examples (UA Energy 01/11/2024; EESC 05/2024; NIIS 29/05/2024; IEA 12/2024; UNN 08/10/2024). All these factors enabled the winter energy demand to be more or less met (KII 05/02/2025 a).

The previously anticipated up to 35% winter energy deficit and a worst-case scenario of countrywide 20-hour rolling blackouts did not materialise. Given information gaps, however, and particularly given the extent of the damage from the resumed attacks, it remained difficult to estimate the actual energy deficit percentage up until the end of January 2025.

With the resumption of combined missile and drone attacks (see 1.2 Driver: Energy Attacks), however, countrywide rolling blackouts were still reintroduced, lasting from mid-November until late December 2024 until the energy situation stabilised (DiXi Group 02/01/2025). The daily sessions ranged between 4–12 hours (Yasno accessed 10/02/2024). Rolling blackouts were not reintroduced in January 2025 even after the 15 January combined missile and drone attack (see Figure 1).

The countrywide combined missile and drone attacks targeting Ukraine's energy infrastructure between mid-November and late December (see Figure 1) have also specifically targeted the electrical substations that transmit power from nuclear power plants (NPPs). Besides damage in direct hits, this tactic was one of the factors for reintroducing and prolonging blackouts. For example, the countrywide combined missile and drone attack on 17 November forced six of the nine operational reactors in three NPPs to reduce power production. As a result of the reduced power input, the Government reintroduced countrywide rolling blackouts the following day (IAEA 17/11/2024; Suspilne 18/11/2024). The following countrywide combined missile and drone attack on 28 November forced all nine reactors to reduce power input as a precaution (IAEA 28/11/2024). As a result, the countrywide rolling blackouts were prolonged to over 12 hours per day from the previous eight-hour schedule (TSN 28/11/2024; OCHA 17/12/2024; Slovo i Dilo 28/11/2024). The next countrywide missile and drone attack on 13 December reduced power input in five nuclear units (TKI 13/12/2024; IAEA 13/12/2024). The following countrywide combined missile and drone attack on 25 December targeted transformer stations connecting NPPs to the grid, once again prolonging the daily blackout schedule (DiXi Group 30/12/2024).

Despite these risks, nuclear power continues to generate 55% of Ukraine's energy (Media Center 14/02/2025). In the longer term, a total of 3GW in energy generation capacity is planned by the end of 2025, including through the completion of additional nuclear units at Khmelnytskyi NPP (Topor 25/01/2025; TSN 15/02/2025; Oil & Gas of Ukraine 25/11/2024).

Looking ahead

The remaining cold season energy outlook has improved, although energy deficit risks remain, as each attack can cause the loss of 1–2GW of generation capacity with potential damage (NV 25/01/2025). The energy production capacity cannot be restored to its 2021 level (56GW) in the short term (WFP 08/07/2024; KSE 19/08/2024; IMF 20/12/2024). An additional 0.9GW of planned distributed generation capacity by the end of the 2024–2025 heating season will further reduce the demand on the energy system (KII 05/02/2025 a; Rubryka 22/01/2025). Significant damage in new attacks can cause an energy deficit that, in turn, results in the reintroduction of rolling blackouts (TSN 16/12/2024; NPC Ukrenergo Facebook 30/01/2025). Countrywide rolling blackouts could last up to 4, 8, or 12 hours per day if applied, depending on the attacks (UACAT 08/01/2025; Oil & Gas of Ukraine 25/11/2024). In 2025, however, rolling blackout schedules are planned evenly across the oblasts; longer blackouts in one oblast compared to others are no longer expected if applied countrywide (TSN 16/12/2024). That said, it remains difficult to predict how long they would last (either per day or overall) if applied, as that mainly depends on the amount of repair required for the ensuing damage. Repairs and the restoration of power generation can help eliminate the rolling blackouts if reintroduced. Countrywide 20-hour rolling blackouts are no longer anticipated. The attacks, however, will highly likely result in unplanned emergency shutdowns and power loss disruptions, even

if rolling blackouts are not reintroduced (NPC Ukrenergo Facebook 30/01/2025). Emergency shutdowns can last up to four hours, while the length of power loss depends on the extent of damage (Yasno accessed 10/02/2024).

