



Construction of a Nuclear Power Plant Unit at Olkiluoto

General Description



Foreword

This publication describes the Teollisuuden Voima Oyj (TVO) project to build a new, fourth nuclear power plant unit (Olkiluoto 4). TVO has applied for a decision-in-principle from the government in accordance with the Nuclear Energy Act on whether the construction of the new nuclear power plant unit is in line with the overall good of society. The new plant unit would be located at Olkiluoto, in the municipality of Eurajoki.

Furthermore, the scope of the project includes the nuclear facilities associated with the operation of the new nuclear power plant unit at the same site, required for the storage of fresh nuclear fuel and intermediate storage of spent nuclear fuel, as well as the processing, storage and disposal of low-level and intermediate-level operating waste. The intermediate storage of spent nuclear fuel and the disposal of low-level and intermediate-level operating waste would be implemented through expansions to existing capacity. Posiva Oy has submitted a separate application for a decision-in-principle to the government regarding the final disposal of spent fuel from Olkiluoto 4.

The Nuclear Energy Act requires the applicant for a decision-in-principle to publish and distribute an general description of the nuclear power plant project. The description must be generally available at least one month before a public hearing is held.

The environmental impacts of the planned nuclear power plant unit have been assessed in a statutory environmental impact assessment (EIA) procedure. The environmental impact assessment has been done for two alternative locations at Olkiluoto.

A decision-in-principle has been applied for through an application addressed to the Government, and Ministry of Employment and the Economy will obtain statements from the appropriate ministries and authorities, such as the Radiation and Nuclear

Safety Authority (STUK), the municipality of Eurajoki and the neighbouring municipalities.

The Ministry of Employment and the Economy provides citizens and organisations with an opportunity to express their opinions on the project in writing directly to the ministry. The ministry will also arrange a public hearing in Eurajoki. At the hearing, opinions may be expressed orally and in writing. A summary of the opinions and statements presented to the Ministry of Employment and the Economy will be prepared and taken into account in the preparation of the decision-in-principle.

The information in this publication is based on TVO's application for a decision-in-principle and investigations made for that purpose. The publication has been prepared in accordance with instructions from the Ministry of Employment and the Economy, and the ministry has inspected it. The general description is distributed to all households in the town of Rauma and the municipalities of Eura, Eurajoki, Kiukainen, Lappi, Luvia and Nakkila.

The general description is available from:

Teollisuuden Voima Oyj
Communications
Olkiluoto
FI-27160 EURAJOKI
Tel. 02 8381 5201
E-mail: viestinta@tvo.fi

The general description and other documents related to the processing of the application for a decision-in-principle can be viewed on the Web site of the Ministry of Employment and the Economy, at <http://www.tem.fi/>.

Helsinki, August 2008



Teollisuuden Voima Oyj
Olkiluoto
27160 EURAJOKI

STATEMENT
(translation)
21 August 2008

1384/815/2008

Reference: Teollisuuden Voima Oyj's application for decision-in-principle dated 25 April 2008 and letters dated 5 May 2008 and 18 August 2008

GENERAL DESCRIPTION OF THE NEW NUCLEAR POWER PLANT UNIT

Teollisuuden Voima Oyj has delivered a general description of the project to build a new nuclear power plant unit (Olkiluoto 4) and its environmental impacts and safety for the inspection of the Ministry of Employment and the Economy referred to in Section 13 of the Nuclear Energy Act (990/1987). Some amendments have been made to the report on the basis of the remarks the Ministry has made and it has been delivered in a more detailed form to the Ministry on 18 August 2008.

The Ministry of Employment and the Economy has inspected the general description. The Ministry states that the instructions for compiling the report provided by the Ministry have been adhered to in a sufficient accuracy, and that the report corresponds with the application and its content is appropriate.

The Ministry of Employment and the Economy does not object to the publication of the report in the presented form. The Ministry is of the view that the plan proposed by the company concerning the distribution of the report and making it publicly available is in accordance with section 28 of the Nuclear Energy Decree (161/1988).

The Ministry of Employment and the Economy also states that Posiva Oy has a pending application for a decision-in-principle concerning spent fuel management of the Olkiluoto 4 plant unit.

Mauri Pekkarinen
Minister of Economic Affairs

Jorma Aurela
Senior Engineer

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Reasons for applying for a decision-in-principle

By virtue of the Nuclear Energy Act, a project to build a nuclear power plant must be submitted to the government as early as possible. In its decision-in-principle, the government decides whether the project is in line with the overall good of society. The validity of the decision-in-principle requires approval by Parliament. Preparation of the project may only continue after this.

TVO considers its project of constructing more nuclear power as part of the required new electricity production capacity to be in line with the overall good of society. As a form of electricity production, nuclear power is in harmony with the objectives of Finland's climate and energy policy. The production of nuclear power does not cause carbon dioxide emissions, nuclear power helps in reducing the dependency on imported power, it is economical when compared to other forms of production and suitable as base-load power for Finnish consumption and the construction of nuclear power does not need economic support from society.

The impacts on people, nature and the built environment resulting from the construction of Olkiluoto 4 have been assessed in accordance with the environmental impact assessment, a.k.a. EIA, procedure. The Ministry of Employment and the Economy on 19 June 2008 issued a statement on the EIA report, and TVO will take any remarks presented in the statements into consideration when implementing the Olkiluoto 4 project. The requirements concerning safety and the environment will be specified in more detail during the construction licence and environmental permit procedures following the decision-in-principle.

On the basis of results from preliminary technical and economical evaluations, TVO has decided to apply for a decision-in-principle in accordance with the Nuclear Energy Act for building Olkiluoto 4. The decision-in-principle constitutes an expression of the government's opinion regarding whether the project is in line with the overall good of society.

