

# UKRAINE – Energy infrastructure damage

## Situation overview for 10-24th October 2022

The invasion of Ukraine in February 2022 has led to wide-spread infrastructural damage across the country. Most recently, between 10th and 24th October, the number and severity of conflict incidents affecting energy infrastructure has drastically increased. This has affected regions situated both in proximity to and at a distance from the line of contact (Map 1). Within this two week period, damage incidents impacting energy infrastructure were recorded in 19 out of 25 oblasts, as well as in the capital city of Kyiv.

Based on a review of official and media reports along with the analysis of satellite imagery, **this situation overview seeks to provide a summary of the impacts on access to energy and subsequent humanitarian consequences.** Incidents relating to energy infrastructure damage were identified through a review of social and news media, and damage to the object was then confirmed via analysis of satellite imagery. Please note that due to the limitations affecting the media review, the count of damaged facilities may not include all affected power generating and transmitting facilities. The results of the imagery analysis do not allow for an assessment of the degree to which the facility is damaged, instead they only confirm that an incident did in fact occur at that location.

### Damage analysis

As has been well publicized, the Government of Ukraine reported that 30% of its power stations were destroyed since 10th October [1]. However, it is worth noting that **damaged infrastructure included power generation plants, as well as crucial power distribution facilities.** There are 97 power plants and transmission substations defined as critically important facilities (CIF) by the Government [3].

Media monitoring identified 14 instances of damage to CIFs between 10th and 24th October. This equates to 14% (14 of the 97) of CIFs, including 16% (8 of 50) of power generation CIFs and 13% (6 of 47) substation CIFs. Map 1 depicts the type of infrastructure damaged by oblast. Notably, it can be seen that:

- **Critical power generation CIFs** were damaged in Ivano-Frankivska, Vinnytska, Kyiv and Kyivska, Dnipropetrovska, and Donetsk.
- **Critical power transmission CIFs** were damaged in Lvivska, Rivnenska, Sumska, Poltavska, and Dnipropetrovska.

