Power System of Ukraine: today and tomorrow

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Ukraine

Neighboring countries: Belarus, Hungary, Moldova, Poland, Romania, Russia and Slovakia

Population – about 46 mln. people
The capital – Kyiv

Total area - 603,700 sq. km
Total length of the borders – 7,590 km
14 Thermal PPs
102 units: 800-150MW

4 Nuclear PPs
15 units: 1000-440MW

7 Hydro PPs
94 units: 117-19MW

3 Pumped-Storage PPs
9 units: 325-37MW

3 large Cogeneration PPs
9 units: 250–100MW

Over 22900 km of HV lines
135 substations

Interconnected Power System of Ukraine

Consumption (TWh) – 187/150,8
Peak Load (GW) – 28,3 (24/11/2011 8 pm)
31,86(02/02/2012 6 pm)
Export (TWh) – 6,45
**Generation**

**Installed capacity – 53,3GW**

- **HPP+HSPS**: 5.4 GW (10%)
- **RES**: 0.3 GW (1%)
- **other**: 2.1 GW (4%)
- **NPP**: 13.8 GW (26%)
- **TPP**: 31.7 GW (59%)

**Production – 194,1 TWh**

- **HPP+HSPS**: 1.0 GW (6%)
- **RES**: 0.1 GW (0%)
- **other**: 8.2 GW (46%)
- **NPP**: 90.2 GW (46%)

**Transmission Network**

- **Substations – 135**
- **Capacity of Transformers - 78192 MVA**

<table>
<thead>
<tr>
<th>Voltage (kV)</th>
<th>Quantity</th>
<th>MVA</th>
</tr>
</thead>
<tbody>
<tr>
<td>800</td>
<td>1</td>
<td>800</td>
</tr>
<tr>
<td>750</td>
<td>8</td>
<td>6000</td>
</tr>
<tr>
<td>500</td>
<td>2</td>
<td>1000</td>
</tr>
<tr>
<td>400</td>
<td>2</td>
<td>1600</td>
</tr>
<tr>
<td>330</td>
<td>88</td>
<td>44400</td>
</tr>
<tr>
<td>220-110</td>
<td>35</td>
<td>8400</td>
</tr>
</tbody>
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- **Length of UH+HVL: 22256 km**

<table>
<thead>
<tr>
<th>Voltage (kV)</th>
<th>Quantity</th>
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<tbody>
<tr>
<td>800</td>
<td>99</td>
</tr>
<tr>
<td>750</td>
<td>4121</td>
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<tr>
<td>500</td>
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<td>330</td>
<td>13346</td>
</tr>
<tr>
<td>220</td>
<td>3976</td>
</tr>
<tr>
<td>110-35</td>
<td>667</td>
</tr>
</tbody>
</table>

- **4762 Circuit breakers of 6-750 kV**
**Import / Export Capability of Ukrainian IPS**

<table>
<thead>
<tr>
<th>Country</th>
<th>Interstate Lines (220-750kV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Russia</td>
<td>14</td>
</tr>
<tr>
<td>Moldova</td>
<td>7</td>
</tr>
<tr>
<td>Belarus</td>
<td>2</td>
</tr>
<tr>
<td>Poland</td>
<td>2</td>
</tr>
<tr>
<td>Slovakia</td>
<td>1</td>
</tr>
<tr>
<td>Hungary</td>
<td>4</td>
</tr>
<tr>
<td>Romania</td>
<td>2</td>
</tr>
</tbody>
</table>

Schedule export on 2012 to:

- ENTSO-E (SL,HU,RO) – 545 MW
- (PL) – 235 MW
- Moldova – 700 MW
- Russia – 0

Mode of operation with neighboring countries:

- most of Ukrainian IPS – synchronously with UPS of Russia / IPS of Belarus / PS of Moldova
- south-western part of Ukrainian IPS - synchronously with ENTSO-E
New UHV Lines and Substations will be put into operation:

2013 – 2015: EUR 2.5 bln., including EUR 935 mln. – from IFO (IBRD, EBRD, EIB and KfW)

2015 – 2020: EUR 0.7 bln.