Stages of the licensing procedure

Application

TVO has submitted an application for a decision-in-principle to the government with regard to the construction of a fourth nuclear power plant unit at Olkiluoto. The application for a decision-in-principle seeks a statement regarding whether the construction of a new nuclear power plant unit is in line with the overall good of society.

Statements

In accordance with the Nuclear Energy Act, the Ministry of Employment and the Economy shall obtain statements on the application from the Radiation and Nuclear Safety Authority, the Ministry of the Environment, the municipality of Eurajoki and the neighbouring municipalities. Other parties are also requested to provide statements. A supporting statement from the municipality of Eurajoki is a prerequisite for the decision-in-principle on a new nuclear power plant unit.

Public hearing

In connection with the processing of the application for the decision-in-principle, citizens and their organisations will be heard. The Ministry of Employment and the Economy will arrange a public hearing in Eurajoki. Further details of the hearing are provided at the end of this description on page 23. At the hearing, opinions may be expressed orally and in writing. Opinions may also be expressed in writing by 12 November 2008 directly to the ministry:

Ministry of Employment and the Economy
P.O. Box 32, FI-00023 VALTIONEUVOSTO
E-mail: kuuleminen@tem.fi

When expressing opinions and issuing statements, kindly refer to the diary number of the matter: 1384/815/2008.

Decision-in-principle by the government

The Ministry of Employment and the Economy will inform the government about the opinions expressed. Before making a decision-in-principle, the government must become aware that the municipality of Eurajoki is in favour of construction. A positive decision by the government also requires, inter alia, that no issues to have arisen pointing out that the plant unit would not be safe.

Parliament procedure

If the government makes a positive decision-in-principle, it shall be submitted to Parliament for ratification. Parliament may either sustain the government's positive decision or overturn it by simple majority.

Construction and operating licences

After the decision-in-principle has been confirmed by Parliament, TVO may request tenders for the new nuclear power plant unit. After the comparison of tenders, TVO shall choose the plant alternative to be implemented. Before starting the construction of the plant unit, TVO must obtain a construction licence for the new power plant unit in accordance with the Nuclear Energy Act.

Before the operation of the new plant unit commences, an operation licence in accordance with the Nuclear Energy Act must be obtained. Separate hearing procedures are associated with the construction licence and operation licence stages. The licensing decisions will be made by the government.

Other permits

In addition to the licences required by the Nuclear Energy Act, the project will require permits and approvals in accordance with other applicable legislation, such as the Environmental Protection Act and the Land Use and Building Act.

Justification for the project

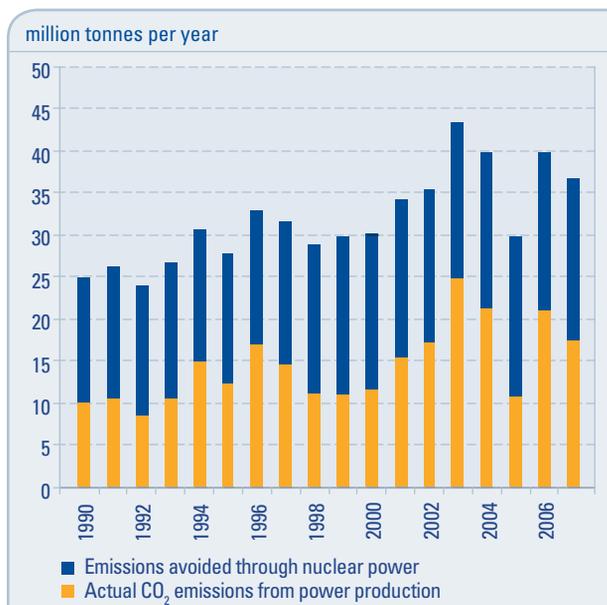
The production of nuclear power does not cause carbon dioxide emissions

The prevention of the climate change is one of the most significant challenges for mankind. Through its policy decision made in the spring of 2007, the European Union has committed to reducing greenhouse gas emissions by 20 per cent from the 1990 level by the year 2020. A variety of actions are required for reducing emissions. The focus is on increasing energy-efficiency, use of renewable energy sources of energy and nuclear power. With regard to impacts and expenses, the construction of additional nuclear power is an efficient way to limit carbon dioxide emissions caused by electricity production in Finland.

Nuclear power helps in reducing dependency on imported electricity

Imports have played a significant role in Finnish supply electricity in recent years. In 2007, imports covered approximately 14 per cent of the electricity demand. Imports to Finland in recent years have corresponded to the annual production of 1–1.5 nuclear power plant units. Finland has been a net importer of electricity in the open Nordic electricity market for several years. Additional nuclear power will significantly reduce Finland’s dependency on imported electricity.

Figure 1 Carbon dioxide emissions avoided through nuclear power. Source: Finnish Energy Industries, TVO, 2008.



The need for electricity is increasing

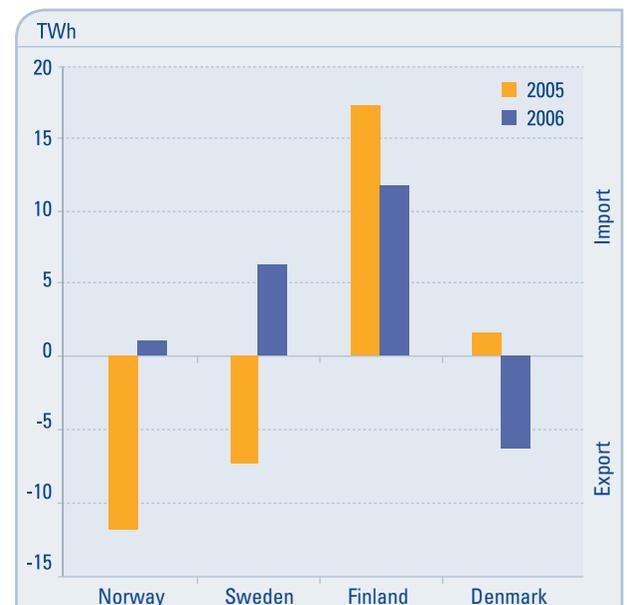
The increased consumption of electricity has been and will be linked with maintaining well-being and increasing production. The use of electricity has increased in all final consumption sectors, industry, services and households alike. According to an estimate by Finnish Energy Industries, electricity consumption in Finland will increase to some 107 TWh by 2020 and 115 TWh by 2030. The current consumption is approximately 90 TWh per annum. The average annual growth will be 1.2 per cent until 2020 and 0.7 per cent between 2020 and 2030.