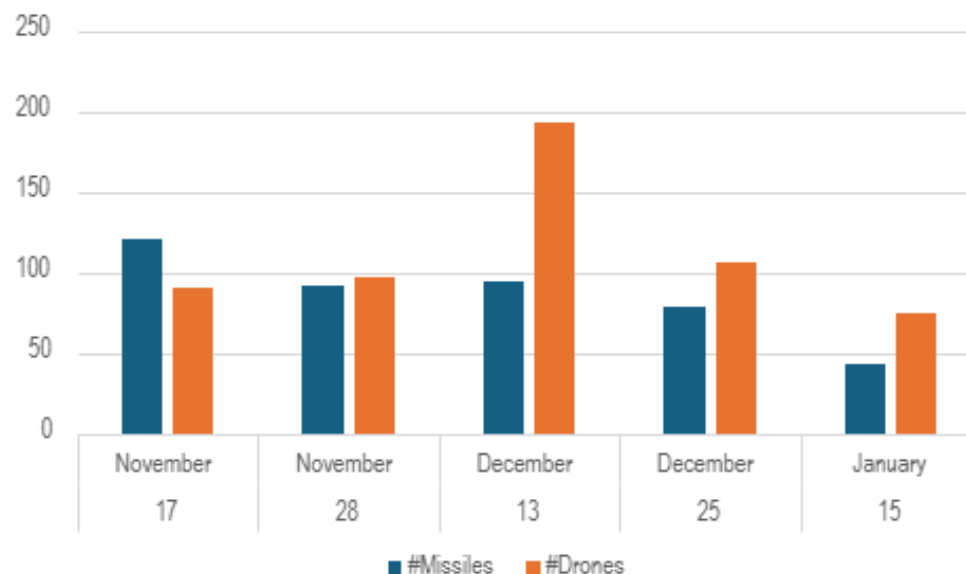
The Russian forces will highly likely continue to target critical substations connected to NPPs to destabilise the energy system besides all other types of energy infrastructure, including the electricity import and export system, as they did during the December combined attacks (Govt. Norway 19/12/2024). Electricity imports remain vital for businesses to cope with the energy deficit. Ukraine imported a total of 4.4 million MWh of electricity in 2024 – five times higher than in 2023 (UA Energy 22/10/2025; NV 06/01/2025; DiXi Group 27/01/2025). Hungary accounted for 39% of the import in 2024, Slovakia 23%, Romania 18%, Poland 14%, and then Moldova 5% (Suspilne 02/01/2025). International tensions with the current Government of Slovakia following the suspension of gas transit from Russia on 1 January 2025 present a risk for the continued import of electricity and gas; the level of this risk remains to be further assessed as it is a developing situation (Radio Svoboda 13/11/2024; NV 06/01/2025; TKI 01/01/2025; Ukrainska Pravda 24/12/2024; European Pravda 11/02/2025). This risk will be compounded by low gas storage levels and targeted attacks on the gas infrastructure (KII 29/01/2025; Interfax 20/01/2025; NV 29/01/2025).

Driver: energy attacks

As anticipated, the Russian forces continued to target the energy infrastructure (ACAPS accessed 10/02/2025).

Countrywide combined Russian missile and drone attacks on Ukraine's energy infrastructure resumed after the start of the 2024–2025 cold season following a temporary pause between September–October 2024. Five such attacks took place almost every two weeks between 17 November 2024 and 15 January 2025 (DiXi Group 02/01/2025; ISW accessed 31/01/2025).

Figure 1. Timeline of the combined missile and drone attacks on energy infrastructure since the start of the 2024–2025 cold season in mid-October 2024 until the end of January 2025

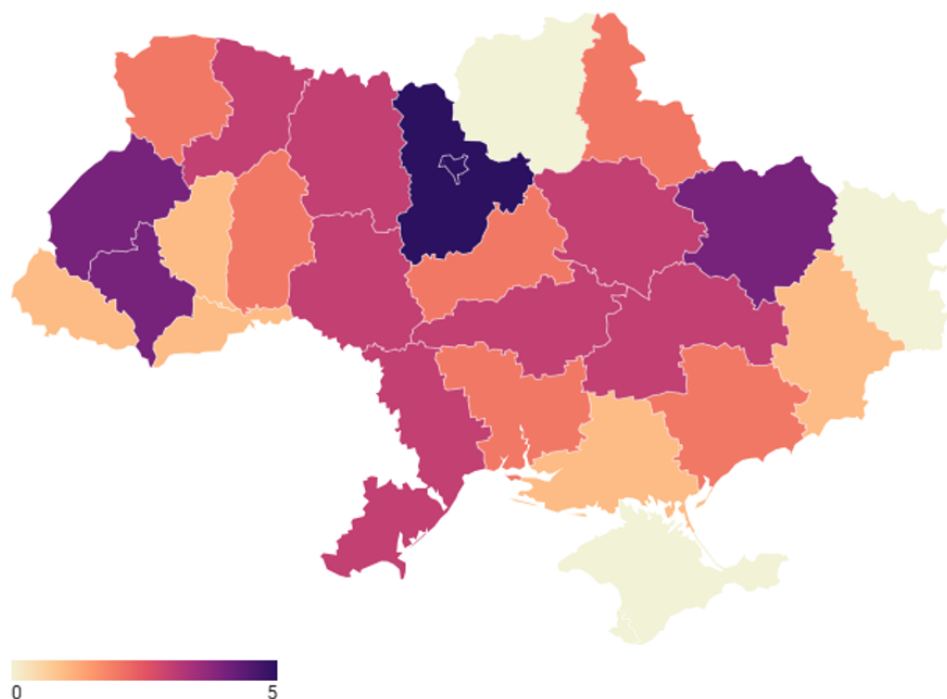


Source: ISW (accessed 31/01/2025)

Note: beyond the scope of this update (which is until the end of January 2025), there was another combined missile and drone attack on 1 February 2025 following the same biweekly pattern since mid-November 2024 (DiXi Group 03/02/2025).

