



# Environmental Impact Assessment Programme Summary

Extension of the Olkiluoto nuclear power plant by a fourth unit



# 1 Project and its justification

To improve its preparedness for constructing additional generation capacity, Teollisuuden Voima Oy (TVO) has initiated the environmental impact assessment procedure (EIA) concerning a new nuclear power plant unit possibly to be located at Olkiluoto. TVO is examining the construction of a nuclear power plant unit with an approximate net electrical output of 1,000 to 1,800 MW and thermal power of 2,800 to 4,600 MW at Olkiluoto, which is the site of two existing nuclear power plant units (OL1 and OL2) and a third one (OL3) under construction. TVO has not made any decisions concerning action to be taken subsequent to the EIA procedure.

The consumption of electricity in Finland continues to grow. Finland consumed approximately 90 TWh of electricity in 2006. The 80 TWh mark was exceeded in 2001, and 50 TWh in 1985. Electricity consumption has doubled in a quarter-of-a-century. The annual consumption is estimated to exceed 100 TWh in 6 to 8 years.

This document presents a summary of the EIA programme of the project. Among others, the document will be used as part of the international hearing.

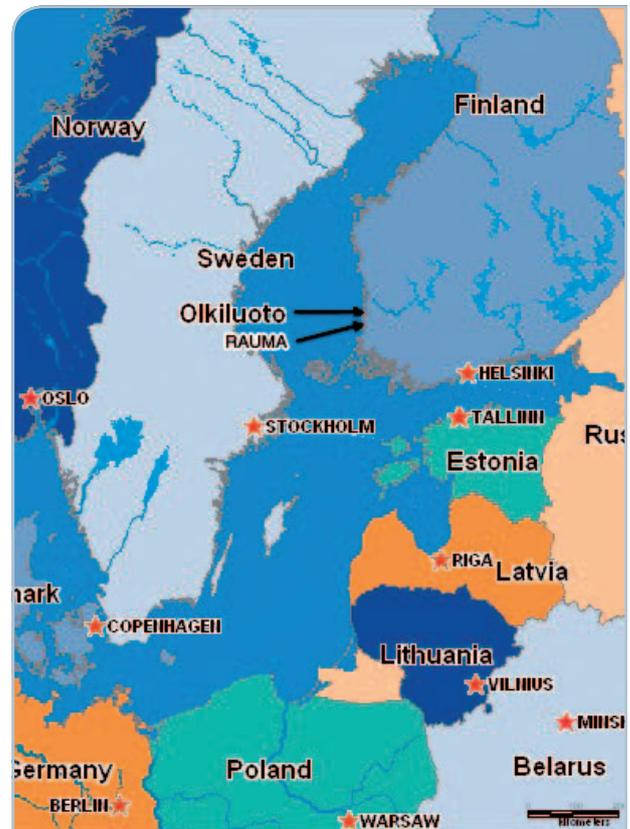
In a press release published on 28 March 2007, Fortum Corporation has announced that it will start an environmental impact assessment procedure for a third power plant unit possibly to be built adjacent to the Loviisa nuclear power plant.

## 1.1 Environmental impact assessment procedure

The directive (85/337/EEC) issued by the Council of European Communities (EC) has been enforced in Finland based on annex twenty (XX) of Treaty establishing the European Economic Community by virtue of the EIA Act (468/1994) and Decree (713/2006) on environmental impact assessment. According to the EIA Act, the projects to which an environmental impact assessment procedure is applicable are provided by the EIA decree. In list of projects within the EIA Act, nuclear power plants are included in projects subject to the assessment procedure.

In the first phase of the EIA procedure, an assessment programme will be prepared. An assessment programme presents the project information; alternatives to be assessed, information about the licences and permits required for the project, description of the environment, and the assessment methods. In addition, a plan for arranging the assessment procedure and participation, as well as the planning and implementation schedule of the project, will be presented.