More production capacity is needed

The electricity production structure in Finland is one of the most diversified in the world. The diversification of production forms contributes to security of supply and stable price development of electricity. Maintaining the reliability and economic viability of electricity production, as well as reducing the climate and environmental impacts, requires that the versatility of electricity production is maintained and that no forms of production are locked out.

Finland’s diversified electricity production structure is also well suited to the Nordic electricity market, in which Norway produces power almost exclusively via hydropower, Sweden uses hydropower and nuclear power, and Denmark focuses on coal and, to some extent, also wind power.

Figure 2 Import and export of electricity in the Nordic countries. Source: Nordel, 2007.



In accordance with the ‘Electricity Production Scenarios until 2030’ report of Finnish Energy Industries, the difference between the peak power requirement and electricity production capacity will increase to 2,800 MW before the completion of the fifth nuclear power plant unit (Olkiluoto 3) and decrease to 1,200 MW due to completion of the unit. After this, the difference will increase to some 5,500 MW by 2020 and some 8,400 MW by 2030.

The nuclear power plant unit subject to the application would cover a substantial share of the increase in electricity consumption as well as the shortage of capacity in our country through emissions-free electricity production.

Nuclear power is economical when compared to other alternatives for production

With regard to renewable energy sources, Finnish Energy Industries estimates that hydropower can be increased by some 1.6 TWh from the present annual volume. The use of biomass will continue to be focused mainly on combined heat and power production, the amount of which can be increased to a total of slightly more than 32 TWh annually in accordance with an estimate in the national energy and climate strategy of 2005. In addition to biomass, combined production is fueled by peat, natural gas and coal. When increasing production of wind power its time variation and the additional

need for balancing power arising from this, as well as the high costs of wind power production has to be taken into account.

These forms of production are not enough to cover the deficit between electricity consumption and production capacity. The main option for covering the deficit is to increase the production of condensing power. Fuels to be used in condensing power production include peat or fossil fuels, such as coal or natural gas. The increase in condensing power can also be implemented via nuclear power, which is a very good alternative when compared to peat and fossil fuels with regard to reliability of power supply, competitive production costs and the reduction of emissions in overall comparison. TVO has not received any financial support from the public sector for the construction and production of nuclear power.

Nuclear power is suitable as base-load power for Finnish consumption

TVO generates electricity for its shareholders all year round. The need for base-load power is still increasing as the use of electricity in housing and services becomes more versatile and industrial production increases. Nuclear power is well suited to base-load power production because the operating costs account for only a small proportion of total production costs.

Figure 3 Procurement of electricity by energy source in 2007.
Source: Finnish Energy Industries, 2008.

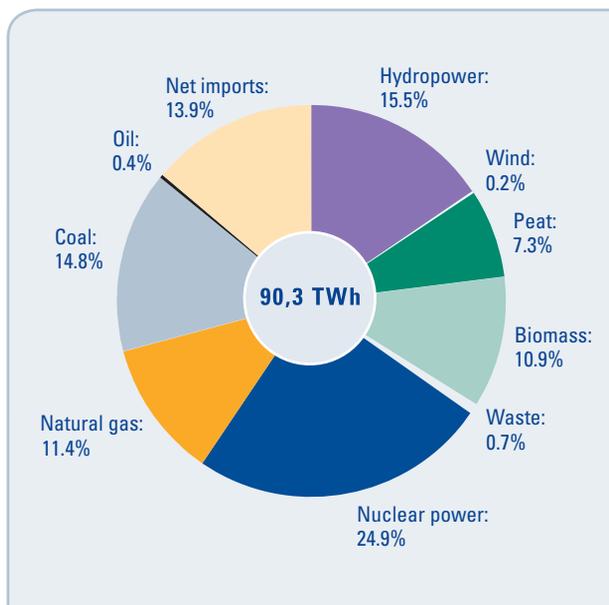
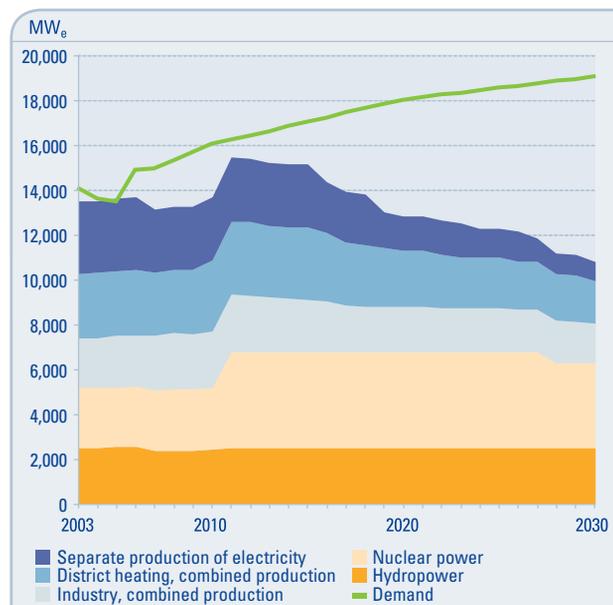


Figure 4 Peak demand for electricity and production capacity available in Finland. Source: Finnish Energy Industries, 2008.



