

GREEN DEAL UKRAÏNA

HELMHOLTZ-ZENTRUM BERLIN

Six options to boost power grid transfers to Ukraine,
for the next two winters



SIX SOLUTIONS

1

Increase the capacity of ENTSO-E exports to Ukraine

- Winter 2024/25: From 1.7 to 2.0 GW
- Winter 2025/26: From 2.0 GW to 2.2 GW

2

Explore using the 220 kV antenna line between Zamość, Poland and Dobrotvir, Ukraine

3

Speed up building transmission projects

- Slovakia and Ukraine (Kapušany)
- Romania, Moldova and Ukraine (Isaccea)

4

Use all available technologies to maximise flows

- e.g., DLR, power electronics

5

Explore using and expanding the abundant 110 kV grids

6

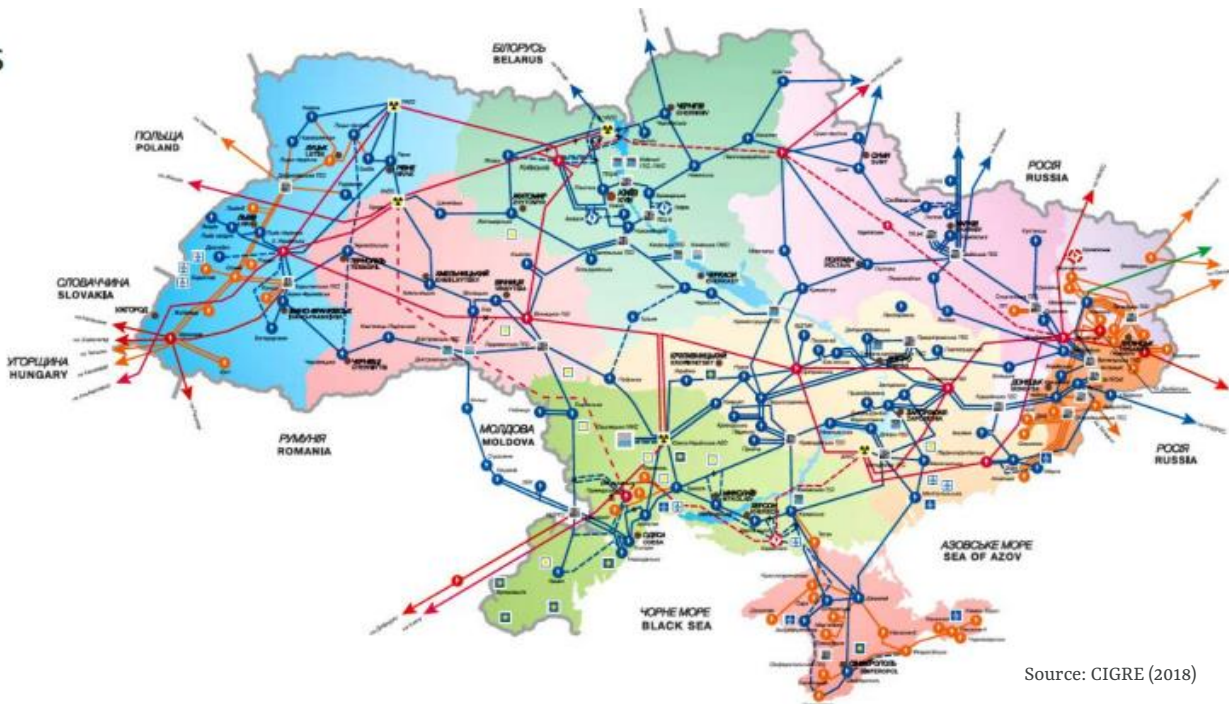
Ensure the availability of spares for repairs



INTERCONNECTORS OF UKRAINE WITH SEVEN NEIGHBORING COUNTRIES

Interconnectors
with:

- Russian Federation
- Moldova
- Belarus
- Poland
- Slovakia
- Hungary
- Romania



Source: CIGRE (2018)