The five combined attacks all affected Kyivska oblast. Other frequently affected oblasts were Ivano-Frankivska, Kharkivska, and Lvivska oblasts. Information gaps related to the damage limit the analysis, but these attacks frequently directly targeted the energy infrastructure located in these oblasts. For example, in the 25 December attack (see Figure 1), **12 out of the 70 missiles launched nationwide targeted boilers, thermal power plants, and other energy-generating facilities in Kharkiv city alone** (RBC Ukraine 25/12/2024 and 28/12/2024).

Map 1: Oblasts affected by combined missile and drone attacks on energy infrastructure (direct hits and debris), 17 November 2024 to 15 January 2025



Sources: ACAPS using data from Babel (17/11/2024); TSN (17/11/2024, 28/11/2024, and 26/12/2024); LB (13/12/2024); RBC Ukraine (25/12/2024 and 15/01/2025)

Note: the interactive version of the map is available [here](#).

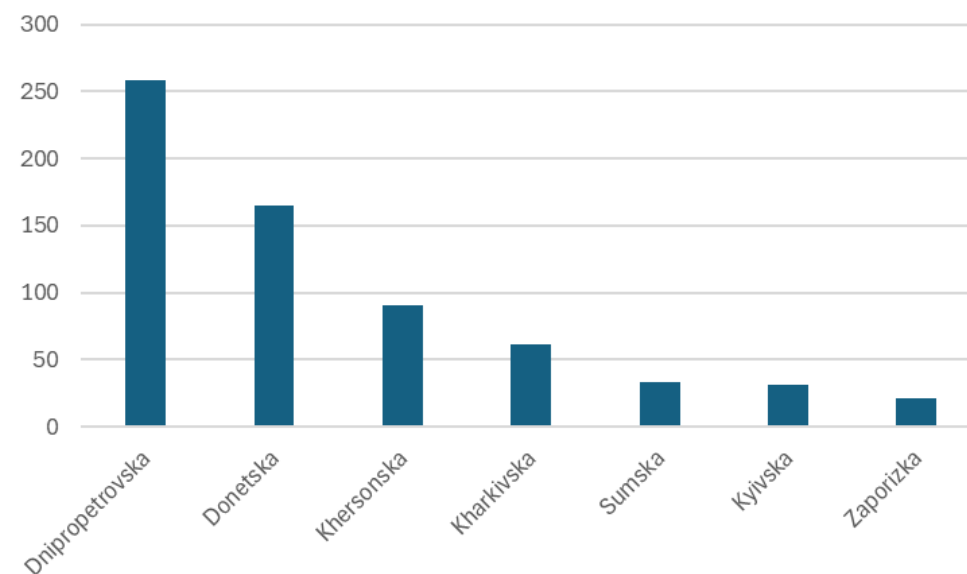
The Russian forces continued to use various types of long-range missiles in their combined missile and drone attacks on energy infrastructure. They launched the missiles and drones from different locations and in large quantities to overwhelm Ukraine's air defence and inflict maximum damage (ISW accessed 03/02/2025). The drones and some of the missiles also change their trajectories during the attacks (24 Kanal 13/12/2024).

In the same period, the Russian forces continued to wage regular countrywide mass drone attacks as a broader full-scale war tactic, the subset of which was to target the energy infrastructure besides other types of infrastructure, while particularly targeting Kyiv city in

almost daily attacks (Radio Svoboda 08/11/2024; RBC Ukraine 01/11/2024). Compared to the same period in the previous year, the number of air attacks between October 2024 and January 2025 more than doubled (from around 3,055 to 6,690) (ACLEd accessed 11/02/2025). This was enabled by an overall increase in missile and drone production in Russia since 2022, as described previously in the original outlook.

Apart from these countrywide tactics, all types of localised attacks have continued, including those indirectly affecting energy infrastructure.

Figure 3. Energy infrastructure damage in the most affected oblasts, October 2024 to January 2025



Note: information gaps on all damage events limit the analysis. The graph also does not reflect the cost of the damage. For example, damage to power lines is not equivalent to damage to a thermal power plant, but each is counted as a damage event in the dataset used.

