SE «NNEGC «ENERGOATOM»: Today and Tomorrow

Kyiv - 2019

POLICY OF SE «NNEGC «ENERGOATOM»

VIEWPOINT OF SE «NNEGC «ENERGOATOM»

The most significant points are as follows:

- ***Safety of nuclear facilities***
- ***Life and health protection of Company`s personnel***

Safety assurance prevails over economical, technical, scientifical and other activities

PURPOSE

The purpose is to be the safest, innovative and competitive Company on electricity generation in Europe, and provide benefit to our consumers and concerned foreign and domestic parties

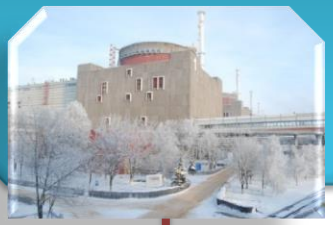
STRATEGY

- **Stable and safe operation of NPPs**
- **Development of the Company**

Total installed electrical capacity

RNPP - 2 835 MW

ZNPP – 6 000 MW



KhNPP – 2 000 MW

Total installed electrical capacity of generating facilities of SE NNEGC "Energoatom"

14 148,5 MW

SOUTH UKRAINE POWER COMPLEX
3 313,5 MW

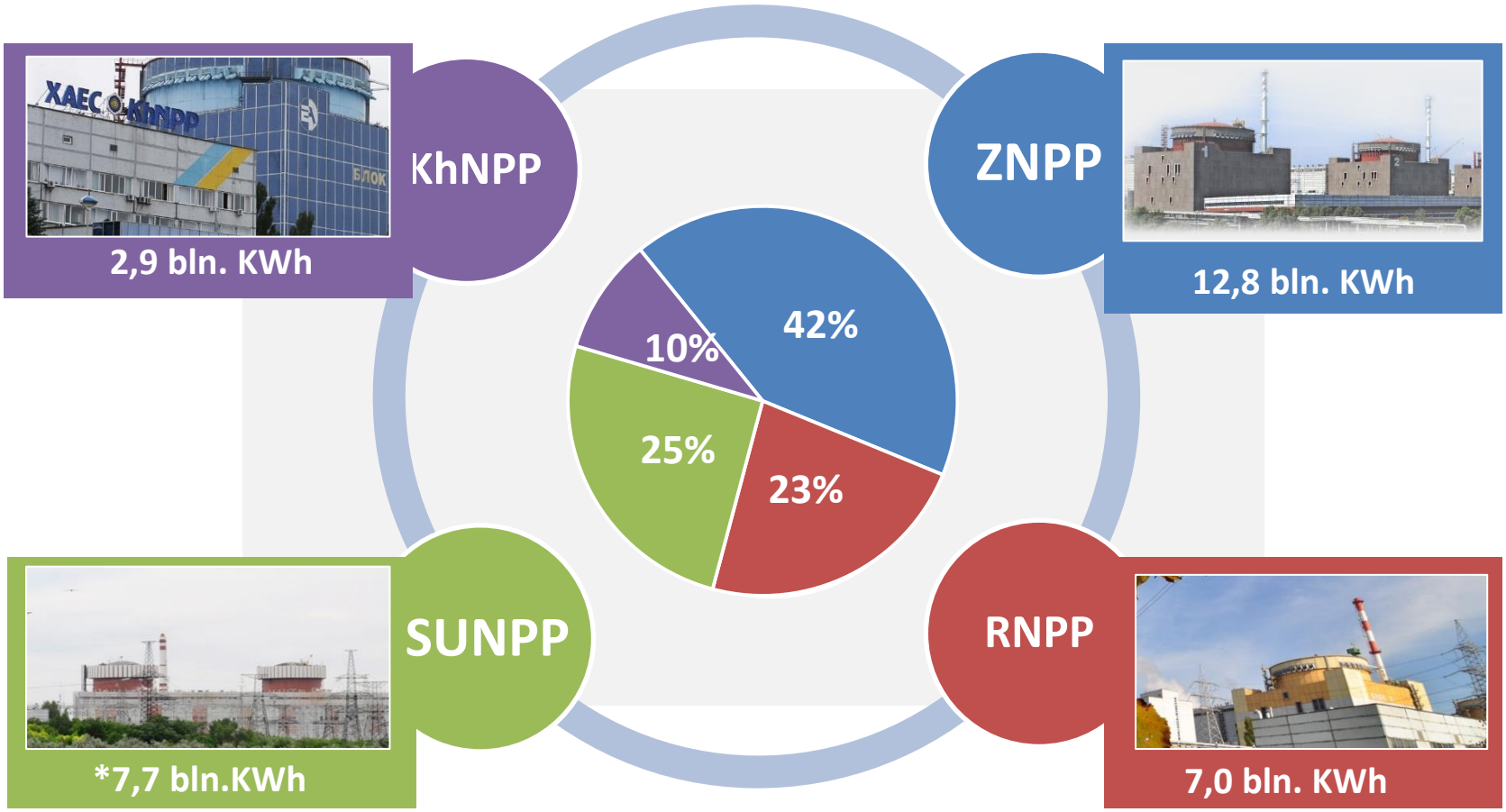
Tashlyk PSP - 302 MW

SUNPP – 3 000 MW

Oleksandrivska HPP- 11,5 MW

SHARE OF THE NPPs IN ELECTRICITY GENERATION

SE «NNEGC «ENERGOATOM» has generated 30,4 bln. KWh
for 4 months in 2019

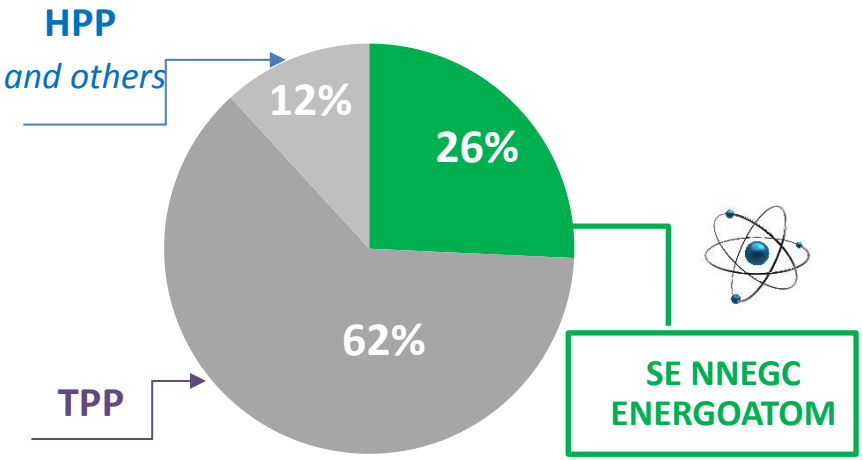


**including Oleksandrivska HPP and Tashlyk PSP*

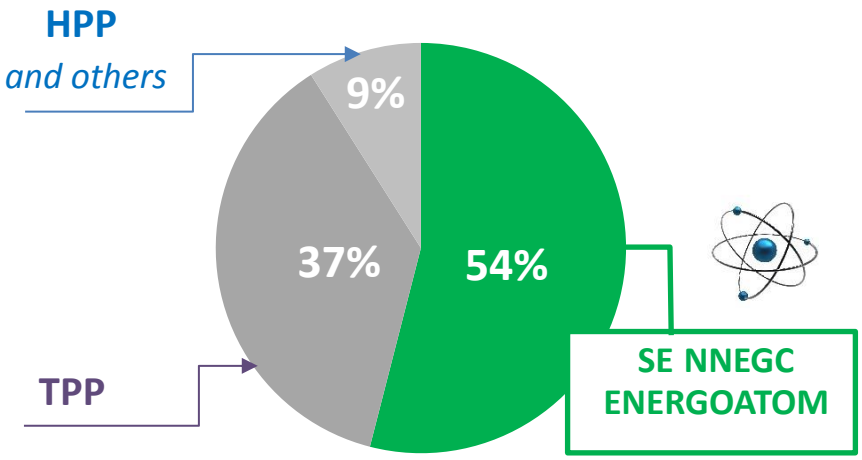
PLACE OF SE NNEGC ENERGOATOM IN THE ENERGY SECTOR OF UKRAINE

(for 4 months 2019)

