

Annex Fennovoima Oy: Project description

The environmental impact assessment program for Fennovoima's encapsulation plant and final disposal facility

Organization responsible for the project and background of the project

The organization responsible for the project as laid down in the EIA Act is Fennovoima Oy (hereinafter referred to as "Fennovoima"), a Finnish nuclear power company established in 2007. Fennovoima is building a nuclear power plant with a generating capacity of around 1,200 MW on the Hanhikivi headland in Pyhäjoki. Fennovoima submitted a construction license application for a nuclear power plant pursuant to the Nuclear Energy Act to the Ministry of Economic Affairs and Employment in late June 2015.

In accordance with the decision-in-principle granted to Fennovoima in 2010, Fennovoima must, by the end of June 2016, present to the Ministry of Economic Affairs and Employment either a final disposal cooperation agreement made with the parties currently under the nuclear waste management obligation, or an environmental impact assessment program for its own encapsulation plant and final disposal facility.

With this EIA program, Fennovoima supplements the nuclear facility construction license application and launches the environmental impact assessment procedure required by the prerequisite included in the 2010 decision-in-principle for its own spent nuclear fuel encapsulation plant and final disposal facility.

Fennovoima has also started cooperation with the Finnish nuclear waste management company Posiva Oy by signing a service contract with its subsidiary company Posiva Solution Oy. This service contract ensures that Posiva's expertise gained during the project period (near the last 40 years) is utilized in the final disposal of spent nuclear fuel by Fennovoima. Furthermore, Fennovoima continues its negotiations with the parties currently under the nuclear waste management obligation on long-term cooperation.

Project description

This EIA procedure is a study of Fennovoima's spent nuclear fuel final disposal project, which consists of an encapsulation plant above ground level and a final disposal facility located several hundreds of meters deep in the bedrock. The term 'encapsulation plant' refers to a nuclear facility where spent nuclear fuel is packed into final disposal canisters. The term 'final disposal facility' refers to tunnels for the final disposal of spent nuclear fuel hundreds of meters deep in the bedrock.

The final disposal project aims at permanent disposal of the spent nuclear fuel generated by Fennovoima's Hanhikivi 1 nuclear power plant in the Finnish bedrock. During the operation of the nuclear power plant, around 1,200–1,800 tons of spent uranium nuclear fuel will be generated. This corresponds to around 700–900 final disposal canisters.

The project consists of the following phases:

- Preliminary research phase. Determining potential research areas which may be suitable for final disposal.
- Research and planning phase. Geological surveys before selection of the final disposal site, interpreting the results, modeling, and preparation of preliminary site-specific facility plans. The research, design, and development work of the

encapsulation plant and final disposal facility will continue throughout the project period.

- Construction phase. Building a research facility, building the encapsulation plant and facilities for processing the low and intermediate level waste generated by the encapsulation plant, building an underground final disposal facility, and other construction activities (incl. any roads and power lines to be built).
- Operational phase. Transporting spent nuclear fuel to the encapsulation plant and final disposal facility, encapsulation, and final disposal in the bedrock.
- Decommissioning phase. Shutting down the operations of the encapsulation plant and final disposal facility, closing the final disposal facility, decommissioning and demolishing the buildings above ground level (incl. disposal of decommissioning waste), and releasing the site from control.
- Some of the project phases can be implemented simultaneously to a certain extent.

Fennovoima's spent nuclear fuel final disposal strategy is based on the KBS-3 concept, which was originally developed in Sweden and Finland. The KBS-3 concept is based on the multibarrier principle, where radioactive substances in the spent nuclear fuel are isolated with several redundant protective structures (barriers). The barriers ensure that the radioactive substances in the spent nuclear fuel do not come into contact with the living environment or people. In a final disposal solution according to the KBS-3 principle, the spent nuclear fuel is inserted into a copper canister with a cast iron insert, surrounded with bentonite clay, and placed in disposal holes drilled deep into the bedrock. The final disposal can take place in vertical (the KBS-3V concept) or horizontal (the KBS-H concept) drilled holes.

Alternatives to be studied in the EIA program

The research, construction, operational, and decommissioning phases of Fennovoima's own encapsulation plant and final disposal facility will be studied during the EIA procedure. Capacity of the encapsulation plant and final disposal facility will be 1,200–1,800 tons of uranium. The chosen technical implementation alternative is the KBS-3 method where the final disposal of nuclear fuel can take place either in vertical holes (KBS-3V) or in horizontal holes (KBS-3H) drilled in final disposal tunnels. The EIA procedure will also include a study of the transport of spent nuclear fuel. Other issues covered by the impact assessment include the effects of ancillary projects, such as the construction of roads and power lines.

The alternative locations are listed below.

- Option 1: Eurajoki
- Option 2: Pyhäjoki (Sydänneva)

The suitability of the alternative locations for final disposal will be assessed during the EIA procedure. It is possible to include new locations for the assessment in the later stages of project or one of the current alternative locations can be excluded. Of the alternative locations listed in this EIA program, the preliminary research phase has been completed at Pyhäjoki. One research area that may be suitable for final disposal (Sydänneva) was identified. The preliminary research phase at Eurajoki will start after the filing of the EIA program. The research area will be determined before the EIA reporting phase.

Another studied alternative is the zero-option, i.e. not constructing the spent nuclear fuel encapsulation plant and final disposal facility.

Project schedule

The submission of the program will initiate a research phase of several years, during which the geological characteristics of the alternative research areas, and their suitability for final disposal will be studied. The suitability of the final disposal site is subject to numerous safety-related criteria pertaining, in particular, to the bedrock conditions which it will take several years or even decades to investigate with a dedicated research program. The schedule for the research phase will be further specified based on the research program. The research program will be drafted separately for each research area.

The environmental impact assessment for the final disposal project and the preparation of the EIA report will start towards the end of the research activities. The EIA report will be completed in time to allow for the selection of the spent nuclear fuel final disposal site in the 2040s. According to the current plans, the final disposal of Fennovoima's nuclear fuel is expected to begin at the earliest in the 2090s, in accordance with the construction license application of the nuclear power plant.

The estimated total project period is more than 100 years (Figure 2 2). The schedule is approximate and will be further specified as the project progresses.