Energy infrastructure damage from attacks that took place between October 2024 and January 2025 affected Dnipropetrovska oblast the most. 80% of the damage events – targeting mainly electricity infrastructure, gas supply systems, and fuel depots – occurred in Nikopolskyi raion alone, possibly the result of Russian forces being positioned on the other side of Dnipro River near the Zaporizhzhia NPP. This trend is not recent, as Dnipropetrovska oblast consistently recorded the highest damage events to its energy infrastructure between

January 2024 and January 2025 as well (ACAPS accessed 10/02/2025; ACAPS 13/09/2024). Russian attacks will likely continue to highly affect the oblast. Overall, 2024 saw nearly 800 air attacks on Dnipropetrovska oblast compared to 185 in 2023 (ACAPS accessed 10/02/2025; NV 12/12/2024; ACLED accessed 11/02/2025).

The anticipated driver in the form of energy infrastructure attacks described in the outlook in the original report has materialised.

Looking ahead

As described in the outlook of the original report, attacks on the energy system and infrastructure remain highly likely in the remaining months of the cold season. Russian missile and drone production capacity remains significant, enabling the Russian forces to continue conducting these attacks (Espresso 21/01/2025). The share of drones used in each combined missile attack on the energy infrastructure increased considerably during 2024 (DiXi Group 02/10/2024; ISW accessed 31/01/2025). Countrywide mass drone attacks, which increased overall since August 2024, will highly likely continue to be used as a tactic to target energy infrastructure (Breaking Defense 08/01/2025; TWP 15/12/2024; Radio Svoboda 08/11/2024; Ukrainska Pravda 28/12/2024 and 16/11/2024). Cyberattacks, including on the energy system, also increased significantly in 2024 compared to the previous year and will highly likely continue to be actively used to compound the impact of air attacks (Ukrainska Pravda 04/12/2024 and 09/01/2025; DTEK 29/01/2025). The Russian forces will likely continue to explore new attack tactics to maximise the impact of their attacks, while continuing to use tried strategies, such as launching combined missile and drone attacks and targeting certain energy infrastructure types more intensively. These include thermal power production systems, nuclear power substations, etc. Combined attacks remain likely; however, it is difficult to anticipate whether they will continue in the same two-week frequency in the remaining cold season or intensify before the end of the season following a temporary pause.

AGGRAVATING FACTORS

Ukraine's defence capacity

There were no significant changes to the defence capacity as Ukraine did not achieve long-range missile production capability to effectively stop missile and drone production or launching from Russian territory, while military support from stakeholders remained largely conditional by the end of January 2025 (ISW accessed 03/02/2025; TKI 15/01/2025 and 16/12/2024; Ukrainska Pravda 18/11/2024). No additional Patriot air defence systems had been transferred to Ukraine since July 2024 despite the at least seven additional such systems needed (Breaking Defense 29/08/2024; TKI 05/07/2024). These defence gaps expose the energy infrastructure to the risk of damage from the targeted attacks.

These gaps in Ukraine's defence capacity identified in the original outlook as a potential aggravating factor that could worsen the impact of the attacks have materialised.

Looking ahead

In February 2025, the new US administration allowed Ukraine to use its weapons on Russian territory; however, without long-range missiles, Ukraine's capacity to prevent or stop attacks remains limited (Espresso 04/02/2025). Additional air fighter jets provided by stakeholders in early February will improve defence capacity by increasing Ukraine's ability to shoot down missiles over its territory (Ukrainska Pravda 06/02/2025; RFI 07/02/2025). Direct hits and debris in residential areas remain a high risk as attacks on the energy infrastructure continue to result in casualties (OHCHR 19/09/2024). Any unforeseen delays in military support that reduce Ukraine's air defence capacity pose a significant risk that can aggravate the impact of these attacks.

The Russian forces will continue to use tactics to attempt to reduce and overwhelm Ukraine's defence, such as using swarms of decoy drones that do not carry explosives (Radio Svoboda 13/11/2024). The ramped-up drone production in Russia enables these increasingly regular cost-effective swarm attacks, meaning electromagnetic technology against drones will continue to aid in preserving defence resources (NV 27/12/2024; The Defense Post 05/12/2024; Espresso 07/02/2025; RBC Ukraine 10/02/2025).

Cold weather conditions

The 2024–2025 cold season in Ukraine commenced in mid-October. Oblast authorities gradually activated centralised heating across the country once temperatures remained below 8° C for three consecutive days. This process took place from mid-October up until late November in some warmer southern oblasts (UNN 01/11/2024; Media Center 23/11/2024). As anticipated, the energy demand has gradually increased since October because of the need for heating, while solar energy production decreased (NV 21/10/2024; AgroPortal 04/12/2024).

