

DEVELOPMENT OF NUCLEAR POWER PROGRAM IN UKRAINE. NEW CAPACITIES.



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**Workshop on Steps for Conducting Nuclear Power Plant Technology
Assessments**

**IAEA Technical Cooperation Project INT/4/141
17-20 November 2008, Vienna**

Summary info on Ukrainian NPPs currently in operation

NPP name	No. of power units	Reactor type	Installed capacity, MW (e)	Start of commercial operation	End of the original design life
Zaporozhskaya	1	WWER-1000/320	1000	10.12.1984	10.12.2014
	2	WWER-1000/320	1000	22.07.1985	22.07.2015
	3	WWER-1000/320	1000	10.12.1986	10.12.2016
	4	WWER-1000/320	1000	18.12.1987	18.12.2017
	5	WWER-1000/320	1000	14.08.1989	14.08.2019
	6	WWER-1000/320	1000	19.10.1995	19.10.2025
South Ukraine	1	WWER-1000/302	1000	31.12.1982	30.12.2012
	2	WWER-1000/338	1000	06.01.1985	06.01.2015
	3	WWER-1000/320	1000	20.09.1989	20.09.2019
Rivne	1	WWER-440/213	415	22.12.1980	22.12.2010
	2	WWER-1000/213	420	22.12.1981	22.12.2011
	3	WWER-1000/320	1000	21.12.1986	20.12.2016
	4	WWER-1000/320	1000	10.10.2004	10.10.2034
Khmelnitsky	1	WWER-1000/320	1000	22.12.1987	21.12.2017
	2	WWER-1000/320	1000	07.08.2004	07.08.2034
Total installed capacity of 15 nuclear units currently in operation			13835		

National Energy Strategy

By its decree issued on March 15th, 2006 the government of Ukraine adopted the National Energy Strategy development up to 2030

The main goals of the Ukrainian National Energy Strategy are:

- **Provision of adequate and reliable energy supply to meet the growing demands of the national industry and population, increase economic efficiency and make power generation ecologically more benign through technological innovations in modernizing existing and constructing new power generating facilities.**
- *Optimization of energy generation mix to ensure achievement of the following ratios by type of generation: Nuclear Energy – 52.1%; Thermal – 42.9%; Hydro and other generation types – 5%.*
- **Ensuring energy security by reducing dependence on the external fuel supplies (in gas, oil, uranium) from 54,8% in 2005 to 11,7% in 2030, due to a planned increase in usage of domestically produced coal, uranium, natural gas, and renewable sources of energy.**
- *Diversification of energy supply sources and supply routes by participating in international energy supply projects.*

New Nuclear Capacities Construction

The strategic task stated by **Ukrainian National Energy Strategy** in the field of **Nuclear Energy** complex is increasing of nuclear energy production more, than twice in comparison with 2005, by 2030.

The ways to reach the stated goal, envisaged by the Strategy:

- *By the end of 2010 construction and start of 3-6 hydroelectric generators at Tashlyk Hydro accumulating Power Plant with total capacity of 600 MWt;*
- *By 2016 construction and start of operation of Khmelnytski NPP – 3 and 4 nuclear power units (KhNPP-3,4);*
- *By 2020 start of new nuclear power units construction.*

Actions performed for KhNPP-3, 4 construction



Questionnaires` content for the units type evaluation

Due to the Ministry Regulations on the Interdepartmental Commission the Questionnaires were developed for the units type selection process.

2 groups of criterion

1 group – strictly obligatory

(all the projects must correspond to)

- ✓Compliance with safety criterion and principles;
- ✓Guarantying of nuclear and radiation safety principles;
- ✓Possibility for Ukrainian enterprises to participate in the project;
- ✓Potential possibilities of the main equipment producers;
- ✓Possibility of delivery of equipment to the KhNPP site;
- ✓Possibility of nuclear facility allocation at the KhNPP site.

