BRIEF

Energy Insecurity in Ukraine: An Overview of Humanitarian and Socio-Economic Impacts

March 2025

Introduction

Energy disruptions have become a defining feature of the war in Ukraine. Targeted attacks on power generation and distribution infrastructure have caused widespread blackouts, disrupted heating systems, and severely impacted essential services, compounding the conflict's broader humanitarian and economic impacts. In early 2025, these challenges are unfolding amid growing uncertainty for Ukraine, marked by a sudden reduction in foreign assistance for both humanitarian operations and direct government budget support, including to the energy sector[1].

An understanding of geographic areas and population groups most vulnerable to energy insecurity can help mitigate short-term impacts and inform sustainable solutions. Using the INFORM methodology as an analysis framework, this brief examines the vulnerabilities of households and enterprises to energy disruptions. Leveraging data from REACH's Multi-Sector Needs Assessment (MSNA) and Humanitarian Situation Monitoring (HSM), it aims to inform the prioritization of resources amid declining funding towards energy security for Ukraine's conflict-affected population.

Key messages

- Continued attacks on Ukraine's energy infrastructure continue to disrupt electricity generation and distribution. While emergency repairs and increased imports have helped stabilize supply, localized blackouts, heating failures, and water disruptions remain widespread, particularly in frontline and de-occupied areas.
- Energy insecurity has deepened humanitarian and economic hardships, affecting access to essential services, livelihoods, and household resilience. Prolonged outages have undermined water and sanitation systems, disrupted healthcare and education, and driven up household expenditures, exacerbating vulnerabilities for displaced populations and those reliant on electricity for heating.
- Regions most at risk include Sumska, Kharkivska, Donetska, Chernihivska and Khersonska oblasts, where high hazard exposure, socio-economic vulnerability, and weak coping capacity converge. Localized impacts also vary at the raion level, with heavily conflict-affected and infrastructure-strained areas facing the greatest risks of prolonged energy insecurity.
- Uncertainty around international funding for Ukraine's energy sector and humanitarian response could undermine resilience and recovery efforts. Reduced foreign assistance could delay infrastructure repairs, limit emergency support for affected populations, and weaken Ukraine's ability to mitigate future disruptions, increasing long-term humanitarian and economic risks.

Photo 1. Photo taken during MSNA 2024 data collection in Zaporizka oblast. Source: REACH Ukraine.

Timeline of energy infrastructure attacks and impacts

Before February 2022

Prior to the full-scale invasion, Ukraine possessed a robust and extensive energy infrastructure. Despite losing control of several energy assets in 2014, Ukraine reliably met domestic demand and was a net exporter of electricity to neighbouring countries[2]. In early 2022, government-controlled territory had up to 59 gigawatts (GW) of installed electricity generation capacity[3], though with some facilities mothballed or in poor condition, available generation capacity stood closer to 37 GW[4]. This largely covered domestic demand, which peaked at 22 GW in January 2022[5].

2022-2023

On 24 February 2022, Ukraine disconnected from the Russian-controlled electric grid covering many former Soviet republics and began operating in isolation mode[6]. Ukraine requested emergency synchronisation with Europe's electric grid, and, following the required technical preparations, cross-border electricity flows began in June 2022[7]. Import capacity gradually rose from 0.7 GW to 2.1 GW by December 2024[8].

Within months after the start of the invasion, Russian forces had occupied power plants with 18 GW of electricity generation capacity, including the Zaporizhzhia NPP (6 GW), Europe's largest nuclear power plant[9]. The first concerted aerial strike campaign against Ukraine's energy infrastructure began in October 2022, primarily damaging substations (used for transmission and distribution of electricity) rather than power plants, causing extensive blackouts in the winter of 2022-2023[10].

2024

The situation deteriorated again in 2024. Ukrainian energy infrastructure was struck hundreds of times during the year[11], adding US$8.0 billion in power sector damages to the US$6.8 billion caused during 2022-2023[12]. Thirteen large attacks from March to December stand out for their devastating effect on Ukraine's electric grid, particularly its generation capacity[13]. The campaign destroyed or damaged power facilities in 20 oblasts, taking out over 9 GW of electricity generation capacity by late May[14]. Repairs are underway, though much of the damage is long-term.[15] Rolling blackouts began on 16 May, peaking in July when the electricity deficit reached 2.3 GW and the share of time with power outages reached 78% of the day across Ukraine[16].

Following the end of scheduled maintenance in October, Ukraine's remaining nuclear power plants – Rivne NPP, Khmelnytskyi NPP, and South Ukraine NPP – are under government control and fully operational, producing about 60% of the country's electricity[17]. This additional baseload capacity helped reduce the electricity deficit[18]. Although the reactors at these nuclear power plants have not been directly targeted, Ukraine's nuclear facilities remain vulnerable. This vulnerability was underscored on February 14, 2025, when a drone carrying a high-explosive warhead struck the New Safe Confinement structure at the Chernobyl Nuclear Power Plant, causing significant damage to the protective shelter. While radiation levels remained normal and no casualties were reported, the incident highlights the ongoing risks to nuclear safety amid the conflict. Additionally, strikes on off-site power supplies have repeatedly forced these plants to reduce output, and attacks on substations have disrupted electricity transmission[19].

2025

With the country's power plants only generating 8-12 GW of electricity during summer 2024[20], experts anticipated a deficit in energy in winter 2024-2025 when demand had peaked at 18 GW the previous winter[21]. As of February 2025, the worst-case scenario of a large-scale, prolonged energy deficit had not materialized, largely due to effective protection of critical infrastructure, increased electricity imports, and an unusually mild first half of the winter. However, recent developments have underscored the continued vulnerability of Ukraine's energy system. On February 18, 2025, a massive drone attack on Odesa left more than 250,000 residents without electricity, water, and heating, disrupting services in hospitals, schools, and residential areas. Just days earlier, on February 16, a strike on a thermal power plant in Mykolaiv deprived at least 100,000 people of heating amid sub-zero temperatures[22]. These incidents highlight the ongoing risk of localized crises, particularly in urban centers, despite broader stabilization efforts.