The relatively mild winter from December 2024 to January 2025 helped mitigate the energy demand when temperatures were temporarily above the seasonal average (UA Energy 20/12/2024).

Overall, this aggravating factor, described in the outlook in the original report, has partially materialised.

Looking ahead

February 2025 is forecasted to be colder than average across the country (TSN 15/12/2024; Meteored accessed 04/02/2025). The February cold spell will likely last longest in Sumska oblast; however, some central oblasts – Poltavska, in particular – are forecasted to have the lowest temperatures (TSN 10/02/2025). Freezing and cold temperatures will remain an aggravating factor for any future attacks. This can manifest through people’s exposure to severe weather elements and respiratory illnesses in attack-related damage to housing, particularly as attacks usually take place during the night and early morning hours (Suspilne 17/11/2024; TSN 28/11/2024; Health Cluster 23/01/2025). Prolonged low and freezing temperatures increase energy demand, adding pressure on the system, and are also a risk to water supply and gas pipelines (DiXi Group 19/11/2024; Oil & Gas of Ukraine 25/11/2024). The gradually rising temperature and improved solar energy production towards April will, however, help mitigate the energy demand, particularly during warmer-than-average temperatures in the spring (MeteoFor accessed 13/02/2025; Severe Weather EU 19/01/2025).

New aggravating factor: US foreign aid suspension

This is a new aggravating factor that was not covered in the original report.

Developmental and humanitarian US aid to Ukraine was suspended in late January 2025 as part of the global US foreign aid 90-day suspension order, which will last until mid-April (Hromadske 28/01/2025). The suspension has disrupted the emergency response for frontline communities and put life-saving response at risk (NRC 10/02/2025).

Until 10 January 2025, the US contributed 6.6% of the total international funding in support of Ukraine’s energy system against attacks since 2022 (Energy Community accessed 08/02/2025). While the diversity of the donors who support Ukraine’s energy system could help mitigate the negative impact of this suspension in the longer term, the suspension has already created significant challenges by causing delays and producing additional costs. USAID, which has been shut down, supported all procurement processes. Despite the transition already taking place, it is not yet known when procurement will resume under the new assigned agent. In-kind assistance (in the form of energy equipment such as gas turbine power plants, power transformers, and generators, as well as technical supplies such as pipes and cable lines) already procured by USAID for direct distribution is on hold, although some supplies contracted earlier will still be delivered (USAID accessed 17/02/2025; KII 05/02/2025 a; Suspilne 27/01/2025). The suspension has additionally affected analytics providers supported by USAID fully or partially, further limiting the energy-related information landscape and analysis (UA Energy 31/01/2025).

The funding disruption, existing financial gaps and shortages in repair labour, and shortages in repair equipment and vehicles resulting from targeting will likely affect annual energy infrastructure repairs, including those in preparation for the 2025–2026 cold season, which are set to start in the spring. Humanitarian winterisation response, which includes support to district heating systems, requires months of planning and preparation and will likely be delayed (KII 05/02/2025 a; KII 29/01/2025).

The US contributed close to 30% of the total humanitarian funding and 20% of developmental aid in the form of grants for Ukraine in 2024 (OCHA accessed 08/02/2025; MOF 02/01/2025). As the global funding stretches thinner, secondary and ripple effects on Ukraine’s energy system remain to be further assessed upon the availability of more information. The Government of Ukraine had planned to add 3GW of energy production capacity in 2025, which might not pan out. This means that if the energy deficit becomes more significant owing to new damage, outages will be more likely in the longer term (Topor 25/01/2025).

The impact on the energy system in the worst case of a long-term US funding stop is beyond the scope of this report, but it poses a high risk.

