

February 2025: Three years of full-scale invasion

Current Developments in the Ukrainian Energy System

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Outline

1) Looking Beyond: Recent Attacks on the Energy Infrastructure (Winter 2024/25)

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- Declining installed capacity
- Transmission Challenges
- Increasing power outages

2) Why the Ukrainian Energy System Remained Resilient (Winter 2024/25)

3) Looking Ahead

- Outlook for different energy sources in 2025
- Key priorities and required actions

4) Disclaimer: The Fog of War

Recent Major Attacks on the Energy Infrastructure

1

December 13, 2024

A targeted attack on **grid infrastructure** that is directly involved in export-import operations between Ukraine and its European neighbours.

2

December 25, 2024

Main attacks on **thermal and hydroelectric power plants** located on the left bank of the Dnipro River (east and south of Ukraine), while transmission substations were relatively less damaged.

3

January 15, 2025

Main attacks focused on **gas assets**.

Key takeaway: The nature of attacks has evolved

- Since the onset of the full-scale invasion: over 1,000 attacks on civilian energy infrastructure
- Increased complexity & types of weapons used by Russians
- Massive attacks predominantly utilise various types of missiles, including cluster munitions. The use of cluster munitions significantly increases the time to restore facilities, as it is necessary to carry out demining operations.



Consequences: Consistently Adapting Energy Mix

Spotlight: attacks on thermal and hydroelectric power plants (targeted mostly on the left bank of the Dnipro River)

→ Meanwhile, in 2024, 90% of thermal generation capacity had been destroyed & 1/3 of hydropower capacity; however, ongoing repairs are in progress;

→ Contribution of thermal & hydroelectric power plants to the overall balance decreased slightly;

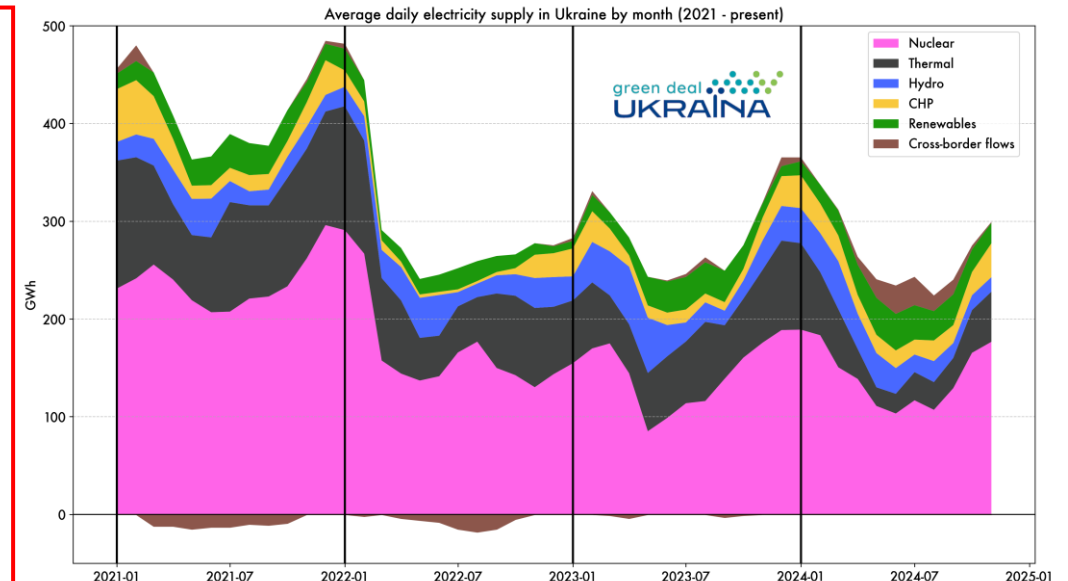
Explanation:

Hydro- and thermal power plants are essential for frequency and voltage stabilisation in the grid.