In January 2025, a sudden and significant reduction in humanitarian funding and direct budget support to Ukraine's energy sector has introduced new uncertainty around energy security, raising concerns about potential disruptions and increased humanitarian needs in the months ahead.

Photo 2. Photo taken during MSNA 2024 data collection in Kyivska oblast. Source: REACH Ukraine.

Humanitarian and socioeconomic impacts of energy disruptions

Energy is central to daily life, service functionality and economic stability. The impacts of energy disruptions often extend across sectors, exacerbating humanitarian needs and undermining livelihoods and recovery. This section highlights key areas where energy shortages are affecting households and enterprises.

Water, Sanitation, and Hygiene

Energy disruptions continue to undermine water supply systems across Ukraine, limiting access to safe drinking water and sanitation services. Power outages directly affect water utilities, reducing pumping capacity and cutting off water flow to households. This is especially critical in frontline and recently de-occupied areas, where infrastructure is already damaged by conflict. Among REACH's Humanitarian Situation Monitoring respondents, in December 2024, 71 % in Donetska, 31% in Kharkivska, and 20% in Khersonska oblasts reported that power outages disrupted their access to drinking water. Additionally, 25% of respondents in Kharkivska and Khersonska oblasts noted that power loss impacted access to functional toilets, posing health and hygiene risks.

According to a WASH Cluster analysis[23], the recent suspension of US-funded humanitarian programs in late January 2025 has further exacerbated these challenges. Key interventions such as bottled water distributions, repairs to water systems, borehole installations, and hygiene kit deliveries have been halted or severely delayed. In eastern oblasts like Donetska and Kharkivska, well-restoration projects and the installation of manual water columns have stopped, leaving residents reliant on unsafe and informal water sources. In Khersonska oblast, the postponement of large-scale bottled water deliveries to healthcare facilities has placed hospitals and clinics under strain, risking hygiene standards and infection control. Water utilities nationwide anticipate a 20% reduction in assistance, further weakening their capacity to maintain services during power cuts.

Without reliable access to water and sanitation, households are more vulnerable to disease outbreaks and deteriorating hygiene conditions, especially during winter months when heating systems are also affected by energy shortages.

Heating

Reliable heating is critical for household safety and well-being during Ukraine's harsh winters, when temperatures can drop to -20°C. Households relying on electricity or district heating are particularly vulnerable to disruptions from strikes on power stations or heating plants. District heating systems, common in urban areas, provide centralized heating and hot water to multiple buildings through an interconnected network of power plants, boiler houses, and pipelines. This system means that damage to a single facility can cut heating to entire neighborhoods.

District heating services remain vulnerable to electricity cuts, as backup generators and alternative fuel sources are limited. A 2024 assessment by REACH[24] found that nearly half of the district heating companies surveyed required backup power generators, while 68% requested cogeneration units and 60% needed boiler houses to maintain operations. Furthermore, 66% of companies reported insufficient funds to sustain services, and nearly half faced staffing shortages, highlighting the fragile state of the system.

Users of both electricity and district heating are more exposed to losing access to heating during winter in case of strikes on electricity or heating producing stations. Accessibility to electricity, including for heating, can be further constrained by rising electricity prices[25].

