



Ukrainian NC CIGRE

Energy transition and war in Ukraine



cigre

For power system expertise



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Joint MB/TAC Meeting SEERC - Vienna 30.05.2022

Before 24.02.2022

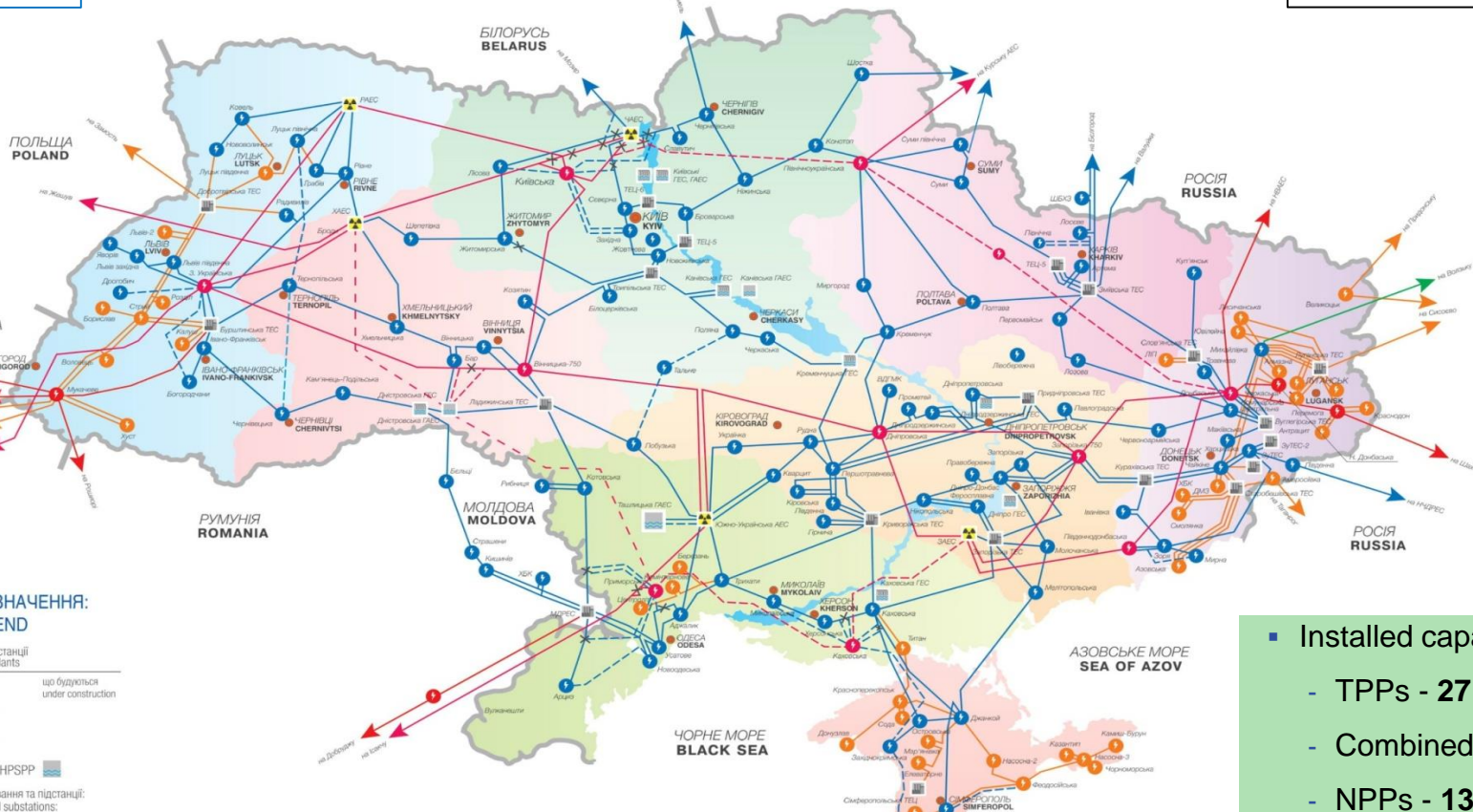
One of the biggest power systems in Europe



ENTSO-E

Russia

Burshtyn Island



УМОВНІ ПОЗНАЧЕННЯ: LEGEND

Електростанції Power plants	
діючі currently in operation	що будуються under construction
	АЕС/НРР
	ТЕС / ТРР
	ГЕС, ГАЕС / НРР, НРСПП
Лінії електропередавання та підстанції: Power lines and substations:	
діючі currently in operation	перспективні future projects
	±400 кВ/кВ
	750 кВ/кВ
	400-500 кВ/кВ
	330 кВ/кВ
	220 кВ/кВ

- Electricity Generation was 157,67 TW·h per year
- Electricity consumption - 118 TW/h per year
- Consumption, capacity max – 30 GW

