

Encouraging demand reduction as potential relief to load shedding in Ukraine

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16.12.2024

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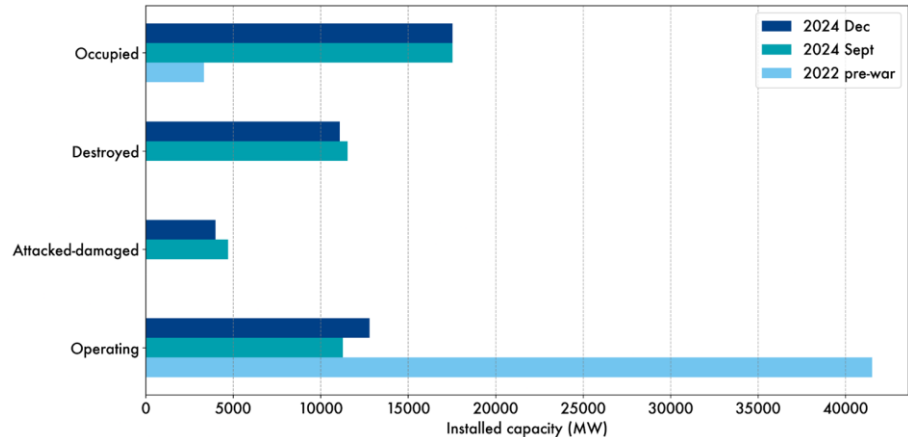


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Key message: Improved price signals can reduce need for load shedding

- Ukraine faces a significant loss of generation capacity due to massive Russian attacks.
- **Thus, extensive load shedding is required in many hours.**
- This situation can be addressed in three complementary ways:
 - expansion of imports,
 - repair and expansion of generation capacities
 - and **restricting consumption on the demand side.**
- We propose **doubling the price of electricity, for each kWh exceeding 80% of pre-war demand.**
- This would enable a **reduction in household demand of around 10% in 2025** and reduce forced load shedding in Ukraine.
- Under these assumptions, the total electricity cost for the average consumer would **not** increase.

Our assessment of the state of generation capacities



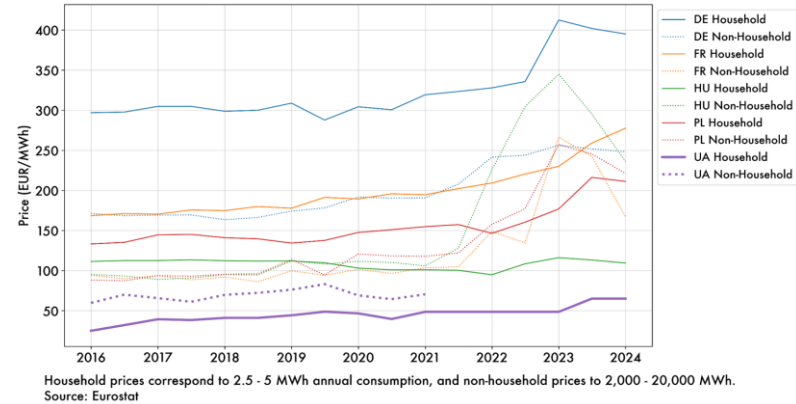
Source: Own representation based on publicly available information

While wholesale prices have increased substantially, retail prices in Ukraine are still much lower than in other EU countries