ANTICIPATED IMPACTS

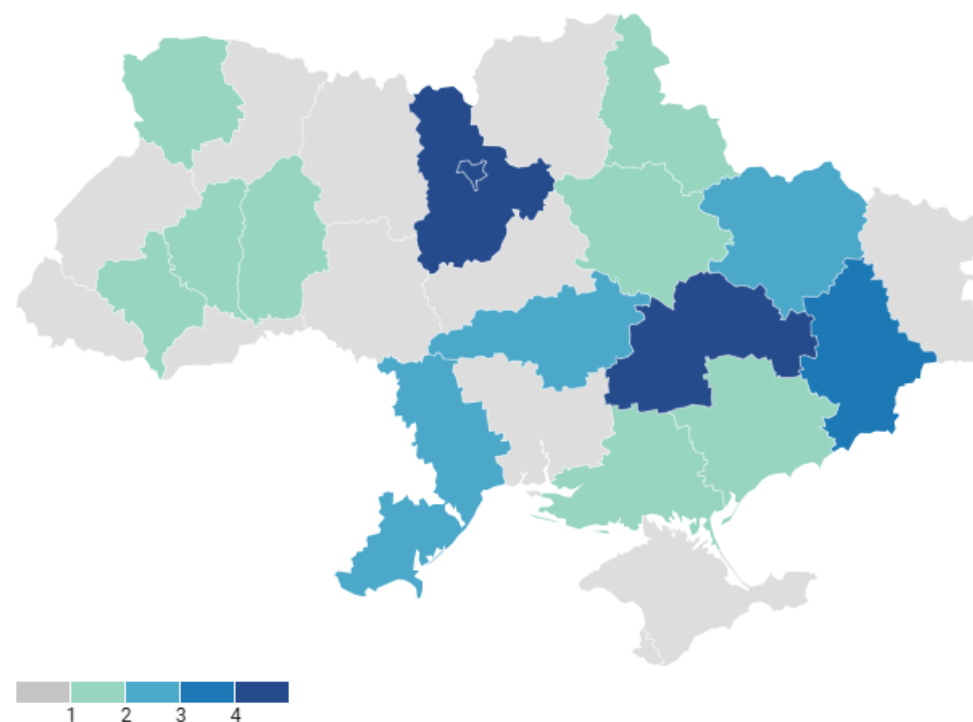
The anticipated impacts of the power outages have partially materialised. The countrywide rolling blackouts were reintroduced, but not as long as previously expected. This means the impact has likely been less than previously anticipated, although limited information makes it difficult to know with certainty.

Looking ahead

The [previously anticipated impacts](#) remain relevant as **missile and drone attacks on the energy infrastructure are highly likely and can result in planned and unplanned power outages**. These impacts will be mitigated by the available governmental, international, and humanitarian response, although persisting response gaps remain. While 20-hour-long countrywide blackouts are no longer anticipated, as explained in the analysis above, **there is still a risk of prolonged localised unplanned power disruptions as a result of direct hits**. For example, in the 25 December combined missile and drone attack on Kharkiv city (see Figure 1), half a million people lost access to heating. Of those, 85,000 had not regained access to heating three days after the attack because of the extent of the damage and repair needed (RBC Ukraine 25/12/2024 and 28/12/2024).

Unplanned localised power cuts are highly likely after countrywide combined missile and drone attacks. Localised emergency shutdowns were introduced after each of the five combined missile and drone attacks in the affected oblasts (see Figure 1), affecting Kyivska and Dnipropetrovska oblasts most frequently, followed by Donetsk oblast.

Map 2. Number of unplanned state-controlled emergency shutdowns after combined missile and drone attacks on the energy infrastructure, 17 November 2024 to 15 January 2025



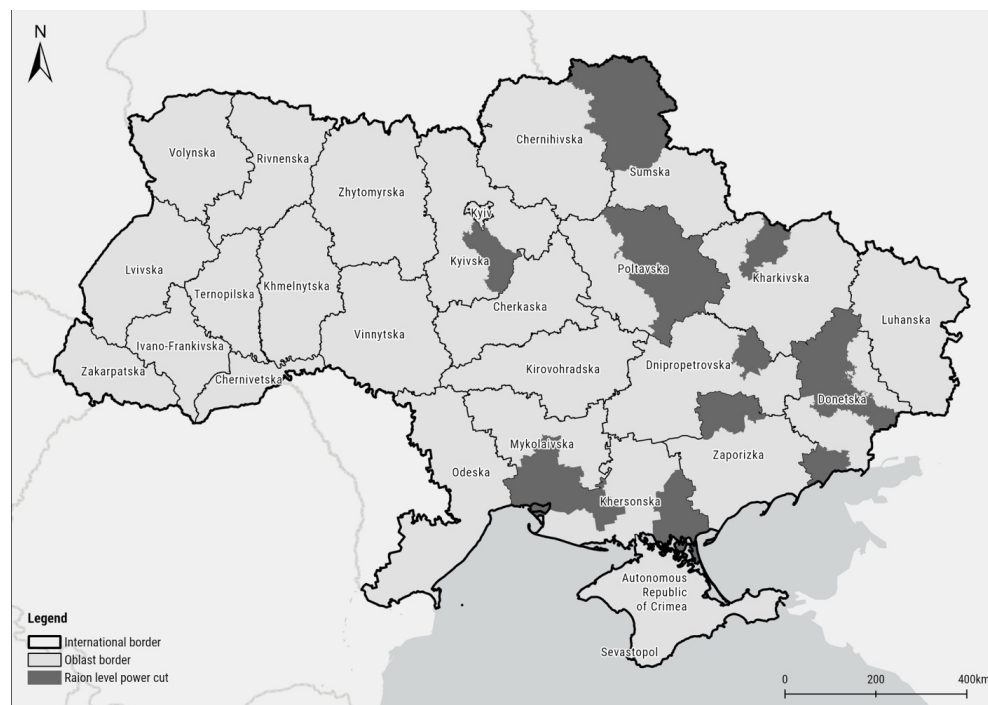
Sources: ACAPS using data from Ukrainska Pravda (17/11/2024); UA Energy (13/12/2024 and 15/01/2025); TKI (13/12/2024); DTEK (25/12/2024); RBC Ukraine (25/12/2024)

Note: the interactive version of the map is available [here](#). Potential data limitations in the publicly available sources used for creating the visual limit the analysis.