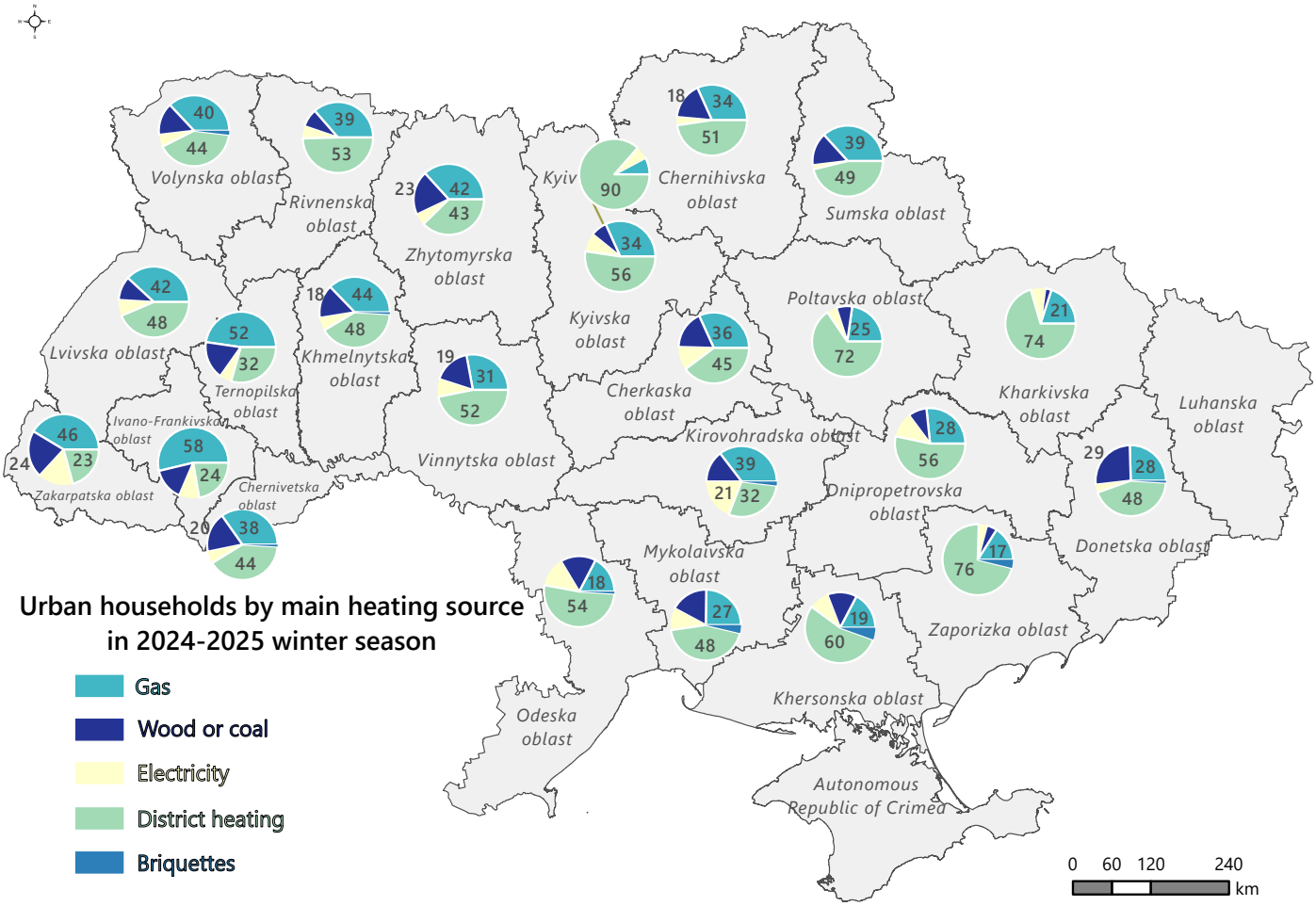
Displacement

While security concerns remain the primary driver of displacement, energy insecurity has increasingly become a significant push factor for people leaving Ukraine. During summer 2024, the lack of reliable electricity and heating emerged as the second-most cited reason for departure, only surpassed by security concerns[26]. UNHCR border monitoring data showed that in June, 25% of people leaving the country cited energy-related reasons, rising to 49% in July as power outages intensified[27]. Similar levels were recorded in November and December when blackouts returned. This energy-driven displacement trend has worrying economic implications, with the National Bank of Ukraine (NBU) warning of a growing net outflow of migrants, which could exacerbate labour shortages, weaken consumer demand, and undermine the tax base, further constraining Ukraine's economic recovery[28].

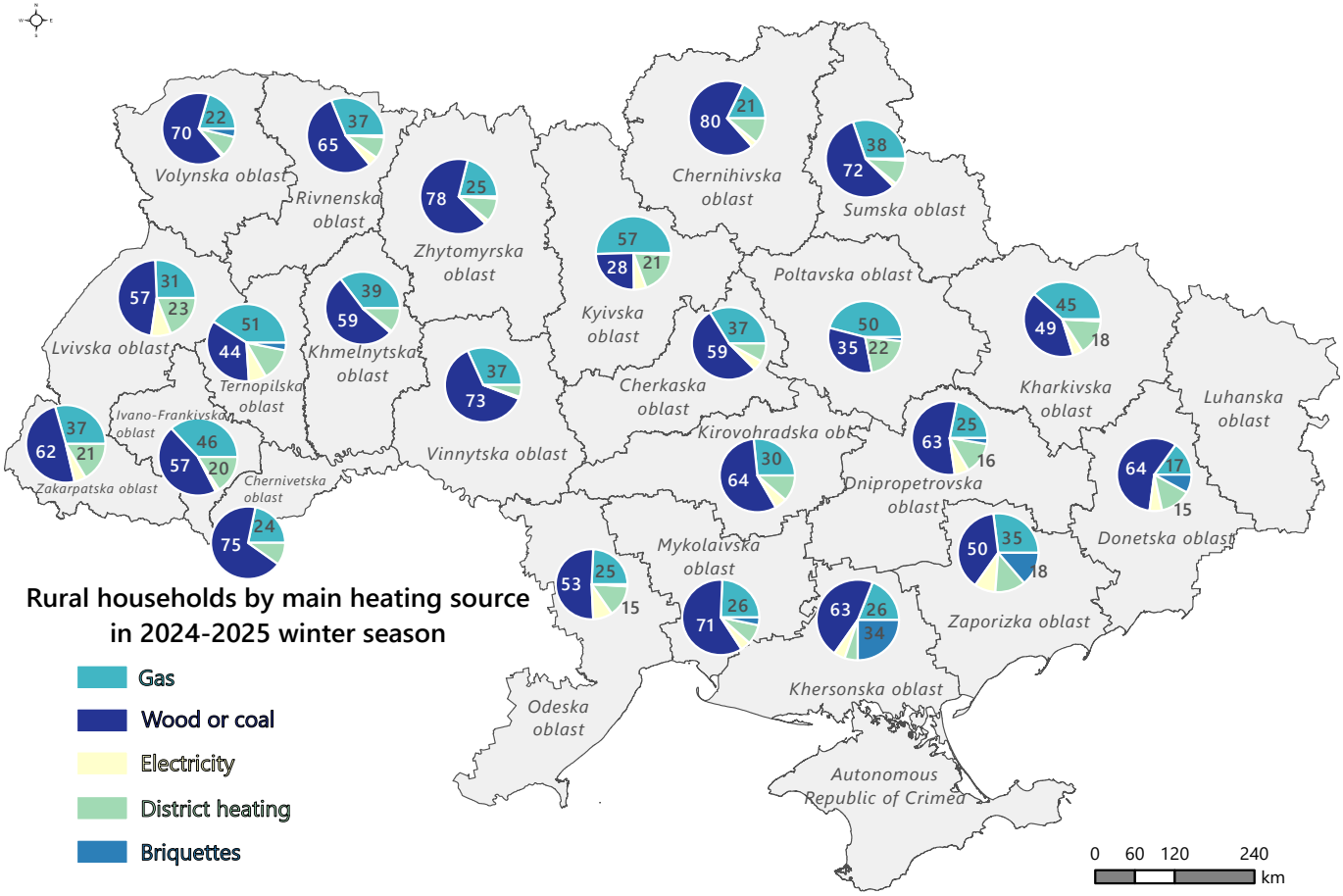
Health

Energy disruptions have profound and multifaceted impacts on public health, particularly in conflict-affected regions. The interruption of electrical power compromises the functionality of healthcare facilities, leading to delays in elective surgeries, interruptions during critical procedures, and failures in life support systems. A study highlighted that 7.8% of healthcare facilities experienced malfunctions in diagnostic equipment, such as X-ray machines and MRIs, due to power outages[29].

