

TRANSITION FROM THERMAL TO FAST REACTORS IN FINLAND

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Abstract

The present study describes a basic transition path from thermal to fast reactor fleet in Finland using the fuel cycle software COSI V6 developed by CEA. The purpose of the calculation is to determine whether the domestic plutonium stockpile created in light water reactors is going to be sufficient to start fast reactors and at which time this could be possible. Another step is to estimate the maximum amount of minor actinides that could be burned in the assumed Finnish fast reactors.

The current nuclear reactor fleet in Finland consists of two VVERs with 490 MWe output each and expected lifetime of 50 years, and two 880-MWe BWRs with overall life expectancy of 60 years. All these reactors started to operate within a few-year-span around 1980. In addition to the operating reactors, a 1600-MWe EPR is under construction and estimated to start the commercial operation in 2014. Yet another two units are under consideration and thought to start the electricity production in the beginning of 2020's. The reactor type choices between PWR and BWR are to be decided in the near future, but the power output will be around the magnitude of EPR. They are supposed to operate 60 years. The impact of the reactor type on the spent fuel composition is worth examining.

It is assumed in the present study that the planned reactors are the last LWRs to be constructed. After their retirement the energy demand is assumed to be mostly satisfied without major nuclear contribution. However, some fast reactors could be introduced at that time to incinerate the legacy waste. Some alternative scenarios including FR deployment could be based on, for example, larger contribution of nuclear power with or without LWRs beyond 2080 or foreign collaboration in waste incineration. On the other hand, a collapse of one or both of the planned new unit projects would drastically change the outcome as they are going to produce a significant fraction of the total spent fuel inventory.