



FINLAND FUTURES
RESEARCH CENTRE

Onkalo: Recent policies on the disposal of nuclear waste in Finland

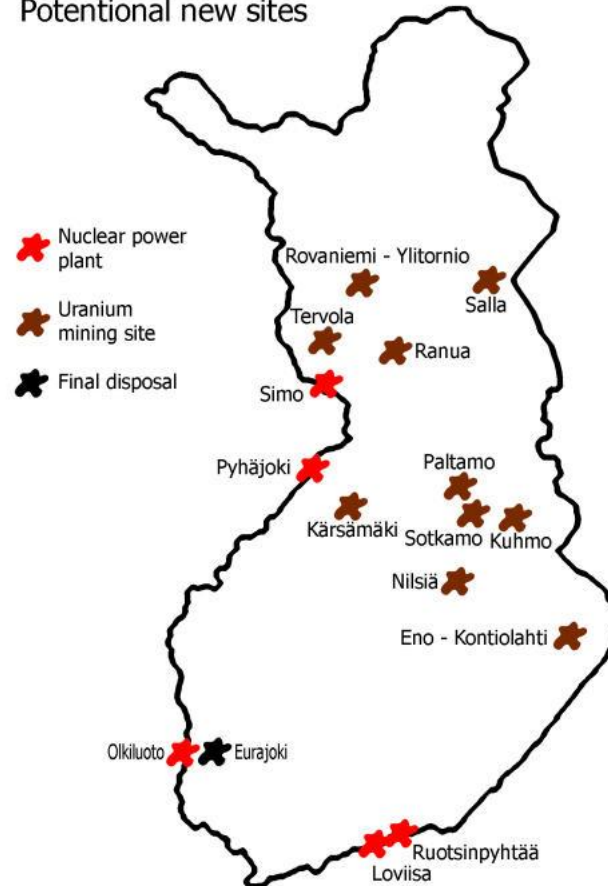
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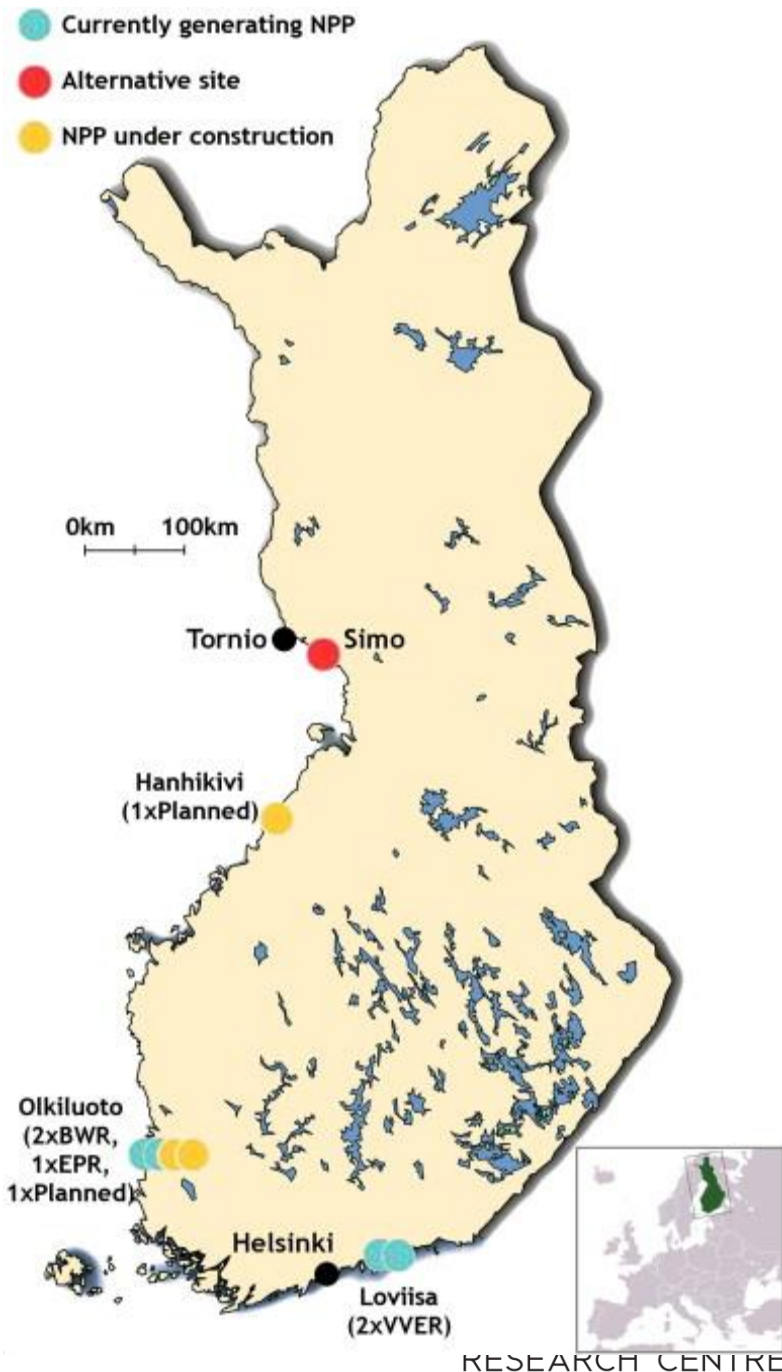
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Present nuclear waste storage policy for high-level radioactive waste