Beyond immediate healthcare delivery challenges, energy insecurity exacerbates mental health issues. The unpredictability of power supply, combined with the stressors of living in conflict zones, contributes to heightened levels of anxiety and depression among affected populations. Research indicates that consistent access to electricity is crucial for mental well-being, as its absence can lead to serious mental health concerns[30].



Map 1. Urban households by main heating source in the 2024-2025 winter season, REACH Humanitarian Situation Monitoring, December 2024 - January 2025.



Map 2. Rural households by main heating source in the 2024-2025 winter season, REACH Humanitarian Situation Monitoring, December 2024 - January 2025.

Education

In frontline and conflict-affected areas, school closures due to insecurity have made remote online learning the primary education modality for children. As a result, energy insecurity, particularly electricity cuts and internet outages, directly threaten children's access to education, interrupting online classes and limiting learning opportunities. According to the Ukraine Education Cluster, approximately 45% of schoolchildren in frontline areas rely entirely on online learning, making them particularly vulnerable to power and connectivity disruptions[39].

Power outages and heating failures also affect children attending school in person, leaving classrooms cold, dark, and poorly equipped during winter. In bomb shelters used during air raids, the lack of power and heating worsens already difficult conditions, further disrupting learning. It is estimated that electricity shortages could result in the loss of up to 311 million learning hours per month across Ukraine in winter, with children in frontline and de-occupied areas facing the greatest risk of falling further behind.[40] Prolonged energy disruptions not only threaten immediate access to education but may also contribute to long-term learning loss, particularly for children who have already endured multiple academic interruptions since the escalation of the war in 2022.

Livelihoods

Energy disruptions in Ukraine have had widespread consequences for both household livelihoods and enterprises, straining coping capacities and threatening economic stability. Frequent power outages interrupt business operations, increase production costs, and reduce working hours, limiting income-generating opportunities for households and small businesses. Rural and agricultural communities face additional challenges, as machinery used for food production and storage relies on stable electricity. Farmers have reported spoilage of perishable goods, such as dairy and meat, due to unreliable refrigeration, while irrigation systems often fail during prolonged blackouts[31]. According to the Food Security and Livelihoods Cluster, rising energy costs have also compounded financial pressures on households, forcing many to reduce expenditure on food and other essentials to cover utility bills[32]. Women, older people, and persons with disabilities have been disproportionately affected, as their income-generating activities are often more vulnerable to disruptions, while they face greater barriers to adapting or finding alternative livelihood options. This is compounded by electricity prices for households increasing by 64% from June 2024. Given the average monthly consumption of 170 kWh, the increase amounted to 285 UAH per month[33].

Economic recovery

The electricity situation put additional pressure on Ukraine's economic recovery. National and international agencies cut their growth forecasts for Ukraine's GDP in 2024, all citing attacks on energy infrastructure[34]. Electricity prices surged after renewed attacks in March 2024, contributing to industrial inflation rising year-on-year to 31% by August[35]. Electricity cuts reportedly impacted Ukrainian businesses

Graph 1. Wholesale energy price changes from February 2022 in UAH, Market Operator.

in many ways, including by decreasing productivity and increasing costs; this affects consumers in turn, including through higher prices and unreliable delivery schedules[36]. In a study conducted by the Ukraine Crisis Analysis Team in Mercy Corps, farmers reported increased operational costs, hampered business development, financial losses, and driven up prices for agricultural products, as well as raw product wastage due to the unpredictability of the power cuts[37].

At the same time, the Ukrainian economy and businesses displayed resilience. The country's GDP grew by about 3.5% during 2024. Energy-intensive industries like steel production surpassed their 2022 and 2023 output figures, when there was more electricity at cheaper prices; while this also reflected global demand, and production volumes began to stagnate in the second half of the year, it indicates the continued operability of these industries. Businesses' expectations for their near-term performance were only slightly lower than 2023[38].

Assessing energy vulnerability

This section presents the results of the Energy Vulnerability Index, designed to support evidence-based targeting of humanitarian assistance and support to Ukraine's energy sector. It identifies the geographic areas and populations most vulnerable to energy insecurity in the context of the suspension of key humanitarian and government funding streams.

The INFORM methodology[41] is used as an analytical framework, measuring risks based on three core dimensions:

1. **Hazard & Exposure**: The likelihood and intensity of a potential disruption (e.g., proximity to conflict, natural hazards).
2. **Vulnerability**: The susceptibility of a population to harm, reflecting demographic and socio-economic factors.
3. **Lack of Coping Capacity (LOCC)**: The ability of households, communities, and systems to withstand and recover from shocks.

In the context of this assessment, the Energy Vulnerability Index measures oblast- and raion-level exposure to energy-related hazards, population vulnerabilities, and coping capacity limitations that can shape the humanitarian consequences of energy insecurity.

Risk = Hazard Exposure x (Vulnerability + LOCC) / 2

The index is built on multiple data sources collected by REACH:

- **Humanitarian Situation Monitoring (HSM) Calibration data**, collected from December 2024 to January 2025, representative at the oblast level (admin 1).
- **Multi-Sector Needs Assessment (MSNA)**: Data collected in May to July 2024, representative at the raion level (admin 2) for more granular analysis.