- Installed capacity 54,83 GW
 - TPPs - 27,80 GW
 - Combined Heat PPs and other TPPs - 6,59 GW
 - NPPs - 13,84 GW
 - HPPs, HPSPPs – 6,04 GW
 - Renewable energy – 6,93GW

After 24.02.2022

Power system was operating 21 days in isolated mode



96 days of war

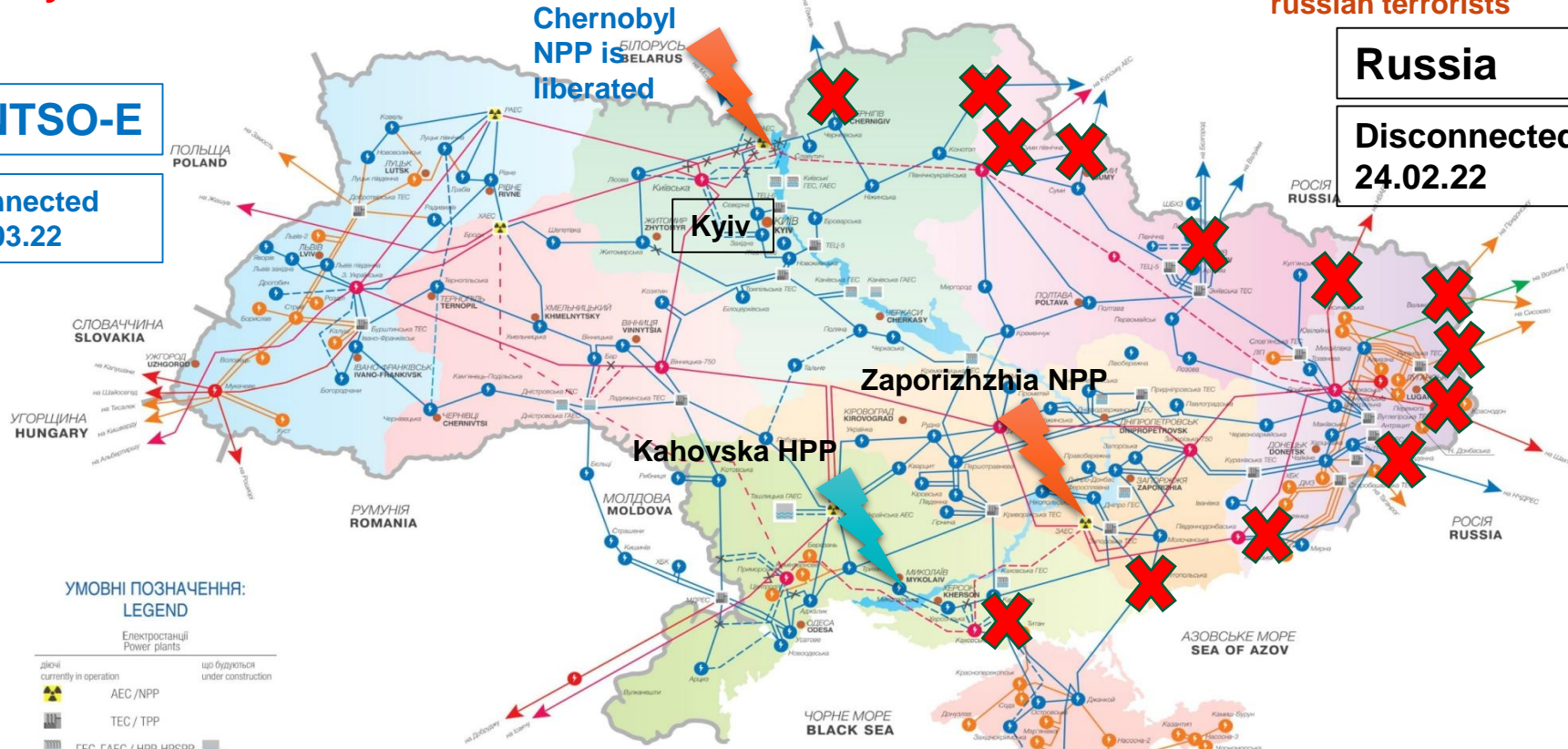
Zaporizhzhia nuclear power plant and Kakhovska HPP are under control of the russian terrorists