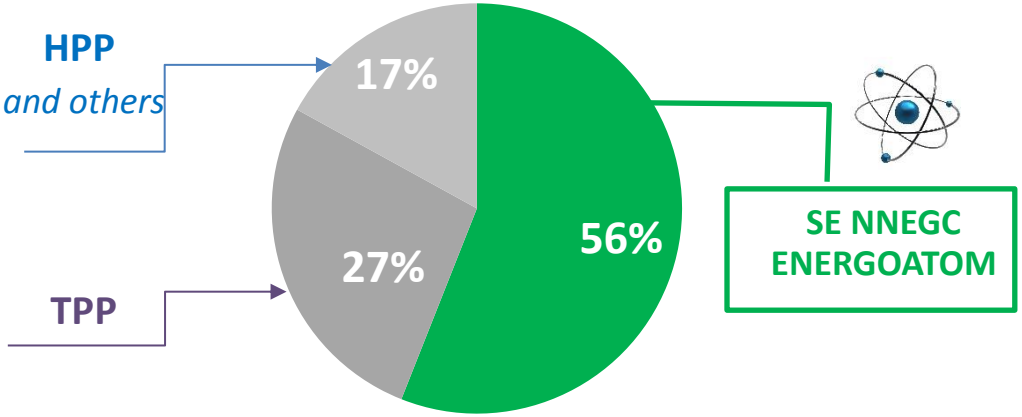
The structure of generating capacities



The structure of energy production in Ukraine



The structure of electricity output to the energy market of Ukraine



INTERNATIONAL ASSESSMENT OF UKRAINE's NPPs SAFETY

SAFETY UPGRADING OF OPERATING NPP POWER UNITS IS A TOP PRIORITY OF THE COMPANY'S PERFORMANCE

International experts have positively assessed safety level for many years:

- *At periodic meetings on compliance with Convention on Nuclear Safety in the IAEA*
- *During continuous monitoring by international experts in the framework of international cooperation (in the course of OSART, ASSET, WANO missions)*

In 2008 – 2009 a unique, in terms of implementation scope, comprehensive safety review of all Ukrainian NPP power units was conducted by 14 missions of the IAEA under Joint Ukraine-EC-IAEA project in the areas as follows:

- design safety
- operating safety
- RAW management and decommissioning

The participants of international safety assessment of Ukrainian NPPs were as follows:

- *62 international experts from 23 countries and international organizations*
- *32 experts of the IAEA*

IAEA and EC's experts established that all Ukrainian NPP power units comply with the IAEA's nuclear safety requirements

“POST –FUKUSHIMA” MEASURES

Following the events at Fukushima–Daiichi NPP the extraordinary in-depth safety assessment of the power units of Ukraine NPPs was performed

Ukraine joined the initiative of the EC on performing “stress tests” and simultaneously carries out the subsequent measures

The “Stress tests” for Ukraine NPPs were performed in line with the methodology of “stress tests” for European NPPs endorsed by the European Commission and ENSREG

Sequence of events that happened at Fukushima-Daiichi NPP are, practically impossible for Ukraine NPPs

The set of “Post-Fukushima” measures is divided into 2 groups:

Prevention of severe accidents	• emergency power supply, make up of steam generator, spraying pool, reactor pools, seismic resistance, emergency monitoring of primary circuit parameters
Severe accident management	• SAMG, containment depressurization, containment bypassing, hydrogen removal, emergency monitoring of parameters under containment

DESIGN AND CONSTRUCTION OF KHMELNITSKY POWER UNITS NO. 3 AND 4

DESIGN AND CONSTRUCTION OF POWER UNITS #3 AND #4 OF KHMELNYTSKYI NPP

Total cost of construction (based on 2016`s prices): - UAH 72,4 bln

Project completion date: KhNPP 3 – 2024
KhNPP 4 – 2026

Once in operation, KhNPP Unit #3 and Unit #4 will ensure additional annual supply of 15,4 bln.kWh(e) to the energy system of Ukraine

