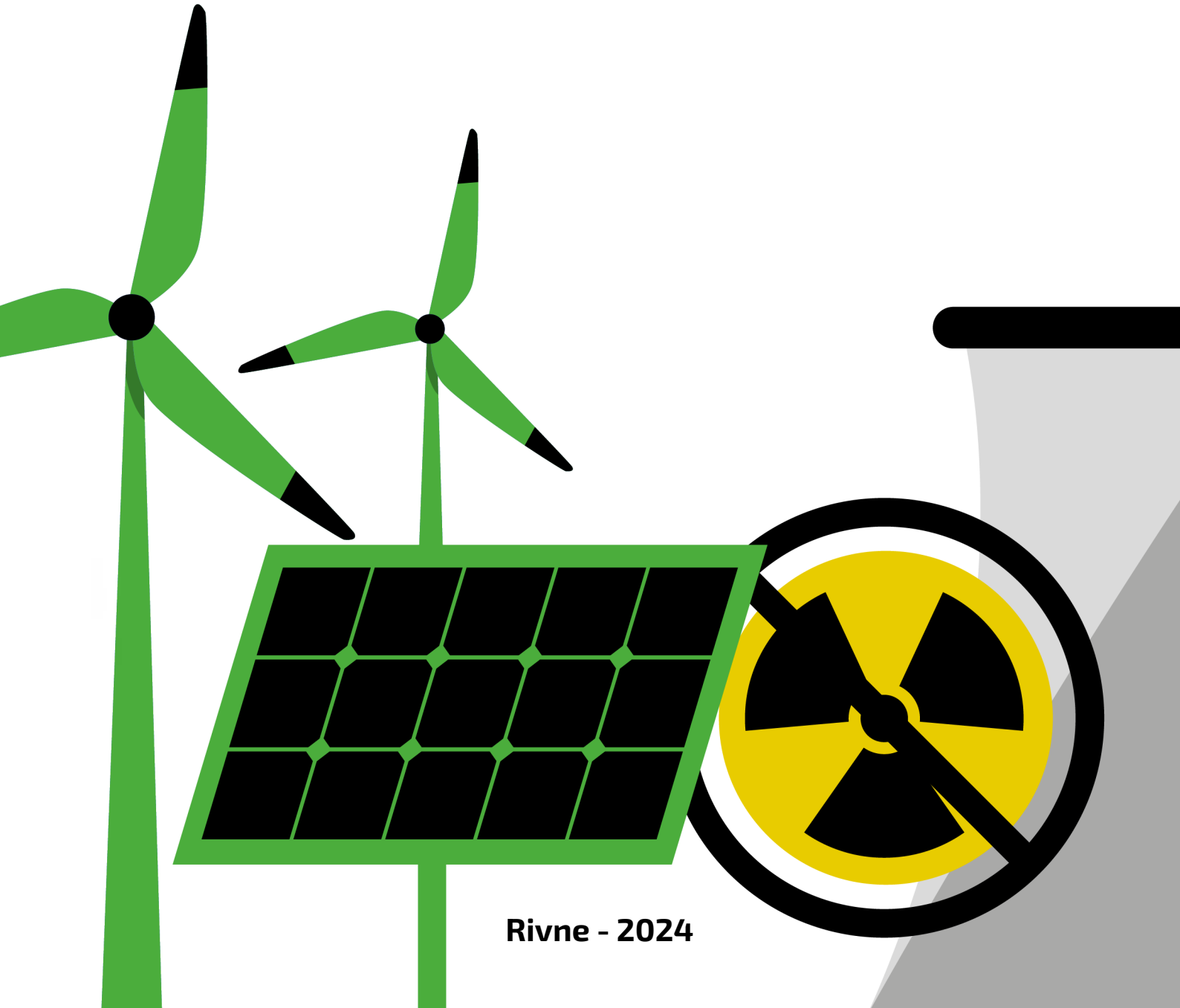
HEINRICH BÖLL STIFTUNG
КИЇВ

Ecoclub

екодія
ecoaction.org.ua

Analytical Paper

on the peculiarities of the completion of the 3-rd and 4-th units of the Khmelnytska nuclear power plant and construction of new units (5-th and 6-th)



Rivne - 2024

Authors: O. Lyashchuk, Y. Kvitka, A. Kolesnyk, O. Savchenko.
Editor: O. Pasyuk.

The publication was prepared within the framework of the project "Supporting Municipal Participation in the Energy Transition and Climate Policy Development" with the support of the Heinrich Boell Foundation in Ukraine and the project "Improving Environmental Impact Assessment (EIA) Tools in Ukraine to Ensure Public Participation and Environmental Compliance during the Reconstruction of Ukraine" with the support of the Bankwatch Network.

Contents

Introduction

Since becoming independent, Ukraine has been developing nuclear power and owns one of the largest fleets of nuclear power plants in the world.

The full-scale war of the Russian Federation has demonstrated that this type of generation has significant drawbacks. Now Russian troops control the largest nuclear power plant in Europe, threatening the security of the entire world.

Ukraine has the most tragic experience of the consequences of construction, commissioning and reaching the design parameters performed with violations and shortcomings (the Chornobyl nuclear power plant).

Therefore, the construction of new nuclear power plants or expansion of existing ones requires public involvement and thorough research with a clear definition of possible risks and how to prevent them.

The European integration process requires Ukraine to strengthen reforms in the nuclear energy sector, in particular by improving regulatory oversight, solving personnel problems, and harmonizing legislation with Euratom standards. NNEGC Energoatom should ensure increased responsibility in terms of safety and implementation of European standards.

Increased control over security factors in the nuclear energy sector and in the context of Energoatom's operations is also envisaged as part of European integration reforms.

In particular, Ukraine is required to make fundamental changes in the energy sector: reforming the energy market, improving energy efficiency and developing renewable energy. As for the nuclear sector, the requirements include the transformation of NNEGC Energoatom into a public sector joint-stock company and the appointment of an independent supervisory board. Ukraine also has gaps in the field of radiation protection of personnel, citizens and the environment, and in the management of radioactive waste and spent fuel.

Therefore, NGOs such as Ecoclub, Ecoaction, and Khmelnytskyi Energy Cluster consider it necessary to closely monitor the status of the third and fourth units completion projects at the Khmelnytska Nuclear Power Plant (hereinafter referred to as KhNPP) and the prospects for the construction of the fifth and sixth units.

The completion of KhNPP 3, 4 may possess a number of problems:

- *the use of Russian-made reactors that threatens national security and violates the principles of independence from the aggressor state;*
- *the lack of a competitive procedure for selecting reactor units and the corruption risks, which raises concerns about the transparency of the construction process;*
- *the unsatisfactory financial condition of Energoatom, the company responsible for the construction and a number of technical problems with the project;*
- *violation of national and international environmental standards and regulations;*
- *unknown financial parameters of the project.*

1 KhNPP 3 and 4: implementation history.

1.1. Historical background

In April 1975 Decision No. 8 of the USSR Ministry of Energy approved the construction of a nuclear power plant at the site near the village of Netishyn, Khmelnytska Oblast.

The technical design of the 4000 MW KhNPP was approved **in November 1979**. Construction of Unit 3 began **in September 1985**, and Unit 4 **in 1986**.

However, in the same year, the works were halted due to the Chornobyl accident, and in 1990 the Verkhovna Rada of the Ukrainian SSR declared a moratorium on nuclear power plant construction.

At the time of the construction halt, according to the State Enterprise "State Scientific and Technical Center for Nuclear and Radiation Safety"[1], the readiness of the third unit was 75% according to estimates/statements, and the fourth unit 28%. However, the existing building structures were not properly preserved and stayed unprotected from elements, which led to their partial flooding and corrosion.

In 1993, the Verkhovna Rada of Ukraine terminated the moratorium on the construction of nuclear power plants, which was introduced after the Chornobyl disaster.[2]

In July 2005, a first attempt to resume the construction was made. At that time, the Cabinet of Ministers adopted a decree "On Preparatory Measures for the Construction of New Khmelnytska NPP Units." To resume construction, they also began preparing the existing structures: cleaning and painting metal structures, installing temporary metal structures for maintenance work, installing pipelines to pump out water, pumps, and a temporary compressed air pipeline in the foundation of the reactor building.

In 2008, a tender for the supply of a reactor unit was held, in which the Russian company Atomstroyexport, the American company Westinghouse and the South Korean company KEPCO took part. The Russian company Atomstroyexport won the tender.

On June 9, 2010, the Cabinet of Ministers of Ukraine and the government of the Russian Federation signed a framework agreement on the completion of the third and fourth power units of the Khmelnytska NPP[3], which was ratified by the Verkhovna Rada in January 2011.

Under the agreement, the Russian side had to finance the project to the extent necessary for the design, construction, and commissioning of the units. The terms and amount of this loan were to be determined by a separate agreement.

---

1 To be or not to be or everything you wanted to know about the construction of KhNPP 3, 4 [Online resource] // State Enterprise "State Scientific and Technical Center for Nuclear and Radiation Safety"... — 2020: https://www.sstc.ua/news/buti-chi-ne-buti-abo-vse-sho-vi-hotili-znati-pro-budivnictvo-haes-3-4.

2 Resolution of the Verkhovna Rada of Ukraine "On Some Measures of Providing the National Economy with Electricity" [Online resource]. — 1993: https://zakon.rada.gov.ua/laws/show/3538-12#Text.

