

Russian approach to the back-end fuel cycle.

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Abstract

The Chernobyl disaster has sent Russian Nuclear Energy development in state of coma for more than 10 years. Now, after country has managed to overcome “Chernobyl syndrome” its Nuclear Energy sector is on the way to expand (from current 16% of share in electricity production to declared 25% by 2025). The motivation is in the need to diversify its economy away from oil and gas, compete in one of the few high-technology areas in which it has world-class advanced technology, and to reduce carbon dioxide emissions. The implementation of such program is assigned to the State controlled vertically integrated structure led by RosAtom, recently restructured to become the State owned corporation.

Rosatom accounts for 20 percent of new reactors under construction worldwide and 17 per cent of global nuclear fuel fabrication.

In Russia, as in France, the industry is looking at spent fuel not simply as a long-term headache but as a valuable source of raw material for a future business, making mixed-oxide fuel. The stated policy adopted during the first term of Putin’s presidency is to invite international customers to bring their spent nuclear fuel to Russian repository and to offer them a complimentary service of reprocessing in order to recuperate fissile Uranium and Plutonium with the end product- MOX fuel. So far Russia did not succeed much in bringing customers beyond the circle of its traditional customers.

The target to reach truly closed fuel cycle, which would include also the incineration (transmutation) of minor actinides, is deferred to the next major step in developing Nuclear Energy,-the massive introduction of the Fast Neutron Reactors. Specific technological scenarios for implementation of such comprehensive cycle are still remaining open ended as well as the choice for concrete designs of future inherently safe fast reactors. On top of already visible efforts on the Sodium cooled

versions (routinely functioning BN-600 and BN-800 under construction) they might construct an experimental version of the Lead cooled BREST (initially for 300 MWe). It is that with such series of different relatively large scale fleet of experimental fast reactors they contemplate to work out the most efficient and economical approach in assigning the burner function to a special class of fast reactors. Expected time scale for the early series of such reactors is definitely closer to 2030. And by 2050 the fleet of commercial fast reactors is expected to take over the lead from thermal ones.

More recent internal discussions of future comprehensive fuel cycle revealed that pure fission only based cycles might end up with about 5% (I found that different groups had different predicted numbers) deficit of neutrons. It resulted in decision to open R&D to add the outside source of neutrons (from Fusion or accelerator based sources).