→ They balance load peaks and compensate for short-term fluctuations;

→ Attacks on these plants weaken Ukraine's ability to stabilise the grid independently;

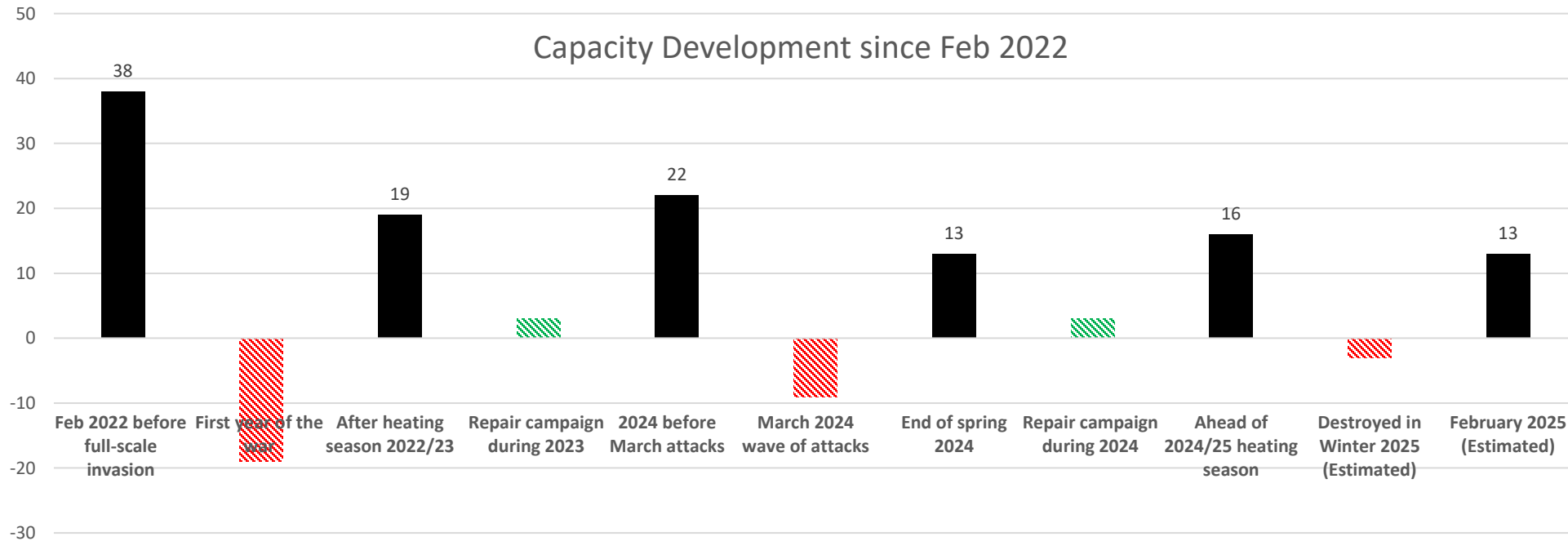
→ As a result, **Ukraine becomes increasingly dependent on alternative grid balancing measures** (imports from Europe, load shedding, etc.)





Consequences: Declining Installed Capacity

The East of Ukraine is especially suffering under a significant shortage of capacities.



Source: <https://www.iea.org/data-and-statistics/charts/available-installed-capacity-of-dispatchable-power-generation-in-ukraine> & own calculated estimates

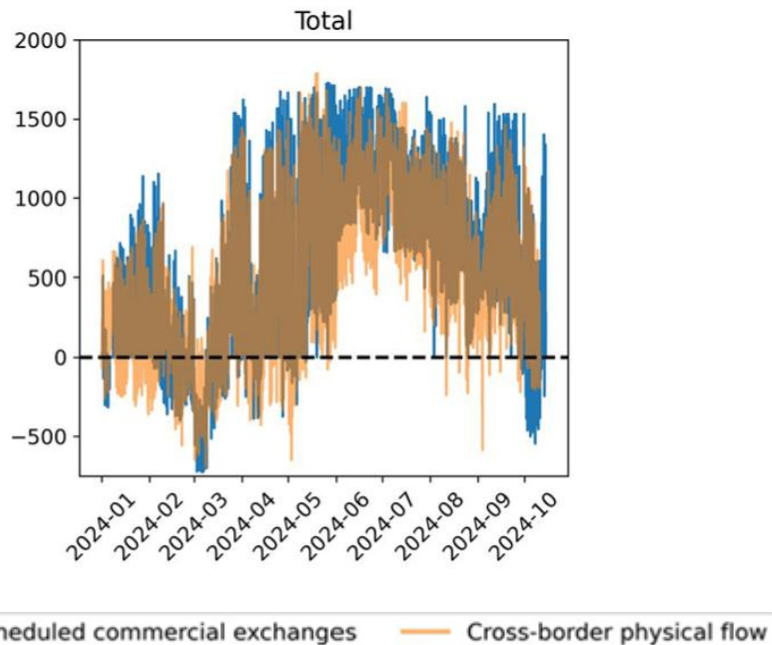


Consequences: More imports, but constrained grids

There were 5 times more electricity imports in 2024 than in 2023:

→ However, regulatory barriers still prevent the full utilisation of available import capacities

Ukraine’s electricity imports & day-ahead prices (2024):



Insufficiently available capacity to transmit electricity from the West to the East

→ Blackouts in East Ukraine may last longer than in West Ukraine ([Source](#))

→ **Protection Measures:** As of Jan 10th 2025, all energy facilities are protected by first level shelters. Additionally, 84 large Ukrenergo facilities are designated to receive second-level protection measures.



Consequence of declining power generation & constrained grids: → Power outages

December 2024

- **Hourly outage schedules** (for households) and **power limitation schedules** (for industry) were in effect from Dec 1-16, 23, 25-28, mainly in the morning, afternoon and evening hours.
- Additionally, **emergency blackouts** were introduced in certain regions on Dec 13, 17 and 18 to overcome the effects of the weather.

January 2025

- **First 2 weeks of Jan: No disconnections of household consumers** thanks to warm weather and reduced consumption.
- **Emergency blackouts** implemented in Zhytomyr region due to Russian attacks on Jan 13.
- **Emergency blackouts** implemented in Kharkiv, Sumy, Poltava, Zaporizhzhia, Dnipropetrovs'k, Donetsk and Kirovohrad regions on Jan 15.

February 2025

- Feb 3, 4, 6-7: **Emergency blackouts** implemented due to drone attacks on generation facilities and damage to transmission networks.
- **Affected regions:** Kharkiv, Sumy, Donetsk, Poltava, Zaporizhzhia, Kirovohrad, Dnipro (partially), Cherkasy (partially), and Kyiv (partially).
- Feb 10-12, Feb 17-20: Ukrenergo imposed **electricity consumption restrictions on industry** to prevent further disruptions.

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Why the Ukrainian Energy System remained resilient

- **Moderate winter temperatures**

- In December: good weather conditions increased the efficiency of solar power plants and wind farms → the generation capacity of renewable power plants increased to 1.0-1.2 GW. ([Source](#))
- In January: due to significantly worse weather conditions, the efficiency of solar and wind power plants reduced to 0.4-0.6 GW. ([Source](#))
- **Overall:** The warm winter in Ukraine with high temperature records played a key role in Ukraine's stable electricity supply.

- **Less industry production during December 2024 & January 2025**

- Since the industry started to recover at the beginning of February, Ukrenergo needed to impose restrictions on the industry in almost all regions.

Looking Ahead: What to expect from different Energy Sources in 2025

	Thermal & Hydro (Source)	Solar (Source)	Wind (Source)	Gas (Source)
2024	4 GW restored	800 MW of solar capacities were installed (~89% of it for self-consumption by businesses and households)	Only 20 MW of new wind power capacity was put into operation	835 MW commissioned (<i>only 183 MW launched by the government, the rest is the result of private initiatives</i>)
Plans for 2025	3 GW are expected to be restored	Installation of solar power plants for own consumption will continue	Number of prepared projects is the highest in five years. The sector expects stable financing due to new Ukrenergo tariffs and improved debt repayment	Planned addition of ~900 MW of distributed generation facilities



Looking Ahead: What needs to be done

- **Remove regulatory barriers that currently prevent the full utilisation of available import capacities.**
 - GreenDealUkraine is preparing a study to be presented at the Ukraine Recovery Conference 2025
- **Enhance resilience by advancing the decentralisation of Ukraine's energy system.**
 - Consider the establishment of an Electricity Price Guarantee Fund to support stability
- **Continue the process of market coupling with the EU.**
 - This aligns with the EU accession negotiations in summer 2025
- **Begin preparations now for the upcoming winter!**
 - Ensure the availability of generators and other critical equipment for winter 2025/26



Disclaimer: The fog of war

Some elements of this presentation are based on preliminary data and ongoing analysis. Given the rapidly evolving context, current assessments may change. A final evaluation requires further confirmation and validation.

There is particularly high uncertainty regarding:

- The current and future status of generation capacities and the transmission system;
- The effectiveness of existing and potential policy measures;
- The ability to ensure reliable electricity transmission between regions.