3 Order of the Cabinet of Ministers of Ukraine "On Signing the Agreement between the Cabinet of Ministers of Ukraine and the Government of the Russian Federation on Cooperation in the Construction of Khmelnytskyi NPP Units 3 and 4. [Online resource]. — 2010. — Mode of access to the resource: https://www.kmu.gov.ua/npas/243379705.

In September 2012, the Verkhovna Rada passed the Law of Ukraine "On the Siting, Design and Construction of Units 3 and 4 of the Khmelnytska Nuclear Power Plant"[4]. The project budget was 40 billion hryvnias, of which 80% was a loan from Russia and 20% was covered by an increase in electricity price.

After the beginning of the Russian invasion of Ukraine in 2015, the Verkhovna Rada adopted Law of Ukraine No. 696-VIII of 16.09.2015 "On Termination of the Agreement between the Cabinet of Ministers of Ukraine and the Government of the Russian Federation on Cooperation in the Construction of Units 3 and 4 of the Khmelnytska Nuclear Power Plant"[5]. The Law of Ukraine "On Siting, Design and Construction of Units 3 and 4 of the Khmelnytska Nuclear Power Plant" was also declared invalid.

On June 6, 2018, a government committee on economy, finance, legal policy, development of the fuel and energy complex, infrastructure, defense and law enforcement approved a feasibility study to complete the construction of Khmelnytska NPP Units 3 and 4. The feasibility study concluded that to complete the work, it was best to use VVER-1000 reactors from the Czech company Skoda JS.

It was planned to install turbines manufactured by the Ukrainian company Turboatom and generators from the Kharkiv-based enterprise Electrotyazhmash. The total capacity of the two power units was to be 2,200 MW, which would have allowed for the annual production of 16,226 billion kWh of electricity.

The construction of the two power units was estimated at UAH 72.437 billion (at prices as of May 2017), of which UAH 46.3 billion was to be spent on equipment. The work was expected to last 84 months, and the launch of Unit 3 was scheduled for 2025.

On April 4, 2019, President of Ukraine Petro Poroshenko signed a decree ordering the government to immediately submit to the Verkhovna Rada a draft law on the construction of Khmelnytska NPP Units 3 and 4.

On September 22, 2020, the President of Ukraine issued a decree obliging the government to submit a draft law on the siting, design, and construction of Khmelnytska NPP Units 3 and 4 to the Verkhovna Rada of Ukraine. Preparations for the completion of the units also begun and the American company Westinghouse, which provides technologies for VVER-1000 reactors, was involved.[6]

On February 12, 2021, a meeting was held at Khmelnytska NPP, chaired by Petro Kotin, Head of SE NNEGC Energoatom, to discuss the status of unfinished structures, necessary equipment, sources of financing and involvement of state-owned enterprises in construction.

---

4 The Law of Ukraine "On Siting, Design and Construction of Units 3 and 4 of the Khmelnytskyi Nuclear Power Plant" [Online resource]. — 2012: https://zakon.rada.gov.ua/laws/show/5217-VI#Text.

5 Law of Ukraine "On Termination of the Agreement between the Cabinet of Ministers of Ukraine and the Government of the Russian Federation on Cooperation in the Construction of Units 3 and 4 of Khmelnytskyi NPP" [Online resource]. 2015: https://zakon.rada.gov.ua/laws/show/696-19#Text.

6 AP1000 water-water nuclear reactor. Technology development for a changing climate. [Online resource] — Access to the resource: https://westinghousenuclear.com/ukraine/%D1%80%D0%B5%D0%B0%D0%BA%D1%82%D0%BE%D1%80-ap1000

On November 22, 2021, Energoatom and the American company Westinghouse Electric signed an agreement on the construction of two more new (5 and 6) power units at Khmelnytska NPP. [7]

On December 17, 2023, at a meeting at the Ministry of Energy of Ukraine, Energoatom President Petro Kotin and Westinghouse Electric CEO Patrick Fragman signed the agreement to purchase equipment for the construction of KhNPP Unit 5 with the AR1000 technology.[8]

1.2. Development of intentions to complete power units 3 and 4 in 2023-2024

On February 16, 2023, President of SE NNEGC Energoatom Petro Kotin inspected the construction site of power unit No.3, where roofing works were completed, a heating system was installed and equipment was being prepared for installation.[9]

In June 2023, Ukraine announced the intention to sign an agreement with Bulgaria to buy two reactors to substitute the loss of ZNPP.

April 2024 — the Verkhovna Rada reviewed draft law No. 11146 on the construction of units 3 and 4, according to which the completion of unit 3 would take about 2.5 years.[10]

Also, **in April 2024**, the environmental impact assessment (EIA) process for KhNPP Units 5 and 6 was launched on the e-EIA platform, although the feasibility study for these units has not yet been approved by the government, which contradicts the actual procedures.

On **April 30, 2024**, a meeting of the board on the completion of power units No. 3 and No. 4 was held under the chairmanship of Petro Kotin at Khmelnytska NPP.

On **May 10, 2024**, during an hour of questions to the government in the Verkhovna Rada, Energy Minister Herman Halushchenko said that the completion of Unit 3 would take another 2.5 - 3 years, and Unit 4 would take approximately 4 years. According to him, the readiness of Unit 3 (which does not yet have a reactor) has already reached 85%.

On **May 30, 2024**, Petro Kotin ordered the Energoatom team to connect power units 3 and 4 to the grid "according to the agreed schedule".[11]

June 17, 2024 — the draft law on the completion of power units 3 and 4 is recommended for the agenda of the Verkhovna Rada of Ukraine.

On June 27, 2024, a production meeting was held at KhNPP to discuss the readiness to start installing equipment at Unit 3 after the adoption of the law.

---

7 Energoatom and Westinghouse signed an agreement to start implementing the project for the construction of new power units at Khmelnytskyi NPP [Online resource] // Ukrainian Nuclear Society. 2021: https://ukrns.org/diyalnist/2021/mizh-naek-energoatom-ta-westinghouse-pidpysano-ugodu-shhodo-pochatku-realizacziyi-proyektu-budivnyczt-va-novyh-energoblokiv-na-hmelnyczkij-aes

8 Ukraine and the US Westinghouse signed an agreement on the purchase of equipment for Khmelnytskyi NPP Unit 5 [Online resource] // Ministry of Energy of Ukraine. — 2023: https://www.mev.gov.ua/novyna/ukrayina-ta-amerykanska-westinghouse-pidpysaly-uhodu-pro-zakupivlyu-obladnannya-dlya

9 Petro Kotin inspected the works on the completion of Khmelnytskyi NPP Unit 3 [Online resource] // Energoatom. — 2023: https://old.energoatom.com.ua/o-1802233.html.

10 Draft Law on Siting, Design and Construction of Units 3 and 4 of the Khmelnytskyi Nuclear Power Plant [Online resource] // Verkhovna Rada of Ukraine. — 2024: blob: https://itd.rada.gov.ua/544a9fd2-37a4-4756-ba4e-341c807451f2

11 Results of the regular meeting of the coordination board at KhNPP: the Energoatom team is united by the task to complete the construction of power units on time [Online resource] // Energoatom. 2024 — Access to the resource: https://old.energoatom.com.ua/o-3105241.html.

August 2024 — the draft law on the completion of power units 3 and 4 was removed from the agenda of the Verkhovna Rada meeting. The reasons included financial and technical issues, lack of agreement among MPs on the economic feasibility and sources of funding for the project.

1.3. Description of the types of reactors that were planned to be used during the history of the project

As part of the history of the project, it is already clear that the state had different approaches to technical solutions in the context of the completion of KhNPP 3 and 4, each of which is worth considering in more detail.

In 1985, during the initial plans for the construction of KhNPPs 3 and 4, it was planned to install a **VVER 1000\V-320 reactor**.

In 2008, as part of the first wave of resuming the idea of constructing KhNPPs 3 and 4, as mentioned above, the initiators of the construction intended to involve the Russian Atomstroyexport, using the **VVER 1000\V-392 reactor**. To this end, the solution was additionally enshrined in the Law on the Construction of KhNPPs 3 and 4 of 2012.[12]

In 2016, after the rejection of the Russian equipment, the option of using a reactor from the Czech company **SKODA JS a.s.** was considered, and an environmental impact assessment (EIA) was even conducted for these reactors (2018).

In particular, the Czech company SKODA JS a.s. proposed **VVER-1000** reactors. Therefore, in 2016-2017, the state updated the feasibility study for the construction of KhNPP units 3 and 4 with adjustments specifically for the use of the VVER-1000 reactor unit of SKODA JS a.s. It should be noted that the change of the reactor equipment supplier from Atomstroyexport to SKODA JS a.s. took place without a tender.

At the same time, during the above-mentioned feasibility study and EIA, Russian holding Obyedinennye mashinostroitelnye zavody owned SKODA JS a.s.

Subsequently, the ownership structure of SKODA JS a.s. was changed by introducing new corporate shareholders. Currently, the holding, which probably remains the real owner of SKODA JS a.s., includes GazpromBank and Obyedinennye mashinostroitelnye zavody[13], which are on the "sanctions list" of the National Security and Defense Council of Ukraine and the European Union, which confirms the continued influence of the Russian Federation on SKODA JS a.s.).

Accordingly, cooperation with SKODA JS a.s. in 2016-2017 and any interaction with this company in 2024, disregarding the concealed ultimate beneficiary through complications or blurring of the structure, contradicts the state policy in the field of national security of Ukraine and poses a threat to Ukraine and the affected states.