### Primary concerns identified in the media review

#### 1. Household access to essential utilities:

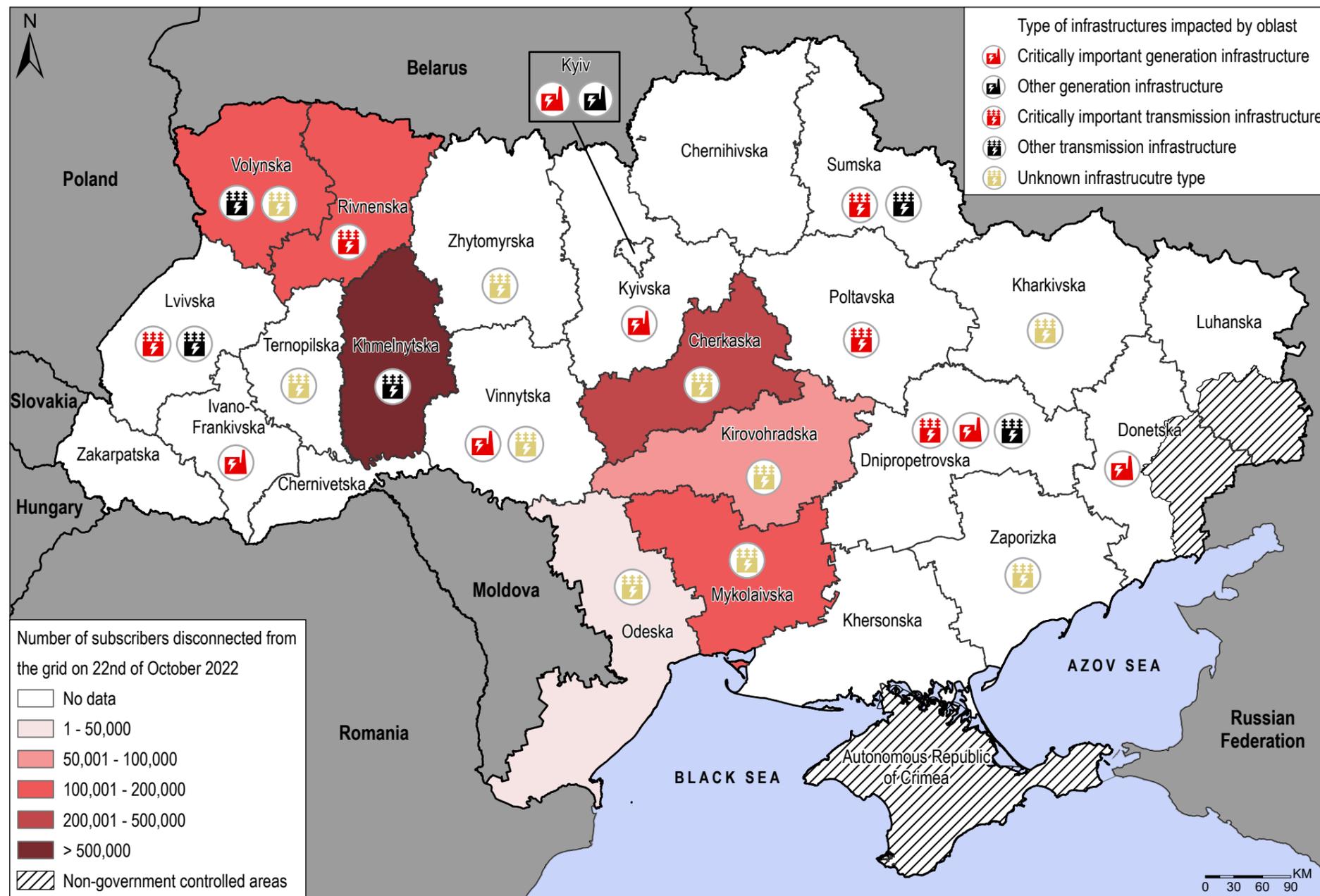
**Most immediately, on 10th of October, power supply was disrupted in 15 oblasts** [4], while the length of disruption ranged from 2-3 to more than 24 hours. Affected oblasts included Lvivska, Ivano-Frankivska, Chernivetska, Khmelnytska, Zhytomyrska, Vinnytska, Kyivska, Kirovohradska, Mykolaivska, Dnipropetrovska, Zaporizka, Poltavska, Kharkivska, Sumska, and Ternopiiska. To maintain the stable operation of the power system, energy supply restrictions were introduced in Kyiv city and ten oblasts of Ukraine [5].

It was later reported on 22nd of October, that **approximately 1.5 million of subscribers were disconnected from the grid in Western and Central Ukraine** [5] (Map 1). While DTEK, one of the largest energy providers in the country, reported that restoration of power was needed by 300,000 households in Donetsk and 327,000 households during October [6].

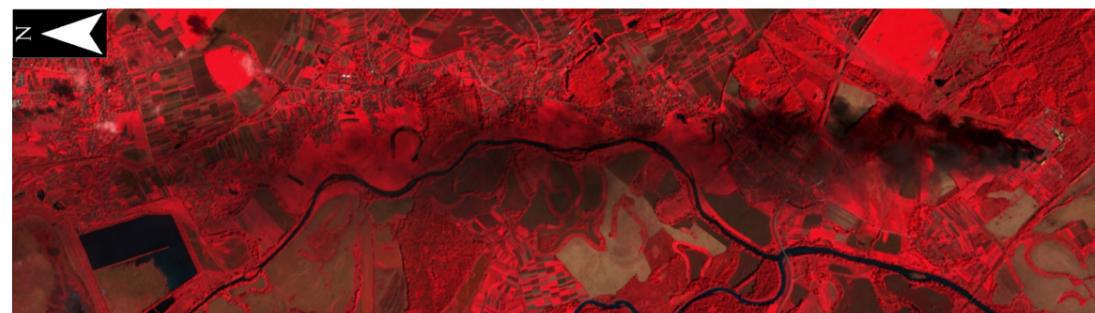
**Similarly, water supply has been intermittently disrupted due to the damage to energy infrastructure.** Following 22nd October, water supply was partially disrupted in Zhytomyr, Khmelnytskyi, Poltava, Kharkiv, Lutsk, Lviv and Kyiv.