Limitations

Data interpretation should be guided by its limitations, including data gaps in hard-to-reach areas, reliance on proxy indicators, temporal variability in rapidly changing conditions, and the potential for oblast- and raion-level aggregation to obscure localized differences. Additionally, the measurement of coping capacity is complex and may not fully capture household resilience. The Index applies indicator weighting to reflect the relative importance of factors, though this involves some subjectivity. This, along with data gaps, proxy indicators, and aggregation limitations, should be considered when interpreting results. Full methodological limitations are available in the annex.

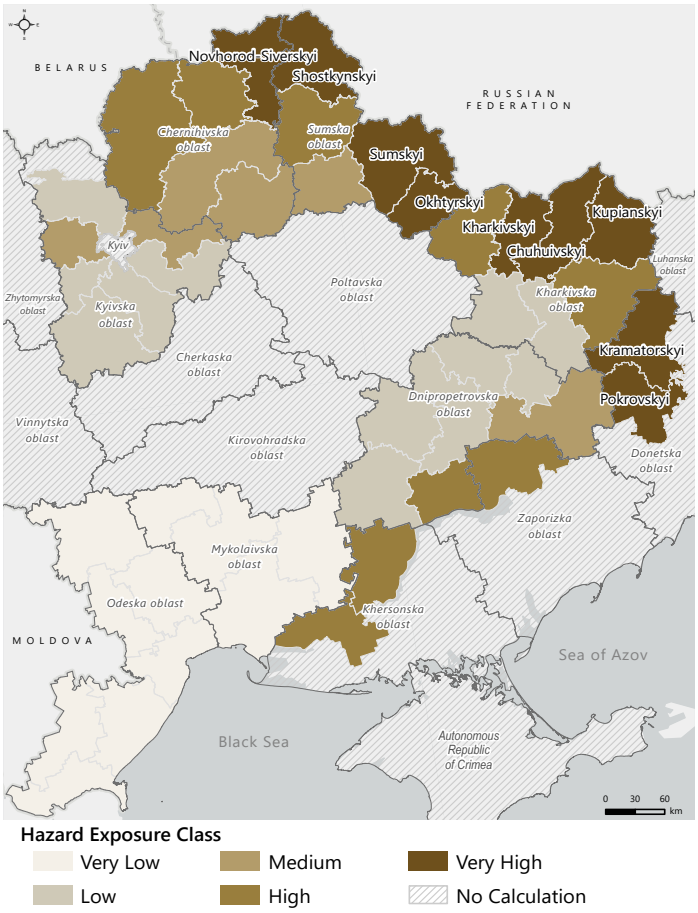
Photo 3. Photo taken during MSNA 2024 data collection in Kharkivska oblast. Source: REACH Ukraine.

Hazard and exposures dimension

The Hazard and Exposure dimension measures the likelihood of energy disruptions and the extent to which populations are exposed to these risks. It captures both conflict-related threats and natural hazards, alongside population density, which amplifies potential impacts. This includes proximity to the frontline (Acted "L-levels") and the frequency of conflict events recorded in 2024 (ACLED), both of which signal the risk of strikes on energy infrastructure and the potential for widespread outages. Additionally, natural hazard data on temperature extremes is incorporated to reflect the heightened energy needs and strain on infrastructure during periods of severe cold. Finally, population size (as a percentage of oblast and national levels) serves as an exposure indicator, showing the scale of the population that could be affected in the event of energy disruption. Together, these elements help identify areas where energy infrastructure is most at risk and where interruptions could have the greatest humanitarian impact.

The results indicate geographic variation in exposure to energy-related hazards. The three highest-ranking oblasts in this dimension – Sumska, Chernihivska, and Kharkivska – are all located along the northeastern frontline and have experienced frequent attacks on energy infrastructure, combined with high exposure to cold temperatures. Donetska also ranks among the most exposed due to ongoing hostilities, further exacerbating risks of prolonged energy cuts. In contrast, oblasts in western Ukraine exhibit lower hazard and exposure scores due to their distance from the frontline and lesser direct attacks on energy facilities.

At the raion level (MSNA data, summer 2024), Shostkynskyi, Sumskyi, Kupianskyi, Kharkivskyi, and Pokrovskyi ranked highest in hazard and exposure. These areas, all near the front line, have faced repeated strikes on infrastructure, including energy, increasing the risk of prolonged disruptions.



Map 3. Hazard and exposure extent by raion.

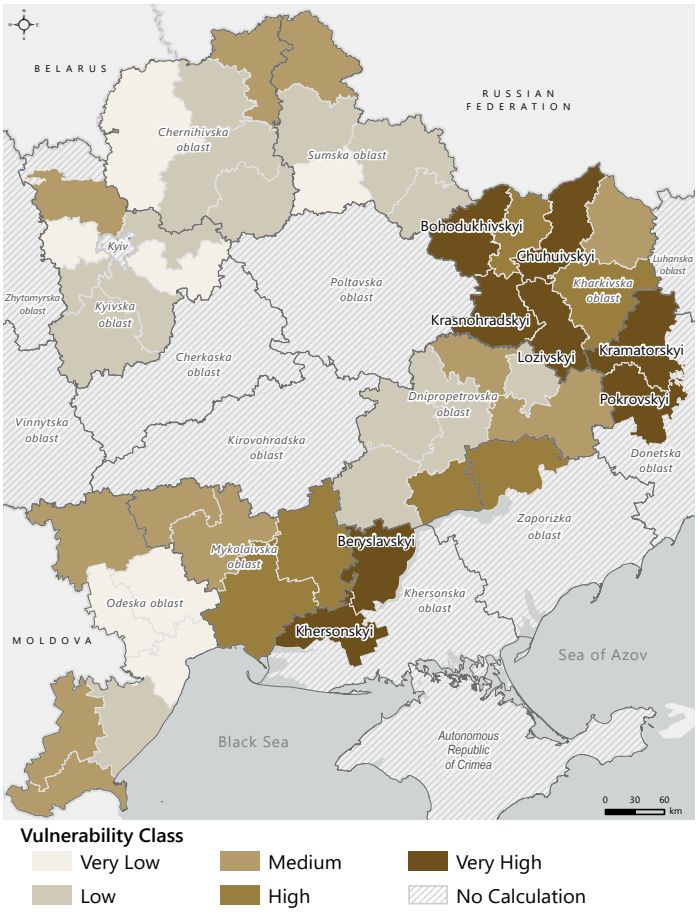
Map 4. Hazard and exposure extent by oblast.

