# UKRAINE

(Updated 2009)

# 1. GENERAL INFORMATION

## 1.1 Country overview

The Ukraine is a sovereign state in Eastern Europe. It has its own territory, higher and local bodies of, Government, a national emblem and a state flag.

The Ukraine is one of the largest republics of the former Soviet Union. As a constituent member of the USSR, the Ukrainian republic, in accordance with the Soviet Constitution, formally enjoyed certain rights and features of a sovereign state: territory, organs of state power and administration, budget, state emblem, flag, national anthem, and Constitution. In 1944, in accordance with a decision of the Supreme Council of the USSR, the Union republics, including the Ukrainian SSR, were granted the right to conduct their own foreign relations. One year later the Ukrainian SSR became a founding member of the United Nations. Despite its dependence on USSR decisions and structures, the international status of Ukraine as a state in its own right increased over the years. During the period from 1944-1990, Ukraine was a signatory of 156 international treaties, a member of 16 international organizations, and participated in the work of approximately 60 permanent and interim international organizations.

On July 16, 1990 the Supreme Soviet of Ukraine adopted an important historic document, the Act proclaiming Ukrainian state sovereignty, independence and indivisibility of power within the boundaries of Ukrainian territory, and independence and equality in conducting foreign relations. On August 24, 1991 the Supreme Rada, in effecting this Declaration and proceeding from the right to self-determination, proclaimed the act of independence of Ukraine. Its territory was proclaimed indivisible and inviolable and the Constitution and laws of Ukraine have exclusive validity. On December 1, 1991 an all-Ukrainian referendum was held. Results of this national referendum indicated that more than 90% of the population favoured independence. Leonid Kravchuk, the former head of the Supreme Rada of Ukraine was elected President of Ukraine.

### 1.1.1 Geography and Climate

Ukraine is an Eastern European State with Black and Azov Seas to the south. Ukraine's border from West to East measures 1316 km, from north to south 893 km, a total border length of 6500 km.

Neighbouring countries: Poland, Slovakia, Hungary, Romania, Republic of Moldova, Russian Federation, Belorus.The Eastern European Plain (95 % of the area), together with Ukrainian Carpathians and Crimean Mountains (5 % of the area) have a temperate continental climate. The Southern Crimean climate has subtropical features.

| **Annual rainfall in 2007, mm** | | | |
|---|---|---|---|
| Steppe | 414 | Forest | 734 |
| Forest-steppe | 580 | Kyiv City | 636 |

| **Average air temperature in 2007** | | |
|---|---|---|
| | ***January*** | ***July*** |
| Steppe | 2,9 | 24,4 |
| Forest-steppe | 1,7 | 21,5 |
| Forest | 2,3 | 20,0 |
| Kyiv City | 2,1 | 21,3 |

In 2007 the absolute minimum air temperature was $26^0$ in February in the Sumy and Chernihiv regions.

In 2007 the absolute maximum air temperature was $42^0$ in July in the Odesa region.

| **Longest rivers** *(length through the territory of Ukraine; km)* | | | |
|---|---|---|---|
| Dnipro | 1121 | Inhulets | 549 |
| Dnister | 925 | Psel | 520 |
| Pivdennyi Boug | 806 | Sluch | 451 |
| Siverskiyi Donets | 700 | Styr | 424 |
| Horyn’ | 577 | Zakhidnyi Boug | 401 |
| Desna | 575 | Oril’ | 384 |

| **Largest lakes and estuaries (sq. km)** | | | |
|---|---|---|---|
| **Lakes** | | **Estuaries** | |
| Yalpuh | 149 | Dniprovsko-Buzkyi | 800 |
| Kuhurluy | 82 | Utlyutskyi | 700 |
| Kahul | 82–93 | Dnistrovskyi | 360 |
| Sasyk-Sivash | 71 | Sasyk, Kunduk | 205 |
| | | Molochnyi | 168 |
| | | Tylihulskyi | 150–170 |

| **Highest mountain peaks (m)** | | | |
|---|---|---|---|
| Ukrainian Carpathians | | Crimean mountains | |
| Hoverla | 2061 | Roman-Kosh | 1545 |
| Brebenskoul | 2032 | Demir-Kapou | 1540 |
| Petros | 2020 | Zeitin-Kosh | 1534 |
| Houtyn Tomnatyk | 2016 | Kemal-Eherek | 1529 |
| Rebra | 2010 | Eklizi-Bouroun | 1527 |
| Pip Ivan | 1936 | Anhara-Burun | 1453 |

## 1.1.2 Population

The population of Ukraine is about 46.6 million (Table 1). The urban population comprises 68% of the total population and the overall population density is 77 people per square km.

TABLE 1. POPULATION INFORMATION

| | | | | | | | Average annual growth rate (%) |
|---|---|---|---|---|---|---|---|
| **Year** | **1970** | **1980** | **1990** | **2000** | **2005** | **2009** | **2000 to 2009** |
| **Population (millions)** | 47.3 | 50 | 51.9 | 49.2 | 47.1 | 46.0 | -0.74 |
| **Population density (inhabitants/km$^2$)** | 81.7 | 86.4 | 85.9 | 81.5 | 78.0 | 76.2 | -0.74 |
| **Urban population (% of total)** | 54.8 | 61.7 | 66.8 | 67.1 | 67.8 | | |
| **Area(1000 km$^2$)** | 579.4 | | | | | | |

Source: World Bank World Development Indicators

## 1.1.3 Economic Indicators

Table 2 shows the historical Gross Domestic Product statistics

TABLE 2. GROSS DOMESTIC PRODUCT (GDP)

| | | | | | | Annual Average Growth Rate (%) | |
|---|---|---|---|---|---|---|---|
| | **1980** | **1990** | **2000** | **2005** | **2009** | **1980 to 2000** | **2000 to 2009** |
| GDP (millions of constant 2000 US$) | .. | 71,953 | 31,262 | 45,188 | 45,390 | .. | 4.23 |
| GDP per capita (2000 US$/capita) | .. | 1,388 | 636 | 960 | 987 | .. | 5.00 |
| PPP (millions of constant 2000 int$) | .. | 441,014 | 202,054 | 286,730 | 288,250 | .. | 4.03 |
| PPP per capita (2000 int$/capita) | .. | 8,508 | 4,109 | 6,091 | 6,265 | .. | 4.80 |

Source: EEDB database

## 1.1.4 Governmental System

On 28 June, 1996 the Constitution was adopted, which gave Ukraine the status of a republic. The country includes the Autonomous Republic of Crimea and 24 administrative regions (oblasts), Kyiv and Sevastopol cities. These cities have special status prescribed by Ukraine's laws.

The head of the State is the President who executes his authority on its behalf. The President is elected by Ukrainian citizens by equal vote and direct countrywide elections for the period of five years and not more than two consecutive terms.

The integral legislative body is the Parliament – the Verkhovna Rada of Ukraine. The top executive authority is the Cabinet of Ministers of Ukraine. Sovereignty and the only source of government power belong to the people of Ukraine. The main public holiday is Independence Day – 24 August.

# 1.2 Energy Situation

The estimated energy resources are shown in Table 3. The historical energy supply and demand data are given in Table 4.

TABLE 3. ESTIMATED ENERGY RESERVES

| | Estimated available energy sources | | | | | | |
|---|---|---|---|---|---|---|---|
| | Fossil Fuels | | | Nuclear | Renewables | | |
| | Solid | Liquid | Gas | Uranium | Hydro | Other Reneables | Total |
| Total amount in Exajoule (EJ) | 965.89 | 7.44 | 30.53 | 44.23 | 4.34 | | 1 052.41 |
| Total amount in specific units* | 33,873 | 151 | 787 | 86,800 | 22,000 | | |

* eg. Mtoe, Btu, Mt,TWh.

(*) Sources: 20th WEC Survey of Energy Resources, 2004 and Uranium 2005: Resources, Production and Demand ("Red Book")

(1) Coal including Lignite: proved recoverable reserves, the tonnage within the proved amount in place that can be recovered in the future under present and expected local economic conditions with existing available technology

(2) Crude oil and natural gas liquids (Oil Shale, Natural Bitumen and Extra-Heavy Oil are not included): proved recoverable reserves, the quantity within the proved amount in place that can be recovered in the future under present and expected local economic conditions with existing available technology

(3) Natural gas: proved recoverable reserves, the volume within the proved amount in place that can be recovered in the future under present and expected local economic conditions with existing available technology

(4) Reasonably Assured Resources (RAR) under < USD 130/kgU

(5) Hydropower: technically exploitable capability, the amount of the gross theoretical capability that can be exploited within the limits of current technology

Source: IAEA Energy and Economic Database.

## 1.2.1 Energy Statistics

TABLE 4. ENERGY STATISTICS

| *(Energy values are in Exajoule exept where indicated)* | | | | | | Annual Average Growth Rate (%) | |
|---|---|---|---|---|---|---|---|
| **Total Energy Requirements** | **1980** | **1990** | **2000** | **2005** | **2009** | **1980 to 2000** | **2000 to 2009** |
| Total | .. | .. | 5.87 | 6.28 | 4.93 | .. | -1.93 |
| Solids | .. | .. | 1.61 | 1.55 | 1.50 | .. | -0.83 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Liquids | .. | .. | 0.45 | 0.58 | 0.55 | .. | 2.16 |
| Gases | .. | .. | 2.90 | 3.13 | 1.93 | .. | -4.43 |
| Hydro | .. | .. | 0.04 | 0.05 | 0.04 | .. | 0.46 |
| Nuclear | .. | .. | 0.84 | 0.97 | 0.90 | .. | 0.78 |
| Combustible Renewables and Waste | .. | .. | 0.04 | 0.04 | 0.02 | .. | -4.84 |
| Other Renewables | .. | .. | -0.01 | -0.03 | -0.01 | .. | 0.56 |
| | | | | | | | |
| **Final Energy Consumption** | **1980** | **1990** | **2000** | **2005** | **2009** | **1980 to 2000** | **2000 to 2009** |
| Total | .. | .. | 3.31 | 3.49 | 3.21 | .. | -0.33 |
| Solids | .. | .. | 1.53 | 1.45 | 1.31 | .. | -1.71 |
| Liquids | .. | .. | 0.16 | 0.19 | 0.17 | .. | 0.76 |
| Gases | .. | .. | 0.70 | 0.81 | 0.75 | .. | 0.83 |
| Hydro | .. | .. | 0.04 | 0.05 | 0.04 | .. | 0.46 |
| Nuclear | .. | .. | 0.84 | 0.97 | 0.90 | .. | 0.78 |
| Combustible Renewables and Waste | .. | .. | 0.04 | 0.03 | 0.03 | .. | -1.70 |
| Other Renewables | .. | .. | < 0.01 | < 0.01 | < 0.01 | .. | 24.46 |
| | | | | | | | |
| **Net Import (Export-Import)** | **1980** | **1990** | **2000** | **2005** | **2009** | **1980 to 2000** | **2000 to 2009** |
| Total | .. | .. | 2.59 | 2.71 | 1.85 | .. | -3.64 |
| Solids | .. | .. | 0.08 | 0.10 | 0.06 | .. | -4.26 |
| Liquids | .. | .. | 0.32 | 0.38 | 0.37 | .. | 1.65 |
| Gases | .. | .. | 2.20 | 2.25 | 1.45 | .. | -4.52 |
| Combustible Renewables and Waste | .. | .. | < 0.01 | 0.01 | > -0.01 | .. | |

Source: IAEA Energy and Economic Data Base

## 1.2.2 Energy policy

The energy policy of Ukraine and its top priorities are established in the "Energy Strategy of Ukraine until 2030" (Energy Strategy). This document was approved by the Cabinet of Ministers on 15 March 2006 (#145-r) and includes the following objectives:

to create favorable conditions to provide for the national demand for energy being satisfied by a stable and high-quality supply;

to develop policies and establish a favorable environment for safe, efficient, reliable and sustainable functioning of the energy sector.

to improve national energy security;

to scale down the negative technological burden on the environment and provide public protection in the field of FEC technological safety;

to improve energy efficiency in energy production and use implementation of energy-saving processes and equipment, enhanced public production structure, and reduced share of energy-intensive technologies;

to integrate the United Power System of Ukraine into the European power system, with an emphasis on a gradual increase in electric power exports, and strengthen Ukraine's position as an oil-and-gas transit country.

