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Current status of SMRs development

Small Modular Reactors (SMRs) (installed capacity ≤300 MWel) are today's a very "hot"topic in nuclear engineering / nuclear-power industry worldwide. In general, there are about 108 concepts / designs of SMRs, which can be classified as: 1) Water-cooled SMRs (land based) – 33; 2) Water-cooled SMRs (marine based) – 7; 3) High-temperature gas-cooled SMRs – 21; 4) Fast-neutron-spectrum SMRs – 26; 5) Molten-salt SMRs – 17; and 6) Other SMRs – 4. From all these 108 SMRs only two KLT-40S reactors (PWRs) (Russia) have been constructed, installed on a barge, and put into operation in December of 2019 in the port of Pevek, Chukotka and RITM-200M was designed and manufactured; also, two High Temperature Reactors Pebble-bed Module (HTRs-PM) SMRs cooled with helium were constructed and put into operation in March of 2023 in China.
Based on these two examples of operating SMRs the following conclusions can be made: SMRs usually require a higher level of fuel enrichment up to <20% to operate with a smaller amount of fuel and to have longer terms between refueling and, usually, lower NPP thermal efficiencies compared
to those of large nuclear-power reactors NPPs of the same type. Also, some other issues have to be resolved before a widespread implementation of SMRs, which include: Legal frameworks for widespread enriched-fuel utilization and its interstate transportation; elimination of potential for plutonium production; sabotage and terrorist-attacks prevention; accounting and remote monitoring of nuclear materials; assured cooling of spent nuclear fuel (SNF) during transportation; and equipment operating without maintenance for a time commensurate with core lifetime. However, in spite of all these difficulties in SMR development, they will undoubtedly have their unique "niche"applications of being implemented in remote areas, small electrical grids, military facilities, and as floating NPPs.

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