

Ukrainian Transmission System Operator – National Power Company “UKRENERGO”

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(Slide 1)

Dear Ladies and Gentlemen, Colleagues!

(Slide 2) About Ukraine in Brief

Being located in Central-Eastern Europe and having the territory of about 603 700 square kilometres Ukraine has borders with the Russian Federation (border line length is 2063 km), Republic of Belarus – 975 km, Republic of Poland – 542,5 km, Republic of Slovakia - 98 km, Hungary – 135 km, Romania – 608 km and Moldova – 1194 km. Ukraine has quite well developed air, railway, sea and automobile transport networks that is favourable for transit of passengers and goods via Ukrainian territory to other countries.

Power sector of Ukraine, and Integrated Power System, in particular, are efficiently used in providing Ukrainian consumers with required power.

(Slide 3) Interconnected Power System of Ukraine (IPS)

What is IPS today?

IPS is in the list of large European power systems. It includes nuclear (NPP), thermal (TPP), hydro (HPP) and hydroelectric pumped storage (HPSPP) power plants as well as 0,4 kV – 750 transmission lines.

Today the total installed capacity of the IPS of Ukraine generating equipment is more than 52000 MW, while the maximum demand in Ukraine is more than 30000 MW.

The total number of transformer substations of all levels of voltage is more than 200 000 units. The number of 35 – 750 kV voltage reducing substations is 5360, while the total capacity of transformers (autotransformers) installed at the above-mentioned substations is 157600 MVA.

(Slide 4) Generating Facilities of Ukraine

The main generating facilities of Ukrainian IPS are the following:

- 14 big thermal power plants having 97 generating units of 150-800 MW. The biggest of them are Zaporizka and Vuglegirska TPPs, each of them having capacity of 3600 MW.

- 4 nuclear power plans having 13 generating units of 1000 MW and 2 generating units of 440 MW. The biggest Ukrainian nuclear power plant as well as one of the biggest in Europe is Zaporizka NPP, installed capacity of which is 6000 MW.

- Dniprovsy HPP cascade, including hydroelectric pumped storage power plant Kyivska HPSPP, and Dnistrovska HPP (installed capacity of about 4600 MW), but the biggest of them is Dniprovska HPP with installed capacity of 1500 MW.

- combined heat power plants (CHPP) including 9 big gas-mazut generating units of 100 – 250 MW ensuring heat and power supplies to the cities of Kyiv and Kharkiv.

Besides, there are small generating facilities belonging to big industrial consumers and owned either by consumers themselves or by communities as well as renewable power sources.

Information:

Installed capacity in MW:

	31.12. 02	31.12. 03	31.12. 04	01.10. 05
TPP of generating companies	28020	28045	27150	27075
CHPP and other TPP	6415	6265	6433	6328
HPP, HPSPP	4776	4785	4785	4724
NPP	11835	11835	13835	13835
Total	51046	50930	52203	51962

Power electrical power output is about 170-180 bln. kWh.

(Slide 5) NPC “Ukrenergo”. Functions

National Power Company “Ukrenergo” is Transmission System Operator of Ukrainian IPS.

The main “Ukrenergo” missions are the following:

- ensuring electrical power transmission through high-voltage and cross-border transmission networks;
- centralized dispatching and technological control of IPS aimed at ensuring reliable parallel operation of thermal, nuclear and hydro power plants connected by high-voltage lines;
- preventing mode violations as well as system contingencies and liquidation of possible breakdowns with minimization of losses;
- ensuring parallel operation with neighbouring state power systems;
- ensuring the reliable functioning of the Ukrainian power market.

(Slide 6) NPC “Ukrenergo”. High-voltage transmission network

NPC “Ukrenergo” is one of the biggest electric power companies of Ukraine, that operates system (bulk) and cross-border 35-800 kV transmission lines totaling about 22 500 km as well as 132 bulk transformer substations of 220–750 kV having installed capacity of more than 76 000 MWA.

NPC “Ukrenergo” is a state company subordinated to the Ministry of Fuel and Energy of Ukraine. The Statutory Fund of the company is UAH 1,24 bln. (USD

232 mln.) The number of employees is about 14 000. The company consists of 8 regional companies responsible for dispatching and operation of bulk transmission lines in their regions and specialized entities such as Head Information and Computation Centre dealing with obtaining and processing statistical and analytical data for the power sector and Personnel Training Centre.