Project to build a new nuclear power plant unit

TVO is the owner and the operator of the Olkiluoto nuclear power plant, located in the municipality of Eurajoki. The combined production of the two plant units, Olkiluoto 1 and Olkiluoto 2, currently accounts for approximately one sixth of all electricity consumption in Finland. The power plant unit Olkiluoto 3 (OL3) is under construction at Olkiluoto.

The application concerns a nuclear power plant unit with a light-water reactor of no more than 4,600 MW of thermal power and an electrical output on the order of 1,000 to 1,800 MW. The annual electricity production of the plant unit is 8 to 13 billion kilowatt-hours. The construction of the power plant unit could begin after the completion of the tender process and construction licence stages following the decision-in-principle, approximately in 2012. The new unit will enter operation in the late 2010s, and its planned technical service life is 60 years.

Olkiluoto as a plant site

The area of some 750 hectares owned by TVO in Olkiluoto provides good conditions for siting of nuclear power plant units. The undivided area allows its flexible use and ensuring and further developing of area security and environmental safety.

The site of a nuclear power plant unit must have a sufficient supply of cooling water and service water, good traffic connections, a sufficiently large area and suitable geological and topographical conditions. These prerequisites are fulfilled well at the Olkiluoto site.

The land use of the site of the new plant unit is in harmony with other land use on the Olkiluoto island and relies on the existing Olkiluoto infrastructure. The new unit may utilise supporting functions, premises and structures built for the existing plant units.

Figure 5 The infrastructure at Olkiluoto, developed during nearly four decades, is ready for the OL4 plant unit. The conceptual photograph shows OL4 completed. Source: TVO



According to the EIA Report by TVO, the new plant unit's impact on the environment is minor and limited mainly to the local warming of seawater and changed flow conditions caused by the cooling water required by the unit.

The licensing procedure and the construction of the new plant unit do not require changes in the current land use plan for Olkiluoto. The plan and its specifications create the preconditions for long-term safe operation of nuclear power plant units at Olkiluoto.

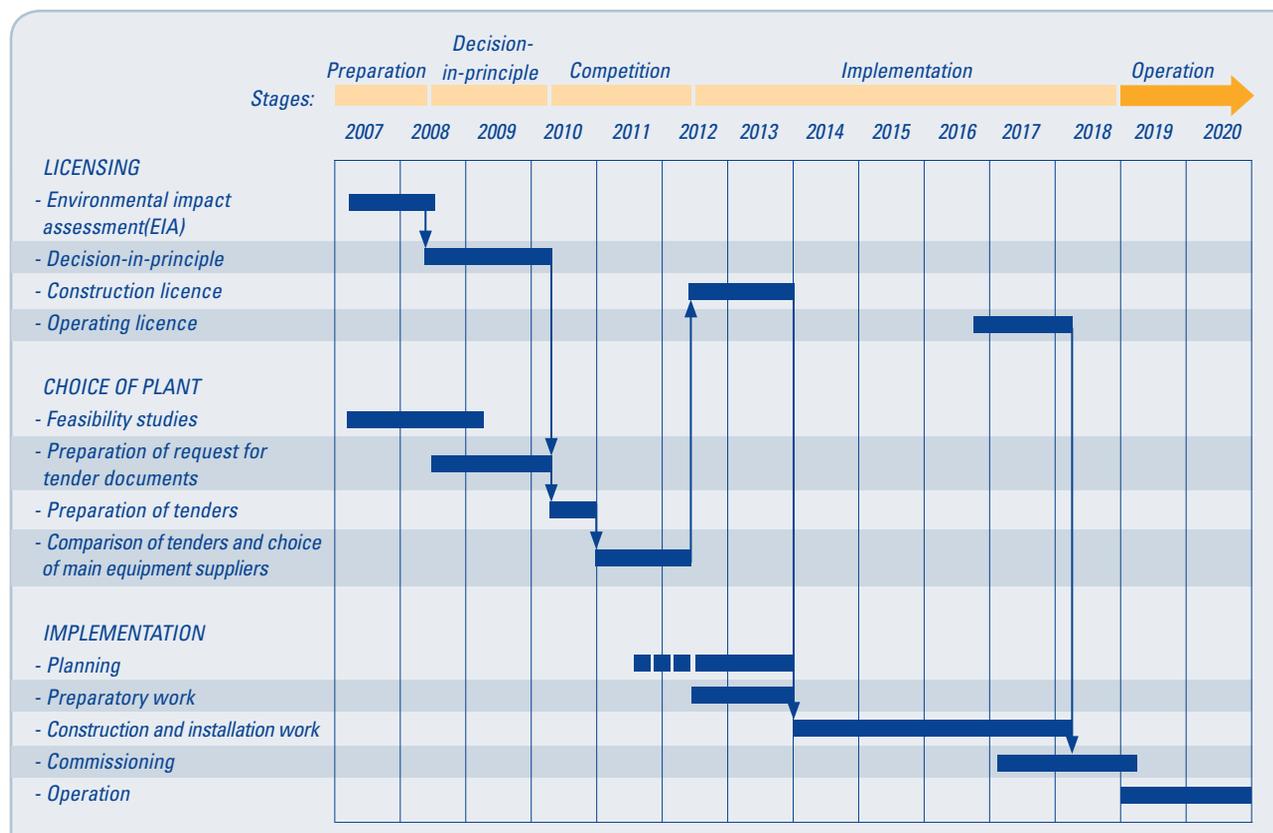
The fuel management and the nuclear waste management for the new unit will be arranged in accordance with the same principles as the fuel and nuclear waste management for the units currently in operation and the Olkiluoto 3 unit under construction.

Several plant alternatives

The planned new nuclear power plant unit will operate on the principle of a light-water reactor plant. Heat generated by uranium fuel is used to produce high-pressure steam. The steam is conducted to turbines that drive an electric generator. In its basic principle, a nuclear power plant is a steam power plant, just as a coal-fired power plant is.