Vulnerability dimension

The Vulnerability dimension assesses the susceptibility of households and communities to harm when energy disruptions occur, focusing on demographic characteristics and socio-economic conditions that heighten risk. It considers populations with specific needs, such as a high proportion of internally displaced persons (IDPs), elderly residents, and children, who may struggle more to cope with power outages or heating disruptions. Additionally, household-level data on utility interruptions (e.g., cold water, hot water, gas, electricity), poor housing conditions (e.g., homes that are too hot or cold, lack of lighting), and reliance on electricity for heating reflect factors that make households more vulnerable when the energy supply is unstable. Barriers to accessing services like education (e.g., remote learning challenges due to internet disruptions) and food storage or cooking due to power cuts further demonstrate how energy disruptions compound everyday hardships. These indicators help reveal where populations are least equipped to absorb shocks, highlighting areas that may require urgent support to prevent deteriorations in living conditions when outages occur.

As expected, frontline, highly-conflict affected oblasts in the South (Khersonska), East (Donetska and Kharkivska) and North (Sumska) rank highest on the vulnerability dimension. This is driven by high concentrations of vulnerable groups, frequent utility disruptions, and shelter damage caused by conflict-related destruction. Zaporizka and Mykolaivska also rank among the most vulnerable, reflecting the ongoing strain on infrastructure and access to essential services in these regions.

At the raion level (MSNA data, summer 2024), Bohodukhivskyi, Kramatorskyi, Beryslavskyi, Krasnohradskyi, and Khersonskyi rank highest in the vulnerability dimension. These areas have high concentrations of IDPs, frequent utility disruptions, and shelter damage due to ongoing conflict, making households particularly exposed to energy insecurity. Other highly vulnerable raions, such as Pokrovskyi and Chuhuivskyi, also face severe infrastructure strain.



Map 5. Vulnerability to energy disruptions extent by raion.

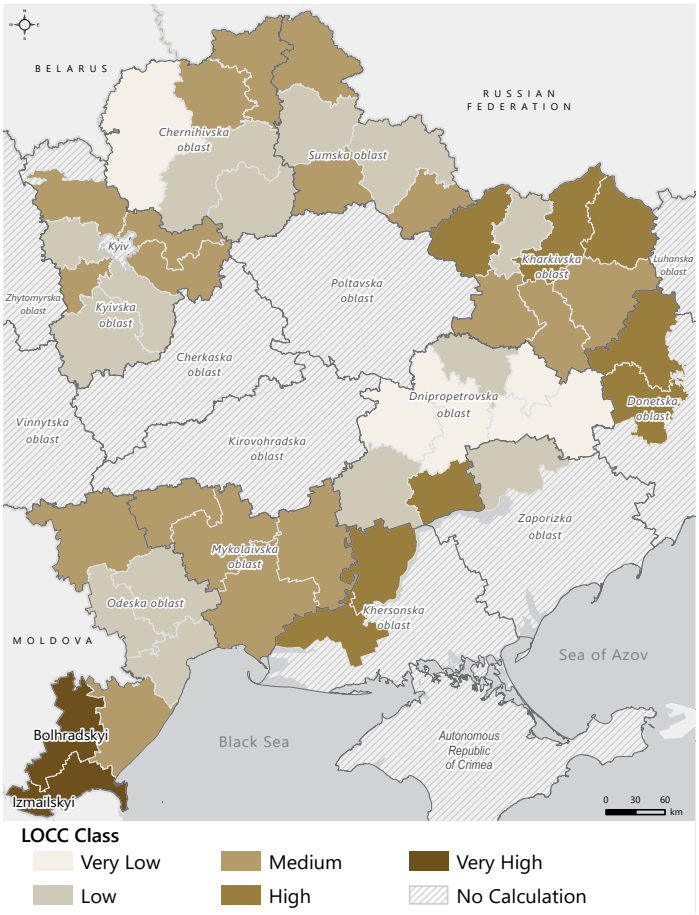
Map 6. Vulnerability to energy disruptions extent by oblast.

Lack of coping capacity dimension

The Lack of Coping Capacity (LOCC) dimension evaluates the ability of households and communities to manage and recover from energy disruptions, focusing on financial constraints, access to essential services, and reliance on collective support mechanisms. Key indicators include the percentage of household expenditure spent on utilities, the availability of hot water for hygiene, reported difficulties in cooking and food storage due to power cuts, and the capacity of active collective sites per internally displaced persons (IDPs). These factors highlight both economic strain and service access barriers, which influence how well households and communities can withstand prolonged energy shortages.

Regions with the highest lack of coping capacity are concentrated in the south (Khersonska, Mykolaivska, and Odeska), east (Donetska), reflecting economic strain and limited access to essential services. Households in these areas face higher utility costs relative to their income, making it more difficult to afford alternative energy sources during disruptions. Additionally, these oblasts report greater difficulties with food storage and cooking due to power outages, further straining household resilience. Khersonska ranks the highest, indicating severe challenges in service provision, reliance on collective sites for IDPs, and inadequate infrastructure to sustain basic needs.