ENTSO-E

Connected 16.03.22

Russia

Disconnected 24.02.22



УМОВНІ ПОЗНАЧЕННЯ: LEGEND

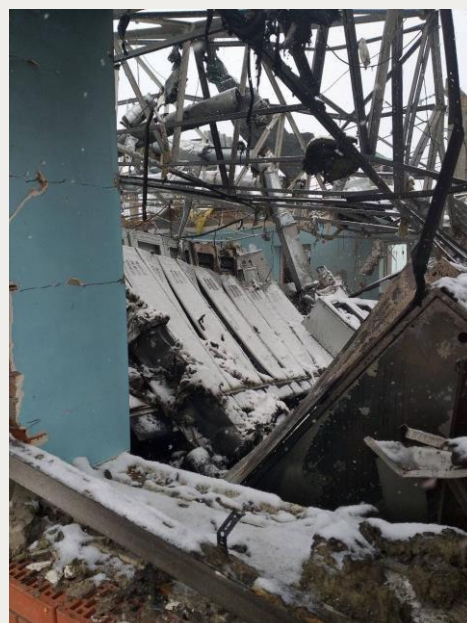
- | | |
|--|---------------------------------|
| Електростанції Power plants | |
| дiючі currently in operation | що будується under construction |
| АЕС / NPP | |
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| Лiнii електропередавання та пiдстанцii: Power lines and substations: | |
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| • ±400 кВ/кВ | • 750 кВ/кВ |
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| • 400-500 кВ/кВ | • 330 кВ/кВ |
| • 330 кВ/кВ | • 220 кВ/кВ |
| • 220 кВ/кВ | |

Destroyed:
 Substation 750 kV – 2
 Substation 500 kV – 1
 Substation 330 kV – 14
 Substation 220 kV – 4

Consumption – 11,1 – 14,4 GW
 Approximately damages – 300-500 millions \$

Destroyed:
 HV lines 750 kV – 9
 HV lines 500 kV – 1
 HV lines 330 kV – 47
 HV lines 220 kV – 4
 9116 villages and cities without electricity

Specific damages of 330-750 kV substations : SF6 GIS buildings, transformers, circuit breakers, CTs and so on.