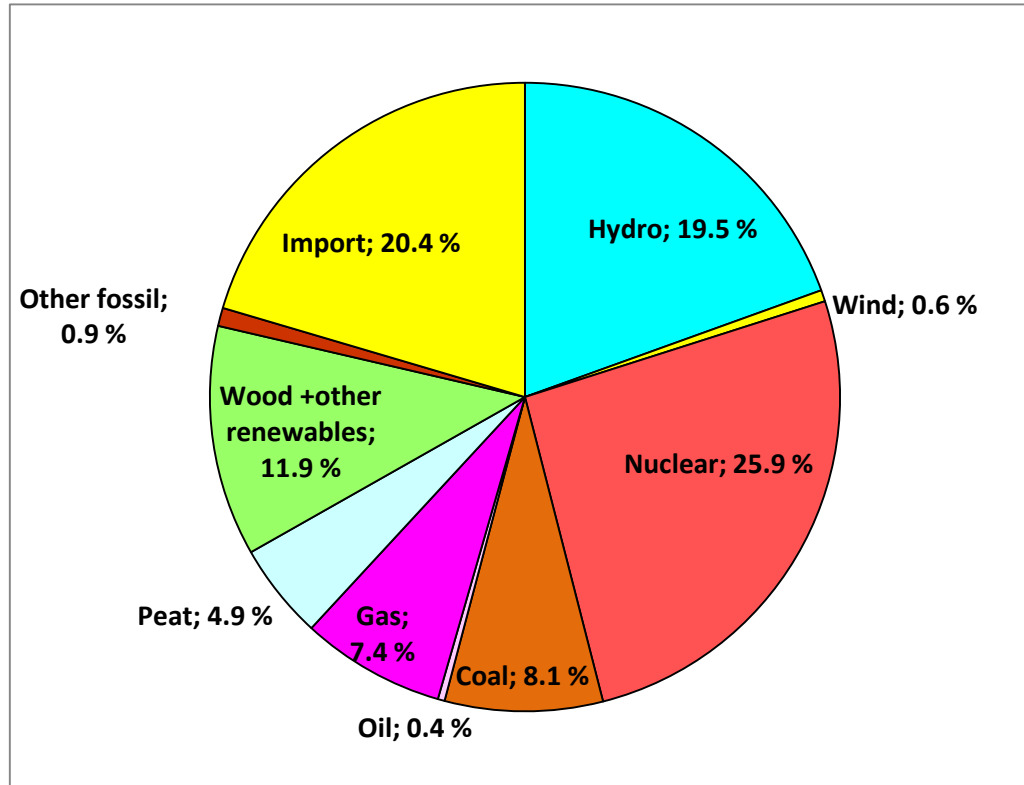
Nuclear activity in Finland:
Potential new sites