#### 2. Household access to heating:

As the country heads into the winter months, there is **heightened concerns around what this may mean for city heating networks.** District heating relies on electric pumps to move heated water from boilers through the



**Map 1. Types of energy infrastructure reported as damaged between 10-24th October 2022 on social and new media and the estimated number of affected people by power-outage on 22nd October 2022. Sources: [3,5] & media reports.**



**Image 1. Smoke stretches over 10 km away from Zakhidnoukrainska substation on 10th October on Sentinel-2 image available via EO browser. Band combination: B8-B4-B3.**

**14** power plants and transmission substations of critical importance were impacted on 10-24th of October 2022

**1.5** million of subscribers were disconnected from the grid following the strikes on 22nd of October 2022

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heating network into the household radiators [7]. Roughly 53% of urban households across Ukraine rely on district heating as their main source for heat in winter [8]. Other traditional alternatives to district heating such as plug-in heaters will also be impacted by electricity cuts.

As winter approaches, **this uncertainty around heating infrastructure is a key concern**. A forthcoming analysis produced by REACH, through the construction of a winter-hazards composite measure demonstrates that 9 out of the 24 oblasts in Ukraine have a very high or high chance of extreme cold exposure (-15 degrees or lower) in the months of December – February [9]. At this temperature, without protection, prolonged exposure can lead to conditions such as hypothermia, frostbite and cardiac arrest [10].

**Authorities and the humanitarian community are currently developing contingency plans to assist the community throughout the winter.** Where possible, authorities urge residents who have the access to wood-burning stoves to stock up on firewood and/or gas-fuel cookers [11]. Oblast authorities have commenced planning for emergency heating and cooling points in schools and kindergartens [12]. Local authorities in Kharkiv have already reported limiting hot water supply to consumers [13].

### 2. Connectivity:

Further to this, **communication infrastructure was also disrupted by damage of power generating and transmitting facilities**. According to the Ministry for Digitalization of Ukraine, mobile phone connection partially disappeared or deteriorated in eight oblasts of Ukraine [15] and its quality varied extensively across the country after the strikes on 10th October [16].

### 3. Transportation:

- The Mayor of Mykolaiv city reported on the necessity for the municipality to reduce the number of trams and trolleybuses on the routes to save electricity [17].
- The national railway operator, Ukrzaliznytsya, reported that during the days of the most massive attacks up to 20 passenger trains were temporarily disrupted or delayed due to blackout [5,18].

### 4. Public safety and utilities:

- In Poltava and Kyiv restrictions on street lighting were introduced [19], while regional authorities in Lvivska oblast decided to prohibit utilization of energy for advertisement and lighting of buildings during the nighttime [20].

### 5. Markets and financial services:

- Problems with electricity supply also affected banks, postal and fiscal electronic services [1].

### 6. Health and safety in the workplace:

- Employees dependent on ventilation infrastructure to ensure airflow in their workspace, such as mines, were affected. In Kryvyi Rih, more than 800 miners were trapped in the underground mine for several hours [18].

### 7. Environment:

- Damage to energy infrastructure damage also caused at least 30 fires on 11th of October 2022 across Ukraine [4].
- Another indirect consequence of the attacks on the energy infrastructure was the urgent need to use hydropower plants to meet the need for electricity. Consequently, an extensive work of such plant in Kyiv led to the increase of water level in Dnipro River and flooding of some areas in the city, however, without reported impact on households or people [21].

## Efforts to repair damage

**Ukrainian energy providers are working to restore the energy grid.** By 24th October, it was reported that the Ukrainian Energy Company, Ukrenerho, and regional grid operators had restored electricity to most of the disconnected subscribers [14].

However, **a lack equipment needed to fully restore the network** (such as transformers, switches, automation, cable products, etc.) is reported. Problems in sourcing compatible components for repair were also reported [7]. Given the age of the infrastructure, new components sent to Ukraine are sometimes incompatible with the older system. Moreover, it has been reported that delays in the delivery of equipment may result from the need to order specialized parts for which there is generally a production queue [22].