Figure 1. Countries of the Baltic Sea region and the location of Rauma and Olkiluoto. (Source: Pöyry Energy Oy)

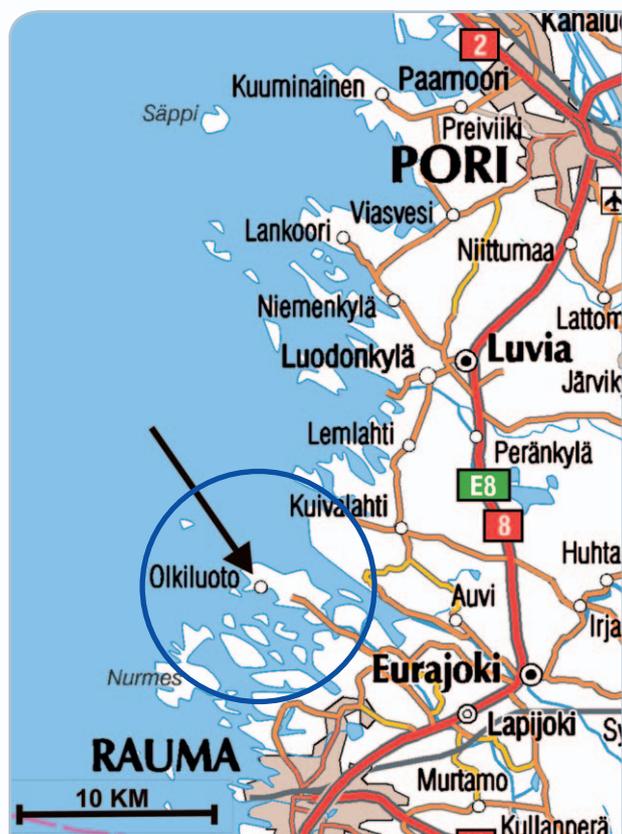


On the basis of the assessment programme and the statements and opinions received on it, an assessment report will be prepared. In nuclear power plant projects, the Ministry of Trade and Industry acts as the statutory coordinating authority of the EIA procedure, ensuring the public display of the assessment programme and report, compiling the statements and opinions given on the EIA programme and report, and providing its own statements on them.

The objective of the EIA procedure is to promote the assessment and uniform observation of environmental impacts in planning and decision-making. Another objective of the procedure is to increase the opportunities for the citizens to receive information and participate.

The UN Economic Commission Convention on Environmental Impact Assessment in a Transboundary Context (the so-called Espoo Convention) is also applied to the project. The nuclear power plant is included in the project list of the Convention. In Finland, the Ministry of the Environment acts as the contact authority for the Convention.

Figure 2. The location of Eurajoki and Olkiluoto. Eurajoki is located along Highway number 8 (E8). The distance from Highway number 8 to the Olkiluoto power plant is approximately 14 kilometres. (Base map © Affecto Finland Oy, Licence number L7153/07)

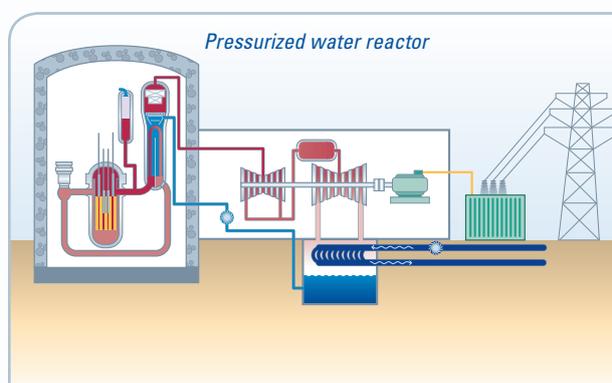
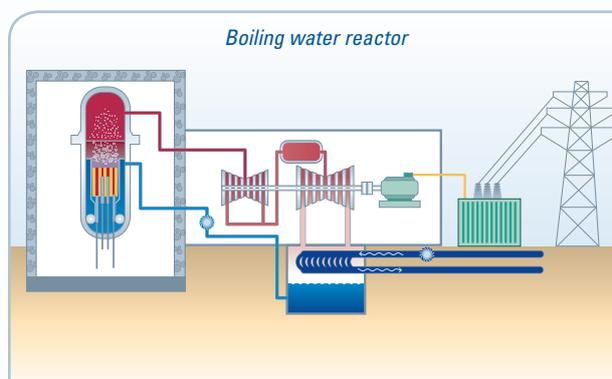


## 1.2 Licences required for the project under the Nuclear Energy Act

The new nuclear power plant unit requires a decision-in-principle issued by the Government and ratified by the Parliament stating that the power plant unit is in line with the overall good of society. The investment decision on the project cannot be made prior to the decision-in-principle. The Government grants the construction licence if the prerequisites for granting a construction licence for a nuclear facility provided in the Nuclear Energy Act (990/1987) are met. The Government grants the operating licence if the prerequisites prescribed by the Nuclear Energy Act are met and the Ministry of Trade and Industry has assured that provision for the cost of nuclear waste management has been arranged according to law.

