

A stylized map of the United States and Ukraine. The US is shown in red, white, and blue, and Ukraine is shown in yellow and blue. A blue banner with white text is overlaid on the map.

SE NNEGC ENERGOATOM: COOPERATION AND DEVELOPMENT PROSPECTS





NUCLEAR POWER INDUSTRY OF UKRAINE



Rivne NPP

VVER-440	VVER-440	VVER-1000	VVER-1000
December 1980	December 1981	December 1986	October 2004
December 2010	December 2011	December 2017	December 2035
Lifetime extended until December 2030	Lifetime extended until December 2031		

RIVNE NPP

- Electricity production for 8 months 2015 – **12.0 bln kWh**
(20.8% of the overall electricity production by SE "NNEGC "Energoatom")
- Number of employees – **7 844**

Khmelnytskyi NPP

VVER-1000	VVER-1000
December 1987	August 2004
December 2018	September 2035

KHMELNYTSKYI NPP

- Electricity production for 8 months 2015 – **10.4 bln kWh**
(18.0% of the overall electricity production by SE "NNEGC "Energoatom")
- Number of employees - **5 087**

SE NNEGC ENERGOATOM IS THE OPERATOR OF 4 RUNNING NUCLEAR POWER PLANTS WITH A TOTAL INSTALLED CAPACITY OF 13 835 MW

SOUTH UKRAINE NPP

- Electricity production for 8 months 2015 – **10.6 bln kWh**
(18.4% of the overall electricity production by SE "NNEGC "Energoatom")
- Number of employees – **6 877**

South Ukraine NPP

VVER-1000	VVER-1000	VVER-1000
December 1982	January 1985	September 1989
December 2013	May 2015	February 2020
Lifetime extended until December 2023	Lifetime extension underway	

Zaporizhzhya NPP

VVER-1000	VVER-1000	VVER-1000	VVER-1000	VVER-1000	VVER-1000
December 1984	July 1985	December 1986	December 1987	August 1989	October 1995
December 2013	July 2015	December 2016	December 2017	August 2019	October 2025
					Lifetime extension underway

ZAPORIZHZHYA NPP

- Electricity production for 8 months 2015 – **24,7 bln kWh**
(42.8% of the overall electricity production by SE "NNEGC "Energoatom")
- Number of employees - **11 076**



Commissioning date
End of lifetime

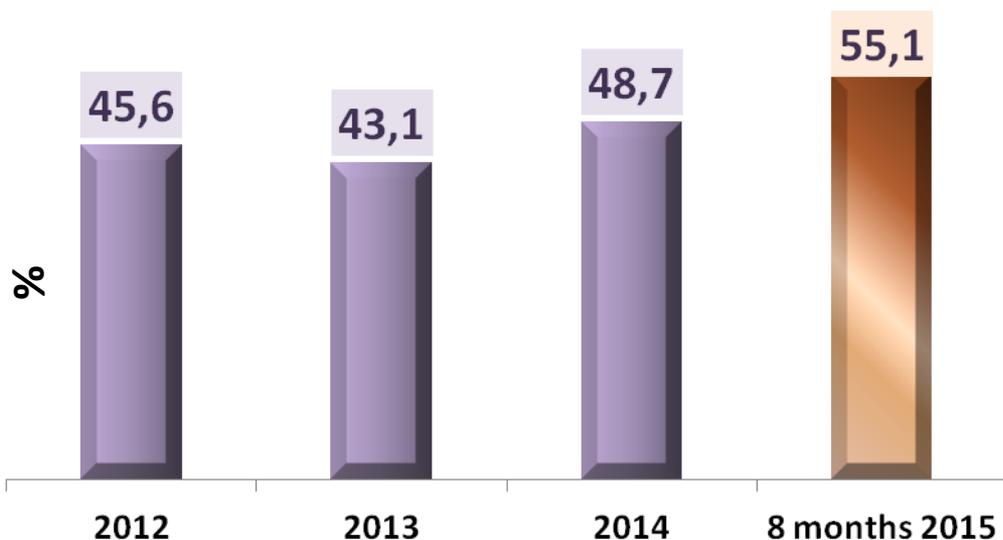
SE NNEGC Energoatom covers over 56% of Ukraine's demand for electricity