12 The Law of Ukraine "On Siting, Design and Construction of Units 3 and 4 of the Khmelnytskyi Nuclear Power Plant" [Online resource] // Verkhovna Rada of Ukraine. — 2012: https://zakon.rada.gov.ua/laws/show/5217-VI#Text.

13 CEZ. (n.d.). CEZ finally takes over Škoda JS, a major Czech company primarily operating in nuclear maintenance and engineering. Retrieved from https://www.cez.cz/en/media/press-releases/cez-finally-takes-over-skoda-js-a-major-czech-company-primarily-operating-in-nuclear-servicing-and-engineering-167450

After a significant resonance regarding the ownership structure of SKODA JS a.s., a new stage of the technical solution for KhNPP 3 and 4 has begun, the main idea of which is to use reactors purchased by the Bulgarian company NEC for the Belene nuclear power plant, the construction of which was canceled by the decision of the Bulgarian government.

As for the Belene project, it was initiated by the National Electricity Company (NEC), the main operator of nuclear facilities in Bulgaria, and used Russian VVER-1000 reactors.

The idea of building the Belene NPP originates from 1981 when the Bulgarian government decided to launch the project to meet the country's growing electricity needs. Construction began in 1987, but was suspended in 1990 due to economic difficulties and political changes after the fall of the communist regime.

In 2002, the project was resumed, and an agreement was signed with the Russian company Atomstroyexport for the supply of two VVER-1000 reactors. The agreement also included supply of key equipment from Russia.

The cooperation began but was not successfully completed, and in 2011 Rosatom filed a lawsuit in the International Court of Arbitration in Paris against Bulgarian Energy Holding (i.e. NEC) for breach of the terms of the cooperation[14]. The company demanded compensation for breach of contract and the cost of manufacturing and storing equipment, claiming that it had not received payment for equipment that had already been manufactured for the project.

In 2012, the Bulgarian government decided to terminate the Belene NPP project due to financial and political reasons.

In 2016, the court ruled in favor of Rosatom, ordering Bulgaria to purchase the equipment. After the court ruling and payment of about 620 million euros, Atomstroyexport handed over the manufactured equipment to Bulgaria. However, the construction of the NPP did not begin, as the reactors were only one part of the project, and the complete project required significant additional funding.

Given that the project had been frozen in Bulgaria for a long time, the Ukrainian side saw an opportunity to use these units to complete the KhNPP.

Initially, the negotiations were successful and the decision to sell the reactors was made in summer of 2023. Ukraine got 60 days to negotiate the deal. In particular, this information was confirmed by Banker.bg[15], which noted that in June 2023, the Bulgarian National Assembly authorized the Minister of Energy to negotiate with Ukraine on the sale of reactors at the minimum price that Bulgaria had already paid for the equipment.

After this deadline expired, the Bulgarian Parliament decided to extend the deadline given to the government by six months to finalize negotiations on the sale of two Russian nuclear reactors and related equipment to Ukraine[16].

---

14 Bulgaria pays 1.2 billion BGN to Russia for Belene NPP [Online resource] // MediaPool.BG — 2016: https://www.mediapool.bg/bulgaria-plati-na-rusiya-12-mlrd-lv-za-aets-belene-news257574.html.

15 News from Bulgaria and the World [Online resource]. — 2023: https://www.banker.bg/.

16 Bulgarian parliament continued negotiations on the sale of nuclear reactors to Ukraine / [Online resource] // RBC-Ukraine. — 2024: https://www.rbc.ua/rus/news/parlament-bolgariyi-prodovzhiv-peregovori-1726124998.html

On September 12, 2024, the Bulgarian Parliament approved a decision providing an additional six-month period to explore the possibility of using steam generators and other equipment from the Belene NPP as spare parts for the Kozloduy NPP. This means that Ukraine risks to purchase two reactors from Belene without steam generators, as they may be left for the needs of Kozloduy NPP[17]. It is known that 4 steam generators for unit 3, initially designed for the B-320 reactor unit, were delivered to the plant in the 90s. However, it is not known whether their operability was assessed either in 2012 or now[18]. Currently, negotiations between Ukraine and Bulgaria on the purchase of reactors are ongoing[19].

At the same time, given the Russian origin of the Belene reactors and their technical features, a logical question arises: is the use of this equipment really the best solution?

Several experts emphasize that the risks to national security in the context of equipment origin are more than significant.

Viktor Kurtev, a Ukrainian expert and former deputy director of Ukrenergo, notes that despite the fact that the reactors were supplied by Russia to Bulgaria many years ago, Bulgaria must obtain Russia's consent to transfer this equipment to Ukraine. In addition, the expert notes that there is a high probability that the delivered equipment is incomplete, in particular, there are no witness samples, because no one in the world can reproduce the conditions of smelting a specific batch of reactor vessel metal, so it will be necessary to organize illegal delivery of these samples together with passports of reactor vessels from Russia[20]. Witness samples are critically needed for periodic inspections of the residual strength of the reactor vessel under the influence of neutron fluxes.

Nikolay Steinberg, an expert with considerable experience, former Deputy Minister of Fuel and Energy (2002-2006), similarly points out that Bulgaria must obtain Russia's consent to the transfer of equipment and additionally notes that in the process of building and operating a nuclear power plant with equipment from Belene, a need for technical consultations with the equipment manufacturer (the Russian company Atomstroyexport) will inevitably arise[21].

As for the technical features, it is also worth considering if the reactors from Belene are compatible with the equipment designed and manufactured for KhNPPs No. 3 and No. 4.

In particular, the reactors VVER-1000 at Khmelnytska NPP 1 and 2 units belong to the B-320 series.

- This is a standard reactor version widely used in the former USSR.
- The design and safety systems were developed in the 1970s.
- It is the main series of reactors for which the unfinished power units No. 3 and No. 4 of Khmelnytska NPP were designed.

This is the most common type of VVER-1000 reactors used at most nuclear power plants in Ukraine. Similarly, KhNPPs No. 3 and No. 4 were supposed to install VVER-1000 reactors of the B-320 or B-392 series.

---

17 Pazarim se otche 6 meses za reactorite from Belene [Online resource] // Telegraph.bg. — 2024: https://telegraph.bg/bulgaria/novini/pazarim-se-oshte-6-meseca-za-reaktorite-ot-belene.-prodazhbata-na-oborudvaneto-na-ukraj-na-otlozheno.-reshavat-stavat-li-parogeneratorite-za-kozloduj-42749.

18 Steam generators from long-germ storage might be installed at KhNPP Unit 3 [Online resource]. — 2012: https://khmelnytsky.com.ua/ru/fullnews/79581

19 News from Bulgaria and the World [Online resource]. — 2024: https://www.focus-news.net/.

20 Viktor Kurtev. BULGARIAN MUGGLING [Online resource]. — 2024. — Access at: https://www.facebook.com/story.php?story_fbid=1056442399814367&id=100063458505237&rdid=YzMrDlwuCNk9tm0c

21 To purchase nuclear reactors from Bulgaria, it will be necessary to sign an agreement with Russia [Online resource] // Ukrinform. 2023: https://www.ukrinform.ua/rubric-economy/3735408-dla-kupivli-adernih-reaktoriv-u-bolgarii-treba-bude-pidpisati-ugodu-z-rosieu-ekspert.html

Instead, at the Belene NPP in Bulgaria it was planned to install VVER-1000 reactors of the B-466B series.

- This is a modernized version of the VVER-1000, designed specifically for projects in countries that sought to adapt Soviet technology to international safety standards.
- It includes improved security systems and modernized components.
- The B-466B series is designed to meet the requirements of the International Atomic Energy Agency (IAEA) and the European Union.

That is, although both series belong to the VVER-1000, they differ in technical specifications, namely in safety systems, design features, and quality standards. In particular, the main distinction of the B-466B design for Belene NPP from the NPP designs with VVER reactors of previous generations is the use of two emergency reactor shutdown systems and a double containment structure in the B-466B design for Belene NPP[22]. At the same time, **Khmelnytska NPP's turbine and reactor halls were designed specifically for B-320,** and therefore the use of **B-466B** equipment at **KhNPP Units 3 and 4** requires a thorough compatibility analysis, in particular, whether the existing structures meet the requirements of the new equipment.

In particular, the need for a compatibility analysis is confirmed by the opinion of the aforementioned expert Viktor Kurtev, who notes that the B-466 equipment has different size and composition, and therefore its installation at KhNPP would require the demolish the reactor shaft and steam generator boxes structures, etc. The expert holds the opinion that: *"it is impossible to combine B320 and B466 reactors within the existing structures and this is a major technical problem, even if we factor out that no one in the world builds a nuclear power plant without guarantees and participation of the general designer of the reactor unit in the construction. The 80% readiness of the building structures of Unit 3 is not a sufficient argument. On the contrary, 25% of Unit 4 readiness is a better argument in favor of fewer changes in the building structures, but in overall it is better to start from scratch in this case."*

In addition, the expert notes an important detail regarding the lack of fuel for the reactors, if they are installed. The latest test results proving that VVER-1000/V-320 units can be used in maneuvering mode, which were conducted in 2015 at Khmelnytska NPP Unit 2, cannot be used, as they were conducted for other nuclear fuel and other maneuvering conditions[23].

To summarize, the use of the equipment from Belene NPP, similarly to the SKODA JS a.s. equipment, contradicts the basic principles of national security and seems to be completely uninvestigated in terms of the technical feasibility of its use[24].