Present nuclear waste storage policy for high-level radioactive waste



Sources of Electricity in Finland 2012; Total 85.2 TWH



Short description of the present nuclear waste storage policy for high-level radioactive waste

- In Finland high-level nuclear waste is produced by the four reactors of the Loviisa and Olkiluoto nuclear power plants. Small amounts of nuclear waste is produced by the Otaniemi research reactor (FiR 1) operated by the Technical Research Centre of Finland (VTT) in Espoo, near Helsinki.
- Intermediate storage of high-level nuclear waste takes place on the sites of the power stations in Loviisa and Olkiluoto
- In December 2012 the final disposal of high-level radioactive waste reached a breakthrough, when the nuclear waste company Posiva submitted an application to the Finnish government (the Ministry of Employment and the Economy) for the construction of a repository at Olkiluoto, aiming at an encapsulation and disposal of spent nuclear fuel (SNF).

Radioactive waste in Finland at the end of 2007

Waste type	Facility	Quantity (Activity)
Spent fuel from NPPs	Loviisa NPP	428 tonnes HM
	Olkiluoto NPP	1197 tonnes HM
	Total	1625 tonnes HM
LILW from NPPs (excluding activated metal waste)	Loviisa NPP	3100 m ³ (18 TBq)
	Olkiluoto NPP	6100 m ³ (65 TBq)
	Total	8600 m ³ (83 TBq)
Small user waste	Central storage	51 m ³ (23 TBq, mostly tritium)

Waste storage concept

- 1981-1996: waste from Loviisa was brought to USSR/Russia for reprocessing and storage
- 1987: interim storage of SNF starts in Olkiluoto
- In 1983 the Finnish government sets an overall timetable for a nuclear waste management programme, basing largely on a draft from the Energy company TVO
- The Nuclear Energy Act states (amendment 1994) that nuclear waste generated in Finland shall be handled, stored, and permanently disposed in the country. This principle concerns only Finnish waste – the handling, storage, or permanent disposal of SNF produced anywhere else is excluded. This means that an import of nuclear waste from other countries is forbidden - as was agreed in the membership negotiations before Finland joined EU in 1995.

Schedule for Finnish SNF disposal (1/2)

- 1977-1978: Operation of the first reactors started in Loviisa and Olkiluoto
- 1978: Interim storage of SNF started in Loviisa
- 1983: The Finnish government sets the overall schedule for the nuclear waste management programme
- 1983-1985: Start of the screening of potential sites for final disposal of SNF
- 1986-1992: Preliminary site investigations
- 1987: Interim storage of SNF started in Olkiluoto
- 1987: Field research started in 5 municipalities for the selection of the final repository
- 1988: The construction of LLW and ILW repository started in Olkiluoto
- 1992: Final disposal of LLW and ILW started in Olkiluoto
- 1992: Detailed site characterization for final disposal of SNF started in Eurajoki, Kuhmo, and Äänekoski
- 1993-2000: Detailed site investigations
- 1993: The construction of LLW and ILW repository started in Loviisa
- 1994: Amendment to the Nuclear Energy Act: Ban of import and Export of nuclear waste
- 1995: The company Posiva established to manage final SNF disposal
- 1997: Loviisa selected as the fourth potential site for the final repository
- 1998: Final disposal of LLW and ILW started in Loviisa

Schedule for Finnish SNF disposal (2/2)