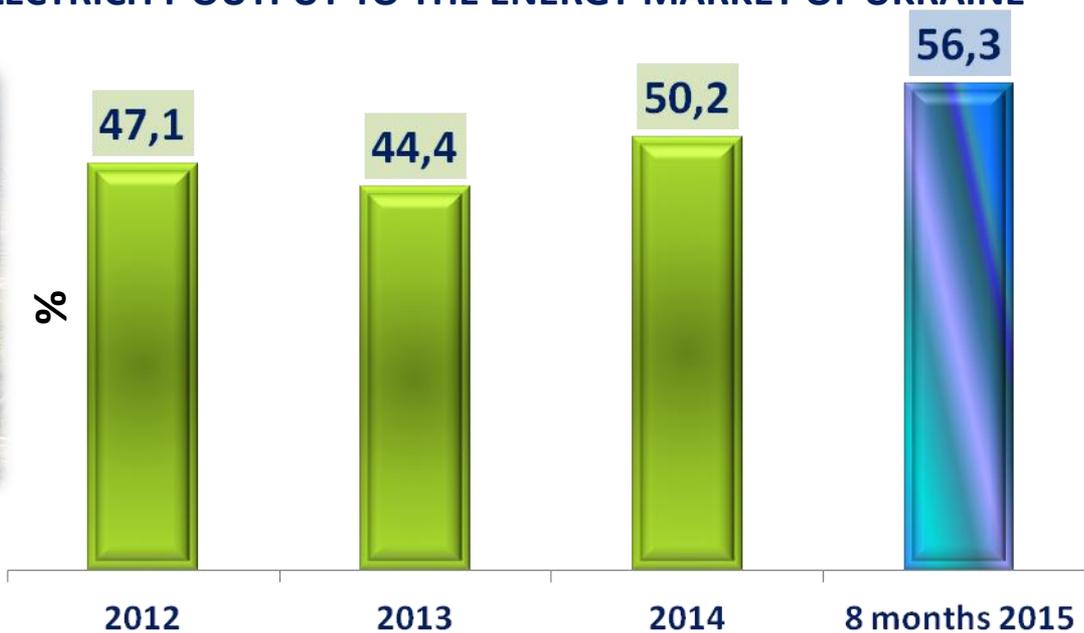
SE NEEGC ENERGOATOM IN UKRAINE'S ENERGY MIX



ELECTRICITY PRODUCTION IN UKRAINE



ELECTRICITY OUTPUT TO THE ENERGY MARKET OF UKRAINE





MAIN TASKS OF SE NNEGC ENERGOATOM



SAFE ELECTRICITY PRODUCTION



IMPROVING SAFETY OF NUCLEAR POWER PLANTS THROUGH INTRODUCTION OF NEW TECHNOLOGIES, IMPROVING SAFETY SYSTEMS' FEATURES



NEW NUCLEAR BUILD AND LIFETIME EXTENSION OF THE EXISTING GENERATING CAPACITIES



PROCUREMENT OF FRESH NUCLEAR FUEL AND REMOVAL OF THE SPENT NUCLEAR FUEL



ESTABLISHMENT OF THE NATIONAL INFRASTRUCTURE FOR MANAGEMENT OF SPENT NUCLEAR FUEL AND RAW



PHYSICAL PROTECTION OF NUCLEAR INDUSTRIAL FACILITIES



PERSONNEL RETRAINING AND PROFESSIONAL DEVELOPMENT



COMPANY'S MAIN INVESTMENT PROJECTS FOR 2015



The Company has **11** main investment projects underway





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 area of a power plant location

ARSMS (Automated Radiation Situation Monitoring System) 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 NPPs **complies with international recommendations and meets national standards.**





COMPREHENSIVE (INTEGRATED) SAFETY IMPROVEMENT PROGRAM FOR NPPS OF UKRAINE



Comprehensive (Integrated) Safety Improvement Program for NPPs (C(I)SIP) is the main program to ensure reliability and safety of Ukrainian NPPs:



- **approved** by the Cabinet of Ministers of Ukraine, Decree No.1270 of 07.12.2011 «*On approval of Comprehensive (integrated) Safety Improvement Program for Nuclear Power Plants*»
- **1265 measures** are planned to be implemented by 2020
- **578 measures** – implemented by now (46%)