TVO has studied the feasibility of nuclear power plant alternatives in Finland. They represent the latest developments in light-water reactor technology with regard to safety and economy-related properties. According to the studies, there are several nuclear power plant alternatives on the market that are suitable for construction in Finland either as such or with feasible changes.

Figure 6 Olkiluoto 4 project schedule.
Source: TVO, 2008.

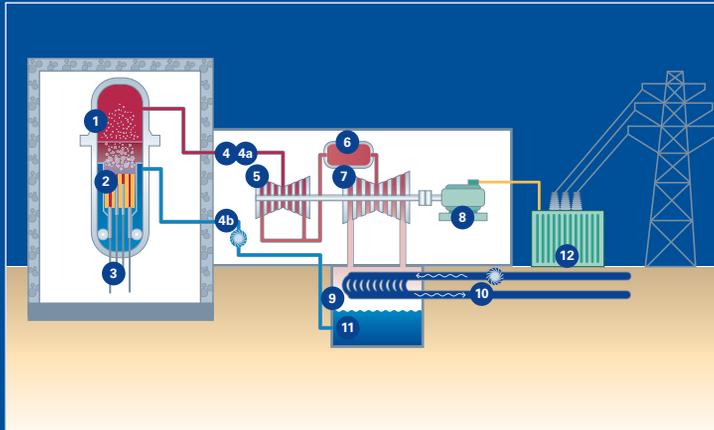


Plant alternatives studied by TVO

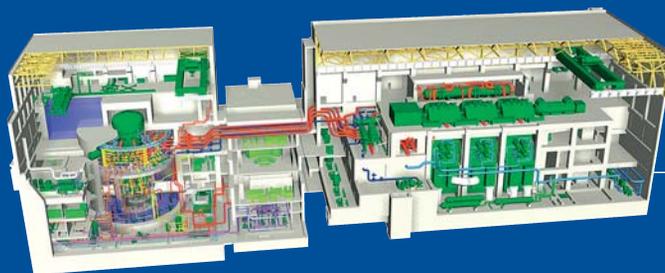
Further information on plant alternatives is available from:
<http://www.tvo.fi/www/page/2842/> (OL4 - Plant type alternatives).

Source: TVO.

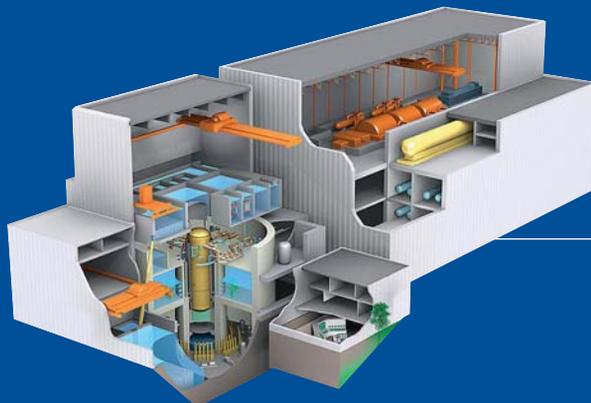
Principle of operation of a boiling-water reactor plant



- | | |
|-------------------------------|--------------------------|
| 1. Reactor | 6. Reheater |
| 2. Core | 7. Low-pressure turbines |
| 3. Control rods | 8. Generator |
| 4. Primary circuit | 9. Condenser |
| 4a. Steam to the turbine | 10. Seawater circuit |
| 4b. Feed water to the reactor | 11. Condensate |
| 5. High-pressure turbine | 12. Transformer |



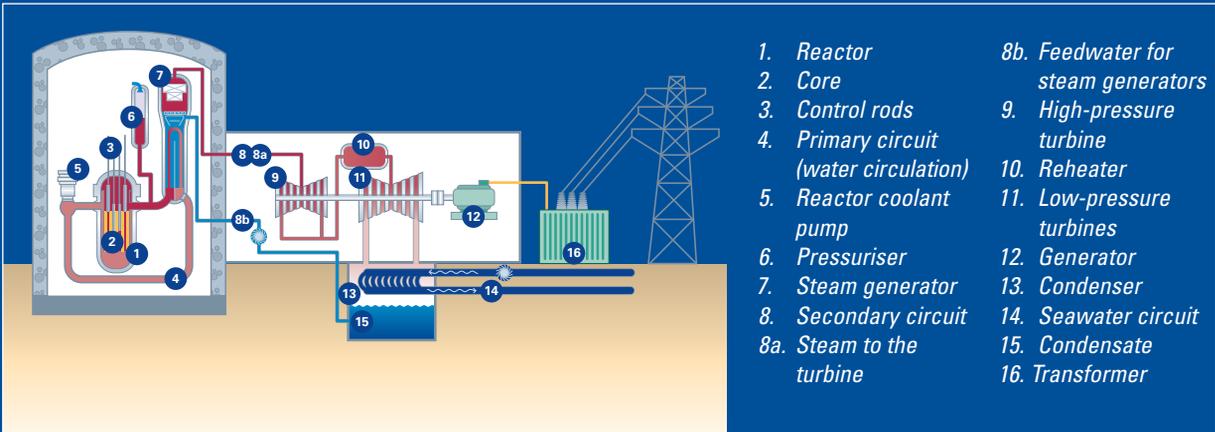
ABWR Toshiba
 Electrical power: approx. 1,650 MW
 Supplier: Toshiba Westinghouse
 Country of origin: Japan-Sweden
 Thermal power of reactor: 4,300 MW



ESBWR GE Hitachi
 Electrical power: approx. 1,650 MW
 Supplier: GE Hitachi
 Country of origin: USA
 Thermal power of reactor: 4,500 MW

Source: TVO.

