

CONCEPT OF SMALL MODULAR REACTORS BASED ON HTGR FOR UKRAINE

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At the current stage of the analysis of the selection of concepts for small modular reactors in Ukraine, among modern concepts for nuclear power systems, the concepts of advanced water-water reactors have been selected: Holtec SMR-160 / SMR-300, NuScale VOYGR, Westinghouse AP300. These concepts are characterized by an average efficiency of 32-33%, which corresponds to the level of modern thermal power plants (TPPs). In Ukraine, over the years of independence, neither the production of components for the cores of water-water reactors operating in Ukraine, nor the production of housings and other infrastructure for nuclear power plants has been established. The only significant achievement in recent decades has been the development of fuel assemblies and absorbing elements for VVER-1000 at the NSC KIPT. Therefore, the deployment of these water-water SMR (if they are selected) at future nuclear power plant sites will occur exclusively using Western developments and technologies.

Apart from the concepts considered, the direction of high-temperature gas-cooled reactors, VTRG, (as nuclear power systems IV generation, namely the concept of small modular reactors), which were developed for a long time at the NSC KIPT, remained. This is a little-known fact, but the results of the development (core components – TRISO fuel, spherical fuel elements, spherical absorber elements, nuclear-pure graphite GSP, structural elements based on CCCM, technological small-scale processes for their manufacture and industrial units, reactor test results) were many years ahead of the level of foreign developments. This can form the basis for the implementation of the latest SMR concepts based on HTGR in Ukraine. It is important to emphasize that nuclear systems with HTGR have an efficiency of 50-52%, the fuel reload cycle is 8+ years (in normal operation at a coolant temperature of 750 °C) and 25-30 years (at a coolant temperature of 500 °C), cooling is carried out with the inert gas helium, which makes their use extremely effective in autonomous mode (with the possibility of underground location) directly on industrial sites of enterprises.

The presented research was carried out with the financial support of the basic program "Informative order of the NAS of Ukraine for conducting scientific research in nuclear science and technology of the National Scientific Center "Kharkiv Institute of Physics and Technology" for 2021-2025" on the topic "Research and development of resource-saving devices and processes for creating and improving the properties of innovative functional materials for renewable, unconventional and nuclear energy of the new generation", topic code III-1-16 (SPE RESST), state registration number 0121U107860.

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