- **No funding assigned from budgetary funds.**
- **Nowadays, the Program is financed at the Company's own cost and expense**
- **From 2015 onwards the Program will be co-financed from the own funds of SE NNEGC Energoatom and out of proceeds of the EBRD/Euratom loans.**



COOPETATION OF SE NNEGCG ENERGOATOM WITH U.S. PARTNERS



The main areas of SE NNEGCG Energoatom-USA cooperation are as follows :

- 1. International Nuclear Safety Program to improve safety of Soviet-design reactors, implemented by the U.S. Department of Energy (completed in 2006), including the Nuclear Fuel Qualification Project for Ukraine;**
- 2. Commercial contract with Westinghouse to diversify fresh nuclear fuel supplies for Ukrainian NPPs;**
- 3. Investment project on construction of a central spent fuel storage facility in Ukraine, based on technology provided by Holtec International.**
- 4. Joint Ukraine-U.S. Nuclear Safety Subgroup.**
 - ✓ **Project on technical retrofitting (upgrading) of the physical protection system at South-Ukraine NPP**





DIVERSIFICATION OF NUCLEAR FUEL SUPPLIES TO UKRAINE



NNEGC Energoatom persists in its efforts to diversify fuel supply sources to nuclear power units of Ukraine.

This process was initiated in 2000 by signing on June 5 the **Implementing Agreement between the Government of Ukraine and the Government of the USA** regarding the Nuclear Fuel Qualification Project for Ukraine

- The project was implemented in two stages
- **Stage I** of the Project (*from 2005 to 2009*) - trial operation of **6 lead test WFA assemblies** at SU NPP unit 3 during four fuel cycles
- **Stage II** of the Project (*since March 2010*) – start of trial operation of a Reload Batch of **42 WFAs** manufactured by “Westinghouse”
- Operation of these fuel assemblies started **in 2011**
- **On 30 December 2014** Westinghouse and SE “NNEGC “Energoatom” signed Amendment No.13 to the Contract for supply of Westinghouse nuclear fuel (WRFA) for the period until 2020 that provides for significant extension of nuclear fuel supplies to Ukrainian NPPs (*5 refueling outages in 2016 and 6 refueling outages per year until 2020*)



WESTINGHOUSE – A LONG TERM PARTNER OF ENERGOATOM UNDER SAFETY IMPROVEMENT PROGRAM



Supply of passive autocatalytic recombiners (PAR)

- Westinghouse - is a winner of the tender for supply of PARs to ZNPP Units 1, 2. The contract has been concluded. Equipment is to be supplied to ZNPP Unit 1 and Unit 2 in 2015 and 2016, respectively
- Prospects - ongoing tenders for procurement of PARs under the EBRD rules for KhNPP Units 1, 2; RNPP Units 3, 4 (*bids were opened on 12 June 2015, their evaluation is underway*). Tenders for ZNPP Units 3-5 will be launched in the 3rd quarter of 2015

Supply of hydrogen control system (HCS)

- Westinghouse - this year participated in tenders for procurement of equipment for SUNPP Unit 2 and ZNPP Units 1, 2. The bidders offering a lower price have been accepted by now.
- Prospects - tenders for HCS under EBRD rules are planned to start in the 3rd–4th quarter of 2015 for RNPP Units 3 and 4, KhNPP Units 1, 2; ZNPP Units 3, 4, 5 and 6; SUNPP Unit 3 (*individual tenders for each NPP*)

Supply of the equipment for filtered containment venting system (FCVS)

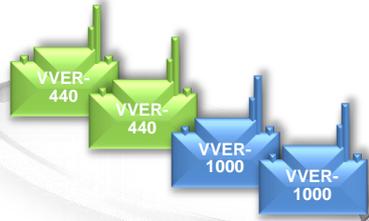
- Westinghouse - participated in tenders for supply of equipment to SUNPP Unit 1, ZNPP Unit 1, 2 (*tenders were cancelled by the decision approved by the Bid Evaluation Committee on 10.07.2015*)
- Prospects - tenders under the EBRD rules for ZNPP Units 3, 4, 5, KhNPP Unit 1; RNPP Unit 3; SUNPP Unit 3 will be announced in 2016.