The attainment of the above objectives will form conditions for an intensive development of the economy and, consequently, for the improvement of living standards in the country.

Energy Strategy goals and areas are as follows:

1. To establish an integrated and efficient management and regulation system within the fuel and energy sector, to promote competition on the national energy markets.
2. To create conditions for a radical reduction of the energy content of domestic products through implementation of modern technologies, good standards and advanced control, management and accounting systems at every stage of energy production, transportation and consumption processes; and to develop adequate market mechanisms to encourage energy savings in every sector of economy.
3. To develop the export potential of the energy sector with an emphasis on electric power by upgrading and rehabilitating the existing generation capacities and power transmission lines, including trans-border lines.
4. To develop the national energy machine building industry, instruments manufacturing and integrated energy system engineering and construction capacities as a necessary prerequisite for strengthening the competitive positions of Ukrainian companies, with regard to participation in domestic and foreign energy projects.
5. To optimize the domestic energy production system in consideration of their supply at foreign markets, pricing policies and geopolitical situation, and increased energy produced by alternative and renewable energy sources.
6. To diversify both foreign energy sources and transportation routes.
7. To establish an integrated national statistics/ strategic planning/ monitoring system to control energy production and consumption processes and form adequate energy supply and demand budgets.
8. To balance pricing policies in the energy sector so as to ensure that the energy production costs are covered, and create proper conditions for stable operation and sustainable development of the FEC companies.
9. To provide legal and regulatory support to ensure implementation of the Energy Strategy with consideration for the relevant international commitments provided for by the Agreement to the Energy Charter, the Kyoto Protocol, multiple bilateral covenants, and requirements of the European energy legislation.

The integration of the Ukrainian Power System into the European system is considered an important step towards the national strategic objective of joining the EU. Unlike the countries that recently joined the EU in the last wave of the EU enlargement, Ukraine may offer a relatively potent and well-developed network of oil and gas transportation and power transmission systems integrated with the relevant EU and CIS systems, and which makes it possible for the country to participate in the shaping European energy

policy and joint energy markets, and play an important role in energy cooperation between CIS and EU countries.

The national economic development plan through 2030 contains the following three stages: through 2010 – innovation restructuring stage; 2011 - 2020 – advanced development stage for the traditional service sectors of Ukraine's economy. In these two stages, a sound foundation for the post-industrial production system will be established. During the period of 2021 - 2030, the transition to the post-industrial society and the relevant adjustment of the economic structure is expected to be completed.

The forecast assumes that the growing national demand for fuel and energy resources for the period to 2030 will be met provided that:

1. energy demand of GDP is scaled down and the national energy supply is increased;
2. domestic production of coal, oil, gas and uranium is expanded;
3. the proportion of domestic nuclear fuel for electric power generation by nuclear power plants is increased;
4. exports of petroleum products are scaled up through increased productivity of the oil processing industry;
5. energy-saving initiatives are implemented in the national economy and social sector;
6. the share of alternative and renewable energy resources is increased;
7. the level of national dependence on fuel-and-energy imports is forced down, and the proportion of domestic energy products in the national consumption is increased.

Thermal power energy development is expected to convert to coal as a primary fuel, and the forecast is based on the assumption that a significant portion of the existing district heating and hot water utilities will convert their equipment to using electric power rather than firing natural gas. By the year 2030, the proportion of coal in the fuel budget of TPP, CHPP and local power plants will grow to as much as 85.1%, the percentage of natural gas will fall to 14.5%, and the proportion of fuel oil (mazut) and other fossil fuels will amount to only 0.4%. This fuel balance will help encourage the extensive development of the local coal mining and facilitate further improvement of their economic efficiency and environmental protection standards, with the relevant positive contribution to national energy security on the whole.

# 1.3 The electricity system

## 1.3.1 Electricity policy and decision making process

The energy strategy plans to meet the goal of international standards by 2020. To do so, there are complex problems to solve. This will provide the possibility of integration of Ukrainian Unified Energy System with the EU Energy System.

The forecasted Electric Power Budget for the relevant periods (2010, 2015, 2020 and 2030) has been developed based on outcome data of trend analysis regarding changes in macroeconomic indicators of Ukraine’s economy development for the period up to 2030. This gives reasonable grounds to predict mainstream trends of the national economic development and resource production potential, with consideration for the relevant growth models. In view of unclear potential outside conditions for the future social and economic development of the country, we offer the forecasted Base Case Electric Power Balance complete with the Best Case and Worst Case Electric Power Balances that relate to the most optimistic and most pessimistic scenarios of the national social and economic

development, correspondingly. The latter electric power balances mark, correspondingly, the top and bottom margins of possible deflections of key performance indicators that describe the potential electric power generation and consumption structure for the period up to 2030.

Electric power consumption in future is expected to gradually rise to 198.9 TWh in 2010; 231.0 TWh in 2015; 287.0 TWh in 2020; and 395.1 TWh in 2030.

The bottom margin of forecasted power consumption that corresponds to the Worst-case scenario of economic development will total 184.3 TWh in 2010; 208.0 TWh in 2015; 244.2 TWh in 2020; and 336.4 TWh in 2030.

The top margin of forecasted power consumption is expected to be the following total consumption indices: 214.5 TWh in 2010; 246.7 TWh in 2015; 303.8 TWh in 2020; and 440.4 TWh in 2030.

Export potential of Ukraine may be raised to 11.35 TWh in 2010; 20 TWh in 2020; and 25 TWh in 2030, provided that the United Power System of Ukraine is set to work in parallel with the UCTE Power System, efforts are taken to scale up the exports to Moldova and Belarus, and exports to South-European and Baltic countries are effectively contracted.

Forecasted Electric Power Budget of Ukraine up to 2030, GWh (Base-case Scenario)

| **Name** | **2010** | **2015** | **2020** | **2030** |
|---|---|---|---|---|
| Electricity supply, total | 210 200 | 251 000 | 307 000 | 420 100 |
| Electricity generation, total | 210 200 | 251 000 | 307 000 | 420 100 |
| 1). General-purpose power plants, including: | 200 290 | 239 450 | 294 100 | 404 600 |
| | | | | |
| A).Thermal and Combined Heat-and-Power Plants (TPP and CHPP), percentage in total generation | 86 590 | 114 350 | 118 600 | 167 000 |
| | | | | |
| percentage in total generation | 41,2% | 45,6% | 38,6% | 39,8% |
| B). Hydropower Plants (HPP), | 10 300 | 11 400 | 12 700 | 14 100 |
| | | | | |
| percentage in total generation | 4,9% | 4,5% | 4,1% | 3,4% |
| C). Hydroelectric Pumped Sstorage Plants (HPSP), | 2 200 | 3 200 | 3 900 | 4 500 |
| | | | | |
| | 1,0% | 1,3% | 1,3% | 1,1% |
| D). Nuclear Power Plants (NPP), | 101 200 | 110 500 | 158 900 | 219 000 |
| | | | | |
| percentage in total generation | 48,1% | 44,0% | 51,8% | 52,1% |
| 2). Local Power Plants and other sources, | 9 910 | 11 550 | 12 900 | 15 500 |
| | | | | |
| percentage in total generation | 4,8% | 4,6% | 4,2% | 3,6% |
| Electricity demand, total | 210 200 | 251 000 | 307 000 | 420 100 |

| | | | | |
|---|---|---|---|---|
| Gross electricity consumption | 198 850 | 231 000 | 287 000 | 395 100 |

## 1.3.2 Structure of electric power sector

In 1996 Ukraine established the Wholesale Electricity Market (WEM) in order to improve the competitive ability of Ukrainian power sector, meet demands of Ukrainian consumers for power at the minimum possible price, (which is based on competition between power generating and supplying companies), ensure reliable electricity supply to consumers, and provide financial stability and profitability of the sector as well as potential investors' attention to it.

According to the Ukrainian Laws on power engineering, the Wholesale Electricity Market is guided by provisions of the Agreement between its members. This Agreement determines terms and conditions, activities, rights, liabilities and responsibilities of its members, as well as operational procedures, market infrastructure and its bodies. Economic and financial mechanisms are governed by the Wholesale Electricity Market Rules and corresponding instructions to the Agreement.

A new economic system of market-oriented relations in the power sector was introduced with the assumption of keeping the United Power System, which included power engineering facilities tied together by a common regime of generation, transmission and distribution of electric power centralized by an operational dispatch control.

The Wholesale Electricity Market is operated by the State Enterprise "Energorynok", which trades in all generated electricity, functions as an administrator of the accounts system (formation of the wholesale market price and calculation of payments) and a manager of WEM funds.

Wholesale market price, for which power supply companies buy power in the WEM, is formed on the basis of a weighted average price with which the Wholesale Electricity Market buys power from the power generation companies (TPP, NPP, HPP, CHPP, WPP), taking into account export prices for electricity, payments for services rendered by the system operator (NPC "Ukrenergo") and the market operator (SE "Energorynok"), and financing investment projects and compensation payments for of losses incurred due to power electricity to privileged consumer categories.