At the raion level (MSNA data, summer 2024), Izmailskyi, Bolhradskyi, Bohodukhivskyi, Beryslavskyi, and Kramatorskyi rank highest in lack of coping capacity (LOCC). These areas face significant constraints in accessing alternative resources, financial strain on households due to high utility costs, and limited capacity to absorb further shocks. Other high-ranking raions, such as Nikopolskyi and Chuhuivskyi, also face limited service access and economic resilience, further compounding humanitarian needs.



Map 7. Lack of coping capacity extent by raion.

Map 8. Lack of coping capacity extent by oblast.

Overall risk calculations

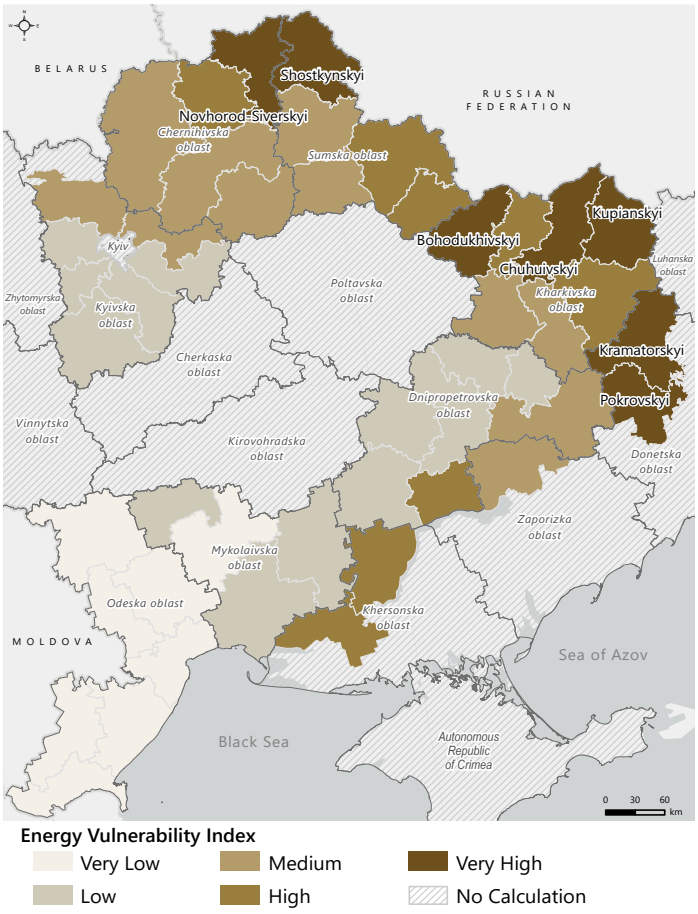
The final Energy Vulnerability Index integrates hazard exposure, vulnerability, and lack of coping capacity to identify oblasts most at risk of severe humanitarian and economic consequences due to energy disruptions.

The results highlight Sumska, Kharkivska, Donetska, and Chernihivska as the most energy-insecure oblasts, with Sumska ranking highest due to a combination of frequent exposure to conflict, extreme winter conditions, high socio-economic vulnerability, and limited coping mechanisms. Kharkivska and Donetska follow closely, reflecting high levels of conflict intensity, infrastructure damage, and disruptions to essential services, exacerbating residents' difficulties in securing reliable energy access.

Other oblasts with elevated risk include Khersonska and Chernihivska, which face significant vulnerabilities due to ongoing conflict-related infrastructure strain and disruptions to district heating and electricity supplies. While western oblasts exhibit lower levels of energy insecurity, owing to greater distance from active conflict zones, more stable infrastructure, and relatively stronger coping capacities, localized vulnerabilities persist in these regions, particularly for internally displaced populations reliant on limited resources.

At the raion level (MSNA data, summer 2024), Kramatorskyi, Pokrovskyi, Chuhuivskyi, Shostkynskyi, and Kupianskyi have the highest risk scores, driven by a combination of high hazard exposure, socio-economic vulnerability, and lack of coping capacity. These areas experience frequent utility disruptions, high reliance on electricity for heating, and widespread shelter issues, exacerbating humanitarian needs.

Other high-risk raions, such as Bohodukhivskyi, Novhorod-Siverskyi, and Beryslavskyi, also show significant vulnerabilities due to high IDP concentrations and limited capacity of collective sites. In these areas, limited infrastructure resilience and economic constraints make recovery efforts more challenging, requiring sustained humanitarian support.



Map 9. Energy vulnerability index scores by raion.

Map 10. Energy vulnerability index scores by oblast.

Conclusion

Ukraine's energy sector has faced challenges from targeted attacks on its infrastructure, significantly impacting electricity generation and distribution. Despite these, Ukraine demonstrated resilience through emergency repairs, increased electricity imports, and a focused operation of its remaining nuclear power plants.

While projections had warned of severe, prolonged blackouts, mitigation efforts - including infrastructure repairs and increased electricity imports - have prevented a total collapse of the grid. Widespread utility disruptions continue, however, to affect access to water, heating, and essential services, exacerbating humanitarian needs.

The energy crisis has also placed strain on Ukraine's economy, driving inflation, increasing production costs, and contributing to emigration. Despite significant challenges, Ukraine's GDP grew by 3% in 2024, demonstrating adaptability amid rising production costs.

Looking ahead, Ukraine's ability to sustain energy resilience could depend on continued infrastructure repairs, external support, and the protection of its remaining energy assets. Addressing vulnerabilities in high-risk regions will be critical to ensuring both humanitarian stability and economic recovery. However, with uncertainty surrounding international funding for Ukraine's energy sector, sustaining this resilience remains uncertain. Without predictable financial support, ongoing repairs and service stability could be at risk.