Wholesale electricity prices – 15-day rolling average



Retail electricity prices, Ukraine vs EU countries

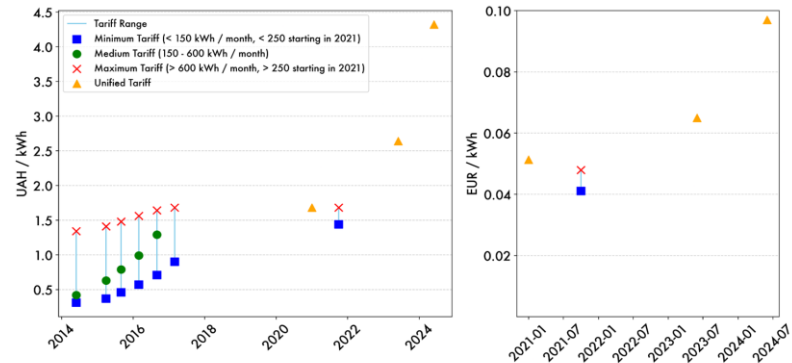


- The baseload **price of electricity has roughly doubled** over the last year, and increased six-fold since 2020.
- Ukraine has **much lower retail prices than EU countries**, due to strong politisation of tariffs.
- In 2024, **household tariffs reflect just 50% of the corresponding wholesale price** (in DE they are ~300%).

Household prices have increased by roughly 50% since July 2023, approaching 0.10 EUR cents per kWh

- A gradual harmonisation of tariffs with market rates has taken place, but they are still relatively low compared to the EU average.
- Block tariffs were applied until June 2023. Since then, a uniform tariff has been introduced for all household customers.
- Electricity bills are usually issued monthly, and payments are expected accordingly.
- Under a moratorium (March 2022 - December 2023) it was not permitted to switch off households despite non-payments, nor levy fines and charges, or collect debts for public utilities from the population.

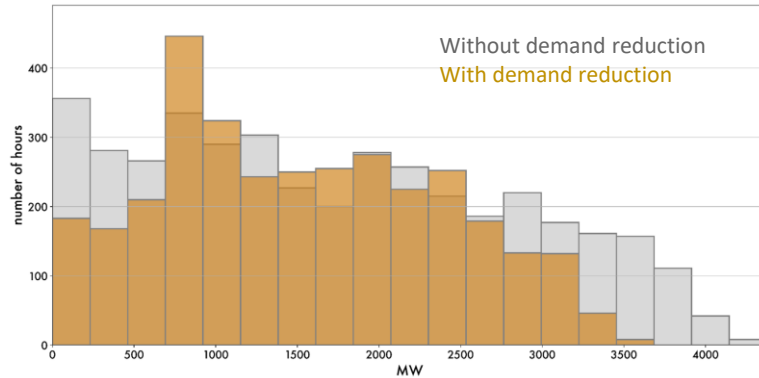
Household tariff range in UAH (2014 - present) and EUR (2021 - present)



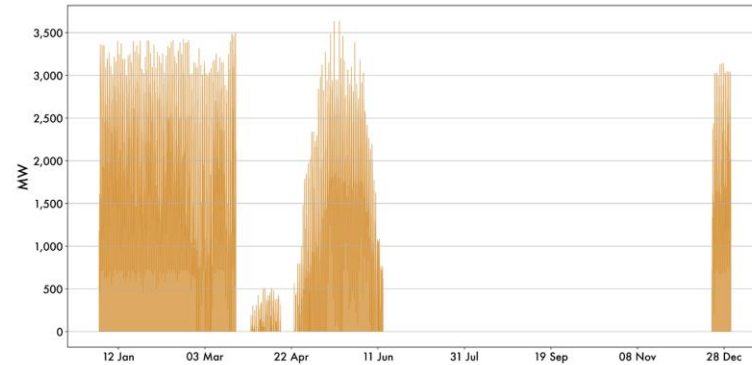
Converted to EUR using average weekly exchange rate between a tariff's start and end date.
Sources: NEURC, Ministry of Finance

A 10 % reduction in household demand can reduce load shedding by 2 TWh, or approximately 27 %