2 group – evaluation of safety, economic issues, reliability etc. (are defined due to their contribution)

Were evaluated with scale from 0,7 to 1,2 for level of importance and information sufficiency

Were evaluated as satisfactory or unsatisfactory

Questionnaires` content for the units type evaluation (continuation)

21 criterion in the 2nd group, among them are:

- Compliance with the requirements on unit capacity;
- Compliance with Ukrainian NPP design and safety regulations;
- Reference in design area;
- Reference in scope of equipment construction, building and mounting, of maintenance and operation;
- Possibility of usage of the existing buildings, infrastructure and equipment;
- Design lifetime;
- Investments and extra investments;
- Staff availability for design, construction, building, mounting, maintenance and operation ensuring;
- Compliance with the European Union regulations and requirements;
- Availability for load rating performance;
- Possibility of putting into operation according to the time frame;
- Possibility of maneuver operation;
- Conditions of technical maintenance of the unit;
- The fuel cycle flexibility;
- Level of radwaste formation;
- Financial issues of project realization.

National Innovative Nuclear System Assessment Study based on INPRO methodology application

In March of 2006 the Ministry of Fuel and Energy of Ukraine approved terms of reference, action plan and organizational structure for a National INS Assessment Study based on INPRO methodology application.

The main tasks of the Ukraine's national INS assessment project were:

1. To assess “nuclear part” of the National Energy Strategy, which is based on the evolutionary reactor technology to be introduced within the next 20-30 years. The assessment focuses on the INS system with the main parameters outlined by the National Energy Strategy with consideration of open and closed nuclear fuel cycle options;
2. *To utilize the results obtained in the course of that assessment in order to lay informational, methodological, and R & D foundation to facilitate selection of ‘innovative type’ of INS system that, in the period beyond 2030-2050, could be introduced on a commercial basis, and could be based on the innovative reactor technology and corresponding nuclear fuel cycles.*

Specific INS Development Projects

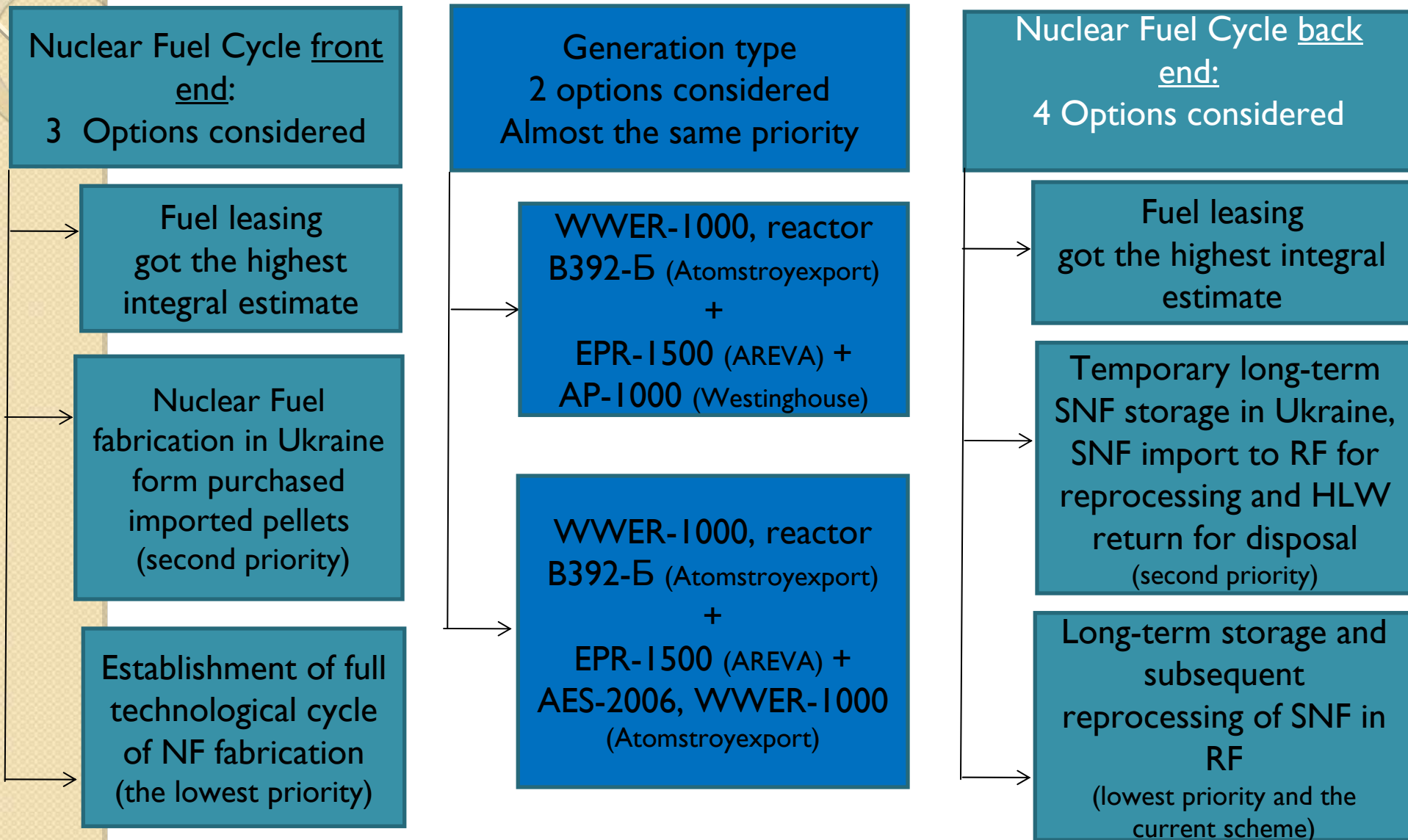
The subtasks of the National INPRO Project were arranged in the following logical sequence:

1. To assess the country's energy needs, available resources and potential role of nuclear power with consideration of power sources;
2. *To define the structure of the national INS based on the application of the PWR/WWER evolutionary reactor technology with consideration of national and regional factors, such as: available resources, nuclear fuel supplies, life extension and subsequent decommissioning of existing NPPs, spent fuel and RAW management, financing schemes, development of required infrastructure;*
3. To assess the INS selected using INPRO methodology;
4. *To identify necessary R & D work to successfully deploy the INS selected;*
5. To define scope of participation of interested national institutions and companies and main areas of desired governmental involvement in selecting INS for the medium to long-term perspective making allowance for the available national infrastructure, natural resources (uranium, zirconium, thorium) and established international cooperation.

NATIONAL REPORT ON INPRO ASSESSMENT IN UKRAINE USING THE INPRO METHODOLOGY FOR AN INNOVATIVE NUCLEAR ENERGY SYSTEM

- During the INPRO project realization Ukrainian experts and scientists (Energoatom, National Science Academy, Kharkov Physics Technical Institute etc.) had been performing the INS assessment using the INPRO methodology.
- *As a result the National Report on INPRO assessment in Ukraine using the INPRO Methodology for an Innovative Nuclear Energy System has been compiled and approved by the Ministry of Fuel and Energy of Ukraine and the INPRO Steering Committee in Ukraine.*
- At the end of September, 2008 the Report has been sent to the IAEA for consideration.
- *The Ukrainian National Report was admitted by the Agency as one of the best ones among the member states of the INPRO project in Europe.*

Results of the National INS Assessment using the INPRO Methodology in Ukraine



Results of the National INS Assessment using the INPRO Methodology in Ukraine

The highest priorities for the INS configuration

Option # 13:
Leasing Scheme →
→ WWER-392Б; AP-1000; EPR-1500 →
→ Leasing Scheme

Option # 14:
Leasing Scheme →
→ WWER-392Б; AES-2006; EPR-1500 →
→ Leasing Scheme



Thank you very much for your attention