The fourth type of reactor considered for implementation at KhNPP, but for non-existing units 5 and 6, is **the American AP1000 reactor from Westinghouse.**

This option utilizes the latest technology, increased safety and energy efficiency, as the AP1000 is a more modern reactor that has several passive safety systems, according to the manufacturer. **However, the application of such a technical solution should also be investigated, and if this solution is selected, all procedures in accordance with the tenders, feasibility studies and EIAs required by law should be carried out.**

---

22 Fourth National Report on the Republic of Bulgaria for the fulfillment of its obligations under the Convention on Nuclear Safety [Online resource]. 2007: https://www.bnra.bg/media/2021/06/cns-iv-bulgaria-bg.pdf.

23 Viktor Kurtev. BULGARIAN MUGGLING [Online resource]. — 2024. — Access to the resource: https://www.facebook.com/story.php?story_fbid=1056442399814367&id=100063458505237&rdid=YzMrDlwuCNk9tm0c

24 To purchase nuclear reactors from Bulgaria, it will be necessary to sign an agreement with Russia [Online resource] // Ukrinform. 2023: https://www.ukrinform.ua/rubric-economy/3735408-dla-kupivli-adernih-reaktoriv-u-bolgarii-treba-bude-pidpisati-ugodu-z-rosieu-ekspert.html

Additionally, the permitting status of each of the reactors planned for use at KhNPPs should be considered in the discussion on the type of reactor.

"SKODA JS a.s":

- the EIA conclusion for the construction of KhNPP Units 3 and 4 (for the reactor of the Czech company SKODA JS a.s.) was issued in October 2021;
- the list of requirements and the necessary documentation, including physical site investigation (as required in the EIA conclusion), especially before the start of the planned activity, are not public;
- report on the state review of nuclear and radiation safety of KhNPP 3, 4 feasibility studies for the reactor of SKODA JS a.s. — is not available.

The use of reactors from Belene:

- no investigation has been conducted.

Other technologies, and combination of technical solutions:

- no investigation has been conducted.

That is, there is currently no clarity as to which technical solution will be used during the construction of KhNPPs 3 and 4. It is obvious that each of the solutions under consideration has many strategic, technical, safety, and procedural (availability of documentation) problems.

At the same time, the analysis of the contract with Westinghouse (for KhNPPs 3 and 4) allows us to make several assumptions about the direction of technical solutions the state is considering.

On November 20, 2023, an agreement between Westinghouse Electric Sweden AB and STATE ENTERPRISE "NATIONAL NUCLEAR ENERGY GENERATING COMPANY 'ENERGOATOM" entitled "Analysis of Options to Complete Construction of Khmelnytska NPP Unit 3 and Unit 4 Using Westinghouse Reactor Technology Experience. Phase 1:" in the amount of 700 000 EUR (seven hundred thousand euros) was concluded on the Prozorro online procurement platform[25] [26] [27].

According to the contract,the analysis of the completion possibility of KhNPP 3 and 4 will be carried out in stages.

Stage 1 consists of analyzing procurement options for the complete reactor, including the reactor vessel, reactor topside, reactor vessel support rings, and preliminary evaluation of the related building structures.

The following works are envisaged as part of this stage:

- analysis of reports and current state of the reactor building of KhNPP Unit 3;
- analysis of design drawings of the reactor shaft building structures;
- detailed inspection of the relevant areas of the reactor building to assess the current condition and scope of construction and installation work performed earlier;

---

25 Prozorro [Online resource] — Access to the resource: https://prozorro.gov.ua/uk

26 Analysis of options for completing the construction of KhNPP-3 and KhNPP-4 using Westinghouse's experience in the field of reactor technologies. Stage 1 [Online resource]. — 2023. — Access to the resource: https://prozorro.gov.ua/tender/UA-2023-11-20-014573-a

27 Contract "Analysis of options for completing the construction of KhNPP-3 and KhNPP-4 using Westinghouse's experience in reactor technology. Stage 1" [Online resource]. — 2023. — Access to the resource: https://ecoclubrivneorg.sharepoint.com/:b:/s/ecoclubrivne.org/EZE1iogKys9MutH8jHy3yK0BY45oiJnuqnFaSHDuOQzhrQ?e=df4IdD.

- assessment of the feasibility of two potential procurement strategies:
- option A – acquiring the B-466B reactor unit (stored at the Belene NPP site);
- option B – acquiring the B-320 reactor from Skoda JS.

Option B also includes determining the legal possibility of cooperation between Westinghouse and Skoda JS; involving Westinghouse's chain of suppliers under the AR1000 project to eliminate potential equipment shortages.

To summarize, the studies will be conducted for Option A (obtaining the B-466B unit stored at the Belene NPP site) and, if agreements are reached to purchase Skoda (Option B), for this option as well. At the same time, Option B will use the documentation of the 2018 feasibility study, which has already passed the EIA procedure and the SNRIU's conclusion on nuclear and radiation safety, after which it is possible to adopt the relevant law and start construction.

In this way, options for using a particular type of reactor will be studied, and this obviously makes it impossible to take any action in the context of completing KhNPPs 3 and 4 until the relevant technical decision is taken and all legal procedures for the chosen option are in due order.

1.4. Legalization Procedure for NPPs

Let's take a closer look at the procedure for legalizing the selected technical solution.

If there are plans to change the reactor, it is necessary to follow a certain procedure, which has taken place in case of KhNPPs 3 and 4:

1. In 1985, the Ministry of Energy of the USSR issued an order to build VVER-1000/B-320 reactor units. Construction of Khmelnytska NPP Unit 3 began in September 1985 and Unit 4 in June 1986.

2. The site selection and documentation of the site selection were carried out in accordance with the requirements of the applicable regulatory documents at the stage of construction of power unit No. 1.

3. In 1990, a moratorium on the construction of new nuclear power units was imposed, and the construction of Khmelnytska NPP units 3, 4 was suspended.

4. The Cabinet of Ministers of Ukraine (CMU) Resolution No. 281r of 21.07.2005 "On Preparatory Measures for the Construction of New Units of Khmelnytska NPP" ordered to resume construction of KhNPP Units 3 and 4.

5. In 2008, the Ministry of Fuel and Energy held a tender to select the type of reactor design for the completion of KhNPP Units 3 and 4, which results (i.e. selection of the VVER-1000/B-392 reactor type) were approved by the Cabinet of Ministers of Ukraine Resolution No. 118 of February 18, 2009 "On Priority Measures for the Construction of KhNPP Units 3 and 4".

6. In 2011, the operating organization (hereinafter referred to as the OO), with the involvement of PJSC Kyiv Research and Design Institute Energoproekt (hereinafter referred to as PJSC KIEP), developed and submitted to the State Enterprise Ukrderzhbudekspertyza the materials of the feasibility study "Construction of Units 3 and 4 with a capacity of 2000 MW of Khmelnytska NPP".

7. On March 13, 2012, the SNRIU Board held a meeting to approve the conclusion of the state nuclear and radiation safety review of the feasibility study for KhNPP units 3 and 4, which envisaged the use of VVER-1000 (B-392).

8. The CMU Order "On Approval of the Feasibility Study for the Construction of Khmelnytska NPP Units 3 and 4" of 04.07.2012, No. 498-r **approved the feasibility study for the construction of KhNPP Units 3 and 4, envisaging the use of VVER-1000 (B-392). On September 06, 2012, the Verkhovna Rada of Ukraine adopted the Law of Ukraine No. 5217-VI "On Siting, Design and Construction of Khmelnytska NPP Units 3 and 4" with VVER-1000 (B-392).**

9. The Russian-Ukrainian relations made it impossible to build power units using VVER-1000 (B-392) envisaged in the feasibility study, so on September 16, 2015, the Law of Ukraine No. 697-VIII "On the Repeal of the Law of Ukraine On Siting, Design and Construction of Units 3 and 4 of the Khmelnytska Nuclear Power Plant" was adopted.

10. Based on the results of negotiations between the Energoatom Company and potential participants of the construction of KhNPP Units 3 and 4, a decision was made to change the supplier of reactor technology and equipment to a consortium of Czech companies led by Skoda JS a.s.

11. The use of VVER-1000 reactor unit manufactured by Skoda JS a.s., subject to the construction of KhNPP Units 3 and 4, is provided for by Technical Decision No. KP.46.001-14 "Construction of KhNPP Units 3 and 4. Conceptual Technical Solution" (hereinafter referred to as the Conceptual Technical Solution No. KP.46.001-14), agreed by the management of the operating organization (OO), SNRIU, the design organization PJSC KIEP, the management of Skoda JS a.s., the Ministry of Regional Development, Construction, Housing and Communal Services and the Ministry of Energy and Coal Industry of Ukraine.

12. In 2015, the OO developed and approved with the SNRIU "Technical Requirements for VVER-1000 Reactor Unit for Khmelnytska NPP Units 3 and 4. TT.46.003-15", which defined safety requirements and features of the reactor unit and its main components.

13. To perform the state expertise, the SNRIU submitted updated/revised materials "Construction of KhNPP Units 3 and 4. Feasibility Study" (hereinafter referred to as the Feasibility Study), which contained information on the need to construct KhNPP Units 3 and 4, compliance with the requirements of the current rules and regulations of the site for the location of the units and their configuration, basic technological, architectural and construction solutions, operation and decommissioning, as well as ensuring nuclear and radiation safety of KhNPP Units 3 and 4.