- ✓ **The revision of Feasibility Study (FS) on construction of KhNPP-3, 4 was carried out**
- ✓ **The positive FS expert report on construction of KhNPP-3, 4 was received under №00-2193-16/ПБ dd 29.05.2017**
- ✓ **The Cabinet of Ministers of Ukraine approved «Feasibility Study on Construction of Khmelnitsky Power Units No. 3 and 4»**
- ✓ **The draft law «On location, design and construction of Khmelnitsky Power Units No. 3 and 4» was developed and submitted to the CMU on 21.05.2019;**
- ✓ **The environmental impact assessment** *(EIA) is in progress (public hearings of EIA report in 9 cities of Ukraine was perfomed in February 2019)*

Note:

Construction of KhNPP Unit#3 and Unit#4 according to initial design (each reactor's capacity is 1000 MW, having reactor installation VVER-1000/V-320) started in 1986, but it was suspended in 1990 by the moratorium for NPP construction. Today, the construction availability of the power units is assessed at the level:

- *75% for Unit#3 (85 items of equipment were installed, including tanks, heat exchangers, filters, etc.)*
- *28% for Unit #4*

PECULIARITIES UNDERLYING THE REDUCTION IN ESTIMATED CONSTRUCTION COST

As compared to a "greenfield" construction project, peculiarities of construction of Units #3 and #4 are stipulated by the following:

- **Use of civil structures, buildings and structures on the sites of Units #3 and #4 of Khmelnytskyi NPP**
- **Use of the site existing infrastructure and of equipment in store of Khmelnytskyi NPP :**
  - ✓ *General plant industrial systems*
  - ✓ *Roads and railway*
  - ✓ *Construction base*
  - ✓ *Warehouse facility (containing about 20 000 components of equipment for KhNPP -3&4)*

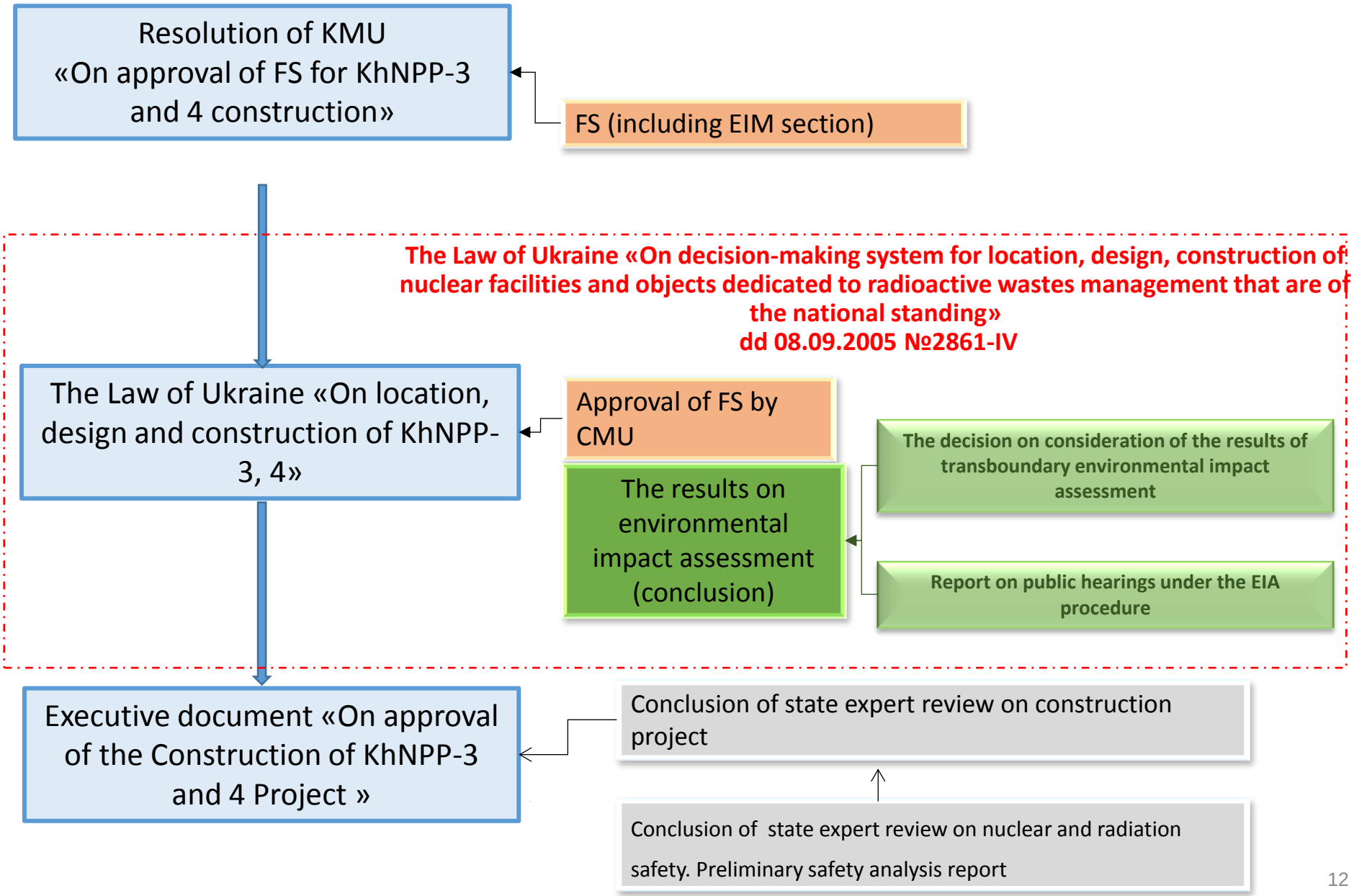
- **Project engineering solutions and planned equipment allow enhancing the level of use of Ukraine's local capabilities in construction project up to 60-70% per cent**