## 1.3 Location

The planned site for the nuclear power plant units is on the West coast of Finland, on Olkiluoto Island in the municipality of Eurajoki. Olkiluoto is approximately 25 kilometres by road from the nearest town, Rauma.



## 1.4 Project options

The following project options will be considered in the environmental impact assessment:

- Construction of a new nuclear power plant unit with an approximate net electrical output of 1,000 to 1,800 MW at Olkiluoto. The nuclear power plant unit may be a boiling or pressurised water reactor plant. The alternatives examined are:
  - two locations at Olkiluoto
  - two cooling water intake and two discharge location alternatives.
- Non-implementation of the project (the zero-option).

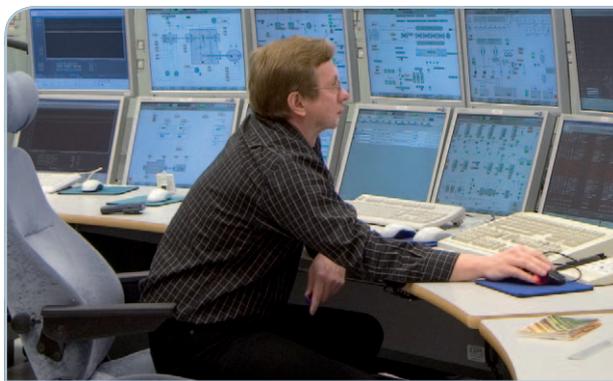
A situation in which the power plant unit will not be constructed at Olkiluoto is examined as the zero-option. The zero-option will examine the environmental impacts that would result if the amount of electricity equal to the production of the power plant unit were purchased from the market.

## 1.5 Nuclear safety

In Finland, the provisions for the use of nuclear energy are stipulated by the Nuclear Energy Act and Decree. The nuclear energy legislation lays down the requirements concerning, among other things, the general safety principles for the use of nuclear energy, the licensing procedure for nuclear facilities, the supervision of safety, and nuclear waste management.

In Finland, the Radiation and Nuclear Safety Authority (STUK) is the authority that supervises the safety of nuclear power plants in Finland and issues detailed regulations that apply to the safety and safe use of nuclear energy and to physical protection, emergency preparedness and safeguards. STUK is also responsible for the supervision of the use of nuclear materials and the treatment and storage of nuclear waste.

A nuclear power plant must be designed in accordance with nuclear energy legislation and Regulatory Guides on



Nuclear Safety published by STUK in order to ensure the safety of its operation. The Regulatory Guides on Nuclear Safety contain detailed safety requirements. The guides apply to the safety of nuclear power plants, nuclear materials and nuclear waste, as well as to the safety systems and emergency preparedness required for the use of nuclear energy. The Regulatory Guides on Nuclear Safety are rules the licensee or any other organisation concerned must comply with.

The latest safety requirements will be taken into account in the potential new power plant unit. The potential plant unit will be one in which preparations have been made for severe accidents and the mitigation of their consequences.

Reactor safety requires the functionality of three factors in all circumstances:

- managing the chain reaction and the power it produces
- cooling the fuel after the chain reaction has ended, also known as decay heat removal
- isolation of radioactive substances from the environment.

The fundamentals of safety include several barriers for radioactive substances and the defence in depth principle. The principle of several barriers means that there is a series



Figure 3. The Olkiluoto power plant site. Locations on the map include the existing nuclear power plant units OL1 and OL2 (1), the construction site for the OL3 unit under construction (2), the interim storage for spent fuel (3), the final repository for operating waste (4), the construction site for an underground rock characterisation facility for the final repository of spent fuel (5), and the Visitor Centre (6). The alternative locations for the new power plant unit are also indicated on the map.

of strong and tight physical barriers between radioactive substances and the environment, preventing the substances from entering the environment in all circumstances. The tightness of any single barrier is enough to ensure that no radioactive substances can enter the environment. The defence in depth principle refers to the prevention of the occurrence of transients and accidents as well as to the control of transients and accidents and mitigation of their consequences.