- 2000: Olkiluoto selected as the site for the final disposal of SNF/HLW
- 2003: Eurajoki municipality issued a building permit for the underground characterization facility ONKALO
- 2004-2009: Ground-level service and monitoring buildings under construction; excavation of the access tunnel to reach a depth of 420 m
- 2005: The Finnish cabinet gave its permission to TVO to construct a new nuclear reactor. The construction of Olkiluoto-3 began in 2005. It is the first European Pressurized Reactor (EPR)
- 2009-2011: Excavation of ONKALO continues down to 520m, research on the mechanical characteristics of the bedrock, and layout adaptation of the repository to continue
- 2012: Posiva submitted an application to the Finnish government for a construction license for the final disposal facility
- 2015: Construction of the final disposal facility to start (PLANNED)
- 2016: Start of energy production in Olkiluoto-3 (ESTIMATED)
- 2020: Final disposal to start (PLANNED)
- 2020-2050: Final disposal facility is operational (PLANNED)
- 2050-2060/2100: Closing of the disposal site (PLANNED)

Legal framework

- The Finnish Nuclear Energy Act from 1987, with amendments from 1994 and 2008 together with the Nuclear Energy Decree from 1988 set together a clear legal framework for the nuclear waste management in Finland. **The producers of the waste are responsible for all measures needed for a safe management and all the costs that arise. State authorities monitor this management and issue regulations when needed.**