Unplanned localised power loss is highly likely with regular large-scale, countrywide drone attacks and other localised missile attacks. On 28 January 2025, for example, a large-scale drone attack on the energy infrastructure resulted in temporary electricity loss for over 70 communities in central Cherkaska oblast (UA Energy 28/01/2025). Localised missile and drone attacks, including those that do not specifically target the energy infrastructure, can also result in localised power loss. On 17 January 2025, for example, ten houses and a heating facility temporarily lost access to power after a missile attack on Kryvyi Rih city in Dnipropetrovska oblast (Hromadske 17/01/2025). Power supply restoration following the

attacks adds pressure on the state response and, at times, requires round-the-clock repairs depending on the extent of the damage, including in high-risk areas near the front line (WASH Cluster 27/12/2024; USAID 05/11/2024).

Map 3. Unplanned raion-level power disruptions resulting from all types of attacks, September 2024 to January 2025



Note: this map does not include all unplanned power outages internal capacity and public data limitations. Lack of consolidated data on unplanned power cuts additionally limits the analysis.

Impact on essential needs

- **Populated urban areas, particularly cities frequently targeted in energy attacks, will have the highest exposure to power disruptions and outages.** For example, in the 28 November countrywide combined missile and drone attack, half a million people lost access to power in Lvivska oblast. In the 25 December countrywide combined missile and drone attack, half a million people lost access to heating in Kharkiv city alone (see Figure 1) (RBC Ukraine 25/12/2024 and 28/12/2024). Dnipropetrovska, Kharkivska, and Kyivska

oblasts, which are frequently targeted, have the highest concentration of populations, including IDPs, mainly in urban areas (IOM accessed 13/02/2025; IOM 17/01/2025). Heating disruptions will affect households living in badly insulated, typically older housing the most, whether in urban or rural areas.

- **Gaps in power back-up support will continue to affect water supply and heating facilities, IDP shelters, geriatric care centres, schools, and hospitals and smaller medical facilities** (WASH Cluster 27/12/2024; OHCHR 19/09/2024; OCHA 16/01/2025; CARE 12/02/2025; KII 05/02/2025 a). Heating companies will continue to face support gaps alongside financial impediments (KII 29/01/2025).
- **Power cuts will continue to disrupt access to essential services, such as heating and water, as well as other services, such as communications and transportation** (Babel 17/11/2024; Ukrainska Pravda 17/11/2024; RBC Ukraine 25/12/2024 and 28/12/2024; WASH Cluster 27/12/2024).
- **Power outages will continue to affect medical procedures countrywide, including through attacks on health facilities, which also cause power loss.** Power outages, both planned and unplanned, affect the timeliness of treatment, the storage of medicine and medical samples, access to the water supply, and health records. Power cuts will continue to disrupt life-saving medical procedures such as surgeries, life support systems, and dialyses, leading to permanent health impacts or death, including from organ failure. This will remain a risk for groups in need of timely medical attention, particularly when factors such as insecurity, labour shortages, medical equipment malfunction, and the failure of power backup aggravate the impact of the attacks. In the 25 December combined missile and drone attack, a hospital in Dnipro city lost power entirely and, consequently, its access to water and heating, which led to the evacuation of over 100 patients (Health Cluster 23/01/2025). These challenges will continue to cause high stress levels that can lead to health staff burnout (Truth Hounds 05/12/2024; PHR 04/12/2024; Health Cluster 23/01/2025, 23/12/2024, and 03/10/2024).
- **Direct hits and debris from missile and drone attacks on the energy infrastructure will continue to cause casualties, mental health issues, contamination with unexploded ordnance, and damage to energy and other civilian infrastructure, such as houses and roads** (OHCHR 19/09/2024; RBC Ukraine 16/01/2025 and 17/11/2024; Censor 25/12/2024; Health Cluster 23/01/2025; AAH 03/12/2024).
- **Critical infrastructure in frontline areas has been and will continue to be the most at risk of damage and destruction** given their exposure to regular artillery shelling and air attacks (OSW 22/10/2024; ACLED accessed 09/02/2025; WASH Cluster 27/12/2024). The risk of electricity repair personnel being attacked with drones in areas close to the front line remains very high (DTEK 09/12/2024). The most severe impact of power cuts remains in frontline areas, particularly in areas where there is no power at all and restoration is not possible because of insecurity and the extent of destruction (Media Center 23/11/2024; UNN 20/01/2025). Areas within 25km of the front line remain populated and face the most severe needs (IOM

08/05/2024; OCHA 16/01/2025). The total loss of power in frontline areas will likely continue to drive displacement, including potential evacuations, further straining the humanitarian response, IDP shelters, accommodation options, and essential services, particularly in areas with high IDP concentration.