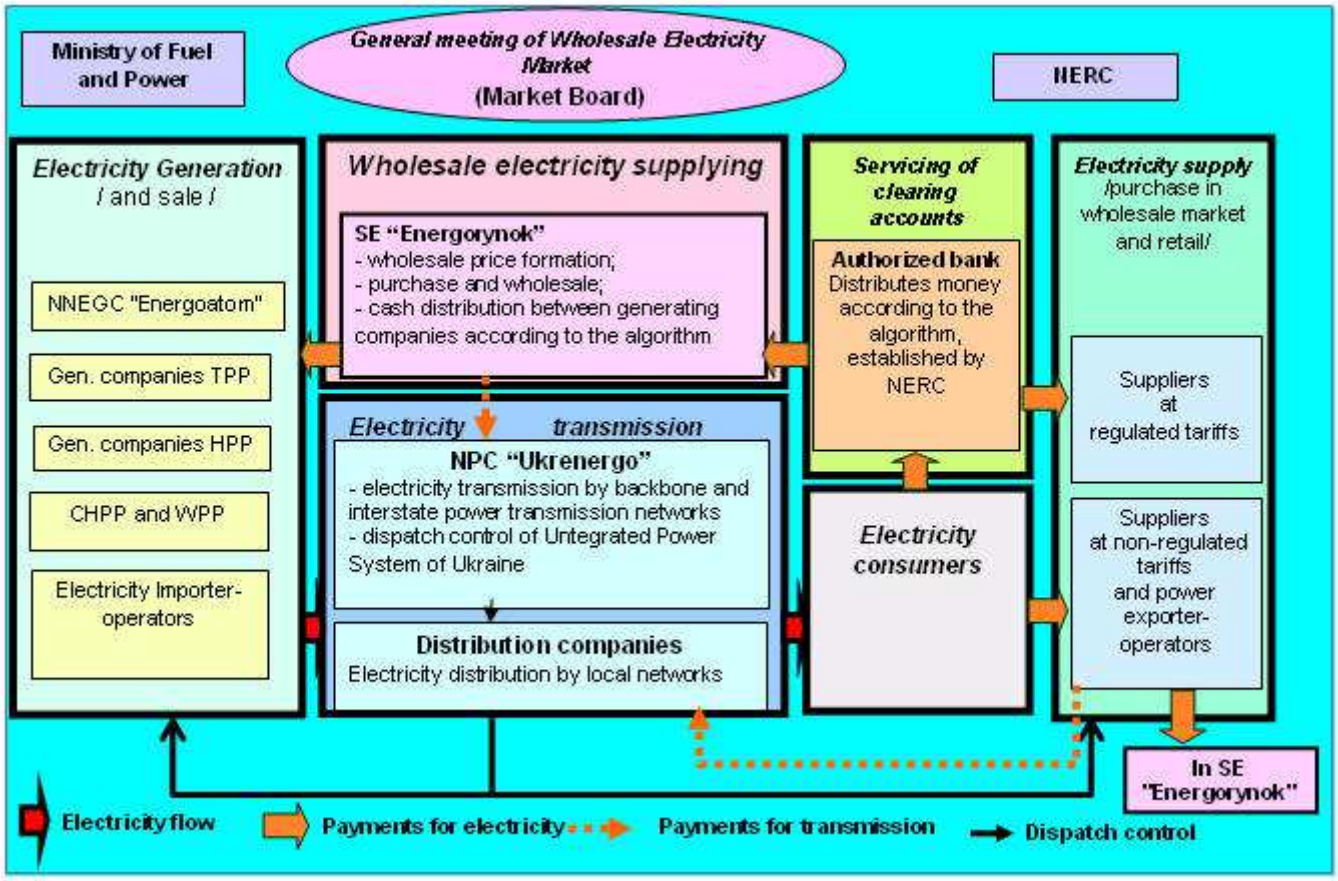
The power in the WEM is distributed by the electricity supply companies, which are licensed to supply electricity according to regulated and non-regulated tariffs. Suppliers under regulated tariffs own distribution electricity networks and, in addition to supply license, obtain licenses for electricity transmission by their own networks.

All business entities have a legal guarantee for equal access to the Wholesale Electricity Market and electricity networks services as well as to free purchase and sale of electricity according to the Wholesale Market Rules, they also help guide formation of prices for electricity of generating companies.

Payments between the Wholesale Market members are effected proportionate to the volume of electricity output and according to an algorithm of fund allocation approved by the National Electricity Regulatory Commission of Ukraine.

Beginning in the second half of 2000, after legislative approval of wholesale market payment procedures, established by the Agreement, and authorization of payments only in monetary form, the level of payments for power bought from WEM rose from 7-10% of total output in 1999 99.2% in 2005.

Fig: 1 Diagram of Wholesale Electricity Market functioning




The Concept of functioning and development of the Wholesale Electricity Market of Ukraine, approved by the Resolution #1789 of the Cabinet of Ministers of Ukraine of November 16 2002, took into account the European Legislation principles concerning power sector. Further WEM development provides for a gradual transition from the current model of a wholesale electricity market to a market which will consist of the following:

direct electricity supply (market of direct contracts), functioning on the basis of bilateral electricity sales contracts between power generating companies and suppliers and consumers;

balancing markets of electricity;

an auxiliary services market.

## 1.3.3 Main indicators

TABLE 5. ELECTRICITY PRODUCTION AND INSTALLED CAPACITY

| | | | | | | Annual Average Growth Rate (%) | |
|---|---|---|---|---|---|---|---|
| **Electricity Generation** | **1980** | **1990** | **2000** | **2005** | **2009** | **1980 to 2000** | **2000 to 2009** |
| Total | .. | .. | 171.45 | 186.06 | 173.62 | .. | 0.14 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Nuclear | .. | .. | 77.34 | 88.76 | 82.92 | .. | 0.78 |
| Hydro | .. | .. | 11.45 | 12.51 | 11.94 | .. | 0.46 |
| Geothermal | .. | .. | < 0.01 | 0.04 | 0.04 | .. | 24.46 |
| Thermal | .. | .. | 82.65 | 84.76 | 78.72 | .. | -0.54 |
| | | | | | | | |
| **Installed Capacity** | **1980** | **1990** | **2000** | **2005** | **2009** | **1980 to 2000** | **2000 to 2009** |
| Total | .. | .. | 52.85 | 52.56 | 54.38 | .. | 0.32 |
| Nuclear | .. | .. | 11.84 | 12.84 | 13.84 | .. | 1.75 |
| Hydro | .. | .. | 4.72 | 4.74 | 5.42 | .. | 1.55 |
| Geothermal | .. | .. | .. | .. | .. | .. | .. |
| Thermal | .. | .. | 36.28 | 34.92 | 35.04 | .. | -0.38 |

Source: IAEA Energy and Economic Databank

TABLE 6. ENERGY RELATED RATIOS

| | | | | | | Annual Average Growth Rate (%) | |
|---|---|---|---|---|---|---|---|
| | **1980** | **1990** | **2000** | **2005** | **2009** | **1980 to 2000** | **2000 to 2009** |
| Energy consumption per capita (GJ/capita) | .. | .. | 119.4 | 133.4 | 107.1 | .. | -1.20 |
| Electricity per capita (KW.h/capita) | .. | .. | 3,486.4 | 3,952.3 | 3,773.5 | .. | 0.88 |
| Nuclear/Total electricity (%) | .. | .. | 45.1 | 47.7 | 47.8 | .. | 0.64 |
| Annual capacity factor - Total (%) | .. | .. | 37.0 | 40.4 | 36.4 | .. | -0.18 |
| Annual capacity factor - Thermal (%) | .. | .. | 26.0 | 27.7 | 25.6 | .. | -0.16 |
| Annual capacity factor - Hydro (%) | .. | .. | 27.7 | 30.1 | 25.1 | .. | -1.07 |
| Annual capacity factor - Nuclear (%) | .. | .. | 74.6 | 78.9 | 68.4 | .. | -0.96 |

# 2. NUCLEAR POWER SITUATION

## 2.1 Historical development and current organizational structure

### 2.1.1 Overview

Nuclear energy in Ukraine started its development in the early 70s with the construction of the first nuclear reactor at Chernobyl. The reactor is an RBMK reactor with a capacity of 1000 MW(e) and commenced operation in 1977. The Ukrainian nuclear energy programme was developed as part of the nuclear energy programme of the former Soviet Union, in order to ensure the military defence of the country. Close co-operation was set up between research centres and relevant industries to include all areas needed for the utilization of nuclear energy, including geology, ore mining and processing industry, metallurgy, chemistry, among others. A significant part of the technical and scientific nuclear complex was based in the Ukraine: 15 power reactors (some of which are under construction, including 10 units of the 3rd generation), - uranium ore mining and processing enterprises, - metallic zirconium and hafnium production centres (used as construction materials in the new reactor types), and - some of the S&R and R&D institutes. The reactors have been built at 5 sites: Chernobyl (ChNPP), Rovno (RNPP), South Ukraine (SUNPP), Zaporozhe (ZNPP) and Khmeltnitski (KhNPP).

After the accident at the 4th reactor unit at Chernobyl, the Supreme Soviet of Ukraine adopted on 2 August 1990 a moratorium on building new nuclear power units in the Ukraine. The construction work at unit 6 at Zaporozhe was interrupted and the construction of 4 new WWER type reactors at Khmelnitski and Rovno was also halted.

In the second part of 1991, the breakdown of the USSR deeply affected the structure of the energy complex, resulting in the separation of its various enterprises and loss of the centralized management system. Because of that situation, the Cabinet of the Minister made the NPP managers personally responsible for the NPP safe operation. Changes were also introduced into the management structure and into document needed by the NPP for receiving permission for the operation. All these documents have been submitted to the regulatory body - GOSATOMNADZOR.

In order to create the State Management System, ensuring the safe operation of the nuclear energy, the Ukrainian State Committee on Nuclear Power Utilization (GOSKOMATOM) was established by a Decree of the Cabinet of Ministers of Ukraine on 16 January 1993.

On 6 May 1997, a Ministry of Power of Ukraine was established in accordance with a Decree by the President, based on the former Ministry of Power and Electrification, as well as the State Committee on Nuclear Power Utilization. This new ministry includes the State Department for Nuclear Power which was entrusted with the functions of the state authority responsible for nuclear power sector administration.

On 14 April 2000, the Ministry of Fuel and Power Industry of Ukraine (Mintopenergo) was established by Decree #598/2000 of the President of Ukraine, based on the Ministry of Coal Industry of Ukraine; the Ministry of Power Industry of Ukraine; State Department of Ukraine on Electric Power Issues; State Department of Ukraine on Oil, Gas and Oil-refining Industry and the State Department of Ukraine on Nuclear Power. The main task of Mintopenergo is the state management of the fuel energy complex.

The state enterprise National Nuclear Energy Generating Company "Energoatom" (NNEGC "Energoatom") has been set up in accordance with Decree of the Government on 17 ctober 1996. This company has been set up with the aim of improving the electricity supply for the population and to the national economy, improving the NPPs operation, increasing the competition ability under various market conditions and modifying the structure of nuclear energy management in accordance to the requirements of the acting legislation. In May 1997, NNEGC "Energoatom" joined the World Association of Nuclear Operators-Moscow Centre as an associate member.