Principle of operation of a pressurised-water reactor plant

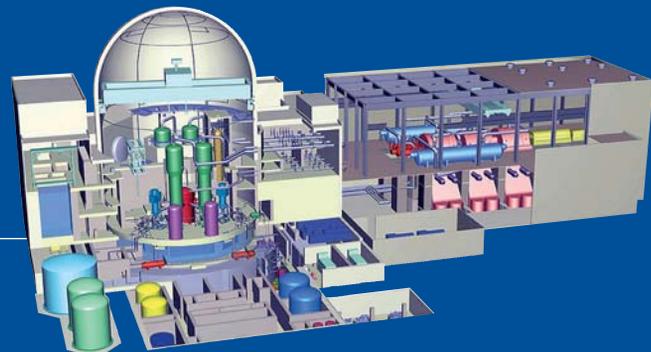


APR 1400

Electrical power: approx. 1,450 MW
 Supplier: Korea Hydro & Nuclear Power
 Country of origin: South Korea
 Thermal power of reactor: 4,000 MW

APWR Mitsubishi

Electrical power: approx. 1,650 MW
 Supplier: Mitsubishi
 Country of origin: Japan
 Thermal power of reactor: 4,451 MW



EPR

Electrical power: approx. 1,650 MW
 Supplier: AREVA
 Country of origin: France–Germany
 Thermal power of reactor: 4,590 MW



Impacts during construction

Active construction site

The construction of the new unit, including preparatory work, will take from six to eight years. At its peak, the construction work will involve more than 3,500 people. The construction stage represents a total of almost 30,000 direct and indirect man-years.

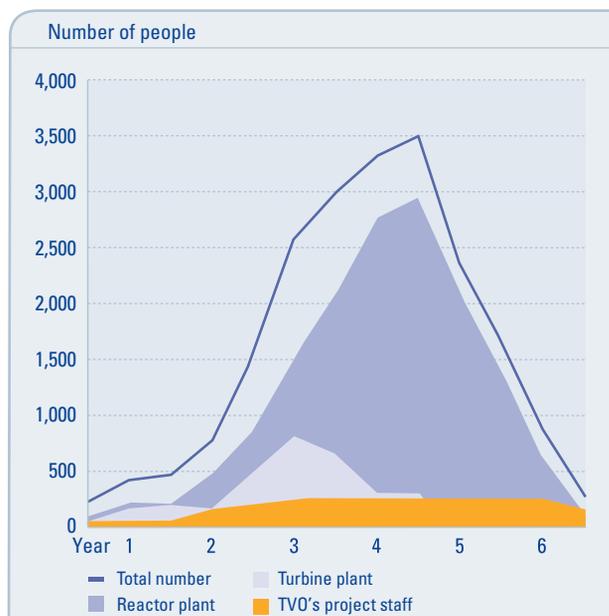
The construction site operations will mostly be focused on the location of the new unit at Olkiluoto. The initial stage of construction at the plant site will involve quarrying, grading and earthmoving work that causes local noise and dust impacts. Subsequent work will mostly involve construction and installation.

Construction in the water area

Work associated with cooling-water structures and a potential dock and ship lane will change the depth relations and the quality of the seabed. Required dredging of the seabed, filling of the sea area (such as the embankment at the Kuusisenmaa island) and construction on shores will cause cloudiness of seawater in the vicinity of the construction site during work.

The cooling water system structures do not have any impact on the water level. The water construction work will not affect fishing either, because the significant fishing sites are rather far away from the work sites.

Figure 7 Estimated time distribution of labour during the construction stage. Source: TVO, 2008.



Traffic

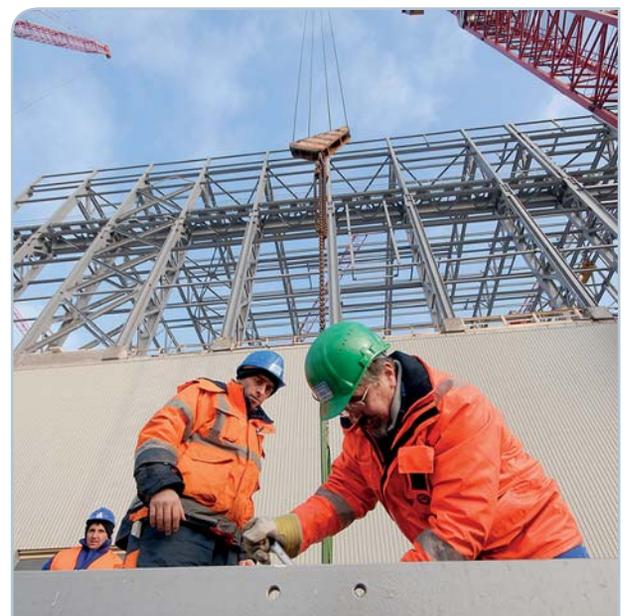
During the construction stage, the volume of traffic, and the proportion of heavy traffic in particular, on the road Olkiluodontie will increase as it did during the construction phase of OL3. Transport during construction will increase traffic to the power plant area by approximately 100 vehicles per day. The road transportation to the power plant includes that of building materials, equipment and components. The amount of goods deliveries and maintenance-related transport will also increase during the construction phase. The largest plant components will arrive at the plant site by ship.

Commuting during the construction of the power plant will increase the road traffic to the plant area by approximately 1,700 vehicles per day from the 2007 level. Some of the labour force will stay in the accommodation village on Olkiluodontie during construction, and some will live at Eurajoki and in nearby municipalities.

Living conditions and comfort

The employment situation will improve during the construction and contribute to better living conditions in the nearby region through new jobs, increased tax income and a boost in economic activity. The temporary labour force brought by a large construction project will increase sales and demand for local services.

Figure 8 Installation of wall structures at the Olkiluoto 3 turbine plant. Source: TVO.



Economic impact

Increased employment

The employment effect of building a nuclear power plant unit is substantial. The extension of the power plant will increase employment in the area. This has been evident during the construction phase of OL3. The effects on the economy and commercial life in the region's municipalities will be positive. The project requires construction labour and construction site services, as well as special expertise and speciality manufacturing both in Finland and abroad.