3300 vs. 4000 hours with at least some load shedding



Hourly load shedding in 2025 of about 5 TWh



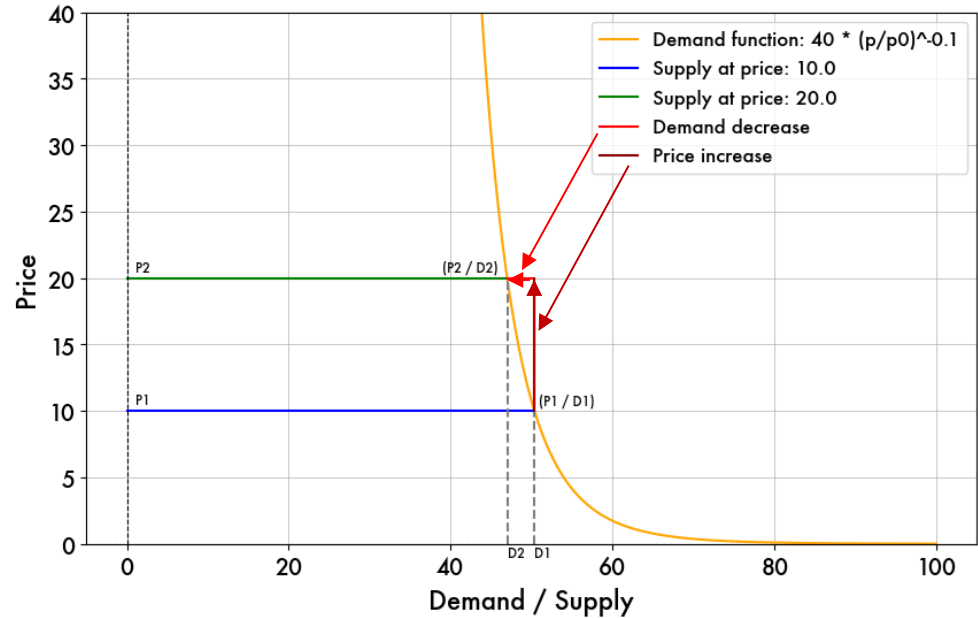
Source: Own representation based on model output

- Assuming a total net electricity demand in 2025 of 100 TWh of which about 30 TWh is households, a household demand reduction by 10 % would decrease the number of load shedding hours by more than 20% (3300 instead of 4000 hours in 2025).
- The maximum hourly load shedding would decrease from about 4500 MW to 3500 MW.
- The **overall load shedding requirement would decrease from 7 TWh to 5 TWh.**

Can we expect higher electricity prices for households to have an effect on demand?

- The demand for goods and services is inversely related to their respective prices.
- Statistically, Alberini et al. (2017) determined a **short-term price elasticity of -0.3** for electricity consumption in **Ukrainian** households.
- **Based on this, we estimated that a doubling of the price for 20% of the unconstrained household demand will lead to a reduction in demand of 10%.**

An increase in the price leads to a decrease in demand. The shape of the demand function determines the extent of this change.



Recommendation: Consider substantial price increase for each kWh exceeding 80% of pre-war demand

- Incentivising a reduction in demand by increasing the prices for part of the household demand.
- As a possible starting point consider:
 - 80% of the pre-war annual demand* per household could remain priced at the old social tariff.
 - The price for any unit exceeding 80% of pre-war demand should be doubled.
- This seems broadly consistent with the aim to reduce overall household demand by 10%.
- **Under these assumptions, the total costs for the average household will not increase**

(*) A specific implementation of the 80/20% split must be defined separately and is not part of the discussion here.

Limitations and the need for data

- There are several uncertainties in this analysis, which have different effects on the change in load shedding through price increases:
 - The further development of Russia's aggression & the speed of repairs and new installations
 - Plans for the maintenance of nuclear power plants
 - The status of the domestic transmission system
 - The real reaction of households to price changes (short-term price elasticity for electricity)
 - More technically, whether households make their consumption decisions on the basis of marginal price or average prices changes
 - Possible non-payment behaviour of households with rising prices (see appendix for depts)
- Access to the following data and information would be needed for proper policy-planning:
 - Verified operation status of the generation capacities
 - Status of the domestic transmission network
 - Micro data on price-demand tuples over a long period of time to estimate price elasticities