ADVANTAGES OF POWER UNITS CONSTRUCTION IN ACCORDANCE WITH THE REVISED FEASIBILITY STUDY ON KHNPP-3, 4 CONSTRUCTION

- **The advantages can be confirmed with the following points:**
  - *Use of reference main equipment*
  - *Use of modern auxiliary equipment with its maximum production in Ukraine (about 70%)*
  - *Terms of references make it possible to replace the list of Russian equipment with the ones produced at the European and Ukrainian facilities, which comply with the current norms and standards on nuclear and radiation safety*
  - *Possibility to develop all the design concepts by own resources engaging the European partners*

- The following additional systems and events on safety enchancement are planned to be implemented under KhNPP-3 and 4 construction:
  - *Hydrogen removal system*
  - *Systems that control pressure release from containment*
  - *Reactor vessel cooling system*
  - *Mobile units of power supply*
  - *Auxiliary stand by diesel power plant*

DECISION-MAKING SYSTEM ON KHNPP-3 AND 4 CONSTRUCTION



SAFETY STATUS AT Ukrainian NPPs

Radiation parameters, which define NPP performance, do not exceed the regulatory values, while the radiation protection of the personnel and the public is secured and appropriately maintained

Operation of nuclear power plants does not result in any ecological changes that would indicate any deterioration of the environmental conditions in the location of a nuclear power plant

The Automated Radiation Situation Monitoring System (ARSMS) *is one of the tools used for radiation monitoring at all nuclear power sites of Ukraine and within a 30-km monitoring (supervision) area.* ***ARSMS*** *comprises stationary monitoring points on NPP sites, monitoring points located within a 30-km area and mobile monitoring points*

For many years, safety assessments by international experts have yielded positive conclusions:

- *During periodic IAEA Review Meetings of the Contracting Parties to the Joint Convention on Nuclear Safety;*
- *During continuous monitoring by international experts under international cooperation programs (OSART, ASSET, WANO missions)*

IAEA and EC experts confirm that the safety level of Ukrainian NPP complies with international recommendations and meets national standards

ENVIRONMENTAL POLICY OF NNEGC ENERGOATOM

OBJECTIVE OF ENVIRONMENTAL POLICY

- **Preservation of natural systems** in the areas of nuclear power facilities location
- **Reduction of anthropogenic load** on the environment
- **Ensuring environmental safety** during production activity

The Company in its activity is guided by

- The principles of the European environmental law
- International standards
- EU directive on environment
- Program on environment protection activity of SE NNEGC Energoatom

Energoatom recognizes full responsibility towards present and future generations for the environmental impact of its activities

ENVIRONMENT SCRUTINIZED BY ENVIRONMENTAL EXPERTS

Environmental conditions in locations of NPP operated by SE NNEGC Energoatom are subject to close scrutiny by more than 200 environmental experts, who belong to radiation safety, chemical and hydraulic engineering departments, services for environmental protection

