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Keynote Address: *Nuclear Reactors and Technology in the Next Stage*
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In the next stage of its development, nuclear power can aspire to reach the goals which the eminent physicists had in mind as they initiated in the mid-century a civil nuclear line when developing nuclear weapons. Being cheap, inexhaustible in its resources and producing no greenhouse gases, nuclear fuel was meant to substitute conventional chemical fuels on a large-scale. However, the reactors created in the first stage of the nuclear era and resulting from the conversion of military developments, failed to fulfil these goals, which is the root cause of the current stagnation in nuclear power and of its projected falling contribution to world energy production.

At the same time, with the solid expertise gained in the area, it is possible to create in a fairly short time reactors and fuel technology that would meet the main requirements for large-scale power production, i.e.:

- to afford a 100-fold reduction in the specific consumption of uranium, by utilizing thousands of tonnes of Pu accumulated in the spent fuel from the reactors of the first stage;
- to rule out nuclear disasters, by taking advantage of the intrinsic properties and behavior of reactor, coolant, fuel, etc., with the plants made simpler and cheaper;

- to hit a balance between the radiotoxicity of waste and that of feed uranium, by providing neutron transmutation;
- to create power reactors and fuel cycle technology that would not afford extraction of weapon-grade materials.

To fulfil all these requirements, it is necessary to provide substantial neutron excess in a chain reaction for Pu breeding, to use fuel with an equilibrium composition, to burn actinides and LLFPs. All this can be done only in fast reactors. Fast reactors can also provide fuel for thermal reactors that might still be used for some applications, operating in a Th^U cycle, which is the best option for such facilities. Novel engineering solutions will be necessary: high-density heat-conductive fuel (UPuN), chemically inert high-boiling coolant (Pb), dry reprocessing. These issues have been studied well enough to allow embarking on the development of advanced fast reactors.

Minatom institutions are finalizing a detailed design of a demonstration BREST-300 plant, complete with an on-site fuel cycle that will meet the requirements of large-scale nuclear power. Hopefully, construction of this plant at Beloyarsk site with its subsequent trial operation would open a door to the next stage in nuclear power development.