CHANGES TO AGREED EXPORTS/IMPORTS BASED ON VARIOUS ENTSO-E ANNOUNCEMENTS, 2022-2024

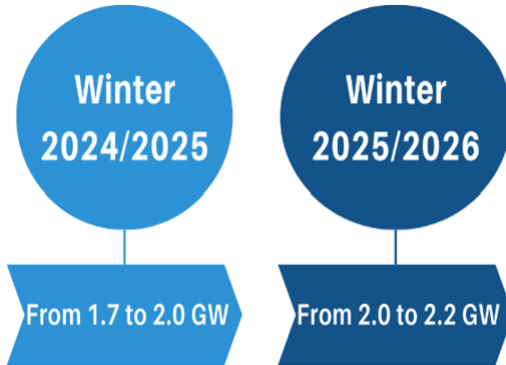
Date	Export to Ukraine	Import from Ukraine	Comments
16 March 2022	0 MW	0 MW	Emergency Synchronisation Ukraine-ENTSO-E (Continental Europe) decided by the EU Commission and the ENTSO-E. In the first two stages of synchronisation, there were no commercial exchanges.
26 April 2022	0 MW	0 MW	Ukraine becomes an ENTSO-E observer member. The first phase of synchronisation trialling was successfully finished.
30 June 2022	-	100 MW	Start of commercial trading through Moldova-Romania.
16 February 2023	700 MW	400 MW	Massive Russian attacks on energy infrastructure from September 2022 to Spring 2023 ended exports from Ukraine.
27 March 2023	850 MW	400 MW	Emergency assistance was agreed upon between the EU and Ukraine.
15 April 2023	1050 MW	400 MW	Start of commercial power exchanges through the rehabilitated Rzeszów- Khmelnytskyi line.
20 June 2023	1200 MW	400 MW	
1 December 2023	1700 MW/h	400 MW/h	The ENTSO-E announces that as of 1 January 2024, Ukrenergo will become the 40 th full member of the ENTSO-E.
27 February 2024	1700 MW/h	550 MW/h	
July 2024	No change	No change	Massive attacks on Ukraine energy system started in 2024 on March 22 nd , with a major attack on May 8 th . More than 9 GW of thermal capacities lost. Russian energy terrorism continues with now more than 20 attack waves in 2024 alone.

FIX GRID BOTTLENECK ISSUES IN UKRAINE AND NEIGHBOURING COUNTRIES

e.g., Reconstruction and upgrades of substations in border regions

Hungarian substation Szabolcsbaka

- **Challenges:** Fixing the issue on the substation is complex (up to 5 years to resolve)



Flows in the Romanian and Ukrainian grids:

- Quick, viable solution
- Allow ENTSO-E to increase transfer by 300 MW to at least 2 GW
- **Solutions (i.e., required measures):**
 - System Operation and Dynamic Stability in Regional Group Continental Europe
 - Technical Measures (e.g., grid optimization technologies)

Flow in the Ukrainian grid:

- **Solutions:** Grid-enhancing measures (e.g., FACTS devices, Batteries, Dynamic Line Rating (DLR) technology)

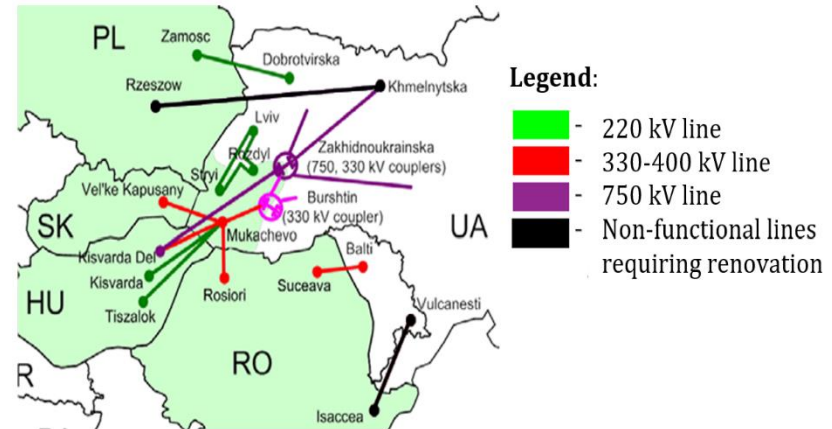
2. EXPLORE USING THE 220 KV ANTENNA LINES BETWEEN POLAND AND UKRAINE

EXPANSION OF INTERCONNECTIONS BETWEEN POLAND AND UKRAINE BY REPURPOSING AND UPRATING THE EXISTING 220KV ZAMOŚĆ-DOBROTIVIR LINE

Dobrotvirska TPP

- **State (present):** Destroyed in May 2024 by Russian attacks
- **Line usage (present):** 220 kV line is **UNUSED**
- **Solutions:** Reverse flow and later uprating to 400 kV

Grid Interconnections of Ukraine and Moldova with Western neighbours before synchronisation



Source: Zasuń (2017)

3. SPEED UP BUILDING TRANSMISSION PROJECTS

SPEED UP CONSTRUCTION AND COMMISSIONING OF EXISTING AND DELAYED TRANSMISSION PROJECTS BETWEEN UKRAINE AND EU MEMBER STATES

e.g., Slovakia, Romania

Interconnections to Ukraine and foreseen dates and capacities

	Country	Net Transfer Capacity, MW					
		2025	2030	2035	2040	2045	2050
Export to	Hungary	429	429	650	650	650	650
	Moldova	264	264	400	400	400	400
	Poland	799	799	1210	1210	1210	1210
	Romania	198	264	264	1400	1400	1400
	Slovakia	264	264	264	1400	1400	1400
	TOTAL EXPORT	1954	2020	2788	5060	5060	5060
Import from	Hungary	297	429	650	650	650	650
	Moldova	264	264	400	400	400	400
	Poland	666	666	1000	1000	1000	1000
	Romania	99	264	1400	1400	1400	1400
	Slovakia	264	264	1400	1400	1400	1400
	TOTAL IMPORT	1590	1887	4850	4850	4850	4850