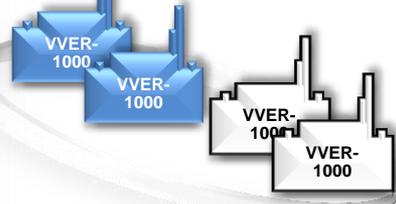
SPENT NUCLEAR FUEL MANAGEMENT



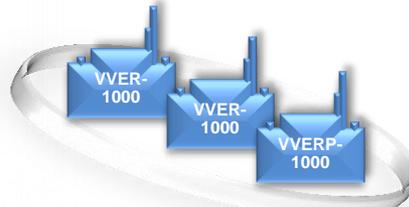
Rivne NPP



Khmelnytskyi NPP



South Ukraine NPP



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SE NNEGC
Energoatom

Zaporizhzhya NPP



The central spent fuel storage facility (CSFSF) for VVER reactors of three Ukrainian NPPs (Rivne NPP, Khmelnytskyi NPP, South Ukraine NPP)

The CSFSF design is based on the technology and equipment provided by Holtec International

Design storage capacity:
12010 SFA from VVER-1000;
4519 SFA from VVER-440

DSFSF at ZNPP

The dry spent fuel storage facility (DSFSF) can house SNF produced by Zaporizhzhya NPP throughout its entire lifetime

Design capacity – 380 casks (9000 SFA)

To date, two stages of DSFSF are in operation on ZNPP site.

129 (3090 SFA) casks have been loaded since commissioning (as of 01.09.2015).



ESTABLISHMENT OF THE CENTRAL SPENT FUEL STORAGE FACILITY FOR VVER REACTORS OF UKRAINIAN NPPS (CSFSF)



Project Objective :

Improvement of spent nuclear fuel (SNF) management system of Ukrainian NPPs towards enhancing energy independence of Ukraine by ceasing the SNF transfer to the Russian Federation

Project completion term – **2050**

incl. start-up complex completion – **in 2017**

All required infrastructure and **94** SNF storage systems will be put in place as a part of the start-up complex on CSFSF site.



- The start-up complex equipment will be supplied under the contracts with the technology owner – **Holtec International**
- The CSFSF is designed under the contract with Ukrainian designer – Kyiv Research and Design “Energoprojekt” Institute

Location: construction of the central spent fuel storage facility for VVER reactors of Ukrainian NPPs is carried out in the Chernobyl Exclusion Zone (Kyiv oblast) in accordance with Law No. 4384 of Ukraine on CSFSF (*dated 09.02.2012*)

Design storage capacity:

- ✓ **12010** SFA of VVER-1000;
- ✓ **4519** SFA of VVER-440

Storage capacity of CSFSF start-up complex:

- ✓ **2511** SFA of VVER-1000;
- ✓ **1105** SFA of VVER-440

It is expected that the CSFSF will be filled up to design capacity in **45-50 years**

Design lifetime – **not less than 100 years**



TECHNICAL RETROFITTING (UPGRADING) OF PHYSICAL PROTECTION SYSTEM AT SOUTH-UKRAINE NPP



- **1st February 2011** saw the joint Ukraine-US Nuclear Safety Subgroup, established under the bilateral working group on energy security, holding in Kyiv its first meeting to agree on the future cooperation areas on nuclear safety issues.
- The decision was made to implement the Project on “Technical retrofitting of the physical protection system at South Ukraine NPP”
- At that time, the total project cost made up **USD 10 M**. The project is co-financed in equal shares.
- **On 4-10 December 2011** Amendment No. 1 to the Terms of Reference was signed.

Primary Objectives:

establish an automated information control system of physical protection engineering and technical means for South-Ukraine NPP, using state-of-the-art developments in this field.

- **In February 2013** the Pacific Northwest National Laboratory (PNNL) signed a **USD 1.03 M** contract for design of physical protection engineering and technical means for SUNPP Units 1-3.
- During the last visit of U.S. delegation in March 2011, an agreement was reached to conclude a **USD 852.1 thousand** contract with the PNNL to procure equipment for the physical protection system of security-sensitive areas of SUNPP Units 1-2.
- The works have started in **August 2015**



**LOOKING FORWARD TO PROACTIVE AND
BENEFICIAL DIALOGUE WITH OUR
U.S. PARTNERS IN FUTURE**