(Slide 7) NPC “Ukrenergo”. Dispatch Control

Ukrainian electric power branch of Ukraine has a single centralized dispatching system controlling and managing generation, transmission and distribution of electrical power. The dispatch control of the Ukrainian IPS is provided by NPC “Ukrenergo”. Centralized dispatch control covers electrical power companies connected to the Ukrainian IPS.

Centralized dispatch control includes:

- planning and controlling operation of Ukrainian power plants facilities taking into account the modes of centralized heat supplies;
- planning and controlling the Ukrainian IPS operation;
- preventing contingencies in Ukrainian IPS and resulting consequences liquidation by means of sustaining the required power balance, ensuring reliable and interruptible Ukrainian IPS operation as well as parallel work with power systems of other states;
- monitoring the installation (in some cases development) of new protection and automatics systems, means of communication and dispatch (operative and technological) control as well as supervision of protection and automatics system operation.

All operative commands and regulations of “Ukrenergo” dispatch centre, keeping with Ukrainian legislation, are obligatory to all electric power companies connected to the Ukrainian IPS.

(Slide 8) IPS of Ukraine – part of Trans-European Networks – Interface and Exchange Level Opportunities

The IPS of Ukraine has 75 electrical links of 0,4-750 kV with 7 power systems of neighbouring states including 29 lines to Russia, 28 - to Moldova, 8 – to Belarus, 4 – to Hungary, and 2 – to Poland, 2 – to Slovakia, 2 – to Romania.

To a considerable extent this fact predetermines developing mutually beneficial relations and electrical power exchanges at the given interface.

Ukrainian Power System has sufficient experience in ensuring transmission of considerable amounts of electrical power. For example, electrical power exchanges in the Western direction were at the level of 6000 MW in 1990s, ensuring annual electrical power export equal to 30 bln. kWh.

Preliminary assessments of the IPS transmission capacity at the interface with neighbouring power systems carried out by Ukrainian experts for the period of 2007 – 2008 show that technically possible upper limits of power exchanges are the following:

Ukraine – Russia: import – 3000 MW, export – 3000 MW
 Ukraine – Belarus: import – 700 MW, export – 800 MW
 Ukraine – Romania (Yuzhnoukrainska NPP (YuNPP) – Isaccea OHL):
 import – 1900 MW, export – 1900 MW
 Ukraine – Moldova: import – 2000 MW, export – 2000 MW
 Ukraine – Western and South-Western Interface:
 import – 3000 MW, export – 3700 MW

(750 kV YuNPP – Isaccea OHL is not included)

Along with a strong cross-border interface the Ukrainian IPS has a well-developed national bulk network enabling to transmit big amounts of electrical power from the Western border to the Eastern one and vice versa. Existence of transit via 750 kV line crossing all the territory of Ukraine from the East to the West and from the North to the South plays a great role in ensuring reliable transmission of big amounts of electrical power.

Uneven day load schedule of the Ukrainian IPS is compensated by means of engaging different types of power plants from the main nuclear power plants to easily operated hydro and hydroelectric pumped storage power plants.

(Slide 9) Burshtyn TPP Island. Characteristic

And a few words about the part of Ukrainian power system already working synchronously with UCTE being included into CENTREL. It is the so-called Burshtyn TPP Island.

In the result of this project there was created a power region characterized by European supply safety standards, high quality of electrical power, up-to-date controlling systems, automatics, telecommunications, and electrical power accounting systems and so on.

At present the territory of the Burshtyn TPP Island is about 27000 sq. km populated by 3 000 000 inhabitants. The total home consumption is within 1000-1100 MW.