## 2.1.2 Current organizational chart

As a supreme governing body, the Cabinet of Ministers of Ukraine was delegated with powers to implement the laws of Ukraine referring to Fuel and Energy Complex (FEC), approve energy policy and terms of public energy assets management, and develop an FEC management system. Powers of Ministries embrace inter alia direct state regulation of industries according to fundamentals established by the Cabinet of Ministers.

Relevant self-governed bodies may be empowered with certain managerial responsibilities for the power sector related to location of energy facilities and establishing socially significant tariffs.

National Energy Regulation Committee (NERC) and Ministry of Construction, Architecture, and Housing and Communal Services (in the field of heat supply) exercise state regulation of activities of natural monopolies and relative markets in the power sector, gas and oil industries. The primary task of the committee is to regulate relations among participants of energy markets, guided by nondiscrimination principles and efficiency of their operations.

State management of business activities is carried our through:

formulation and ensuring implementation of a single public policy for development and functioning of relevant markets;

formation of price and tariff policies in markets having natural monopoly status, and control over competitive pricing in the industries;

ensuring that customers have equal access to relevant markets;

preventing monopolization and encouraging competition in the markets adjacent to those having natural monopoly status;

balancing interests of energy markets entities and consumers of goods and services of such markets;

protection of rights of consumers of goods and services rendered by natural monopoly entities and adjacent markets to ensure adequate quality of goods and services at economically justified prices;

licensing activity of relevant markets participants and control over observance of license conditions by business entities.

In the established procedure, NERC reviews conditions of licensing business activities and formulates qualification requirements to business executives, sets up systems of licensed activities monitoring, establishes mechanisms of license termination.

Control over technical conditions of facilities, energy consumption modes, compliance with the safety standards is exercised by the relevant governmental inspections and committees responsible for technogenic and environmental safety and emergency situations.

# 2.2 Nuclear power plants: Overview

## 2.2.1 Status and performance of nuclear power plants

In the established procedure, NERC reviews conditions of licensing business activities and formulates qualification requirements to business executives, sets up systems of licensed activities monitoring, establishes mechanisms of license termination.

Control over technical conditions of facilities, energy consumption modes, compliance with the safety standards is exercised by the relevant governmental inspections and committees responsible for technogenic and environmental safety and emergency situations.

TABLE 7. STATUS OF NUCLEAR POWER PLANTS

| Station | Type | Net Capacity | Operator | Status | Reactor Supplier | Construction Date | Grid Date | Commercial Date | Shutdown Date | UCF for 2008 ** |
|---|---|---|---|---|---|---|---|---|---|---|
| KHMELNITSKI-1 | WWER | 950 | NNEGC | Operational | PAA | 01-Nov-81 | 31-Dec-87 | 13-Aug-88 | | 82.3 |
| KHMELNITSKI-2 | WWER | 950 | NNEGC | Operational | PAIP | 01-Feb-85 | 07-Aug-04 | 18-Jan-06 | | 59.7 |
| ROVNO-1 | WWER | 381 | NNEGC | Operational | PAIP | 01-Aug-73 | 31-Dec-80 | 21-Sep-81 | | 76.2 |
| ROVNO-2 | WWER | 376 | NNEGC | Operational | PAIP | 01-Oct-73 | 30-Dec-81 | 30-Jul-82 | | 81.5 |
| ROVNO-3 | WWER | 950 | NNEGC | Operational | PAIP | 01-Feb-80 | 21-Dec-86 | 16-May-87 | | 77.3 |
| ROVNO-4 | WWER | 950 | NNEGC | Operational | PAIP | 01-Aug-86 | 10-Oct-04 | 15-March-06 | | 66.9 |
| SOUTH UKRAINE-1 | WWER | 950 | NNEGC | Operational | PAIP | 01-Mar-77 | 31-Dec-82 | 18-Oct-83 | | 85.1 |
| SOUTH UKRAINE-2 | WWER | 950 | NNEGC | Operational | PAA | 01-Oct-79 | 06-Jan-85 | 06-Apr-85 | | 81.1 |
| SOUTH UKRAINE-3 | WWER | 950 | NNEGC | Operational | PAA | 01-Feb-85 | 20-Sep-89 | 29-Dec-89 | | 59.7 |
| ZAPOROZHE-1 | WWER | 950 | NNEGC | Operational | PAIP | 01-Apr-80 | 10-Dec-84 | 25-Dec-85 | | 81.4 |
| ZAPOROZHE-2 | WWER | 950 | NNEGC | Operational | PAIP | 01-Jan-81 | 22-Jul-85 | 15-Feb-86 | | 84.6 |
| ZAPOROZHE-3 | WWER | 950 | NNEGC | Operational | PAIP | 01-Apr-82 | 10-Dec-86 | 05-Mar-87 | | 85.3 |
| ZAPOROZHE-4 | WWER | 950 | NNEGC | Operational | PAIP | 01-Apr-83 | 18-Dec-87 | 14-Apr-88 | | 82.2 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| ZAPOROZHE-5 | WWER | 950 | NNEGC | Operational | PAIP | 01-Nov-85 | 14-Aug-89 | 27-Oct-89 | | 87.6 |
| ZAPOROZHE-6 | WWER | 950 | NNEGC | Operational | PAIP | 01-Jun-86 | 19-Oct-95 | 16-Sep-96 | | 83.9 |
| KHMELNITSKI-3 | WWER | 950 | NNEGC | Under Construction | | 01-Mar-86 | | | | |
| KHMELNITSKI-4 | WWER | 950 | NNEGC | Under Construction | | 01-Feb-87 | | | | |
| CHERNOBYL-1 | LWGR | 725 | SSE ChNPP | Shut Down | MNE | 01-Mar-70 | 26-Sept-77 | 27-May-78 | 30-Nov-96 | |
| CHERNOBYL-2 | LWGR | 925 | SSE ChNPP | Shut Down | MNE | 01-Feb-73 | 21-Dec-78 | 28-May-79 | 30-Nov-91 | |
| CHERNOBYL-3 | LWGR | 925 | SSE ChNPP | Shut Down | MNE | 01-Mar-76 | 03-Dec-81 | 08-Jun-82 | 15-Dec-00 | |
| CHERNOBYL-4 | LWGR | 925 | SSE ChNPP | Shut Down | MNE | 01-Apr-79 | 22-Dec-83 | 26-Mar-84 | 26-Apr-86 | |

*UCF (Unit Capability Factor) for the latest available year (only applicable to reactors in operation).

** Latest available data

Source: PRIS database (www.iaea.org/pris).

Fig: 2 Map of the country indicating the nuclear power plants

The situation which has become usual in the Nuclear Power Sector on the one hand corresponds to the general tendencies of manufacture stagnation, and on the other has specific features. In the whole, condition of Nuclear Power Sector is possible to characterize as the following:

1. Growth of a share of electricity generation by NPS in general energy structure from 26% up to 46.8% for the period 1990-2008.
2. 35.7% reduction of total electricity production for the same period.

The reduction of total electricity production was not connected either with the reduction of NPP installed capacity or with decrease of operating reliability. Is fact, Capacity Factor (or Load Factor) even has grown in 2008 (73.9%) in comparison with 1990 (62.9%). Even if to take into account basic mode of NPP operations the above stated testifies to high stability of NPS.

*Zaporozhe NPP*

The Zaporozhe NPP now is the most powerful energy supplier in Europe, generating one-fifth of the Ukraine electricity. It makes 40 % of the electrical power produced by the Ukrainian NPPs. Zaporozhe NPP is situated in the south-eastern part of Ukraine on the bank of Kakhovka reservoir in Kamenko-Dneprovsky district, 60 km from Zaporozhe. Zaporozhe NPP is situated not far from Zaporozhe Thermal Power Plant which operates on fossil fuels (coal, gas, fuel oil). The construction of the Zaporozhe NPP was commenced in 1979. The plant's site occupies 104,7 hectares. Zaporozhe NPP consists of six units with WWER-1000 units. Each of the 6 power units consists of the WWER-1000/V-320 reactor, K-1000-60/1500-2 Turbine, TWW-1000-4 Generator. The service water supply is used with cooling pond and cooling towers. Compensation of losses within the service water system is conducted through the discharge channel of Zaporozhe TPP.

ZNPP is the first among Ukrainian nuclear power plants with WWER type reactors that constructed on-site spent fuel dry storage facility (SFDSF).

*South-Ukraine NPP*

The South-Ukraine NPP is located in the south of Ukraine on the river Yuzhny Bug in Nikolayev region. The NPP design foresees creation of the new type of the Utility that would resolve the problems of the complex and rational use of the power, generated by the nuclear power plant, the Hydroelectric Power Plant and also by the Hydroelectric Pumped Storage Plant. The construction of the South-Ukraine NPP began in 1976. At present the plant has 3 nuclear power units in operation (Electrical capacity of each unit is 1000 MW). Unit 1 consists of the WWER-1000/V-302 reactor, K-1000-60/1500-2 Turbine, TWW-1000-4 Generator, unit 2 consists of the WWER-1000/V-338 reactor, K-1000-60/1500-2 Turbine, TWW-1000-4 Generator, unit 3 consists of the WWER-1000/V-320 reactor, K-1000-60-3000 Turbine, TWW-1000-2 Generator. The service water supply (reverse flow) with cooling tower and cooling pond are used. Compensation of losses within the service water system is performed from Yuzhny Bug river.

*Khmelnitski NPP*

The KhNPP is located in Slavuta area of Khmelnitsk region, near the Pripyat's tributary. The construction of KhNPP has been started in 1981. The total design capacity of NPP is 4000 MW. Unit 1 has been put into operation in 1987, unit 2 – in 2004. Units 1, 2 include the WWER-1000/V320 reactor, K-1000-60-3000 Turbine, TWW-1000-2 Generator. The

service water supply (reverse flow) with cooling pond is used. Compensation of losses within the service water supply system is performed from Horyn river.

*Rovno NPP*

The Rovno NPP is located in Rovno region on the bank of the river Styr. The construction of NPPs began in 1973. In 1980 and 1981 the power units with WWER-440 type reactor (second generation's units) were put into operation. At present Rovno NPP comprise 4 nuclear power units in operation, the total electric capacity of which is 2,835 MW. Units 1 and 2 include WWER-440 reactors, two turbines K-220-44, 2 generators TWW-220-2; units 3 and 4 consist of WWER – 1000/V-320 reactor, K-1000-60-3000 turbine, TWW-1000-2 generator. The service water supply (reverse flow) with cooling towers is used. Compensation of losses within the service water supply system is performed from Styr river.