The total employment effect of the construction of the fourth nuclear power plant unit at Olkiluoto will be approximately 22,000 to 28,000 man-years in Finland, with the direct employment effect in Finland amounting to approximately 12,000 to 15,000 man-years. The indirect employment effect in Finland is expected to be 10,000 to 13,000 man-years. The construction stage, including preparatory work, is expected to take from six to eight years. In the plant unit operation stage, the direct employment effect will be approximately 300 people per year, and the indirect employment effect will be several hundred annually.

In addition to permanent new jobs, the plant unit will provide work for approximately 700 to 1,200 people during annual maintenance outages. As the

labour force for the nuclear power plant is going to increase from the present level, more services will be required in the area. The increased demand for services will boost the economy of the municipality and nearby regions and indirectly create new jobs.

Increased tax income

The construction of the new nuclear power plant unit will affect the development of tax income in the municipality through personal taxes, real-estate taxes and other tax income. During the operation stage, municipal taxes levied on wages and salaries in the region will increase by an estimated more than 2 million euros annually as the number of personnel at the nuclear power plant at Olkiluoto increases.

Greater attractiveness of the plant area

The Olkiluoto nuclear power plant is an interesting tourist attraction, with approximately 20,000 visitors annually. The Olkiluoto 3 plant unit under construction has also increased the attractiveness of the site for visitors internationally.

The new plant unit will strengthen the recognition of the municipality and its image as a significant production site for nuclear power.

Figure 9 Visitors at the Olkiluoto Visitor Centre.

Photo: TVO.



Impact on the environment



Figure 10 Conceptual photograph of plant site alternative 1, discharge point alternative A and intake point alternative C. Photo: TVO.

Landscape

The new unit will add a fourth power plant building to the existing complex of power plant area buildings. The addition will not change the landscape characteristics of the plant area.

The building volume of the new plant unit will be 500,000–1,000,000 m³, and the building will have a maximum height of approximately 60 metres. The vent stack reaches a height of approximately 100 metres. In addition, a number of lower auxiliary buildings will be constructed in the vicinity of the new unit.

The construction of the new unit will cause some rearrangements of traffic routes.

Reinforcement of power lines between the power plant and the national grid may result in the construction of parallel power line areas or widening of the existing power line areas.

Cooling water

The new unit's cooling water requirement will be 40–60 m³ per second, depending on the size of the plant unit. The cooling water will be returned to the sea 11 to 13 degrees warmer. The discharge flow will





Figure 11 Conceptual photograph of plant site alternative 2, discharge point alternative B and intake point alternative D. Photo: TVO.

Figure 12 Conceptual photograph of Olkiluoto island viewed from the sea, OL4 on the left, the existing units OL1 and OL2 in the middle and OL3 under construction on the right. Photo: TVO.



be directed either to the Kaalonperä bay or to the north of the Ulkopää headland in the direction of the existing discharge flow.

The combined impact of the cooling waters of four plant units will cause an increase in seawater temperature and a larger-than-before area of weak ice on the sea. Model calculations show that the cooling waters of four plant units will cause a temperature increase of at least one degree in the surface layer extending to approximately 10 kilometres in southerly wind conditions in the summer. The size of the warmed-up area depends on wind direction and velocity. The mixing of cooling water into surrounding waters will be less intense and the warmed area will be larger with weak winds than in strong winds.

In the winter, as in summer, the impact of cooling water from the OL1–OL4 units is projected to cover an area approximately 2.5 times larger than what is the present situation with two plant units in operation – that is, to a distance of approximately 7.5 to 12.5 kilometres from the discharge point. The unfrozen area or area of weak ice off Olkiluoto will increase to slightly more than 10 km², or approximately 1.5 times the size with three plant units (OL1, OL2, and OL3) in operation. The combined impact of the increasing thermal load will show as a longer growth period and increased total production of phytoplankton and aquatic vegetation. The most substantial impact of the new plant unit’s cooling water with regard to fishing takes place in the winter season, when the increased area of unfrozen water and weak ice limits jigging from the ice. The cooling water has no impact on the suitability of fish for human consumption.

The discharge of cooling water does not involve any nutrient load. Studies and environmental monitoring over three decades have shown that the impacts of cooling water from the existing nuclear power plant units, OL1 and OL2, at Olkiluoto have remained local.

It is estimated that the cooling water of the new unit as a whole does not impose any substantial or extensive adverse effects on the fish populations of the area. The increased amount of warm water will benefit aquatic species that favour warm water, such as pike-perch, perch and roach. The increase in warm water will be unfavourable to fish that favour cold water, and the cooling water can be expected to

Figure 13 An example of the increase in temperature caused by the cooling waters of units OL1 to OL4 in the surface layer in a summertime example situation with a south wind. In this situation, it is assumed that cooling water from the new unit will be discharged to the north of the existing discharge point. Source: YVA Oy, 2007.

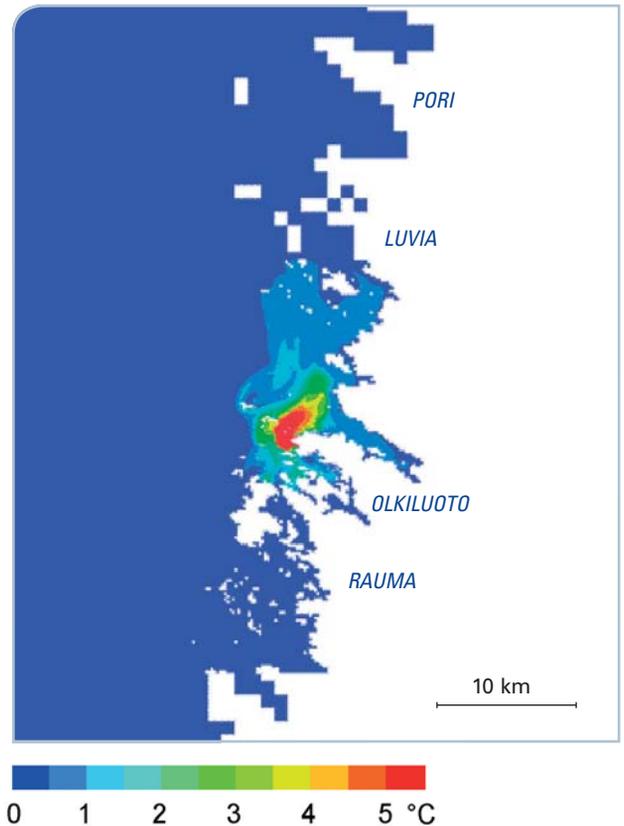


Figure 14 Drilling of a soil sample. Photo: TVO.