- Since the amendment of the Nuclear Energy Act in 1994 (put into effect in 1996) it is determined that all radioactive waste produced in Finland must be handled and disposed in the country itself.
- According to the Nuclear Energy Act, the producers of nuclear waste are responsible for the management and all costs of nuclear waste management. The companies have to present annually estimates of the cost estimates for the future management of their nuclear waste to the MEE. The estimates have to base on the latest technical plans of the power companies, and have to include the costs for the decommissioning of the power plants.

Legal framework

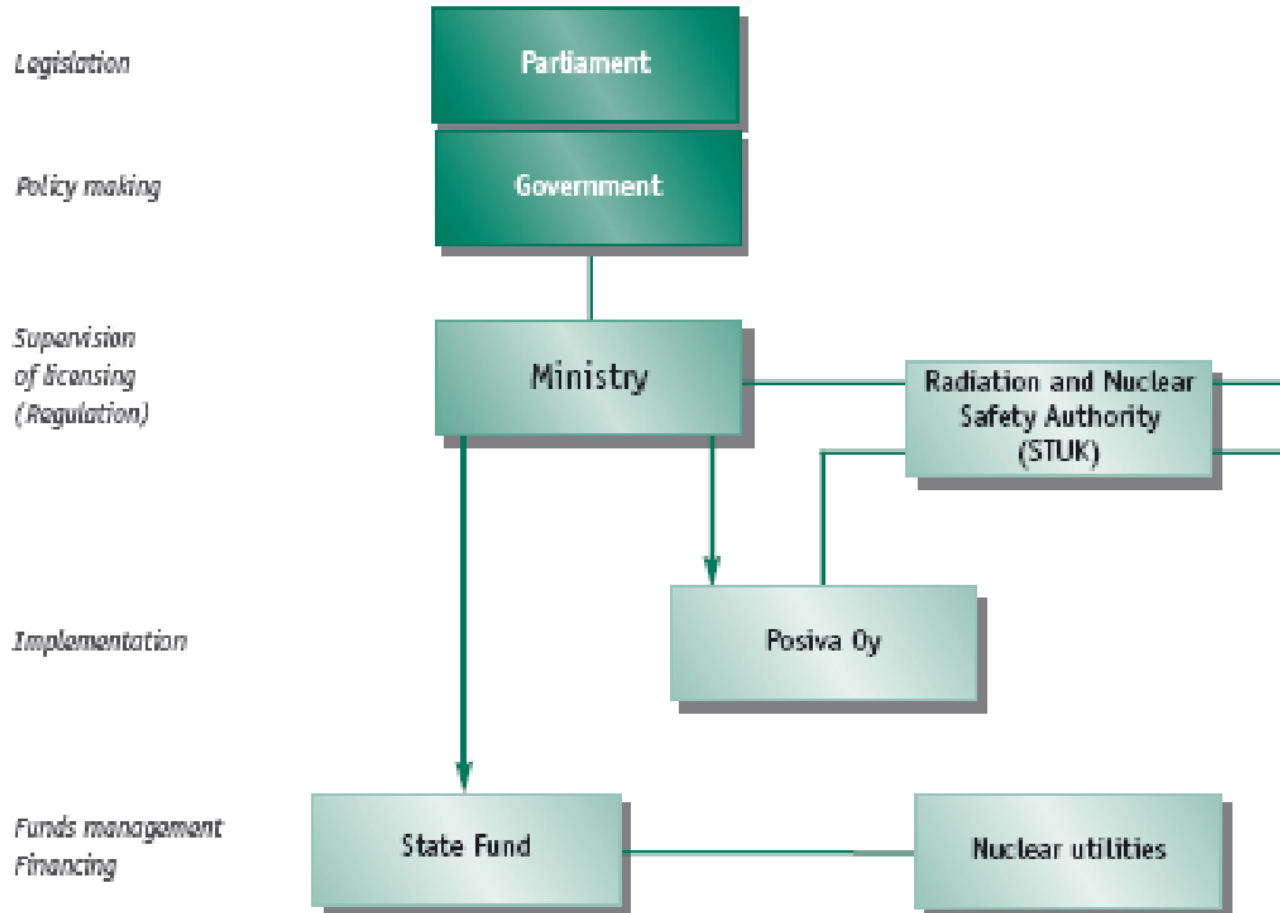
- In 1988, the **fund for nuclear waste management** was established. Its purpose is to collect, store and reliably invest the money that is going to be needed to take care of nuclear waste in future. It is now administered by the MEE; decisions are made by a board. On the basis of cost estimate and expert reviews of them, the Ministry decides annually about the contributions to be made by the energy industry to the fund. The fund includes **in July 2013 2.1 billion euros** – located outside the annual state budget. On this basis the Finnish state provides a financial guarantee for the handling of nuclear waste “under all circumstances”. As the Ministry bases its decisions on the payments largely on the data provided by “the parties liable for nuclear waste management” (the energy industry), one can say, that the industry decides to quite an extent itself about the money to be saved for the waste management.