The materials of the feasibility study approved by the CMU Resolution No. 498-p of 04.07.2012 were updated/adjusted in view of the following:

- replacement of the supplier of the reactor unit (RU) and type of RU from VVER-1000/B-392 to VVER-1000 manufactured by Skoda JS a.s. in accordance with the Conceptual Technical Solution No. KP.46.001-14 and Technical Requirements for VVER-1000 Reactor Unit 3,4 of Khmelnytska NPP. TT.46.003-15" (hereinafter referred to as the Technical Requirements for the RU);
- the need to take into account additional solutions and measures in the design of power units in accordance with TT.46.003-15 "Technical Requirements for VVER-1000 Reactor for Khmelnytska NPP Units 3, 4" and taking into account the measures of the Complex (Consolidated) Safety Upgrade Program for Nuclear Power Plants of Ukraine (CCSUP);
- the need to implement the provisions of laws and regulations amended or enacted after the approval of the feasibility study (FS).
- publication of the EIA report on the construction of KhNPP Units 3 and 4 in 2019.

The general requirements to the composition and content of the FS are defined in the Section 5 and Annex B of the State Construction Standards DBN A.2.2-3-2014 "Composition and Content of Construction Project Documentation". Additionally, the OO used the Decision on the Scope and Composition of Information to be Provided in the Feasibility Study for the Completion of KhNPP Units 3 and 4 on Nuclear and Radiation Safety and Environmental Impacts, approved by the SNRIU on 10.01.2009, when developing the FS. As we can see, the legal procedures for the construction of a nuclear power plant are very complicated, complex and regulated. A significant share of the legal procedure for the construction of KhNPP units 3 and 4 was completed during the preparation of the necessary documentation, approval of the use of Russian reactors and change of the technical solution to Skoda JS a.s.

Regarding the use of the Belene reactors, there is no information on whether any work was done to legalize their use. The absence of information indicates that the necessary procedures were not carried out and that the procedures for legalizing the change of reactors were grossly violated.

1.5. Draft law on the construction of KhNPP Units 3 and 4. Status: withdrawn from consideration

The adoption of the law on the completion of power units 3 and 4 by Verkhovna Rada deserves special attention.

Voting on the draft law is currently suspended, but it can resume any time, although most MPs have noted the critical comments to the draft law.

In particular, the draft law No. 11146[28] defines the location of KhNPP units 3 and 4; the number of reactors, their type and general parameters (each unit is to have a VVER-1000 reactor (pressurized water reactor).

It also defines the general requirements for the design and construction of power units; the rate of the socio-economic compensatory fee to the population for the risk of living in the Khmelnytska NPP observation area during the construction of power units 3 and 4. After the draft law was prepared by its initiators, the document was sent to the Verkhovna Rada Committee and relevant ministries, which submitted a number of comments to the draft.

In particular, the comments of the Anti-Corruption Committee stated that **the draft law contaied a provision entailing corruption-prone factors.**

The draft law:

- lacks competitive procedure for selecting the type of reactor units for these power units;
- lacks information on requests to reactor manufacturers in other countries and analysis of their proposals, in particular, on the cost of construction, technologies used in their units, the possibility of adapting other reactor units to existing facilities, and compliance with safety requirements. In other words, conditions have not been created to ensure a competitive selection of reactors type;
- it is proposed to use VVER-1000 reactor units that are manufactured by the Russian corporation Rosatom using technology owned by the Russian Federation. Therefore, there is no justification for the possibility of warranty service without the involvement of the aggressor state.

Accordingly, guided by the provisions of paragraph 3 of part one of Article 16 of the Law of Ukraine "On Committees of the Verkhovna Rada of Ukraine", part one of Article 93 of the Rules of Procedure of the Verkhovna Rada of Ukraine, the Committee at its meeting on July 16, 2024 (Minutes No. 164) concluded and decided that the draft Law of Ukraine "On the Siting, Design and Construction of Units 3 and 4 of the Khmelnytska Nuclear Power Plant" (Reg. No. 11146) does not meet the requirements of anti-corruption legislation[29].

The expert opinion of the Ministry of Finance of Ukraine on the draft law No. 11146 of 03.04.2024 states that there are risks regarding the financing of the construction. In particular, the Ministry of Finance emphasized that according to the feasibility study "Construction of KhNPP Units 3 and 4" approved by the Cabinet of Ministers of Ukraine on 26.07.2018 No. 579-r, the total estimated ***cost of construction is UAH 72.3 billion,*** and the construction customer is Energoatom JSC.

---

28 Draft Law on Siting, Design and Construction of Units 3 and 4 of the Khmelnytskyi Nuclear Power Plant [Online resource] // Verkhovna Rada of Ukraine. — 2024: https://itd.rada.gov.ua/billInfo/Bills/Card/43948.

29 Opinion (anti-corruption expertise) [Online resource] // Verkhovna Rada of Ukraine. — 2024: https://itd.rada.gov.ua/billInfo/Bills/pubFile/2449237.

At the same time, according to the results of financial and economic activities in 2022, Energoatom JSC received a net loss of UAH 6.75 billion, and in 2023 — UAH 8.9 billion. As of 01.01.2024, the uncompensated loss of Energoatom JSC amounted to UAH 200.8 billion, and the debt amounted to UAH 42.5 billion, the service of ensuring the availability of electricity for household consumers adds another UAH 20 billion owned to the State Enterprise Guaranteed Buyer.

Therefore, the Ministry of Finance also did not approve the draft law[30].

The combination of these factors led to the removal of the draft law from the agenda. At the same time, there is a risk of its return without taking into account all the shortcomings.

We also provide the position of the management of NNEGC Energoatom on the above-mentioned draft law. In particular, Acting Chairman of the Board of NNEGC Energoatom P. Kotin published a column in which he noted: *"Under these circumstances, stopping the development of domestic nuclear energy, as suggested by some politicians and "experts" calling on the Verkhovna Rada not to vote for the draft Law "On the Siting, Design and Construction of Units 3 and 4 of the Khmelnytska Nuclear Power Plant" No. 11146, is a crime against the people of Ukraine and future generations of Ukrainians"*[31].

30 Expert opinion of the Ministry of Finance of Ukraine [Online resource]. — 2024: https://www.kmu.gov.ua/storage/app/bills_documents/document-4027175.pdf

31 LOOK: We did it then, we need to do it now [Online resource] // KyivPost.com. — 2024: https://www.kyivpost.com/uk/opinion/37987.

2 Current situation regarding construction of power units 3 and 4

Despite the fact that the Law on Construction has not been adopted, KhNPP units 3 and 4 are being prepared for construction with the involvement of Ukrainian and international partners.

Currently, restoration work is underway at units 3 and 4 of Khmelnytska NPP[32]. In particular, an overpass connecting the to-be-built unit No. 3 to the operating unit No. 2 has been installed at KhNPP. This step was part of the restoration work at KhNPP Units 3 and 4, as the new overpass connects the two power units. In addition, in the last month alone, Khmelnytska NPP has conducted a number of procurements through ProZorro, which may indicate the implementation of a large project. The following procurement has taken place:

- engineering and geological surveys for the construction of an apartment building for construction workers in Netishyn (KhNPP satellite city);
- four modular houses for temporary residence that cost 1.5 million per unit;
- 30 "dressing rooms" costing 800 thousand UAH each, six canteens costing 860 thousand, three meeting rooms costing 1 million, and a medical center costing 600 thousand;
- UAH 9 million worth of protective equipment for construction workers, such as helmets and masks for welders;
- a concrete mixing plant for UAH 11 million.

The fact of these procurements is confirmed by ProZorro data and the following identifiers of logistics procurement[33]: UA-2024-06-12-011005-a-c2; UA-2024-06-17-004890-a-c1; UA-2024-05-31-004963-a-b2; UA-2024-05-31-004963-a-c1; UA-2024-04-30-006507-a-b1; UA-2024-04-22-011138-a-c1.

We emphasize that the massive procurement is surprising to industry experts, as there are more urgent costs for NNEGC Energoatom, and there is no technical solution for KhNPPs units 3 and 4.

Thus, according to the commentary of Olha Kosharna, co-founder of the Anti-Crisis Nuclear Expert Center of Ukraine: "Energoatom was engaged in preparatory work for the construction of Kh3/Kh4 power units. They repaired a crane for UAH 215 million, purchased construction trailers, but did not create stocks of transformers for their NPPs. For example, in July, two transformers at the South Ukrainian NPP burned down simultaneously in one day. They announced a tender for the purchase of transformers, fired the director, appointed another, but the problem has not been solved"[34].

We also draw attention to the services procured to legalize the construction of new blocks.

Below are the planned studies related to the construction of nuclear units. Among them is "Conducting a State Nuclear and Radiation Safety Expertise" which meets the terms of the EIA conclusion on the construction of KhNPP 3 and 4. However, such a procurement indicates a violation of the procedure, as the EIA conditions have not yet been met, the technical solution has not been tested for feasibility, while the preparatory work is already underway.

---

32 To prepare for the completion of KhNPP units, twice as many specialists will be attracted [Online resource] // Energoatom. — 2024: https://energoatom.com.ua/ua/post/1524

33 Identifiers of procurement [Online resource] // Edition "Our Money." — 2024. — Access to the resource: https://t.me/NashiGroshiUA/1719.