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7 Ministry of Energy, ENTSO-E; preparations for Ukraine's integration with the European electricity network had been underway for several years (ENTSO-E, Stiftung Wissenschaft und Politik).
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14 International Energy Agency.
15 Kyiv School of Economics, Kyiv School of Economics.
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ABOUT REACH

REACH Initiative facilitates the development of information tools and products that enhance the capacity of aid actors to make evidence-based decisions in emergency, recovery and development contexts. The methodologies used by REACH include primary data collection and in-depth analysis, and all activities are conducted through inter-agency aid coordination mechanisms. REACH is a joint initiative of IMPACT Initiatives, ACTED and the United Nations Institute for Training and Research - Operational Satellite Applications Programme (UNITAR-UNOSAT).

Annex - Methodology note

The Energy Vulnerability Index assesses geographic areas and population groups most at risk of energy insecurity in Ukraine, combining conflict-related threats, infrastructure damage, and socio-economic vulnerabilities. It follows the INFORM methodology, which measures risk through three core dimensions:

- **Hazard & Exposure** – The likelihood and intensity of energy disruptions, incorporating conflict dynamics (e.g., shelling density, frontline proximity), population exposure, and historical cold wave frequency.
- **Vulnerability** – The susceptibility of populations to harm, including high proportions of internally displaced persons (IDPs), elderly residents, and children, alongside socio-economic constraints like reliance on electricity for heating and frequent utility disruptions.
- **Lack of Coping Capacity (LOCC)** – The ability of households and communities to manage and recover from disruptions, measured through financial strain (e.g., energy expenditure as a share of household income), access to essential services, and infrastructure limitations (e.g., capacity of collective sites per IDP).

Data Sources and Calculation

The index integrates **multiple datasets** to provide a granular understanding of energy insecurity:

- **REACH Humanitarian Situation Monitoring (HSM) Calibration Data (Winter 2024)**: Representative at the oblast level (admin 1).
- **REACH Multi-Sector Needs Assessment (MSNA) (Summer 2024)**: Representative at the raion level (admin 2).
- **Conflict Event Data (ACLED, 2024)**: Measures shelling intensity and proximity to the frontline as indicators of infrastructure damage risk.
- **Demographic and Socio-Economic Data**: Population density - Common Operational Dataset on Population Statistics (COD-PS) produced by UNFPA (May 2024), IDP concentrations - International Organization for Migration (IOM), Round 39, Ukraine, (December 2024), and household-level energy dependency inform exposure and vulnerability indicators – UNFPA (May 2024), Ukraine Collective Site Monitoring: Round 15, (November - December 2024).
- **Historical Climate Data (2004-2024)**: Cold wave frequency data reflects seasonal energy stressors.

Scoring and Normalization

Each dimension is weighted and normalized on a scale from 0 (lowest risk) to 1 (highest risk). The final Energy Vulnerability Index is calculated as:

RISK = Hazard Exposure x ((Vulnerability + LOCC) / 2)

However, oblast-level scores provide a broader strategic overview, while raion-level data enables more localized targeting of energy-related vulnerabilities.

Limitations

- Temporal variability: Energy conditions fluctuate due to conflict dynamics and seasonal factors, meaning findings reflect a snapshot in time rather than real-time conditions.
- Proxy indicators: Some metrics, such as expenditure on heating, serve as proxies for broader energy insecurity but may not fully capture all aspects of household resilience.
- Aggregation effects: While oblast-level findings provide strategic insights, localized disparities may be obscured at higher administrative levels.

List of indicators

MSNA (Summer 2024)	HSM (Winter 2024)
Socio-economic	
Households reportedly experiencing utility interruptions on the admin of oblast	Households experiencing utility interruptions lasting 3 hours or more in the past 4 weeks on the admin of oblast
- Cold water	- Cold water supply
- Hot water	- Hot water supply
- Gas	- Gas (decentralized or centralized)
- Internet	- Internet
Households reportedly experiencing issues with electricity on the admin of oblast	Households experiencing issues with electricity on the admin of oblast
- No electricity	- No electricity
Household members (5-18 y.o) who attended school by learning modality on the admin of oblast	School-aged household members (5-17 y.o) attending school by learning modality during 2024-2025 school year on the admin of oblast
- Remote learning	- Never
Households reportedly having access to the Internet on the admin of oblast	Households access to internet in the past 4 weeks, by frequency on the admin of oblast
- Never	- Never
Households reporting shelter issues that were NOT caused by the war on the admin of oblast	Households by current shelter issues that were NOT caused by the war, by issue on the admin of oblast
- Often too hot or cold inside	- Often too hot or cold inside
Households reporting main heating source last winter on the admin of oblast	Households by main heating source in 2024-2025 winter season on the admin of oblast
- Electricity	- Electricity (decentralized)
Households reporting missing non-food items on the admin of strata	Households reporting missing or inadequate non-food items in the past 6 months, by type on the admin of oblast
- Winter clothes for a household member (e.g. jacket, boots, underwear, clothes)	- Winter clothes for a household member (e.g. jacket, boots, underwear, clothes)
- Fuel for heating (coal, firewood, liquid gas)	- Fuel for heating (coal, firewood, liquid gas)
- Heating appliances (heaters, boiler systems)	- Heating appliances (heaters, boiler systems)
Preferred modality of assistance per aid type on the admin of strata	Households reporting heating as main challenge, by preferred modality for heating assistance on the admin of oblast
	- Yes
LOCC	
Estimated Household's Domestic Expenditure on Heating during the last winter on the admin of oblast	Heating expenditure as percentage of the total expenditures on the admin of oblast
Households reportedly experiencing issues while cooking on the admin of oblast	Households experiencing issues with cooking on the admin of oblast
- Cooking	- Yes, with issues
Households reportedly experiencing issues while storing food on the admin of oblast	Household experiencing issues with storing food on the admin of oblast
- Food	
Households reporting to experience cuts in assistance from the government on the admin of oblast	Households experiencing cuts in assistance from the government in the past 6 months on the admin of oblast
	- Yes, IDP allowance
Capacity of Active collective sites per IDPs	Capacity of Active collective sites per IDPs