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Veľké Kapušany (SVK) - Mukacheve (UKR)

- **Purpose:** Rehabilitation of overhead line
- **Start:** 2013
- **Tech. details:** 53 km, 400 kV
- **Fin. Instrument:** PCI - Late submission to the TYNDP 2024 accepted (i.e., a precondition to PCI)
- **Commissioning (planned):** 2026

Pivdneukrainska NPP (UKR)—Isaccea (ROU)

- **Purpose:** Construction of 400 kV transmission line
- **Fin. Instrument:** Late submission to the TYNDP 2024 accepted (i.e., precondition to PCI)
- **Commissioning (planned):** 2028 (potentially operational by 2026)
- **Note:** Would end Moldova's dependency on Transnistrian MGRES TPP

SPEED UP CONSTRUCTION AND COMMISSIONING OF EXISTING AND DELAYED TRANSMISSION PROJECTS BETWEEN UKRAINE AND EU MEMBER STATES

e.g., Slovakia, Romania

Rzeszów (POL) – Khmelnytskyi (UKR)

- **Purpose:** Rehabilitation of the line and repowering it as a 400 kV line
- **Commissioning:** 2023
- **Capacity (present):** 550 MW
- **Challenges:** Impedance
- **Solutions:**
 - Impedance control devices
 - Power electronics, or so-called FACTS
 - Replacing parts of the overhead line with sections of underground cable
 - Buffer batteries

● ● 4. USE ALL AVAILABLE GRID ENHANCING TECHNOLOGIES

USE OF ADVANCED TECHNOLOGIES TO OPTIMIZE THE FUNCTIONING OF EXISTING GRIDS

e.g., Dynamic Line Rating (DLR), power electronics

Dynamic Line Rating (DLR)

- Timeframe for the DLR deployment: Less than 6 months
- Planned start of installation: Summer 2024
- Grid transmission capacity increase: 10-30 % (Note: Especially during winter)

Challenges: ENTSO-E permission is needed to ensure additional capacity on interconnectors (Current cap: 1.7 GW)

Solutions: Political pressure to accelerate the deployment

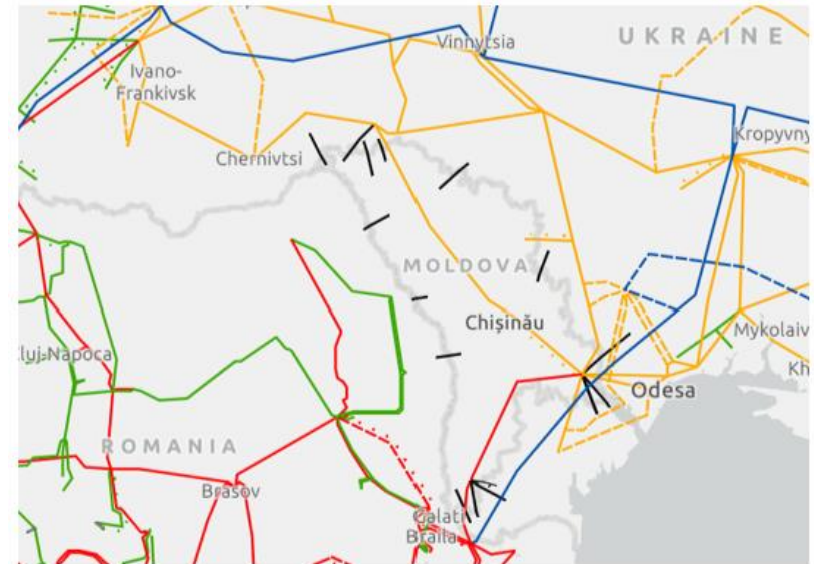
URGENT ACTION NEEDED: The 2035 implementation deadline is **TOO LATE.**

IMPORT ELECTRICITY OR CONNECT NEW CAPACITIES OUTSIDE UKRAINE VIEW 110 KV LINES

Well-developed network with 11 existing 110 kV lines to Moldova

- Moldova (5 lines), Transnistria (6 lines)
- **Challenges:** Intersection of 110 kV and higher voltage grids
- **Solutions:** Special transformers and phase-shifting devices

Moldova Grid Connections. 110 kV lines appear in black



Source: ENTSO-E. (n.d.)



LAST BUT NOT LEAST... GOVERNANCE THROUGH UEMIP OR CESEC?

Boost regional integration through UEMIP: an **Ukraine and Moldova Energy Market Integration Plan**, using the experience from BEMIP (Baltic Energy Market Integration Plan), foster the region, the uptake of low carbon technologies and grids.

Question: is setting up a working group within CESEC a straightforward solution?