CURRENT STATE OF THE TECHNOLOGIES DEVELOPMENT PROGRAM OF ADDITIONAL HEATING AND FUEL INJECTION BY THE NEUTRAL ATOMS BEAM FOR THE FFHS IN THE RUSSIAN FEDERATION [[1]](#footnote-1)\*)

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The fusion-fission hybrid systems (FFHS) development program proposed by NRC Kurchatov Institute provides for the creation of a mock-up for testing technologies and their mutual integration. Timely provision of specialized stands and qualified personnel will make it possible to effectively implement the project for the construction of a GRU with a thermal capacity of up to 500 MW.

The tasks of the current period include substantiation of the fuel cycle and a hybrid blanket technologies choice, as well as technical design of the FNS-K fusion neutron source and a hybrid reactor facility (GRU) for testing technologies, materials and components of the FFHS. The work is coordinated with the federal project of the comprehensive "Development of equipment, technologies and research in the field of atomic energy use in the Russian Federation for the period up to 2024" (DTTS) program of the State Corporation Rosatom.

As a result of the work, until 2024, it is planned to prepare draft and technical designs for a multi-isotope neutral injection complex with the characteristics of FNS-K and GRU, develop and commission a physical model (stand) of the system for the fast atoms beam formation and transportation for research aimed at determining operational parameters, performance of auxiliary subsystems, the amount of hydrogen isotopes in them and other neutral beam injection system (NBIs) parameters using DEMO-FNS [2] and FNS-ST [3] projects as the basis for the TIN-K and GRU design. It is planned to analyze and justify the safety of technological systems, as well as train personnel for operating the FFHS with a tritium reserve at the facility's site from 0.1 to 2.0 kg. These neutral beam injection systems under development are focused on the use of positive ions for FNS-K with a total power of up to 10 MW and negative ions with a power of up to 40 MW for a GRU. The corresponding fluxes of neutral atoms reach from 3.7·1019 to 4.6·1019 1/s.

At later stages, technical projects NBIs [4-6] for FNS-K and GRU should be developed, mock-ups were made and their joint operation was carried out in accordance with the research program aimed at efficient thermal loads removal with tokamak structures interacting with beams and plasma, selection of the optimal technology for the ions beam formation and separation of charged and neutral beam components, optimization of the gas support cycle architecture, facility's radiation safety justification. The main stages of the roadmap drawn up, focused on the launch of FNS-K in 2030 and the GRU in 2040, and the planned results of the joint NBI technologies development as an active participant of the FFHS fuel cycle will also be described.

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1. \*) [abstracts of this report in Russian](http://www.fpl.gpi.ru/Zvenigorod/XLIX/Mu/ru/BR-Ananiev.docx) [↑](#footnote-ref-1)