EuroSciCon

2nd Edition of EuroSciCon Conference on

Chemistry

February 19-20, 2019
Prague, Czech Republic

J Org Inorg Chem 2019, Volume: 5
DOI: 10.21767/2472-1123-C1-021

COMPARATIVE EVALUATION OF DOMESTIC AND FOREIGN APPROACHES TO THE DEVELOPMENT OF ADVANCED REACTOR TECHNOLOGIES AND THE FUEL CYCLE IN NUCLEAR POWER

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In the development of nuclear energy in Russia and the world, there are three stages, separated by major accidents at nuclear power plants: Three Mile Island (USA, 1979). Chernobyl nuclear power-plant (USSR Ukraine, 1986) and Fokuma-1 nuclear power plant (Japan, 2011). On the first and second stages (with a slight delay in 80's years) and up to 1990, there was a rapid development of nuclear power, when in the year (20's)-30 blocks were introduced and their number increased to 391, with a total capacity 321 W, followed by a sharp decline (after 90's), removing many of the blocks out of operation, reached the maximum term of 40 years. So for the post-Fukushima period from 2011-2016, 24 units were introduced, and 17 withdrawn (5 years added 7 blocks). As a result, on 01.12.2016, the total installed capacity of 450 units was 392 GW. At the same time, the prices for uranium and gas decreased and the latter led to the excess of the competitiveness of gas thermal power plants (PSU with an efficiency of up to 55-60%). The introduction of new technologies began to develop wind and solar power. It is projected that by 2035, the share of elektroprovodka on the "clean" energy sources (hydro, CCGT, nuclear and renewables) will be more than 50%. The share of world electricity production at nuclear power plants fell from 17.6% (1995) to 10.7% (2015). To improve the competitiveness of nuclear power plants required a significant increase in safety while simplifying and reducing the cost of the actual projects, primarily the reactor compartment (nuclear island-NW), the cost of power unit equipment, construction and installation on site, reducing operating costs. The result was developed and have built water cooled reactors "Generation-3+". These are reactors of Westing house (USA) AR-1000, ARR-1400 (Korea), boiling-General Electric (USA) ESBWR-1650, Areva (France) EPR (1600mw), and also in Russia Rosatom-NPP-2006 (1200mw) and VVER-TOI (1250 MW). The paper presents the results of comparing the economic efficiency of these projects. The pace of development of nuclear power has significantly decreased, proven uranium reserves have increased to 5.7 million tons with a cost of less than $130/kg (these reserves with the existing structure of nuclear power will be enough for ~70 years) and up to 7.6 million tons with a cost of less than $260/kg (these reserves are estimated to last for ~120 years), in this case, the need to solve fuel supply problems by implementing a closed fuel cycle (ZTC) in the nuclear power industry may move to ~2050. This report discusses the features of the development of nuclear power, the implementation of ZTC in different countries and mainly in Russia, the stages, timing of their implementation, emerging problems. The use of supercritical pressure water cooled reactors (SCWR) with a fast neutron spectrum in the near future and in systems with ZTC is substantiated.

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