- **Older people, IDPs, people with disabilities, and people in frontline areas will remain particularly affected by the attacks** owing to a combination of factors, such as the negative socioeconomic impacts of war, access constraints, response gaps, and damage to civilian infrastructure (REACH 23/01/2025, 05/12/2024, and 03/10/2024; OCHA 16/01/2025; WASH Cluster 27/12/2025; CORE 20/11/2024; KII 29/01/2025).
- **Power cuts will continue to drive displacement, including abroad.** In December 2024, around 30% of the people leaving for the EU cited lack of access to water, heating, and electricity as the second main reason for moving abroad after insecurity, down from almost 50% in July but still a significant amount (UNHCR 12/2024 and 08/2024).
- **Power outages will continue to disrupt online education for millions of children,** particularly in areas that are more frequently affected by insecurity and additional unplanned power outages (Education Cluster 24/01/2025; OCHA 16/01/2025; ACAPS accessed 10/02/2025).
- As described in the *original report*, rural areas are less reliant on district heating than urban areas as they use more diversified heating sources – mainly wood, coal, or decentralised gas. Some also have manual access to water wells. That said, despite different mitigation measures, **power outages will continue to affect rural households that rely on power to access water and heating and cannot afford to purchase a generator.**
- **Financial and in-kind international support has been one of the main factors mitigating the impact of power disruptions** (Govt. Norway 19/12/2024; Direct Relief 19/12/2024; UNDP 13/12/2024; Energy Community accessed 10/02/2025; KII 29/01/2025). Power back-up solutions such as generators, for example, have been vital in ensuring that hospitals can maintain critical and life-saving services and that district heating systems are running during power outages in the cold season (KII 29/11/2025; MOZ 26/12/2024).
- **War-affected communities across Donetska, Kharkivska, and Sumska oblasts will remain most at risk** with the combination of cold weather conditions, civilian infrastructure damage, and the number of affected people, such as IDPs, according to REACH's cold spot assessment (REACH 31/10/2024 and 28/11/2024; OCHA 30/12/2024; Shelter Cluster 22/10/2024). **Sumska oblast, in particular, is at greater risk because of response gaps** resulting from the prioritisation of support for frontline areas over Sumska and Chernihivska oblasts, where response coordination is also less effective. At the same time, overall delays in winterisation funding as well as mobilisation-related centralised heating and electricity repair labour shortages aggravate the situation (REACH 31/10/2024

and 23/01/2025; KII 29/01/2025). Sumska oblast was also one of the three most affected oblasts in terms of district heating facility damage after Kharkivska and Kyivska in September 2024 (REACH 18/09/2024).

Impact on humanitarian operations

- Power outages will continue to disproportionately affect **smaller NGOs and volunteers**, who are the main direct responders in frontline communities as previously anticipated.
- **Coordination and response gaps** will continue to affect the response, making it challenging to prioritise the areas where it is needed. This issue will continue to affect **Sumska oblast** in particular (KII 29/01/2025; KII 23/10/2024; KII 24/10/2024a; KII 30/10/2024b; ACAPS 05/12/2024).
- **A lack of available information** will continue to affect response coordination and preparedness planning among humanitarian clusters, humanitarian NGOs, and the Government (KII 29/01/2025).
- **The US funding suspension** will affect humanitarian support for the energy sector, as detailed earlier in the analysis.
- Prolonged power outages will continue to affect **communications**, in turn affecting planning and response (Ukrinform 05/11/2025; PHR 04/12/2024).

Socioeconomic impacts

- **The negative impacts of the war, such as inflation and labour shortages, will continue to compound the negative socioeconomic impact of the energy attacks** (IMF 20/12/2024; OHCHR 19/09/2024; NBU 05/12/2024 and 01/2025). The energy deficit from the overall increase in the number of attacks in 2024 compared to 2023 has also been driving inflation upwards. Inflation has continued to rise monthly, reaching 12% by the end of 2024, higher than the earlier 8.5% forecast (NBU 13/01/2025 and 10/2024). By the end of January 2025, inflation had risen further to 12.9% (NBU 11/02/2025).
- **Small and micro businesses will continue to face increased operational costs and losses**, compounded by a lack of financial and in-kind support, which will, in turn, reduce their resilience to future shocks (UN Women 12/12/2024; UACAT 08/01/2024).