Information:

Burshtyn TPP power balance

	2002	2003	2004	2005
Power plants output (mln. kWh)		8 347	8 729	9 307
Home consumption (mln. kWh)		5 004	5 400	5 568
Export (mln. kWh)	2 137	3 343	3 329	3 739
Scheduled export (MW)	450	450	500	500/550 winter/ summer

Since 2002 power exchange level is characterized by a stable increasing tendency from 450 MW in 2002 – 2003 to 500 MW in 2006. It worth to be mentioned that there are only three generation sources in the Island, namely: Burshtyn TPP, Kalushska CHPP, and Treblya – Rikaska HPP. That is why the only way to increase export simultaneously with home consumption increase was possible only through modernization of existing generation sources. Therefore, Burshtyn TPP Island units' modernization has been continued. Separate generating units' capacity amounted to 190 – 195 MW, the total power plant capacity increased by 150 MW.

(Slide 10) Burshtyn TPP Island. History of development

A few words about history of Burshtyn TPP Island building and development. The process began in November 1995, when the first meeting of UCTE representatives with NPC “Ukrenergo” experts was held in Lviv. During 1995 – 1997 the Catalogue of Measures on Burshtyn TPP Island integration into UCTE was prepared and approved. In 1999 the Agreement on long-term physical separation of the Burshtyn TPP Island from the Power System of Ukraine was signed. On April 6 – 20, 2002 a test operation before interconnection of the Island to UCTE was performed. Annual test operation of the Burshtyn TPP Island as a part of UCTE, which resulted in permanent synchronous operation of the Island with European interconnected power system began on July 1, 2003. On October 10, 2004 resynchronization of the 1 and 2 UCTE synchronous zones resulted in energizing the 400 kV cross-border Mukachevo – Rosiori (Romania) OHL.

(Slide 11) Burshtyn TPP. Development plans for the nearest future

It is worth to be mentioned that despite the fact the requirements of the Catalogue of Measures on Burshtyn TPP Island were fulfilled its modernization is now being carried on. Further increasing capacity of Burshtyn TPP Island is planned for the nearest future, namely:

- 2006-2007 – increasing the capacity of generating units No. 5 and No. 7 to 205 MW.
- 2008-2010 – increasing the capacity of generating units No. 1-4 to 225 MW.

To increase stability reserve and more efficiently use the plant capacity further modernization of communication devices and relay protection is planned at the Burshtyn TPP. It should increase export by 600 – 650 MW.

Relay protection and equipment modernization will be continued throughout the whole territory of the Island.

Fibre-optic communication development is planned as well.

(Slide 12) On the way to meet UCTE requirements. Researching

To ensure the consistent adjusting of the Ukrainian IPS to the standards accepted in European power systems Ukrainian power branch experts have done a number of research works, the results of which give primary assessment of the amount of work to be performed both technical field and in legislation of Ukraine. The performed works include:

- analysis of accordance of Ukrainian technical documentation with UCTE Operation Handbook and proposals concerning their harmonization;
- analysis of the Ukrainian IPS from the point of view of meeting technological requirements to the parallel operation with European power companies, including N-1 criterion, stability, voltage and reactive power control, contingency results liquidation in the network, system frequency characteristics, power reserves (primary, secondary and tertiary), operative-technological control and electrical power accounting;
- revising some nuclear plant generating units of Zaporizka NPP (ZaNPP), Rivnenska NPP (RiNPP), Yuzhnoukrainska NPP (YuNPP) as well as thermal power plant generating units of Zaporizka TPP (ZaTPP), Zmyivska TPP (ZmTPP), Trypilska TPP (TpTPP), Vuglegirska TPP (VugTPP), Starobeshyvska TPP (SbTPP);
- revising electrical equipment at 3 substationns: Novokyivska SS, Losevo SS and Kovel SS.

There was also started the work on developing the Grid Code of Ukraine.

(Slide 13) On the way to meeting UCTE requirements. Research works to be completed in 2006

Besides, plans for the current year include:

- developing the program of further modernization of all other TPP and HPP generation units and “close” modernization of two or four generating units;
- taking measurements on harmonization of the present Ukrainian legislation in the power sector with European legislation requirements;
- further revising the electrical equipment and developing design documentation on modernization of 2 bulk SS;
- developing of the program of measures on voltages control.