*Chernobyl NPP*

The Chernobyl NPP is located in Polesye region, on the bank of the river Pripyat. The construction of ChNPP began in 1970. From 1977 till 1984 four power units were put into operation. The Units 1 and 2 are the first generation's units and Unit 3 and 4 are the second generation's ones. All power units at ChNPP have only 1 heat transport circuit. Each power unit comprises the light water cooled graphite moderated reactor (Pressurized Tube Reactor), 8 main circulation pumps, 4 steam drums and two turbines K-500/65-300 with generator TWW-500. The turbines are installed in the turbine building which is common for all units. Each reactor is housed in a separate building.

After the accident at Unit 4 all power units of ChNPP were shut down. The start-up of the Units 1, 2 and 3 was conducted after the development and implementation of the large complex of top-priority and long-term measures, focused on the upgrading of the safety of NPPs with RBMK type reactors.

Unit 1 was shut down at 30 November 1996, unit 2 – at 11 October 1991.

The State Specialized Enterprise “Chernobyl NPP” (SSE ChNPP) is the enterprise on power plants units decommissioning and Shelter Object transformation into environmentally safe system. The Resolution of the Cabinet of Ministers of Ukraine dated 17.11.2001 the enterprise is appointed as operation organization (operator) of Nuclear Installations of Chernobyl NPP.

Ukraine, showing good will and confirming the intention, stated in the Memorandum of Understanding between the Government of Ukraine and G7 countries Governments and Commission of the European Union, dated December 25, 1995, made the decision on ahead of schedule Chernobyl NPP decommissioning.

On December 11, 1998 the Law of Ukraine «On the general principles of Chernobyl NPP further operation and decommissioning and transformation of the destroyed fourth Unit of this NPP into ecologically safe system» was adopted.

On March 29 2000 the Decree  598 of the Cabinet of Ministers of Ukraine "On Unit 3 ahead of schedule shutdown and Chernobyl NPP final closure" was adopted.

On December 15, 2000 at 1.17 p.m. by the order of the President of Ukraine Chernobyl NPP Unit’s 3 reactor was forever shutdown by turn of a emergency protection key (EP-5). The Plant ceased electric power generation.

On March 22, 2002 the State Nuclear Regulatory Committee of Ukraine has issued given the License to the State Specialized Enterprise "Chernobyl NPP" for ChNPP decommissioning. Earlier, the License for Shelter object operation and transformation into ecologically safe system has been obtained on December 30, 2001.

"State Program of Chernobyl NPP Decommissioning and Shelter Transformation into Ecologically Safe System" (further as SDP) will come into force on January 1, 2010, accepted by the Law of Ukraine #866-VI dated January 15, 2009.

SDP contains primary measures to be implemented during 2009-2012 at the stage of Chernobyl NPP shutdown and Shelter transformation into ecologically safe system. The main source of SDP financing is State Budget of Ukraine.

Started in December 15, 2000, Chernobyl NPP shutdown stage will be completed in 2013 after removal of nuclear fuel from Units 1, 2 and 3.

The main activities currently carried out at Units are final shutdown of systems, equipment and partial dismantling of decommissioned equipment.

Radioactive waste management at "Chernobyl NPP" is implemented according to the conditions established in the licenses of the State Nuclear Regulatory Committee of Ukraine:

License No. 000040 of 22 March 2002 to decommission Chernobyl NPP ;

License No. 000033 of 30 December 2001 to operate the Chernobyl Shelter;

License OV No. 000334 of 23 August 2006 to transport radioactive materials.

### 2.2.2 Plant upgrading, plant life management and license renewals

Rovno NPP-1,2 and South Ukraine NPP-1 were identified as pilot power units for lifetime extension beyond the designed period. Their designed lifetime expires in 2010, 2011 and 2012, respectively.

Activities on extension the NPP units operation beyond the design lifetime are carried out in compliance with the "Comprehensive Program for Lifetime Extension of Operating Nuclear Power Units" approved by the Resolution of the Cabinet of Ministers of Ukraine No. 263-r of 29 April 2004, "Action Plan of NNEGC Energoatom to implement the "Comprehensive Program for Lifetime Extension of Operating Nuclear Power Units" PN-D.0.08.341-04, and the appropriate schedule.

At the end of 2008, Rovno NPP-1, 2 were taken out of operation for long outage to implement the activities envisaged by the schedules. Activities on extension of South Ukraine NPP-1 operation beyond the design lifetime are being developed and programs and guidelines are being agreed upon now.

Extension of Zaporozhe NPP-1 (pilot unit in viewpoint of lifetime extension of power units with standard WWER-1000) operation beyond the design lifetime is at the initial stage.

## 2.3 Future development of Nuclear Power

### 2.3.1 Nuclear power development strategy

The Strategy assumes that the NPP share in the total national power generation reached in 2005 will be maintained on the same level during the period of 2006 to 2030 (that is about a half of the total annual electric power generation in Ukraine).

Decision on the above assumption was made primarily on the following grounds: availability of domestic uranium deposits; stable operations of the existing NPPs; and good potential opportunities for expansion of the power generation capacities at the NPPs, with due consideration for the present operational, financial and environmental problems faced by the thermal power engineering.

The forecasted NPPs generation of 219.0 TWh by the year of 2030 will require 29.5 GW of installed capacity operating with CF of 85%.

Construction of new generation facilities at the NPPs in the period up to 2030 will depend on the number of existing nuclear units that may be kept in operation during this period, with consideration for the upgrade options intended to extend service lives of the units by 15 years. By the year of 2030, nine of the existing nuclear power units will still stay in operation, including 7 nuclear units with extended (over designed) service life (namely: ZNPP -3, 4, 5, 6; RNPP -3; KhNPP -1 and SUNPP -3) and 2 power units that were newly commissioned in 2004 (namely: KhNPP -2 and RNPP -4). Therefore, the objectives of the Strategy geared to address the current power generation challenges will be attained only if 20 to 21 GW of replacing and new power generation facilities are commissioned at the existing NPPs for the period up to 2030.

The best internationally accepted experience of the nuclear powers operators and the local experience in water-cooled reactor operations in Ukraine suggest that when it comes to the projects to build up new units, the country should opt for pressurized water reactors of PWR/WWER type as apparently the best possible option. The expected capacity of the newly constructed nuclear power generation units should be within the range of 1000 to 1500 MW.

When selecting a type of the newly constructed power generation units for selected construction site, the decision-makers should ensure that the selected units are of the same type. The same-type principle will be of special importance in the transitional period of 3 to 5 years.

It is expected that KhNPP -3, 4 will be put into operation by the end of 2016. Generation facilities construction and commissioning schedules will be based on the power unit construction cycle - approximately 12-year period that will cover all stages of the process, beginning from the feasibility study (including project design, construction and putting into operation) to the relevant licensing and permitting procedures to be complied at each of the above mentioned stages. It may be pertinent to mention that this process cycle will be shorter by 2 to 3 years for the power units slated for commissioning by the year of 2021.

To provide for practical implementation of the Strategy, it is important to improve the nuclear fuel efficiency by having completed the ongoing transition to the 4-year fuel cycle with further transition to the 5-year fuel cycle, to cut-down the time for scheduled and preventive maintenance works through better management, efficient scheduling of the works and improvement of their quality standards. It will be most important to upgrade and rehabilitate main process equipment and systems of the existing NPPs and complete every task under the service life extension initiatives, with a special attention being given to those system elements that cannot be replaced at all or the replacement is too expensive. Furthermore it is necessary to meet the decommissioning schedules for the power units that come close to the end of their design service lives, and take timely steps to design and construct new generation facilities as a replacement or addition to the nuclear units scheduled for decommissioning.

Within the period of 2011 - 2030, the following works need to be completed:

to commission, by the end of 2016, new power generation units with total capacity of 2 GW at KhNPP (Power Units -3, 4);

to commission, within the period of 2019 - 2021, nuclear power generation facilities with total capacity of 6 GW on the new construction sites;

to implement upgrade projects to extend the design service lives of SUNPP -1, 2, 3; ZNPP -1, 2, 3, 4, 5, 6; RNPP – 2,3 and KhNPP-1;

to commission, within the period of 2024 - 2030, replacing and additional nuclear units with total capacity 12.5 GW;

to start decommissioning of 6 nuclear power generation units when their extended service lives is over.

In addition, special efforts need to be taken within the period of 2027 - 2030 to launch construction of new 6.5 GW nuclear power generation facilities, to have them put into operation after 2030.

TABLE 8. PLANNED NUCLEAR POWER PLANTS

| Station/Project Name | Type | Net Capacity | Expected Connection to the Grid | Expected Commercial Date |
|---|---|---|---|---|
| KhNPP - 3 | WWER | 950 | 2016 | 2017 |
| KhNPP - 4 | WWER | 950 | 2016 | 2017 |

## 2.3.3 Project funding

The Energy Strategy requires an upward adjustment of the existing tariff for electricity produced by NPPs to support implementation of the nuclear power sector development program and address the critical problems faced by the sector today. This tariff must include a provision for nuclear power units decommissioning and radioactive waste disposal projects. Furthermore, it requires developing a long-term investment program to support the national nuclear power sector development. Targeted and timely efforts to create favorable conditions for investments in the nuclear power sector development projects will have critical importance in this context.

Investment Required for the Development of Nuclear Power Sector of Ukraine, by periods

| Items | 2006-2010 | 2011-2020 | 2021-2030 | Total |
|---|---|---|---|---|
| Installed capacity, GW | 13,84 | 21,84 | 29,5 | |
| Capacity Factor (CF) % | 82,8 | 85 | 85 | |
| Electric power generation, Wh (by periods) | 488,3 | 1 185,7 | 1 837,0 | 3 511,0 |
| Spendings breakdown* for new construction**, UAH mln | 4 525 | 61 955 | 103 024 | 169 504 |

* Prices as of 2005, disregarding inflation;

** Including UAH 700 mln required to complete the THPSP construction project, and UAH 2880 mln for the spent nuclear fuel disposal facilities;

* Prices as of 2005, disregarding inflation;** Including UAH 700 mln required to complete the THPSP construction project, and UAH 2880 mln for the spent nuclear fuel disposal facilities;

Investment Required for the Development of Nuclear Industry for the Period of 2006-2030

| Periods | Average investment requirement per annum, UAH mln | Total, UAH mln |
|---|---|---|
| 2006 – 2010 | 807 | 4 037 |
| 2011 – 2015 | 1862 | 9 314 |
| 2016 – 2020 | 792 | 3 964 |
| 2021 – 2025 | 660 | 3 303 |
| 2026 – 2030 | 213 | 1 065 |
| **Total for the period of 2006 to 2030** | | **21 700** |

## 2.3.4 Electric power sector development

Transmission networks is one of the main components of IPS of Ukraine, which includes 22 700 km, of them 4,900 km are of 400 – 750 kV, 13,200 km - 330 kV, 4,600 km - 220-110 kV and 132 power substations (PS) of 220 – 750 kV.

Insufficient allocation of funds for upgrading and rehabilitation of operating power networks and substations, and for construction of new ones results in lowering reliability of the Integrated Power System operation.