Joint operation with ENTSO-E, restoration and reconstruction of power system

ENTSO-E

Connected
16.03.22

Russia

Disconnected
24.02.22

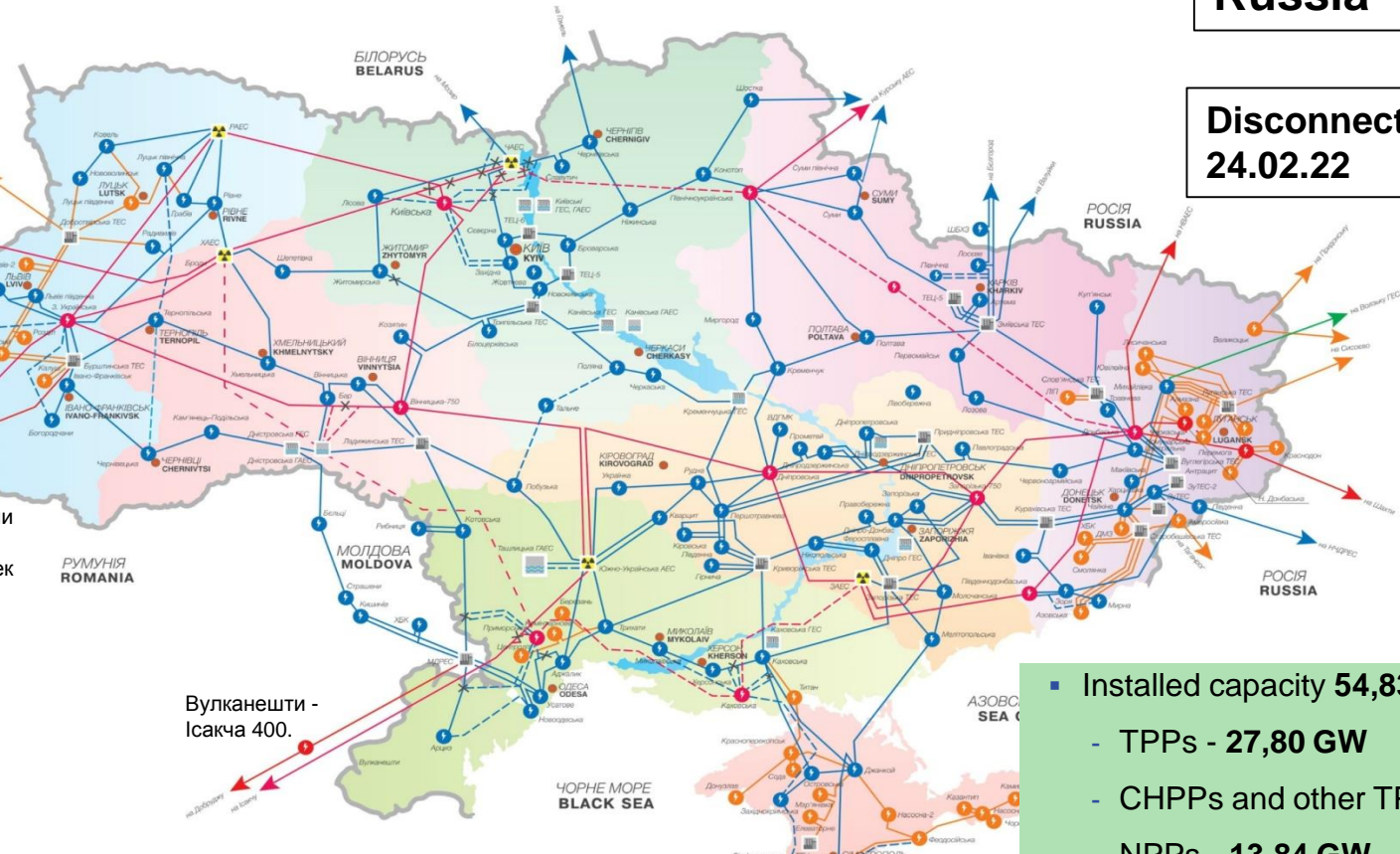
Добротвори -

Burshtyn Island

ЗУ-Саболчка 750, Мукачево-Капушани 400, Мукачево-Саболчка 400, Мукачево-Рошіорі 400, Мукачево-Тісалек 220, Мукачево-Кішварда 220

УМОВНІ ПОЗНАЧЕННЯ: LEGEND

Електростанції Power plants	
діючі currently in operation	що будуються under construction
АЕС / NPP	
ТЕС / TRP	
ГЕС, ГАЕС / HPP, HPSPP	
Лінії електропередавання та підстанції: Power lines and substations:	
діючі currently in operation	перспективні future projects
±400 кВ/кВ	±400 кВ/кВ
750 кВ/кВ	750 кВ/кВ
400-500 кВ/кВ	400-500 кВ/кВ
330 кВ/кВ	330 кВ/кВ
220 кВ/кВ	220 кВ/кВ



Вулканешти - Ісачка 400.

- Daily consumption before 24.02.22 was **453 million kW/h**
- Daily consumption 29.05.22 - **242 million kW/h**
- Consumption, capacity max before 24.02.22 – **30 GW - 11,1 – 14,4 GW (29.05.22)**

Installed capacity 54,83 GW	?
- TPPs - 27,80 GW	3 GW
- CHPPs and other TPPs - 6,59 GW	0,28 GW
- NPPs - 13,84 GW	5,9 GW
- HPPs, HPSPPs – 6,04 GW	2,6 GW
- Renewable energy – 6,93GW	1,61 GW

Decreasing



Restoration and power system development plans



- TSO and DSO perform restoration and repairs of substations and OHLs using own resources and international assistance.
- Modernization of SCADA and AGC algorithm in NPC Ukrenergo was performed.
- Reconfiguration of excitation systems on 50 generators of NPP, TPP, HPP, HPSP at the ENTSO-E request is in progress.
- WAMS emergency automation is installed on 40 OHLs
- Documents for participation in European electricity market are developed

- International fund for restoration of Ukrainian power system is created
- Conception for development of power system in energy transition conditions is developed
- Ukrainian NC of CIGRE work groups for development of recommendations are created:
 - Power system development
 - Power grid development
 - Smart Grid
 - Controlled-load consumer
 - Development of regulatory documents and standards



Power system

Ukrainian power system is one of the largest ones in Europe with capacity of 54 GW including 15 nuclear units, thermal power plants with units of 200,300,800 MW, Hydroelectric power plants on the Dnieper and Dniester rivers and lines with a voltage of 110-750 kV. Since February 24, our power system has been separated from the power system of Russia, and has been working locally, the system operator supports the 50 Hz mode of operation and ensures the stability of the mode despite the destruction of some 110-330 kV power lines.

The Russian army entered the territory of the Chernobyl nuclear power plant **where radioactive elements** are buried. There is a threat of invasion of Zaporizhzhia NPP where six 1000-MW units are installed. **Zaporizhzhia nuclear power plant are under control of the russian terrorists.** Chernobyl NPP is liberated.

In these conditions, the system operator Ukrenergo continues to operate. Ukrhydroenergo, Energoatom, and electric network companies have not stopped working. We understand that energy security is the security of the country.

Conclusion.

Ukrainian NC of CIGRE is working together with Ministry of Energy, National Energy and Utilities Regulatory Commission of Ukraine, experts of companies that develop regulatory documents and concepts of Ukrainian power system development.

Many thanks to all international experts and organizations that supported the Ukrainian power industry and are ready to participate in our projects.

I believe that we, all members of CIGRE, will have many joint projects to improve the reliability of the power system in the "energy transition". Today these words gain a new definition in Ukraine.

This war must be stopped.

This is war of putin's Russia against not only Ukraine, but against the World civilization.



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For power system expertise

Thank you and wish peaceful sky over your countries!