Number of environmental experts employed by NPP:

- **>60** ZNPP
- **>40** RNPP
- **>55** SU NPP
- **>40** KhNPP

Radiation monitoring of the environment at Ukrainian NPP includes:

- *Monitoring of gas and airborne emissions and water discharges into the environment;*
- *Monitoring of environment pollution by radioactive materials;*
- *Control of equivalent and annual cumulative dose rates*

NPP deploy the most advanced and the most comprehensive automated environmental monitoring systems in Ukraine providing effective on-line monitoring of the environment and on-line placement of the monitoring results on the official web-sites

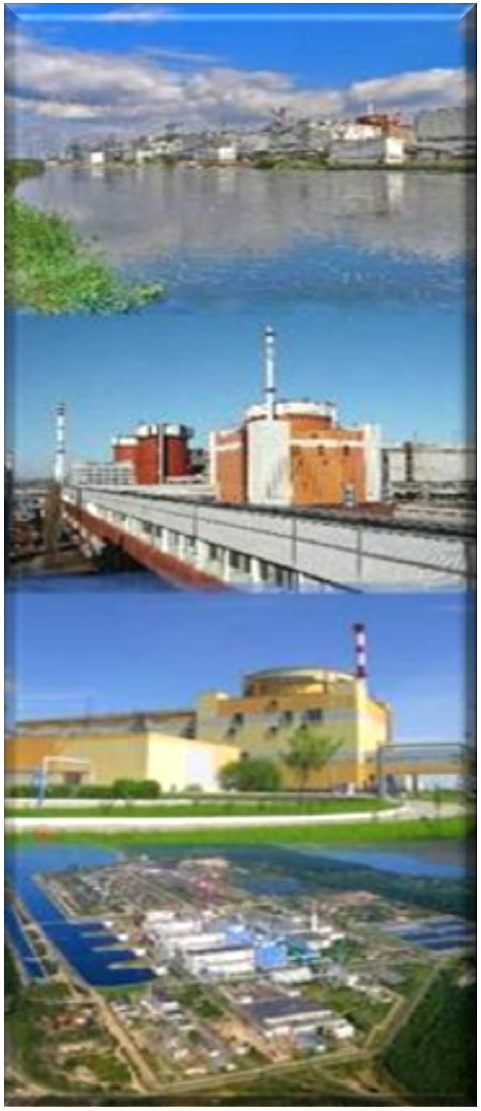
ENVIRONMENTAL MANAGEMENT SYSTEM OF THE COMPANY

The Company's environmental management system is certified to ISO 14001

Tangible achievements and endeavors of the Company focused on environmental load reduction are demonstrated by the certificates, issued by the internationally recognized body TÜV NORD to SE NNEGC Energoatom subdivisions between 2007 and 2016, which certify conformity to ISO 14001:2004 "Environmental management systems - Requirements with guidance for use"

Annual supervisory audits also acknowledge the Company's continuous efforts to improve the environmental management system

CONTRIBUTION OF UKRAINIAN NPP TO MITIGATION OF CLIMATE CHANGES



For the time of operation of Ukrainian NPPs, the total volume of prevented CO_2 emissions has made up 3.25 billion metric tons. If Ukraine had not operated nuclear power plants at all, the annual volume of CO_2 emissions released into the environment would have increased by 117 million metric tons *(+ 30%)*

The cost of prevented emissions exceeds USD 120 billion *(as compared to the Carbon Capture & Storage Technology that otherwise would need to be utilized for thermal power plants and cogeneration plants)*

Since 1990 Ukraine has generally halved CO_2 emissions, thereby contributing significantly to the achievement of the European 20-20-20 targets

The Company spares no efforts in enlightening the public on the impact the Ukrainian nuclear power industry has on the climate, and holds open discussions with environmental experts and representatives of environmental organizations

NUCLEAR POWER INDUSTRY OF UKRAINE

Nuclear power industry of Ukraine is a reliable foundation of the national energy independence, the most advanced and high-technology sector of the economy

NPPs, which occupy relatively small areas, keep the air, river and sea water clean, pure and fresh

Their operations suppress the global warming and atmospheric pollution

THANK YOU FOR YOUR ATTENTION!