## Key considerations identified in media monitoring

*To mitigate extended disruptions, the following actions may be needed:*

- Replace the damaged equipment: transformers, circuit breakers, switches, generators, cables.
- Continued advocacy in the search for older model parts used for repair of the old system, including non-functional components.
- Conduct additional training for energy network personnel on safety.
- Ensure sufficient capacity to respond efficiently to emergencies (vehicles, fuel stocks, maps of potentially mine/unexploded ordnance-contaminated areas)
- Enhance coordination with firefighting units with detailed instructions for grid operators' staff.
- Provide generators and fuel for the sewage system (wastewater treatment plants and sewage pumping stations).
- Identify sites where people can collect drinking water, alternative means of air-raid notification during electricity outage (e.g., by vehicles).
- Establish sites where citizens can warm-up, cook, charge phones and laptops to stay connected.
- Improve electricity outage notification system for public to be prepared.
- Ensure social infrastructure has fuel for generators in case of blackout.
- Alternative power systems for traffic lights on major crossroads.
- Create shelters/heating points for cold period in case of damage to district heating infrastructure.



**Image2.Zaknidnoukainska substation in fire after attack on the very-high resolution image provided by Planet.**

## References:

1. OCHA (October 2022). [Russia's war on Ukraine \(UN, Government of Ukraine\) \(ECHO Daily Flash of 21 October 2022\)](#).
2. The Atlantic Council (October 2022). [Putin's blackout blitz: Russia aims to freeze Ukrainians into surrender](#).
3. The Government of Ukraine (July 2018). [Decree on approval of the list of critically important objects in the energy sector](#).
4. News portal "BBC Ukrainian service" (October 2022). [Ukraine will not export electricity to the EU. Because of Russian missile strikes](#).
5. News portal "BBC Ukrainian service" (October 2022). [Volyn region again under attack, strike to energy sector. What are the consequences of the second attack per day](#).
6. Energy group DTEK (November, 2022). [Media Release](#).
7. The Economist (October 2022). [Ukraine races to stop Russia from destroying its power grid](#).
8. USAID's Ukraine Energy Security Project, via Time Magazine (October, 2022). [Soviet-Era Centralized Heating Systems Were Ukraine's Secret Weapon for Cutting Emissions. Now They're a Vulnerability](#).
9. REACH (November 2022). [Cold Spot Risk Assessment](#).
10. Nature (December, 2016). [The impact of cold spells on mortality and effect modification by cold spell characteristics](#)
11. Information portal "Visit Ukraine" (October, 2022). [Advisory](#).
12. Rueters (November, 2022). [Kyiv prepares 1,000 heating points as Russia attacks energy infrastructure](#)
13. Telegram channel of Kharkiv city Mayor (October 2022). [Ihor Tieriekhov](#)
14. Governmental portal of Ukraine (October 2022). [24th of October: Situation in energy sector](#).
15. Telegram channel of the Ministry for Digitalization of Ukraine (October 2022). [Mintsyfra](#).
16. Telegram channel of the Minister for Digitalization of Ukraine (October 2022). [Fedorov](#).
17. Telegram channel of Mykolaiv city Mayor (October 2022). [Sienkevych Online](#)
18. GLOBSEC (October, 2022). [Ukrainian Electricity Network Withstood Russian Shelling](#).
19. News portal "Poltavshchyna" (October 2022). [The residents of Poltava oblast were warned about the lack of street lighting and asked to limit the use of electrical devices](#).
20. News portal "Varianty" (October, 2022). [Lighting on the facades of buildings and structures has been banned in Lviv region](#).
21. News portal "BBC Ukrainian service" (October 2022). [The water level rose in the Dnipro River, flooding the Obolon embankment: photo](#)
22. Energy group DTEK (October 2022). [The enemy knows where to strike. Interview with Dmytro Sakharuk, DTEK's Executive Director](#).

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