Legal framework

- The Nuclear Waste Fund lends 75 % of the money back to the nuclear power companies and 25 % to the government. So in practice, the nuclear power companies collect money that they then borrow and pay interest equal to the 12 month euro prime level.
- The fund is managed by its board and a director appointed by the government. The board makes all of the most important decisions concerning the operative functions of the fund.

Institutional framework

Main bodies involved in radioactive waste management in Finland

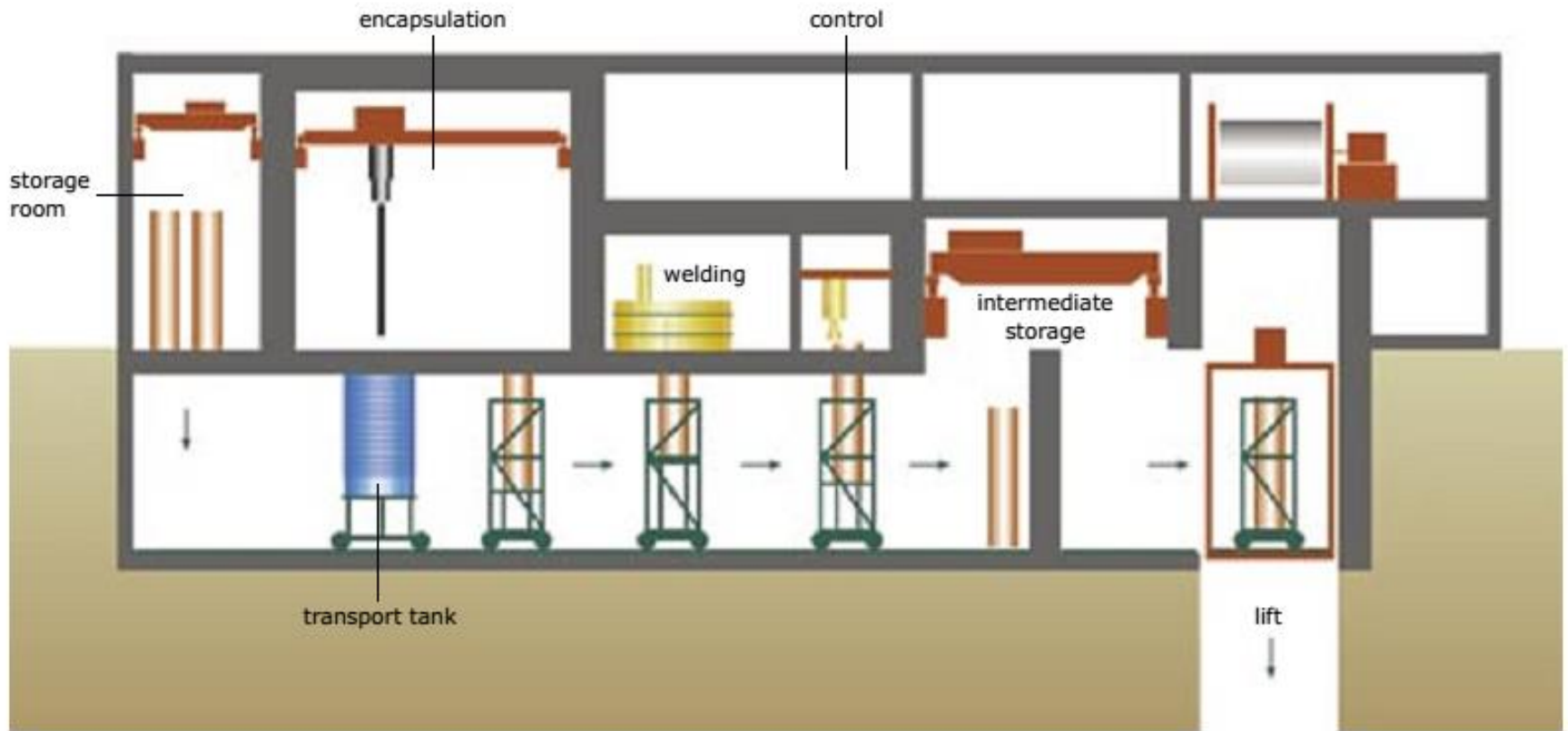


Institutional framework

- The main actors in the field of nuclear power are the owners of the NPPs in Loviisa, **Fortum Oyj** (earlier Imatran Voima Oy/IVO) and in Olkiluoto, **Teollisuuden Voima Oyj/TVO**. The two companies formed in 1996 a joint company, **Posiva**, to fulfil the duties according the amended Nuclear Energy Act from 1994, to take care of the nuclear waste their NPPs produced.
- Political guidance and control in matters of nuclear energy in Finland is exercised by the **Ministry of Employment and the Economy (MEE)** (until 2008: Ministry of Trade and Industry/MTI), which is responsible for preparing and monitoring national legislation and negotiating international agreements. The **Radiation and Nuclear Safety Authority (STUK)** is in charge of the management of nuclear and radiation safety.

Final Disposal in Olkiluoto-4

Encapsulation plant for spent nuclear fuel



Final Disposal Canisters

Loviisa 1 and 2

- Height 3.6 m
- Mass 16.1 t (empty)
- 12 spent fuel assemblies per canister

Olkiluoto 1 and 2

- Height 4.8 m
- Mass 20.7 t (empty)
- 12 spent fuel assemblies per canister

Olkiluoto 3

- Height 5.2 m
- Mass 26.0 t (empty)
- 4 spent fuel assemblies per canister



Information policy and participation

- Role of municipality
- “Nuclear municipalities”
- Industry funding the local community

Lessons learnt

- Successful propaganda of the industry in favour of “safe Finnish Nuclear Energy”
- Role of the so-called “experts”
- Consensus society: opposition and the role of decisions made
- NIK