353 km of 750 kV line construction between Rivne NPP and Kyiv SS – for power transmission from Rivne and Khmelnytska NPPs (Eur 365 mln)

190 km of 750 kV line construction between Zaporizhia NPP and 750 kV Kakhovka SS (2x1000 MVA) – for power transmission from Zaporizhia NPP (Eur 500 mln)
Upgrading of IPS of Ukraine

- upgrading and rehabilitation of existing generation equipments for TPPs and HPPs (control systems), as well as backbone network entities, under obligatory performance of modern technical requirements

- creation of up-to-date telecommunication system
- development of automatic frequency and power control system, as also switching devices remote control

- connection of energy control center of IPS of Ukraine to the data transmission system Electronic Highway and to the coordination centre of European system operators

Implementation of power market, market of system services and balancing market

Legislation for power industry sector

Adapt Ukrainian power industry legislation to international rules and standards, revise the regulatory basis and create normative-technical framework with proper approval of technical requirements for power industry objects

Adapt technical regulations, rules and requirements that are acting in Ukraine, to the provisions of Operation Handbook by ENTSO-E

On the way to European integration

Memorandum of understanding on co-operation in the field of energy between Ukraine and the European Union

«… the parties will devote their best endeavours to contribute to the establishment of an interconnection between the UCTE system and the Ukrainian electricity grid system». «Recognising the need for technical standards of networks, generation equipments and network operation in Ukraine which are compatible with UCTE standards…»

Decree of the Cabinet of Ministers №145-p “On approval of Energy strategy for the period up to 2030 year”

UCTE accepted the request for extension of synchronous zone by interconnection of the power systems of Ukraine and Moldova

Decree of the Cabinet of Ministers №408-p “On adoption of the action plan for energy sector reformation and development”

… in 2007-2008 years development of standards for the control of frequency, power, power flows, safety and reliability criteria for the IPS of Ukraine, that meet the requirements of power industry association of European countries
On the way to European integration 2

Agreement on financing of the Program “Implementation support for the Energy strategy of Ukraine“
Action plan development on integration of IPS of Ukraine with trans-European electrical grid

Ministry of Fuel and Energy Order № 499
«On adoption of Reconstruction and upgrading plan for TPPs and CPPs for the period up to 2020 year»
Upgrade units according to the requirements of UCTE (939 mln.hrn till 2015 years)

Ministry of Fuel and Energy Orders №157 and №158
Approved technical documents:
- basic requirements for frequency and power control in IPS of Ukraine;
- method guidelines on primary and secondary frequency and power control arrangements for power units;
- method guidelines on inspection of TPP, HPP and APP readiness for frequency and power control

Consortium of ENTSO-E TSOs was formed to perform investigations (CEPS, ELIA, EMS, MAVIR, PSE-OPERATOR, Terna і TRANSELECTRICA)

Ministry of Fuel and Energy Order № 532
«On adoption of the Program of first-priority measures to prepare IPS of Ukraine for operation with European countries association»
First priority measures: till 2015 years – over 3,1 bln.hrn
EU-Ukraine Association Agenda

to prepare and facilitate the implementation of the Association Agreement

Accelerate work towards integration of the integrated power system of Ukraine into the central European electricity network, in accordance with the requirements of UCTE

Ukraine – is a party to the Energy Community Treaty

Verkhovna Rada of Ukraine ratified the protocol on Ukraine's accession to the Energy Community Treaty. In order to ensure compliance with Title II of the Energy Community Treaty was approved implementation timetable for Ukraine acquis communautaire (implementation of directives, regulations and decisions of the EU Commission to the legislation of Ukraine).

The Energy Community Treaty entered into force for Ukraine.

Decree of the Cabinet of Ministers №733-p “On approval of a plan to implement the obligations under the Energy Community Treaty”

Plan for 2012-2014

Feasibility Study on Synchronous Interconnection of Ukrainian and Moldovan Power Systems to ENTSO-E Continental Europe Power Systems
Power System of Ukraine

Thank you for attention!