(Slide 14) On the way to meet UCTE requirements. Secondary control

Within the framework of technical measures on adjusting the Ukrainian IPS to the European requirements and standards we have done the following:

- the first stage of TPP reconstruction and rehabilitation within the framework of the Project on TPP and System Control Rehabilitation supported by the World Bank: 18 hydro units have been reconstructed including replacing hydro turbines, control systems, excitation systems, contingencies recording, controlling, installed generator and high voltage circuit breakers, hydro generator and power transformer protection equipment. It is very important that both technical and ecological characteristics have been improved, the latter being especially important taking into account the role of the Dnipro river in water supplies in Ukraine and other states.
- A new programming equipment for the system monitoring and automatic generation control has been put into operation.

Today more than 400 MW of TPP secondary reserve is under stable and powerful flows control. It is possible during some periods to increase the amount of power AGC to 700 MW.

(Slide 15) On the way to meet UCTE requirements. Network construction

Since 2002 NPC “Ukrenergo” has put into operation the following:

- 330 kV Khmelnytska NPP – Khmelnytska OHL;
- 330 kV Rivnenska NPP – Lutsk Pivnichna OHL with distribution plant of 330kV Lutsk Pivnichna SS;
- 500 kV Donbaska–Novodonbaska OHL with 500 kV Novodonbaska SS;
- 750 kV Rivnenska NPP – Zakhidnoukrainska OHL switching over to the nominal voltage.

Modernization and reconstruction of the bulk networks of the Ukrainian IPS including subsequent replacement of air high voltage circuit breakers with sulfur hexafluoride ones are being carried out.

Since the end of the last decade much attention has been paid to the relay protection system developing. This process was started in 1997 when 40 Siemens microprocessor protecting systems were installed on 750 kV lines sponsored by the World Bank. Replacement of the previous analogue protection systems is being carried out and 97 additional devices have been installed. At the present moment all 750 kV, 500 kV, 400 kV OHL have the relay protection microprocessor devices.

Uninterruptible power supply devices have been installed in all regional dispatching centres to ensure safe operation of their technological equipment of substations.

SCADA/AGC/GCD/EMS system has been put into operation ensuring data obtaining and processing (SCADA), power and frequency automatic control (AGC), generation distribution (GCD), controlling and sustaining reliability and efficiency of the network operation.

To improve controlling and managing system 1160 km fibre-optical communication line (FOCL) has been installed in anti-lighting cable of transmission lines to connect the majority of (5) regional dispatching centres, generating (4 TPP) and 7 distributing companies. Besides, FOCL was constructed on cross-border 220 kV Dobrotvirska TPP (DTPP) – Zamosc that connected Ukrainian and Polish communication systems.

In 2004 two new 1000 MW generating units were put into operation at Rivnenska and Khmelnytska NPPs (RiNPP and KhNPP), in the Western part of the Ukrainian IPS. The first launch of generating unit No. 2 in KhNPP was made in August, and on October 5 its operating capacity was already 700-750 MW. In the mid-October it achieved 1000 MW. The generating unit No. 4 of RiNPP started its operation on October 10 having achieved 95% of its nominal capacity by the end of 2004.

To increase the reliability of Ukrainian IPS operation there are being carried out the works on creating transient modes monitoring system (TMMS) on the basis of the most new contingency recorders. TMMS (analogy to WAMS) pilot project is implemented at 3 IPS of Ukraine substations, namely: Zakhidnoukrainska, Mukachevo, Donbaska, and 2 nuclear power plants, namely: KhNPP and YuNPP. TMMS putting into operation is planned for March, 2006.

(Slide 16) On the way to meeting UCTE requirements

Plans for the nearest future are the following:

- (2 x 150 MW) Tashlytska HPSPP putting into operation – 2006;
- (3 x 390 MW) Dnistrovska HPSPP putting into operation – 2007;
- construction of connections from 330 kV Dniprovska HPP- Ladyzhynska TPP line to Dnistrovska HPSPP – 2007;
- 750 kV Rivnenska NPP – Kyivska OHL with SS Kyivska construction – 2007;
- Crimea – 2007 (Sevastopol-Simferopil transition to 330 kV);
- Moldova (330 kV Novoodeska – Artsyz OHL – 2008, Adzhalyk-Usatove - 2007)
- 330 kV Zakhidnoukrainska – Bogorodchany OHL – 2008.

(Slide 17) Thank you very much for your attention