STUK is responsible for supervising all activities, ranging from the design of power plants to their decommissioning. The objective is to ensure nuclear power plant safety so that plant operation does not cause radiation hazards, which could endanger the safety of workers or of the population in the vicinity or could otherwise harm the environment or property.

## 1.6 Spent fuel and operating waste

Spent fuel is initially cooled down and stored for a few years in water pools at the power plant unit. After this, it is taken to the interim storage for spent fuel to be cooled in water pools at the Olkiluoto power plant site. Intermediate storage will continue for decades until the final disposal of the spent fuel.

The low and intermediate-level operating waste produced by the power plant unit, as well as the decommissioning waste and dismantled components will be placed in the operating waste final repository. The implementation of the new power plant unit requires that the currently used interim storage facility for spent fuel and operating waste final repository be extended in a later phase.



In Finland spent nuclear fuel will be disposed of in a final repository to be excavated in bedrock. An environmental impact assessment concerning the final repository for spent nuclear fuel was completed in 1999. After positive decisions-in-principle (in 2001 and 2002), Posiva Oy, the company responsible for the disposal of spent nuclear fuel, focused its further research on Olkiluoto site and started preparations for building an underground rock characterisation facility. The intention is to dispose of spent nuclear fuel in the bedrock of Olkiluoto at a depth of approximately 400 to 500 metres. The disposal of spent fuel is scheduled to start in 2020. The spent fuel from a potential new plant unit will be disposed of at the same location as spent fuel from other nuclear power plant units in Finland.

### 1.7 Present state and monitoring of radiation

The releases of radioactive substances from the power plant to air and seawater are under constant monitoring. The releases are carefully measured to ensure that they remain clearly below the prescribed limits. Radioactivity is measured on and around the power plant site from objects such as seawater, fish, algae, seabed fauna, air, soil, grass, as well as garden and agricultural products and meat. Monitoring is carried out in accordance with the radiation control programme for the surroundings of the power plant, and the results are reported to STUK.

Annual radiation doses to the environment are calculated on the basis of radioactive releases from the power plant. The calculating models account for the spreading of radioactive substances in the atmosphere and waters, as well as accumulation phenomena in different food chains. The calculation of radiation doses to people residing near the plant accounts for the means by which they utilise the environment surrounding the power plant for purposes such as agriculture, recreation and fishing in order to be able to

determine the radiation doses caused by people through different routes of origination.

The environmental radiation caused by the Olkiluoto nuclear power plant is very marginal in comparison to the average radiation dose received by Finns from other sources of radiation, which amounts to approximately 3700 microsieverts annually. However, environmental monitoring measures can be used to monitor the occurrence of radioactive substances originating from the nuclear power plant in the environment because they can be distinguished from natural radioactive substances and those originating from other sources.

The radiation dose to nearby residents due to atmospheric and aquatic releases in 2006 was approximately 0.27 microsieverts/inhabitant. The allowed maximum annual dose caused by releases from Olkiluoto power plant is 100 microsieverts.

Radioactive substances originating from the Olkiluoto power plant are detected relatively rarely in samples taken from the ground environment. A few observations are made each year in air and fallout samples, but the concentrations have only been in the order of one thousandth of natural activity at maximum. Small amounts of radioactive substances originating from the power plant are regularly observed in aquatic samples, such as algae, aquatic vegetation, sea bed fauna and sinking matter, taken from the immediate vicinity of the power plant, but the concentrations have been insignificant both for humans and nature. Observations of radioactive substances in food samples have been rare. Radioactive substances originating from the Olkiluoto power plant have never been detected in samples of milk, crops and meat during the entire operating history of the power plant.

If radioactive substances were to be released from the plant to an extent that would increase the radiation level in the immediate surroundings, the monitoring network surrounding the plant units would immediately observe the situation. The network consists of measuring stations located at distances of 1 to 5 kilometres from the nuclear power plant from which the data is automatically transmitted to the computers of the plant units. This data is also available for the inspections of STUK.

To provide for the occurrence of accidents in the land use planning, the existing Olkiluoto power plant has been allotted a protection zone extending to approximately 5 km from the power plant as well as an emergency planning zone of rescue operations comprising the nearby municipalities of Eurajoki, Luvia and Rauma.