Serious problems arise due to insufficient line capacity for realization of NPP potential (RNPP, KhNPP, ZNPP).

Essential increase in power export to European countries may come true within the specified period only subject to fulfillment of commercial projects for construction of direct-current converter stations (DCCS). The existing 750 kV OTL West Ukraine – Albertirsha (Hungary), Khmelnitska HPP – Zheshuv (Poland) and South Ukraine – Isakcha (Romania) will be included in this process. The capacity of specified 750 kV OTL is sufficient to implement up to three 600 MW DCCS modules at each line.

In future, in order to ensure stable operation of IPS of Ukraine, to use efficiently Ukrainian power plants capacity, to observe standard conditions of power transmission from KhNPP, RNPP and ZNPP and regulating facilities of HPSPs, in particular, Dniestrovska HPSP, it is necessary to complete construction of two 750 kV transit backbone transmission lines: **Southern** ( KhNPP – Dniestrovska HPSP – Prymorska – Kakhovska – ZNPP, with total length up to 1,050 km. and 4,000 MW of transformer capacity of Prymorska and Kakhovska switch-yards) and **Northern** (RNPP – Kyiv – North Ukrainian – Kharkiv – Donbass, with total length 1,200 km. and 4,000 MW of transformer capacity of Kyivska and Kharkivska switch-yards).

Commissioning of these backbone transmission lines will provide necessary basis for parallel operation of Ukrainian IPS with the UCTE power system and for considerable increase in power export, which is in line with the long-term foreign policy task related to the integration of Ukraine into the European Union.

Depending on selection of sites for NPPs location and taking into consideration the program for development of resistance heating in localities, the total length of 330 kV OTL and OTN may extend within the period of 2010 – 2030 by 1,200-1,500 km with

adding 1,500-2,000 MW of transformer capacities, the total cost of which will amount to UAH 4,5-5 billion.

# 2.5 Organizations involved in operation of NPPs

Operator of 4 NPPs is the state enterprise NNEGC due to the Cabinet of Ministers' Decree "On assignment of operation organization (operator) of Nuclear Installations": 830 (June 8, 1998).

Operator of ChNPP is the State Specialized Enterprise "Chernobyl NPP" due to the Cabinet of Ministers' Decree "On assignment of operation organization (operator) of Nuclear Installations of Chernobyl NPP ": 1532 (November 17, 2001).

There are some separated subdivisions in the structure of NNEGC:

ZNPP;

SUNPP;

RNPP;

KhNPP;

AtomRemontServis;

Atomcoplect;

Scientific and Technical Center;

Atomenergomash;

Atomproekt engineering;

SS "AtomRemontServis" (ARS) was established in 2000 with aim to improve quality management and efficiency of maintenance and repair at nuclear power plants and with the purpose to employ the personnel of Chernobyl NPP that was made redundant as a result of its final shutdown. The main activity of ARS is safe and efficient implementation of maintenance works that provide for installation, repair rehabilitation and modernization of equipment at nuclear power plants and other enterprises of the of Fuel and Power of Ukraine. Comprehensive engineering and technological support of maintenance campaigns help reduce maintenance work duration while implementation of the modern diagnostic systems and technologies promotes quality improvement of the maintenance work. ARS has a training facility for personnel qualification upgrading and retraining.

SS "Atomcoplect" was found in 2002 with the aim to make universal policy of providing NNEGC "Energoatom" with material and technical resources. For today, one of the main tasks of SS "Atomcomplect" is selection of suppliers by tender and providing of centralized supplies of material and technical resources for NPP. There are also refilling of centralized and emergency stocks of NPP of Ukraine, control of the storage conditions of ware and material values on the storehouses of the Company and participation in development of the normative on the stocks of ware and material values, organization of

effective usage of material and technical resources among the main functions of the SS "Atomcomplect".

SS "Scientific and Technical Center" was created in 2003. The purpose of creation Separated subdivision "Scientific and Technical Center" is formation in Ukraine complex and effective system of scientific and technical support of nuclear power which provides optimum use of intellectual and technical potential of scientific and engineering organizations that services render in the field of use of a nuclear energy and radiating safety. Primary goals of Separated subdivision "Scientific and Technical Center":

Definition of real NPP need in services on scientific and technical support, formation of effective system of planning and management of projects at performance of research and developmental works.

Coordination of activity of institutes and the organizations performing works on scientific and technical support of atomic engineering.

Development and support of introduction of effective engineering decisions in the field of operation, repair, modernizations and increases of NPP safety.

Scientific and technical support of development of legislative acts and normative documents, adaptation of documents of Russia and the international standards in the field of use of a nuclear energy.

Participation in development of programs and plans for development of a fuel and energy complex.

SS "Atomenergomash" was established in 2003 on the basis of three enterprises: non-standard equipment and pipeline plant, special constructions plant, and machinery and repair plant. "Atomenergomash" is a strong multi-field institution that manufactures certificated products of power engineering industry for all Ukrainian nuclear power plants and performs aggregate-restoring repair of heat-exchange equipment. With new technologies, unique specialized equipment Separated subdivision "Atomenergomash" provides nuclear power plants of Ukraine with resource increase of equipment in operation and increase of plant ration for power units. Today Separated subdivision "Atomenergomash" is the only enterprise in Ukraine with effective capacities on production of pipeline elements and non-standard equipment for energetic objects.

SS "Emergency and technical center" was created in 2003. The main goals of SS ETC are:

preparedness of Ukraine for quick and effective actions in case of accidents at nuclear power and industrial enterprises in accordance with the international obligations of Ukraine and IAEA requirements (requirements of the International Atomic Energy Agency) on creation of the national system of nuclear accident management;

decommissioning and preservation of nuclear installations and facilities intended for nuclear technologies utilization and radioactive wastes;

post-accident activity planning in case of transport accidents during radiation dangerous material transportation.

SS "Atomproektengineering" was found in 2008. The main goals of Atomproektengineering are:

provision with engineering support;

new nuclear installations designing;

development and supplying of special and general equipment for new installations;

arrangement of execution of the construction-and-assembling operations and precommissioning;

decommissioning management

# 2.6 Organizations involved in decommissioning of NPPs

The State Specialized Enterprise "Chernobyl NPP" (SSE ChNPP) is the enterprise on power plants units decommissioning and Shelter Object transformation into environmentally safe system. SSE ChNPP is created on the base of Chernobyl NPP according to the Decree of President of Ukraine 1084/2000 dated 25 September 2000 and Decree of the Cabinet of Ministers of Ukraine 399 dated 25 April 2001.

The Decree of the Cabinet of Ministers of Ukraine dated 17.11.2001 the enterprise is appointed as operation organization (operator) of Nuclear Installations of Chernobyl NPP.

# 2.7 Fuel cycle including waste management

At present, the domestic uranium production meets only 30% of the demand of nuclear power industry of Ukraine. Therefore, the uranium production industry of Ukraine considers the increase in uranium concentrate production to the level that will satisfy at least the national demand for this product as one of its top-priority objectives.

It was estimated that the proved reserves of natural uranium in Ukraine are enough to meet the demand of national nuclear power industry for more than hundred years.

Ukraine has good potential to become one of the world largest producers of natural uranium, provided that the country succeeds in maintaining stable operation of the existing production facilities followed by a gradual build-up of the uranium production capacities.

It is the Russian contractors that now dominate on the market of nuclear fuel supplies for the Ukrainian NPPs. To diversify fuel supply opportunities, in August 2005 Ukraine launched a pilot project in SUNPP 3 to test operation of 6 assembling manufactured by a US-based Westinghouse Company. In case that the outcomes of the pilot project are found successful, Ukraine will have an opportunity to acquire fuel for its NPP on competitive basis from at least two potential suppliers that offer fuel licensed for use at Ukrainian NPPs.

In view of proportion of nuclear power industry in the overall electric power generation in Ukraine, significant domestic resources of raw materials for the industry and the available national industrial, research and engineering potential it was decided to scale down the national dependence on the fuel imports through development of domestic nuclear fuel production capacity that will supply fuel for the Ukraine's nuclear power plants.

In according of the Cabinet of Ministers' Decree 650-r (April 17, 2008) it was founded the State concern "Nuclear Fuel" with main aim to create nuclear fuel production.

For SF of the Ukraine's NPPs, it envisaged to implement the so-called "deferred" option that implies long-term (up to 50 years or even longer) storage of SF until a final decision on its processing and/or disposal is made and approved.

In addition, it is important to provide the following: safe operation of the storage site for "dry" spent nuclear fuel (DSNF) in ZNPP; establishment of a central DSNF storage facility designed for the SPF produced by WWER-440- and WWER-1000-type reactors of the existing NPP and for the SF of new nuclear power units, with an objective to have the central DSNF storage facility commissioned in the period of 2009 - 2010; development of a strategy and techniques for safe SNF management after their long-term storage is over.

The current RW management activity is limited to the existing NPP sites. Analyses of existing opportunities for RW disposal in temporary storage facilities at sites of each operating NPP and studies of the existing and developed RW management systems suggest that the year of 2020 should be a deadline for disposal of the operational RW.

The top-priority initiatives in the NPP operational RW management will be: modernization of existing and construction of new process lines designed for interim and full processing of solid and liquid RW at the NPP sites; efforts to be taken at the existing NPPs to remove the accumulated RW from temporary storage facilities and to have them processed; improvement of existing RW transportation systems; improvement and development of the existing pools of special vessels for RW collection, transportation and storage.

The fundamental engineering decisions must be developed as regards to the high-level RW management and long-term storage systems, and the top-priority steps need to be taken to provide for reception and management of RW produced by the SNF-processing systems, as these RW come back from the Russian Federation after processing.

# 2.8 Research and development

## 2.8.1 R&D organizations

One of the conditions of nuclear power complex development is a creation of system on scientific and technical support:

1. normative and legal support - State Nuclear Regulatory Committee of Ukraine;
2. NPP design - science-research and design institute (Kiev, Kharkov);
3. Engineering support of reactor installations – SE NNEGC "Energoatom;
4. Scientific support of reactor installation projects and nuclear fuel cycles – State scientific and engineering Centre of systems of monitoring and emergency response;
5. material science - E.O. Paton Electric Welding Institute;
6. welding technology - E.O. Paton Electric Welding Institute;
7. Radiation Safety - Institute of NPP Safety problems.

## 2.8.2 International co-operation and initiatives

International co-operation in Nuclear branch is based on bilateral and multilateral agreements, international programs and projects, memorandums and commercial contracts.

International co-operation intended for:

the improvement of nuclear safety and safety culture;

NPP units upgrading;

diversification of nuclear fuel supplying;

planning of stability of nuclear power development;

participation in development of new units construction co-operation.

NNEGC is a WANO (May 1997) and WNA member (August 2006). The USA, Russian Federation, France, Germany, Spain, Canada and other countries are the partners of Ukraine in the field of nuclear power.