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Literature review table on price elasticities

| | Author | Publication Year | Publication Type | Elasticity | Observation Unit | Region | Observation Period | Observation Frequency | Estimation Methodology | Remarks |
|----------------|------------------------|------------------|----------------------------------|--|---------------------|----------------------|----------------------|-----------------------|---|---|
| Hourly | Hyun, Eom | | Working Paper | -0.11 to (-0.03) | Res./Household | South Korea | 2017 | Hourly | SUR, Discrete continuous choice model | Higher elasticities before and after work |
| | Hirth, Lion; Khanna | 2022 | Working Paper | -0.05 | Wholesale | Germany | 2015-2019 | Hourly | Wind as instrument for supply, linear, log linear, nonparametric, 2SLS and 2S generalized additive models | Wholesale! Controls for regional and time heterogeneity |
| | Knaut, Andreas; Pöhl | 2016 | Working Paper | -0.006 | Wholesale | Germany | 2015 | Hourly | 2SLS, renewable energy as instrument | Higher elasticities in morning and afternoon |
| | Genc | 2016 | Publ. | -0.144 to -0.013 -0.019 to -0.083 | Wholesale | Ontario | 2006-07 | Hourly | Cournot competition model | |
| Monthly/Annual | Ondřej Michálek | 2022 | Central Bank Mon | -0.75 | Res./Household | Czech Rep. | 2017-2020 | Annual | Non-linear Seemingly Unrelated Regressions approach for budget data sets | Relies on household budget data |
| | Alberini, Anna; Khanna | 2019 | Publ. (The Energy | -0.3- 0.93 to (-0.2) | Res./Household | Ukraine | 2013-2016 | Monthly | Monthly panel, log-log, Fixed Effects | Price instrument is regulated price, Varies by changing the households. House owners less responsive than flat renters, -0.93 seems unrealistic |
| | Garcia-Cerrutti | 2000 | Pub. (Res. And En | -0.79 to 0.01, mean -0.17 | Res./County | California | 1983-1997 | Annual | Panel, dynamic random variables model, heteroskedastic and correlated error terms over time and space | |
| | Liu, Gang | 2004 | Working Paper | -0.013 (short run) -0.044 (long run) | Res./Ind./Countries | OECD | 1978-1999 | Annual | GMM | |
| | Csereklyei | 2020 | Publ. (Energy Polic | -0.56 to (-0.53) (Res.) -1.01 to (-0.75) (Ind.) | Res./Ind./Countries | EU | 1996-2016 | Annual | Lagged prices and other sector as instrument, Between estimator, System GMM longrun | |
| Meta-study | Espey, J.A., Esp | 2004 | J. Agric. Appl. Econ. 36, 65-81. | -0.85 (long run) -0.35 (short run) | Residential | Various (Meta study) | Various (Meta study) | Monthly/Annual | Various (Meta study) | |

For household customers, the purchase of electricity is heavily regulated and subsidised

- A uniform tariff was introduced for all household customers from 1 June 2024. This currently amounts to 4.32 UAH / kWh.
- A reduced tariff (2.64 UAH/kWh) is expected to be introduced for the 2024/25 heating period for households with electric heating and a consumption of less than 2000 kWh per month.
- Electricity bills are usually issued monthly and payments are expected accordingly.
- The procedures for meter reading and billing are governed by the National Energy and Utilities Regulatory Commission (NEURC) of Ukraine.
- The payment compliance of households has fluctuated between 85 and 100 % in recent years (see next slide).
- A payment moratorium came into force on 5 March 2022 following the start of the full invasion of Russia.
- Under the moratorium, it was not permitted to switch off households utilities despite non-payments, nor levy fines and charges and collect debts for public utilities from the population.
- The moratorium was lifted on 29 December 2023. Households in areas affected by hostilities and temporarily occupied regions are still exempt.



Appendix: payment discipline

- With the exception of the outlier in January 2021, at least 90% of households pay their utilities as required (see upper below).
- The debts to providers have risen by 60% since 2020 and stood at UAH 7.5 bn UAH or €200 mn at the end of 2021.
- This corresponds to an average debt of €10 per household.