## 2 Examined impacts

The EIA report will present the impacts occurring during the construction and operation of the plant unit, as well as those arising from the decommissioning of the unit. In addition to the above, the impacts of production and transport of nuclear fuel, as well as the impacts arising from the final disposal of spent nuclear fuel, will be assessed to the required extent, and the possible associated projects and their environmental impacts will be examined.

The EIA procedure will primarily assess the environmental impacts of operations taking place on the power plant site, including radiation impacts. Operations extending outside the site include, for example, traffic during the construction and operation of the plant unit. The impacts of these operations will also be assessed to the required extent. The environmental impact of the construction of transmission lines to the national grid will be assessed in a separate EIA procedure.

*The EIA procedure will assess:*

- **the impacts of construction on**
  - soil, bedrock and ground water
  - vegetation, animals and objects of protection
  - employment and industries
  - residents' welfare
  - noise levels
  - traffic
- **the impacts during the operation of the new plant unit on**
  - air quality and climate
  - waters, water fauna and fishing
  - soil, bedrock and ground water
  - vegetation, animals and conservation areas
  - land use, structures and landscape
  - people and society
  - energy market.

*In addition, the following will be assessed to the required extent:*

- impacts of waste and by-products and their treatment
- environmental impact of traffic
- impacts of exceptional and accident situations
- impacts of power plant unit decommissioning
- impacts of nuclear fuel production and transport
- impacts of associated projects
- impacts of the zero-option
- comparison between alternatives.



In practice, the project's environmental impacts will be assessed by examining the present state of the environment and assessing the changes caused by the projects as well as their significance. Planned assessments include e.g. cooling water dispersion calculations, noise modelling, an assessment concerning the regional structure and economy, an assessment of the power plant's landscape impacts, and preparation of conceptual drawings. If required, a resident survey and thematic interviews will be carried out to investigate the attitudes of nearby residents towards the project and to support the assessment of social impacts. The investigation of health impacts is part of the assessment of the project's social impacts.

The EIA report will discuss the environmental impacts of accidents based on the safety analyses of the existing power plant units and the requirements imposed on the new unit. The consequences of exceptional situations will be assessed based on the extensive research data on the health and environmental impacts of radiation. In addition to the above, the development in the safety of nuclear power plants will also be considered.

## 2.1 Limits of environmental impact assessment

Observed area refers to the area defined for each type of impact within which the environmental impact in question is examined and assessed. Affected area, on the other hand, refers to the area where, based on the assessment, the environmental impact in question is expected to appear. The affected area is thus expected to be substantially smaller than the observed area.

The aim is to define the observed area so large that significant environmental impacts cannot be expected to appear outside it. If, however, it becomes apparent during the assessment work that a specific environmental impact has a respective affected area larger than is estimated, the scope of the observed and affected areas will, in that case, be re-defined with regard to the impact in question. The actual definition of affected areas will thus be carried out in the environmental impact assessment report as a result of the assessment work.

## 3 Information about possible transboundary environmental impacts

Safety will be the basic design principle of the potential new nuclear power plant unit. If the decision is made to implement the new plant unit, the most recent safety requirements will be taken into account. The plant unit in question will be one in which provisions have been made for severe accidents and the mitigation of their consequences. The potential hazardous situations will be analysed already in the plant design phase, and reliable technical protection will be designed for each situation.

Protection against external hazards will also be carried out. The design of the plant unit includes preparations for, among other things, a big passenger airplane crash and exceptional weather conditions. Other contemporary threats, such as the effect of climate change, will also be considered in the design.

In the extremely unlikely event of an accident as a consequence of which a large radioactive release were to occur regardless of the provisions made for severe accidents and the mitigation of their consequences, there is an extremely small possibility for impacts outside of Finland in some weather

conditions. At this stage, the project has not been identified as having any other impacts extending beyond Finnish territory. This issue will be examined in more detail in the EIA report.

## 4 Schedule

The environmental impact assessment report is planned for completion in February 2008, and the EIA procedure concerning the project is intended to be completed during summer 2008. If it is decided to implement the project, the aim is to start construction of the new nuclear power plant unit around 2013. Thus the plant could be commissioned around 2018.

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