USA. There was an International Nuclear Safety program (1992-2008), directed on Operational Safety upgrading, decreasing of operation risk degree and consolidation of civil nuclear objects regulation systems. There is a co-operation with Westinghouse Electric and Holtec Int.

Ukraine has a technical assistance within TACIS program for improving safety of the Ukrainian NPP's and national training centre creating.

Russia. There is a Program of co-operation between utilities SE NNEGC "Energoatom" and "Rosenergoatom", which contains the following directions:

nuclear Safety upgrading;

maintenance co-operation;

metrology;

radiation Safety;

information exchange on new units commissioning;

personnel training.

France. There is a co-operation with industrial group AREVA.

INPRO. In 2005 Ukraine jointed to INPRO. The national expert was directed to IAEA in 2008. In 2008 the report "Assessment of nuclear power system of Ukraine with methodology INPRO using" was prepared.

GNEP. Ukraine is a member of GNEP (September 2007).

# 2.9 Human resources development

There are Plant Training Centre in ZNPP, SUNPP, RNPP, KhNPP and ARS, which has the license on staff training.

# 2.10 Stakeholder Communication

There are the web-site addresses:

Ministry of Fuel and Power of Ukraine (Mintopenergo) - http://mpe.energy.gov.ua

NNEGC Energoatom - http://www.energoatom.kiev.ua

Magazine "Energoatom" - http://www.energoatom.kiev.ua/ua/lemag

# 3. NATIONAL LAWS AND REGULATIONS

## 3.1 Regulatory authority(s) and the licensing process

The State Nuclear Regulatory Committee of Ukraine is the main competent central executive body that regulates nuclear and radiation safety in Ukraine. It was established by the President Decree in December 2000. The State Nuclear Regulatory Committee of Ukraine, as a regulatory body is independent from institutions and organizations that conduct their activity in the area of nuclear energy use. According to international requirements the State Nuclear Regulatory Committee of Ukraine as a regulatory body is responsible for issuing official permits, conducting regulatory activities, reviewing and making assessments, undertaking inspections and enforcement measures, as well as establishing safety principles, criteria, provisions and guides.

The main functions of the State Nuclear Regulatory Committee of Ukraine in the area of regulation of the safe use of nuclear energy are:

1. Establishing safety criteria, requirements and conditions in the area of nuclear energy use (normative regulation);
2. Issuing permits and licenses to conduct activities in this area (licensing);
3. Conducting supervisory activity on observance of codes and standards on nuclear and radiation safety (supervision);
4. Imposing sanctions stipulated by law in case of violations(enforcement).
5. The State Nuclear Regulatory Committee of Ukraine regulates the safety of:
6. 15 power units in operation at the territory of Ukraine:

*– 6 ZNPP Units*

*– 4 R NPP Units;*

*– 3 SU NPP Units,*

*– 2 Kh NPP Units;*

1. 3 Chernobyl NPP Units at the stage of Decommissioning;
2. 2 Spent Fuel Storage Facilities in operation at ZNPP and ChNPP, and the Storage Facility, which is under construction at ChNPP site;
3. 2 research reactors;
4. radioactive waste storage facilities and radioactive waste management plants: *6 Specialized Enterprises"Radon", State Specialized Enterprise "Complex",State Specialized Enterprise "Technocenter"*;
5. uranium milling plants;
6. radioactive material transportation through the territory of Ukraine;
7. using and production of ionizing radiation sources.

Organization Chart of the State Nuclear Regulatory Committee of Ukraine

**Chairperson of the State Nuclear Regulatory Committee of Ukraine**

**First Deputy Chairperson:**

Physical Protection Regulation Dept

Performance Control Division

Safeguard Division

Administrative Service sector

1. **Deputy Chairperson**

Nuclear Installations Safety Assessment Directorate

Information Emergency Dept

Organizational-Analytical support Division

Economics, Finance and Accounting Dept

Personal and Occupation Safety Division

Legal Division

International Cooperation and European Integration Division

Internal Audit Sector

Diplomatic Adviser

**Deputy Chairperson:**

Safety Radwaste Management and Decommissioning Dept

Radiation Technologies Safety Dept

West State Inspection on Nuclear and Radiation safety

Crimea State Inspection on Nuclear and Radiation safety

South State Inspection on Nuclear and Radiation safety

South-East State Inspection on Nuclear and Radiation safety

North State Inspection on Nuclear and Radiation safety

North-West State Inspection on Nuclear and Radiation safety

East State Inspection on Nuclear and Radiation safety

Central State Inspection on Nuclear and Radiation safety

**Deputy Chairperson**. Chief State Nuclear Safety Inspector of Ukraine:Central Inspection Dept

State Inspection on Nuclear and Radiation safety at Zaporozhe NPP

State Inspection on Nuclear and Radiation safety at Rovno NPP

State Inspection on Nuclear and Radiation safety at Khmeltnitski NPP

State Inspection on Nuclear and Radiation safety at Chernobyl NPP

1. State Inspection on Nuclear and Radiation safety at South-Ukraine NPP

# 3.2 Main national laws and regulations in nuclear power

**The Constitution of Ukraine: 254k/96-VR (June 28, 1996).**

Article 16. There is responsibility of state: the guarantee of ecological safety and ecological balance supporting on Ukraine territory; overcoming of Chernobyl catastrophes' consequences and genofond saving.

Article 50. Everybody has a right on safe environment and indemnification.

1. It is guaranteed the right of free access for information on environment condition, food and goods quality.

   The Law on Environment Protection: 1264-XII (June 25, 1991).

   The Law on Atmospheric air Protection: 2707-XII (October 16, 1992).

The Cabinet of Ministers' Decree on the Creation of the State Committee on Nuclear Power Utilization – GOSKOMATOM: 22 (January 16, 1993).

The Cabinet of Ministers' Decree on the Creation of State Emergency and technical center on the basis of the "SPEZATOM" liquidated by the same decree:  447 (June 16, 1993).

The Cabinet of Ministers' Decree on the Creation of the Permanent Government Commission on the Ecological Safety and Emergency: 617 (August 10, 1993).

The President's Decree on the Measures for the physical protection of the nuclear materials and Facilities:  608/93 (December 28, 1993).

1. Concept of the State regulation of safety and nuclear sector administration in Ukraine: 3871-XII (January 25, 1994).
2. The Law on Ensuring of sanitary and epidemic welfare of population: 4004-XII (February 24, 1994).
3. The President's Decree on the Creation of the Ministry of the Environment Protection and Radiation Safety of Ukraine (On the basis of the Ministry of the Environmental Protection and the Ukrainian State Committee for Nuclear and

Radiation Safety, which were liquidated by the same Decree: 768/94 (December 15, 1994).

The Law on the Nuclear Power Utilization and the Radiation Safety: 39/95-VR (February 8, 1995).

4. The Law on Ecological expertise: 45/95-VR (February 9, 1995).
5. The Law on Radwaste management: 255/95-VR (June 30, 1995).
6. The Law on Ukraine Joining to Vienna convention on civil liability for nuclear damage: 334/96-VR (June 12, 1996).
7. The Cabinet of Ministers' Decree on Establishment of the National Nuclear Energy Generating Company "Energoatom: 1268 (October 17, 1996).
8. The President's Decree on the Ministry of Ukraine for Emergency situations and protection of population against the Chernobyl accident's consequences (On the basis of the Ministry of Ukraine for Protection of Population against the Chernobyl NPP accident's consequences and Civil Defense Headquarters of Ukraine): 1005/96 (October 28, 1996).
9. The Cabinet of Ministers' Decree On confirmation of Principle on state system of nuclear materials accounting and monitoring: 1525 (December 18, 1996).
10. The Law on Ratification of grants Agreement (Nuclear Safety Project for Chernobyl NPP) between EBRD, Ukraine government and Chernobyl NPP: 147/97-VR (March 18, 1997).
11. The President's Decree on Establishment of the Ministry of Power Industry of Ukraine (On the basis of the Ministry of Power and Electrification and the State Committee on Nuclear Power Utilization): 388/97 (May 06, 1997).
12. The Cabinet of Ministers' Decree on Improvement of the systems of payments for the electric and thermal power supplied: 388/97 (May 21, 1997).
13. Law on "Power industry": 575/97-VR (October 16, 1997).
14. The Law on Uranium ore mining and processing: 645/97-VR (November 19, 1997).
15. The Law on Ratification of Convention on nuclear safety: 736/97-VR (December 17, 1997).
16. The Law on Person protection from ionizing radiation: 15/98-VR (January 14, 1998).
17. The Law on Ratification of Framework agreement between Ukraine and EBRD on Chernobyl fund "Shelter" activity in Ukraine: 80/98-VR (February 04, 1998).
18. The Cabinet of Ministers' Decree on Assignment of operation organization (operator) of Nuclear Installations: 830 (June 8, 1998).
19. The Cabinet of Ministers' Decree on Confirmation of public hearing conducting Order on Nuclear energy utilization and radiation safety: 1122 (July 18, 1998).
20. The Law on the general principles of Chernobyl NPP further operation and decommissioning and transformation of the destroyed fourth Unit of this NPP into ecologically safe system: 309-XIY (December 11, 1998).
21. The Cabinet of Ministers' Decree on "Order of license issue by the National Electricity Regulatory Commission of Ukraine": 753 (April 29, 1999).
22. The Law on Permission activity in the Nuclear Power Utilization sphere: 1370-XIY (January 11, 2000).
23. The Cabinet of Ministers' Decree on Unit 3 ahead of schedule shutdown and Chernobyl NPP final closure: 598 (March 29, 2000).
24. The President's Decree n Interdepartmental (Governmental) Commission on complex solution of Chernobyl NPP problems: 557/2000 (April 3, 2000).
25. The President's Decree on Ministry of Fuel and Power Industry: 598/2000 (April 14, 2000)
26. Law on "Economical activity licensing": 1775-III (June 1, 2000).
27. The Cabinet of Ministers' Decree on List on activities connected with provision of Physical Protection of Nuclear Installations and Materials, which are under obligatory licensing": 1115 (July 12, 2000).

28. The President's Decree n Measures, connected with Chernobyl NPP closure statement: 1084/2000 (September 25, 2000).
29. The Law on Physical security of nuclear installations, nuclear materials, radwastes and other source of ionizing radiation: 2064 –III (October 19, 2000).
30. The Cabinet of Ministers' Decree on Some issues on State regulation for ionizing source using activity: 1718 (November 16, 2000).
31. The President's Decree n State Nuclear and Radiation safety regulation: 1303/2000 (December 5, 2000).
32. The Cabinet of Ministers' Decree on the Licensing Order of some activity kind in the sphere of Nuclear Power Utilization: 1782 (December 6, 2000).
33. The President's Decree n Statute on the State Nuclear Regulatory Committee of Ukraine: 155/2001 (March 6, 2001).
34. The Cabinet of Ministers' Decree on Creation of the State Specialized Enterprise "Chernobyl NPP": 399 (April 25, 2001).
    1. The Cabinet of Ministers' Decree on Assignment of operation organization (operator) of Nuclear Installations of Chernobyl NPP: 1532 (November 17, 2001).
35. The Law on Civil liability for nuclear damage and their finance compensation: 2893-III (December 13, 2001).