34 Energoatom did not build the necessary protective structures over open switchgear [Online resource] // Espresso publication. — 2024: https://espreso.tv/atomna-energetyka-energoatom-ne-zbuduvav-neobkhidnikh-zakh-isnikh-sporud-nad-vidkritimi-rozpodilchimi-pristroyami-ekspertka-z-pitan-yadernoi-energetiki-y-bezpeki-kosharna

Procurement	Procurement status
Miscellaneous engineering services (Engineering services for maintenance (re-preservation) of equipment Kh3, Kh 4 of the Khmelnytska NPP branch of Energoatom JSC)[35]	The auction is canceled.
Provision of services under the subject: "State Nuclear and Radiation Safety Review of Documents Submitted by the Khmelnytska NPP Branch of the Energoatom Company to the SNRIU for Approval"[36].	Term of delivery of goods, performance of work or provision of services: December 31, 2025. Date of conclusion: 04/18/2024. State Scientific and Technical Center for Nuclear and Radiation Safety.
Public opinion poll service[37].	The agreement was concluded on 04.09.2024. Individual entrepreneur Oksana Mykytyuk. The agreement is valid until 20.09.2024.
Service for microbiological and chemical research of finished products[38].	The agreement was signed on 10.09.2024. Khmelnytska Regional Center for Disease Control and Prevention of the Ministry of Health of Ukraine. The agreement is concluded until 31.12.2024.
Repair of anti-corrosion coating of the CWO equipment[39].	The agreement was signed on 13.08.2024. SMALL PRIVATE ENTERPRISE "HERMES S". The contract is concluded until 11/30/2024.
Adjustment of the Regulation on NPP Cooling Pond Purge (discharge of heat exchange water from the industry water pond into a water body)[40].	LLC Research and Production Firm Ligos, notice of intention to enter into an agreement.

35 Miscellaneous engineering services (Engineering services for the maintenance (re-preservation) of equipment Kh 3, Kh 4 of the Khmelnytska NPP branch of Energoatom JSC) [Online resource]. 2024: https://prozorro.gov.ua/tender/UA-2024-03-15-010967-a

36 Provision of services under the subject:"Conducting a state nuclear and radiation safety review of documents submitted by the Khmelnytska NPP branch of the Energoatom Company to the SNRIU for approval" [Online resource]: https://prozorro.gov.ua/tender/UA-2024-05-01-010401-a

37 Public opinion poll service [Online resource]. — 2024. — Access to the resource: https://prozorro.gov.ua/tender/UA-2024-09-09-002093-a

38 Service for microbiological and chemical research of finished products [Online resource]. — 2024: https://prozorro.gov.ua/tender/UA-2024-08-05-002353-a

39 Repair of anticorrosive coating of CWO equipment [Online resource]. — 2024: https://prozorro.gov.ua/tender/UA-2024-06-28-003010-a

40 Correction of the Regulations for purging the NPP cooling pond (discharge of heat exchange water from the process pond into a water body) [Online resource]. 2024: https://prozorro.gov.ua/tender/UA-2024-08-26-005772-a

3 Problems of the KhNPP 3 and 4 completion project

3.1 National security aspect

As noted above, both the procurement of Skoda JS a.s. reactors and the use of reactors from the Belene NPP pose significant risks to Ukraine's national security.

In the case of the Skoda JS a.s. reactors, the manufacturing company was owned by a Russian holding company, which includes the main companies of the Russian Federation that are under sanctions in Ukrainian and the EU. Even though the beneficiary of the company has changed, there is no evidence that this move was not to disguise the real beneficiary to avoid sanctions. As for the reactors from the Belene plant, experts believe that the transfer of these reactors is impossible without the consent of the Russian Federation, their use in construction without the participation of specialized designers from the Russian Federation seems unlikely, as well as the possibility of using other than Russian fuel in the operation.

At the same time, the possibility of even indirect involvement of the Russian Federation, which is destroying Ukraine's energy system, in the construction of new energy facilities in the country looks absolutely surreal and cannot be tolerated by the public.

3.2. Technical aspect

Designs

In the available studies and reports on the prospects for completion of power units 3 and 4 for 2006-2020 (see below), experts have drawn attention to the following technical issues:

- defects in structures (mechanical damage);
- lack of complete information on the condition of the structures;
- unusable condition of the monolithic walls;
- the emergency condition of metal elements and the need for dismantling;
- lack of additional inspections on the strength of structures.

According to the study "Construction of Khmelnytska NPP Units 3 and 4: Project Risk Analysis" (June 2018, hereinafter — the Study)[41], in 2006-2007, the Kyiv Research and Design Institute Energoproekt conducted an inspection, research and assessment of the technical condition of structures of the buildings at Unit 3. The inspection revealed that in 2006-2007, the building structures had several defects. **The inspection report repeatedly mentions mechanical damage to structures, corrosion of armature and metal elements of ferroconcrete structures, rust and cracks in concrete.**

In 2009, the SNRIU Board reviewed the reports on the structure analysis developed during the inspections. The main conclusion was that the reports lacked complete information. The reports did not contain enough data, in particular, not all premises and structures were analyzed (for example, because everything below the sea level was flooded).

The study also notes that from 2008 to 2013, repair and construction works were carried out on the building structures of KhNPP Unit 3, which were 80% complete according to the concluded contracts. No repair and restoration works were performed at the KhNPP Unit 4.

41 Construction of Khmelnytskyi NPP Units 3 and 4: Project Risk Analysis [Online resource] // Center for Environmental Initiatives "Ecoaction" — 2018: https://ecoaction.org.ua/sporudzhennya-atomnyh-blokiv-khaes.html.

The itudy concluded that the building structures of KhNPPs 3 and 4 can be used only after repair and construction works. At the same time, such repairs may be large-scale: the Study states that the "external and internal monolithic walls" of the underground part of the block pumping station of KhNPP Unit 3 are recognized as "unsuitable for usual operation" and some metal elements (stairs, pipes) are in an emergency condition, so they need to be dismantled.

At the same time, experts emphasize that the condition of armature of ferroconcrete structures was not analyzed at all. They also did not analyze the possibility of using VVER-1000/V-392B on structures intended for VVER-1000/V-320. The SNRIU Board recommended Energoatom to finalize the reports on this issue. However, according to Ihor Shevchenko, Director of the State Scientific and Technical Center for Nuclear and Radiation Safety, as of August 2020, no new documents were received by the SNRIU[42].

In 2017, the SNRIU's Conclusion of the State Nuclear and Radiation Safety Review of the FS stated that the draft FS was approved subject to the following conditions: the implementation of mandatory studies on the use of existing building structures of power units 3, 4 and a number of others. According to the Ministry of Energy, the survey will be completed before the start of the Project stage, i.e. after the final decision to continue construction. To perform the survey, Energoatom has to prepare technical requirements. As of now, there is no information on the preparation of such requirements.

In addition, in 2011, it was required to create an additional protective containment of the reactor vessel from the outside that increases the likelihood of retaining radioactive materials inside the reactor in an emergency event, as provided for in the design solution for KhNPP Units 3 and 4 based on the 1992 NPP design. In 2012, the SNRIU worked on these issues. The SNRIU Resolution "On the Results of the State Nuclear and Radiation Safety Review of the Feasibility Study for the Construction of KhNPP Units 3 and 4" (57) stated: ***"The feasibility study materials do not substantiate the possibility of using existing building structures designed for VVER-1000/V-320 for the construction of power units with VVER-1000/V-392 technical specifics of reactors, leaving this an open issue"***. This was supposed to be implemented at the next stage of the Project but has never been done.

In January 2016, the Ministry of Energy and Coal Industry sent a letter to Energoatom and Ukrenergo requesting to determine the feasibility of constructing two new units at KhNPP[43]. In the letter, the Ministry drew attention to the risks posed by the potential use of existing building structures and required an additional independent inspection of their strength and compliance with the safety requirements for the operation of nuclear facilities. The Ministry of Energy also pointed out that "the existing building structures are not suitable to accommodate modern reactors that fully comply with the IAEA and other international organizations recommendations on the safety of nuclear facilities."

According to the available information, no additional surveys or inspections have been conducted to fulfill the requirements of the Ministry of Energy.

42 To be or not to be or everything you wanted to know about the construction of KhNPP 3, 4 [Online resource] // State Enterprise "State Scientific and Technical Center for Nuclear and Radiation Safety"... — 2020: https://www.sstc.ua/news/buti-chi-ne-buti-abo-vse-sho-vi-hotili-znati-pro-budivnictvo-haes-3-4.

43 The Ministry of Energy and Coal Industry asks Energoatom to determine the feasibility of building two units at Khmelnytskyi NPP [Online resource] // UNIAN News Agency — 2016: https://www.unian.ua/economics/energetics/1252739-minenergovugillya-prosit-energoatom-viznachiti-dotsilnist-budivnitstva-dvoh-blokiv-na-hmelnitskiy-aes.html.

3.3. Cooling of power units

Another significant technical challenge for the completion of the units is cooling.

In particular, since 2007, experts have been discussing the issue of the amount of water to sufficiently cool KhNPP power units.

In 2007, experts of the Public Councils under the Ministry of Nature Protection and Environment of Ukraine and the State Nuclear Regulatory Committee of Ukraine stated that: *"Khmelnytska NPP is located in the upper reaches of the Goryn River, which annual runoff does not allow cooling 4 power units at KhNPP without destroying the Goryn ecosystem"*[44].