    The Cabinet of Ministers' Decree on the Civil liability compulsory insurance for nuclear damage: 953 (June 23, 2003).

36. The Cabinet of Ministers' Direction on "Approval of the Comprehensive Program for Lifetime Extension of Operating Nuclear Power Units": 263-r (April 29, 2004).
37. The Law on Adjustment of questions, connected with Nuclear Safety assurance: 1868-IY (June 24, 2004).
38. The Law on Order of decision making on location, design, construction of Nuclear installations and objects, intended for radioactive waste treatment: 2861-IY (September 8, 2005).
39. The Cabinet of Ministers' Decree on Approval of onception on NPP units Safety Upgrading: 515-r (December 13, 2005).
40. The Cabinet of Ministers' Direction on "Approval of the Energy Strategy of Ukraine til 2030": 145-r (March 15, 2006).
41. The Cabinet of Ministers' Direction on "Approval of the Plan of Measures on Ukrainian Energy Strategy for the period until 2030": 436-r (July 27, 2006).
42. The President's Decree n National Security and Defense Council resolution "On Nuclear Energy security": 156/2008 (February 1, 2008).
43. The Cabinet of Ministers' Decree on "Some issues of State economic associations in Nuclear industry": 650-r (April 17, 2008).
44. The Cabinet of Ministers' Decree on Some issues of State concern "Nuclear Fuel": 841 (September 10, 2008).
45. The Law on National ecological radioactive waste treatment program: 516-YI (September 17, 2008).
46. The Law on State Program of Chernobyl NPP Decommissioning and Shelter Transformation into Ecologically Safe System: 866-YI (January 15, 2009).

# REFERENCES


[1] Ukraine in figures. Statistical Publication. State Statistics Committee of Ukraine.

[2] Statistical Yearbook of Ukraine. State Statistics Committee of Ukraine.

[3] Energy Strategy of Ukraine for the Period until 2030.

[4] Nuclear legislation. Kiev, Ukraine 1999.

[5] http://zakon1.rada.gov.ua

[6] Nuclear and Radiation Safety in Ukraine. Annual Report 2008. The State Nuclear Regulatory Committee of Ukraine.

[7] IAEA Energy and Economic Data Base (EEDB).

[8] IAEA Power Reactor Information System (PRIS).

# APPENDIX 1: INTERNATIONAL, MULTILATERAL AND BILATERAL AGREEMENTS

AGREEMENTS WITH THE IAEA

| | | |
|---|---|---|
| Amendments to Articles VI and XIV of the Agency statute | Not ratified | |
| Agreement on privileges and immunities | Entry into force: | 5 October 1966 |
| NPT related safeguards agreement INFCIRC/153 | Entry into force: | 22 January 1998 |
| Additional Protocol | Signed: | August 2000 |
| Supplementary agreement on provision of technical assistance by the IAEA | Entry into force: | 21 September 1990 |

MAIN TREATIES OR AGREEMENTS

| | | |
|---|---|---|
| NPT | Entry into force: | 5 December 1994 |
| Conventional on the physical protection of nuclear material | Entry into force: | 5 August 1993 |
| Convention on early notification of a nuclear accident | Entry into force | 26 February 1987 |
| Convention on assistance in the case of nuclear accident or radiological emergency | Entry into force | 26 February 1987 |
| Vienna convention on civil liability for nuclear damage | Entry into force | 20 December 1996 |
| Paris convention on civil liability for nuclear damage | Not applicable | |
| Joint protocol | Entry into force | 24 June 2000 |
| Protocol to amend Vienna convention on civil liability for nuclear damage Signed on: 29 September 1997 | Signed on: | 29 September 1997 |
| Convention on supplementary compensation for nuclear damage | Signed on: | 29 September 1997 |
| Convention on nuclear safety | Entry into | 7 July 1998 |

| | | |
|---|---|---|
| | force | |
| Joint convention on the safety of spent fuel management and on the safety of radioactive waste management | Ratified on: | 24 July 2000 |

OTHER RELEVANT INTERNATIONAL TREATIES OR UNDERTAKINGS

| | |
|---|---|
| Improved procedures for designation of safeguards inspectors | Not requested |
| Zangger Committee | Non Member |
| Acceptance of NUSS Codes | No replay |
| Nuclear Suppliers Group | Member |
| Nuclear export guidelines | Not adopted |

BILATERAL AGREEMENTS

- The agreement between Ukraine and Russian Federation government on nuclear energy science and technical-economic co-operation (January 14, 1993)
- The agreement between Ukraine and Poland government on notification of a nuclear accident, information exchange and co-operation in the Nuclear Safety and Radiation Protection area (May 24, 1993)
- The agreement between Ukraine and Germany government on issues, which represent mutual interest in view of nuclear-technical safety and radiation protection. (June 10, 1993)
- The agreement between US government and Ukraine government on operational safety improving, operational risks decreasing and civil nuclear objects regulatory system strengthening (October 25, 1993)
- The agreement between Kingdom of Norway and Ukraine government on notification of a nuclear accident and nuclear installation information exchange (September 28, 1994)
- Law on Ratification of agreement on partnership and co-operation between Ukraine and
- European communities and their member-states: 237/94-VR (November 10, 1994).
- The common understanding memorandum between EU committee and Ukraine government on technical aid program implementation on Nuclear safety area (October 23, 1995)
- Memorandum of Understanding between the Government of Ukraine and G7 countries Governments and Commission of the European Union on ChNPP closure (December 20, 1995)
- The agreement between Ukraine and Finland government on notification of a nuclear accident, information exchange and co-operation in the Nuclear Safety and Radiation Protection area (February 08, 1996)
- The agreement between Ukraine and Austria government on information exchange and co-operation in the Nuclear Safety and Radiation Protection area (November 08, 1996)
- The grant agreement (ChNPP nuclear safety project) between EBRD, Ukraine government and ChNPP (November 12, 1996)
- The agreement between Ukraine and Hungary government on notification of a nuclear accident, information exchange and co-operation in the Nuclear Safety and Radiation Protection area (November 12, 1997)
- The framework agreement between Ukraine and EBRD on Chernobyl Fund "Shelter" activity in Ukraine (November 20, 1997)

- The cooperation agreement between Ukraine and USA on nuclear power peaceful utilization (May 6, 1998)
- The agreement between Cabinet of Ministries of Ukraine and French Republic government on nuclear energy peaceful utilization cooperation (September 03, 1998)
- The agreement between Ukraine and Slovak Republic government on notification of a nuclear accident, information exchange and co-operation in the Nuclear Safety and Radiation Protection area (September 24, 1998)
- The agreement between Ukraine and Turkey government on notification of a nuclear accident and nuclear installations information exchange (November 23, 2000)
- The agreement between Ukraine and Byelorussia government on notification of a nuclear accident and co-operation in the Radiation Protection area (October 16, 2001)
- The agreement between Ukraine and Latvia government on notification of a nuclear accident, information exchange and co-operation in the Nuclear Safety and Radiation Protection area (August 20, 2003)
- The agreement between Ukraine and Bulgaria government on notification of a nuclear accident, information exchange and co-operation in the Nuclear Safety and Radiation Protection area (August 20, 2003)
- The agreement between Ukraine and Byelorussia government on notification of a nuclear accident and co-operation in the Radiation Protection area (October 16, 2001)
- The agreement between Ukraine and Kingdom of Sweden government on general conditions of technical and finance co-operation (August 29, 2007)

# APPENDIX 2: MAIN ORGANIZATIONS, INSTITUTIONS AND COMPANIES INVOLVED IN NUCLEAR POWER RELATED ACTIVITIES

| | |
|---|---|
| *NATIONAL NUCLEAR ENERGY AUTHORITIES* | |
| Ministry of Fuel and Power of Ukraine (Mintopenergo)<br>30, Khreshchatik Str., Kiev, Ukraine 01001 | Tel: 8 (044) 206-3800<br>Fax: 8 (044) 239-4394<br>http://mpe.energy.gov.ua |
| *NATIONAL REGULATORY AUTHORITY* | |
| State Nuclear Regulatory Committee of Ukraine<br>9/11, Arsenalna Str., Kiev, Ukraine 01011 | Tel: 8 (044) 254-3375<br>Fax: 8 (044) 254-3311<br>http://www.snrc.gov.ua |
| *OTHER ORGANIZATIONS* | |
| National Nuclear Energy Generating Company Energoatom | http://www.energoatom.kiev.ua |
| ZNPP | http://www.npp.zp.ua |
| RNPP | http://www.rnpp.rv.ua |
| KhNPP | http://www.xaec.org.ua |
| State specialized enterprise "Chernobyl Nuclear Power Plant" | http://new.chnpp.gov.ua |

| | |
|---|---|
| International Nuclear Safety Centers | http://www.insc.gov.ua |
| Chornobyl Center for Nuclear Safety, Radioactive Waste and Radioecology | http://www.chornobyl.net/ |
| Open joint-stock company Kharkiv science-research and design institute | http://www.energoproekt.com.ua |
| National Electricity Regulatory Commission of Ukraine | http://www.nerc.gov.ua |
| National Power Company "Ukrenergo" | http://www.ukrenergo.energy.gov.ua |
| State Enterprise "Energorynok" | http://www.er.gov.ua |
| Sevastopol Institute of Nuclear Power and industry | http://www.sinp.com.ua/ |
| E.O. Paton Electric Welding Institute | http://www.paton.kiev.ua |
| Institute of NPP Safety problems | http://ipbaes.org.ua |
| State owned "Eastern Mining And Processing Complex" (SkhidGZK) | http://vostgok.com.ua |
| State scientific and technology on Nuclear and Radiation Safety | www.sstc.kiev.ua |
| NPP Operation Support Institute | www.npp-osi.kiev.ua |
| Research and Production Enterprise "Atom Komplex Prylad" (RPE "AKP") | www.akp.com.ua |
| Ukrainian Research and Design Institute for Industrial Technology | www.iptzw.dp.ua |
| Ukrainian Scientific Research Institute of Ecological Problems | www.niiep.kharkov.ua |
| National Science Center<br>Kharkov Institute of Physics and Technology | www.kipt.kharkov.ua |
| Kiev Institute for Nuclear Research<br>National Academy of Sciences of Ukraine | http://www.kinr.kiev.ua |
| G.S.Pisarenko Institute for Problems of Strength<br>National Academy of Sciences of Ukraine | http://www.ipp.kiev.ua |
| HARTRON | http://www.hartron.com.ua |
| Institute of NPP Safety problems<br>National Academy of Sciences of Ukraine | http://ipbaes.org.ua |

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