Subsequently, for example, in July 2016 and 2017, additional water was pumped from the Horyn River, although only 2 KhNPP units were in operation. This indicates a regular need for additional water to cool two KhNPP reactors. That is, in the case of completion of two more power units, the use of water from the Goryn River to cool 4 units could have an even more significant impact on the ecosystem of the waterbody.

In addition, on February 26, 2024, a notification was published at the EIA register on the planned activities of the Khmelnytska Nuclear Power Plant, a separate subdivision of the National Nuclear Energy Generating Company Energoatom (Registration No. 5811). The document envisages the construction of facilities to connect the reservoir of the Chysta Voda quarry with the Goryn River and the existing reservoir of the Polyany village quarry in Shepetivka district of Khmelnytska region.

The planned complex of structures is designed to improve the flow in the Chysta Voda quarry and involves the construction of a culvert to connect the Chysta Voda quarry with the Goryn River.

However, based on the facts presented in the EIA report of the "Construction of facilities to connect the Chysta Voda quarry reservoir", and the results of public hearings, it is obvious that one of the purposes of the planned activity is to use water from Chysta Voda for the technical needs of KhNPP. That is, initially, these works were planned to improve the condition of the plant's reservoir, with a possibility of its use for KhNPPs 1 and 2 needs, but in fact they are being done to improve the supply of water and appropriate cooling to KhNPP.

Despite the steps taken to ensure cooling of the existing KhNPP units, they are not enough. The acceptability of the technical solutions for cooling units 3 and 4 in the light of using the same reservoir is controversial. The public has no information on other proposed solutions.

The technical problems of completing the KhNPP are emphasized in the specialized documents and experts' commentaries. In particular, the aforementioned Olga Kosharna noted: "The feasibility study for the construction of the third and fourth reactors of the Khmelnytska NPP was approved in 2017, but since then, much has changed, including the prices of equipment and fuel. In addition, the approved feasibility study referred to VVER reactors manufactured by the Czech company Škoda. Now they are talking about purchasing other reactors from Bulgaria. Therefore, in my opinion, a new feasibility study needs to be developed for construction, and this is a very large-scale document that should contain the results of a large number of surveys — sanitary, fire, construction, etc.

44 Crisis in Water Supply of Nuclear Power Plants of Ukraine [Online resource] // National Ecological Center of Ukraine. — 2007: https://necu.org.ua/nuc-water-ua/.

The sites at Khmelnytska NPP have also been prepared for reactors of a different modification. These reactors will not be able to be placed geometrically in available shafts, so they will have to be rebuilt"".[45]

3.4. Environmental risks

The process of environmental impact assessment (EIA) for Khmelnytska NPP Units 3 and 4 is not new to Ukraine. We note that the EIA for KhNPP-3 and KhNPP-4 is one of the most discussed topics in the nuclear energy sector in Ukraine.

The EIA procedure includes an assessment of the environmental impact in the context of possible accidents, taking into account current safety challenges. Among other things, there is a growing concern about the increased possibility of accidents at the unfinished units due to their technical condition and climate change impacts in the region.

In particular, in 2019, the EIA report on the construction of KhNPP Units 3 and 4 was published. According to the EIA report, Khmelnytska NPP was designed as a four-unit plant with a total capacity of 4000 MW. Such facilities as the cooling water reservoir (CWR), supply and discharge channels, splashing equipment, special building, auxiliary building, gas building, general plant compressor room, radioactive waste processing building, administrative building, laboratory and utility building, etc. were designed to ensure the operation of four power units. These facilities were commissioned as part of the first building phase with the launch of Unit 1 in 1987.

At the same time, the EIA report does not contain information and studies that have to be included in accordance with the provisions of Article 6 of the Law of Ukraine "On Environmental Impact Assessment" (hereinafter - the Law), in particular:

- there is no information on the current state of water in the cooling pond, sediments and soils on the site, no environmental audit of the existing power units 1 and 2, and no study of the cumulative impact of the planned activities based on this data;
- no up-to-date water balances of the Goryn River basin are provided, and its water balances were calculated based on outdated data from 2006 that do not reflect reality;
- there is no information on the amount of waste, discharges and emissions, including radioactive ones, that will be produced as a result of the planned activity;
- there is no information on the specific type and number of fuel rods, as well as information on the volume and quantitative composition of spent nuclear fuel generated by the two additional KhNPP units, and comprehensive information on spent nuclear fuel management;
- there is no information on the description of the characteristics of further activities on preparatory, construction works and implementation of the planned activities;
- there is no information on the type and parameters of the reactor unit, steam turbine and other equipment to be used for the construction and implementation of the planned activities;
- lack of analysis of technical alternatives and "zero scenario";
- non-compliance of the selected reactor unit (VVER-1000/V-320) with modern safety standards and partial compliance with modern NPP design principles. Modern standards require the installation of multiple independent safety systems to ensure "deep protection" against possible accidents. VVER-1000/V-320 reactors often have a limited number of backup systems, which increases the risk in the event of simultaneous failures;

45 Peaceful Atom in Ukrainian: Does our country need new nuclear reactors [Online resource] // Apostrophe publication. 2024 — Accessed at: https://apostrophe.ua/ua/article/economy/jenergetika/2024-02-08/mirnyiy-atom-po-ukrainski-nujnyi-li-nashey-strane-novyie-yadernyie-reaktoryi/56292.

- underestimated risks of external extreme events. The information provided in the EIA documents shows that the assessment of the NPP site does not meet modern international requirements, as the international recommendations used are outdated, in particular, with regard to seismic risk assessment;
- lack of up-to-date information on the condition of existing buildings, structures, and facilities;
- insufficient analysis of possible severe accident scenarios. EIA documents do not systematically analyze design-basis and beyond-design-basis accidents, i.e. accidents with significant negative consequences for people and the environment. Only the radiological consequences of one design-basis accident and one beyond design-basis accident are described, but the worst-case scenarios are not analyzed.

In 2021, the Ministry of Environmental Protection issued an EIA Conclusion on the admissibility of the planned activities, considering/fulfilling environmental requirements.

In particular, the following environmental requirements were set out before the start of the planned activities:

- identify and establish sanitary protection zones;
- inspect the technical condition of buildings and structures;
- reservoir dams (publish the results on the website);
- research of flora and fauna in accordance with the Berne Convention, and publish the results on the website;
- provide additional information on the water balance of the Horyn River, taking into account the operation of 4 power units, and publish it on the website;
- prepare a concept for the safe decommissioning of power units 3 and 4;
- publish the materials of the previous Security Report;
- a list of other conditions, for example, it is forbidden to start the activity without surveying species and habitats in the Emerald network site, since, according to the EIA Report, the KhNPP protection zone includes protected areas of more than 3000 hectares, and the cooling pond belongs to the Emerald network (UA0000123 iziaslavsko-slavutytskyi).

Additionally, the project initiator is responsible for post-project monitoring. That is, a post-project monitoring plan must be developed and approved before the start of the planned activity. There is no information on such a plan.

Also, in 2024, the NGOs Ecoclub, Ecoaction, and Khmelnytskyi Energy Cluster jointly sent requests to the Ministry of Environmental Protection, Energoatom, and the SNRIU for information on the implementation of the requirements of the Ministry's EIA conclusion. Most of the responses to the requests stated that the recipients did not have such information (according to the response from the Ministry of Environmental Protection, and the SNRIU. Energoatom did not respond to the requests).

In the context of ensuring compliance with environmental standards, it is worth paying attention to Ukraine's international obligations.

Thus, since 2020, the Procedure for Decision-Making on Transboundary Environmental Impact Assessment has been in force. According to the Procedure, a transboundary environmental impact assessment is carried out at a decision of the Ministry of Environmental Protection based on information about the planned activity or at a request from a foreign state, considering international requirements. The state of origin and the affected state agree on the duration of consultations on the planned activity[46].

46 Resolution of the Cabinet of Ministers of Ukraine "On Approval of the Procedure for Decision-Making on the Implementation of Transboundary Environmental Impact Assessment" [Online resource] // Verkhovna Rada of Ukraine. 2020: https://zakon.rada.gov.ua/laws/show/877-2020-%D0%BF#Tex

In the context of reducing the cross-border impact of activities, the following requirements are in place:

- at the "project" stage, present special technical solutions to improve the safety level to modern standards, taking into account the proposals of the affected countries;
- inspect the technical condition of existing buildings and structures for Units 3 and 4 before the start of the design stage; identify the mechanisms of aging of buildings and structures; develop an aging management program at the design stage and take measures to monitor the technical condition of structures;
- analyze the safety in case of accidents;
- provide access to the public and affected parties (countries) to materials on the technical condition of buildings and structures and technical solutions and measures to improve safety, taking into account the comments and proposals of the affected states adopted at the "project" stage.

It is currently unknown whether the above requirements have been met, and in fact, none of the above information is available on Energoatom's official resources.

Also, according to Energoatom's response, the design stage of the Project will start after the adoption of the Law of Ukraine "On the Siting, Design and Construction of Units 3, 4 of the Khmelnytska Nuclear Power Plant". **As of today, the Draft Law has been made public, but there is no information on the fulfillment of the conditions for reducing the transboundary impact of the activity.**

At the same time, states affected by or concerned about environmental risks express their concerns within the framework of transboundary impact.

The Austrian government and a number of international environmental organizations have expressed concern about the safety of the units, given the long period of their construction and problems with the conservation of equipment. In particular, a Belarusian non-governmental organization filed an appeal regarding the planned construction of units 3 and 4 at Khmelnytska NPP, which is located approximately 150 kilometers from the border with Moldova and Romania and 350 kilometers from the border with Belarus. The appeal was considered at the 34th session of the Convention's Implementation Committee (Geneva, December 8-10, 2015). This happened after Ukraine announced the denunciation of the agreement with Russia on cooperation in the construction and financing of these power units, which actually led to the postponement of the project[47] [48].

A separate concern is the fact that during martial law, more and more information that should be open to the public becomes inaccessible. For example, feasibility studies. It is not known how a procurement contract was signed without an approved feasibility study. Although the government claims that the feasibility study has already been approved, the EIA has not yet been started.

47 Report of the Implementation Committee on its thirty-fourth session [Online resource] // United Nations Economic and Social Council. — 2016: https://unece.org/fileadmin/DAM/env/documents/2019/ece/Restart/Ukraine/14_oct-IC_Report_34_ENG_Report_ece_mp.eia_ic_2015_4_e.pdf.

48 EIA/IC/INFO/10 Ukraine [Online resource] // United Nations Economic and Social Council. — 2012: https://unece.org/eiaicinfo10-ukraine-0.

4 Prospects for KhNPP units 5,6 construction

On December 17, 2023, in the presence of the Minister of Energy of Ukraine Herman Galushchenko, President of the Energoatom Company Petro Kotin and CEO of Westinghouse Electric Company Patrick Fragman signed an agreement on the purchase of equipment for Khmelnytska NPP Unit 5[49] in the amount of 437 500 000 USD[50]. It is planned to be built using the American AR1000 technology.

On July 17, 2023, a tender was announced for design work on environmental safety and environmental protection for the construction of power units 5, 6 with the AR1000 reactor unit at KhNPP with an expected cost of UAH 27,021,468.91[51]. However, the tender was canceled. Therefore, as of now, civil society does not have access to information on which contractor will develop the EIA report and its cost. Subsequently, Energoatom published a notice of planned activities in the EIA register.

Accordingly, Ecoclub prepared and sent proposals and comments on the scope of research in the EIA report.

At the same time, it can be concluded that the project's feasibility study is currently being finalized. In particular, according to Energoatom, "The feasibility study materials were developed on the basis of the source data from WESTINGHAUSE ELEKTRIC COMPANY LLC, which are marked as "commercial secret" and are subject to a confidentiality agreement, and therefore it is not possible to provide the materials of the mentioned feasibility study to civil society organizations. At the same time, the EIA Report will be posted in the EIA Register on the Ecosystem platform for public review and suggestions. A transboundary assessment will also be carried out in accordance with the EIA Law as part of the initiated procedure.

That is, it remains unknown whether studies have been conducted on the possibility of siting units 5 and 6 at the KhNPP location. At the same time, the plant was designed for 4 units, as evidenced by the Technical Specification for the Agreement (clause 4.1)[52]: "during the construction of power units 1,2, the infrastructure for a NPP with a design capacity of 4000 MW was created, which includes: a special building, pipelines for technical water of Group A consumers, auxiliary buildings on the NPP site, off-site buildings, including a cooling reservoir for the full design capacity."

Siting acts were also prepared for units 3 and 4: "the site of the KhNPP with a capacity of 4000 MW was selected in accordance with the siting act issued in accordance with the established procedure". The existence of such an act or procedure for units 5 and 6 is unknown.

As for the issue of cooling the units, it has already been noted above that even existing units face cooling problems, and for those that were not planned for this location, it is impossible.

---

49 Ukraine and the US Westinghouse signed an agreement on the purchase of equipment for Khmelnytska NPP Unit 5 [Online resource] // Energoatom. — 2023: https://energoatom.com.ua/ua/post/1352

50 Equipment for the implementation of the nuclear installation AR1000 [Online resource]. — 2023: https://prozorro.gov.ua/plan/UA-P-2023-12-18-001945-b

51 Design work on environmental safety and environmental protection. Construction of power units 5, 6 with the AR1000 reactor unit at the Khmelnytskyi NPP site [Online resource]. 2023: https://prozorro.gov.ua/tender/ua-2023-07-17-002306-a

52 Contract "Analysis of options for completing the construction of KhNPP-3 and KhNPP-4 using Westinghouse's experience in reactor technology. Stage 1" [Online resource]. — 2023. — Access to the resource: https://ecoclubrivneorg.sharepoint.com/:b:/s/ecoclubrivne.org/EZE1iogKys9MutH8jHy3yK0BY45oiJnuqnFaSHDuOQzhrQ?e=df4IdD.

In addition, according to Article 8 of the Law of Ukraine "On Permitting Activities in the Field of Nuclear Energy Use": "...commencing activities at a separate stage of the life cycle of a nuclear facility, including all facilities located on the site of this nuclear facility, is possible only after the operating organization obtains a license issued by the state nuclear and radiation safety regulatory authority (SNRIU)".

As of now, as we know, the license has not been issued and cannot be issued until all the necessary procedures are completed in accordance with Ukrainian law, namely:

- approval of the feasibility study for KhNPP 5,6 by the Cabinet of Ministers of Ukraine (did not take place);
- conducting an environmental impact assessment (EIA) based on the developed feasibility study (only the first stage of the EIA took place, namely the announcement of the notification of the planned activities of NNEGC Energoatom "Construction of power units 5, 6 with the AR1000 reactor unit at the Khmelnytska NPP site"). At the same time, at the stage of public discussions of the notification of planned activities, some communities expressed significant concern about the safety preconditions for such a project (on the safety of the 30-km residential zone, water supply, risks of accidents and emergencies)
- adoption by the Verkhovna Rada of Ukraine of the Law "On the Siting, Design and Construction of Units 5 and 6 of the Khmelnytska Nuclear Power Plant" (did not take place).

Thus, any announcement and commencement of work without following the above procedure is illegal. At the same time, a separate concern is the fact that no statements from the SNRIU leadership regarding this violation have been made, at least publicly.

All of the above makes it possible to assert that in the context of the construction of KhNPPs 5 and 6, there is a gross violation of Article 14 of the Convention on Nuclear Safety: "Each Contracting Party shall take appropriate measures to ensure that: "... (i) Comprehensive and systematic safety assessments are carried out prior to the construction and commissioning of a nuclear facility and throughout its life cycle", which is a catastrophic violation of Ukraine's international obligations.

Conclusion

The state energy policy of recent decades has created conditions under which nuclear power plays a key role in meeting Ukraine's energy needs. However, war and systematic rocket attacks have demonstrated the vulnerability of centralized energy. Prolonged power outages in large areas of the country during attacks demonstrate the critical dependence of the power system on single powerful nodes, which reduces its resilience.

The completion of KhNPP-3 and KhNPP-4 contradicts the government's statements about the need to decentralize energy supply to increase the reliability of the system. In addition, the construction of any nuclear facilities requires strict adherence to established standards, procedures and international obligations. Attempts to accelerate this process without proper preparation pose significant risks not only for the current generation but also for future generations.

Currently, a number of inconsistencies have been identified in the implementation of the KhNPP 3 and 4 completion project:

1. There is already a draft law on the completion of KhNPPs 3 and 4 without understanding what technical solution will be adopted for such completion.
2. It is impossible to use the technical solutions that are being publicly voiced, as the companies/equipment/technologies of these solutions are directly linked to and dependent on the terrorist state - the Russian Federation.
3. The public does not have complete information on all the procedures and studies necessary to determine the feasibility of completing the KhNPP and the possibility of ensuring its further operation. There are reasonable suspicions that the procedures and documents defined by law were not developed either for the use of reactors from the Belene NPP or for Westinghouse AP1000 equipment.
4. Obviously, the design of KhNPPs 3 and 4 is not suitable for newer equipment, as it was designed for what was relevant in the 1980s. The use of incompatible structures and equipment poses a safety hazard even at the stage of attempting to implement such a technical solution.
5. The KhNPP structure has not been properly preserved since its construction. The impact of time on the existing buildings, metal, etc. is irreparable and makes it impossible to use them.
6. The environmental impact assessment procedure lacks basic research and information required by the Law of Ukraine "On Environmental Impact Assessment"
7. Ukraine does not consult with the states that may be affected by the construction of the KhNPP, as provided for in the Procedure for Decision-Making on Transboundary Environmental Impact Assessment.
8. The work carried out at KhNPPs 3 and 4 and the choice of a technical solution already has signs of corruption;
9. The initiator of the project, Energoatom, does not have the funds and understanding of financing for the completion of KhNPPs 3 and 4;
10. There is no communication between the initiator of the KhNPP 3 and 4 completion project and civil society.

Given the magnitude of the combination of the above factors, the following becomes obvious:

- the necessity to stop all processes on the completion of KhNPP;
- the efforts to select an appropriate technical solution for the completion of KhNPP are necessary;
- the need to fulfill all required procedures and develop the documentation for the selected technical solution.

Today, in the context of complete uncertainty about the construction/completion of a 2 GW nuclear power plant, not a factory or production line, society must be as scrupulous as possible to all processes taking place and prevent violations of its rights and interests, including those of future generations, to live in a safe environment.

At the same time, it is advisable to redirect the investments to the distributed generation and renewable energy sources (RES) in communities. Such solutions will help decentralize the energy system, increase its resilience to external threats, strengthen energy independence, and reduce environmental impact.

Ukraine must ensure maximum transparency and justification of decisions in the nuclear energy sector, taking into account not only current needs but also long-term consequences for the environmental and technological safety of future generations.