reduce the number of burbot in the discharge area, for example. TVO will carry out a Natura review pursuant to Section 65 of the Nature Conservation Act regarding the impact of cooling waters on the Rauma archipelago Natura 2000 area (FI02000073).

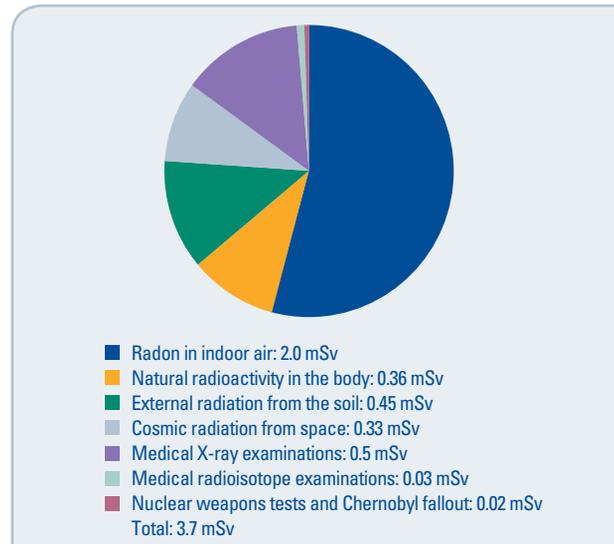
Radioactive emissions

Since there will be only minor radioactive emissions from the fourth nuclear power plant unit during operation, they will not have any adverse effects on human health or the natural environment. According to safety assessments prepared, the processing and final disposal of radioactive waste does not cause any adverse impact on the environment or people.

The radiation dose caused by emissions from the operation of the four plant units of the Olkiluoto nuclear power plant to a member of the most exposed group of the population, as a result of their place of abode and living habits, will not exceed 0.001 millisieverts (mSv) per year. The limit for radiation exposure arising from the operation of a nuclear power plant has been set at 0.1 mSv in Finland. It can be noted for comparison that the average radiation dose received by each Finn from other radiation sources is approximately 3.7 mSv annually.

The nuclear power plant will be designed in compliance with the Finnish nuclear safety

Figure 15 The annual average radiation dose of people in Finland.
Source: Radiation and Nuclear Safety Authority,
<http://www.stuk.fi/>, 2007.



regulations. This means that even the radioactive emissions from a very improbable severe reactor accident will not cause a health hazard for nearby residents. In the absence of any protective measures, the radiation dose incurred from such a reactor accident during the first 24 hours by a person living 10 kilometres from the power plant could in the most extreme scenario be approximately five times the annual average dose received by each Finn from natural sources of radiation.

Figure 16 Taking of a kelp sample. Photo: TVO.



Nuclear waste management

The operation of a nuclear power plant produces nuclear waste. In proportion to the amount of energy produced, the amount of waste and the associated space requirements are small. The principle of nuclear waste management is to isolate the waste from the living environment. In addition, the final disposal will be designed in a way that does not call for supervision to ensure long-term safety.

Preparation for costs

In accordance with the Nuclear Energy Act, the operator of a nuclear facility is responsible for all stages of the management of nuclear waste produced. These include all measures to manage radioactive waste, including the management of waste arising from the decommissioning of the plant.

The funds required for nuclear waste management related to the new plant unit will be collected in the form of a nuclear waste management fee included in the price of electricity produced, as is the case with the existing power plant units. The funds to be collected will cover costs arising from the management of spent fuel and power plant waste, as well as the decommissioning of the plant unit and the management of waste arising from this. The money is deposited in the Finnish State Nuclear Waste Management Fund, from which it will be returned to the operator of the nuclear facility as the different stages of processing of the waste are implemented.

Spent nuclear fuel

After the removal from the reactor, spent nuclear fuel is stored in water pools at the power plant for 3–10 years. Water cools down the fuel and protects against radiation. Storage continues in an interim storage facility for spent fuel, located at the power plant site. The fuel is also kept in water pools at the intermediate storage facility. The existing interim storage facility can be expanded if required, or a new facility can be built for the needs of the new plant unit. The new plant unit will produce 25 to 40 tonnes of spent fuel per year, depending on the size of the unit.

Intermediate storage will last at least 20 years, in which time the radioactivity and heat production of the fuel will be substantially reduced. After 20 years in intermediate storage, for example, the remaining

activity of the nuclear fuel is on the order of a few thousandths of the initial value when removed from the reactor. After intermediate storage, spent nuclear fuel will be permanently isolated from living nature through disposal deep in the bedrock. For this purpose, the fuel will be encapsulated in tight thick-walled iron–copper containers that will be placed in the bedrock at a depth of approximately 400 metres. The location of the final disposal facility is Olkiluoto.

The measures required for the final disposal of spent fuel are the responsibility of Posiva Oy, which is jointly owned by TVO and Fortum Power and Heat Oy. Posiva is currently constructing a rock characterisation facility (ONKALO) at Olkiluoto for the purpose of conducting research that will confirm the suitability of the location for final disposal. On 25 April 2008, Posiva Oy submitted a separate application for a decision-in-principle to the government regarding the final disposal of spent fuel from Olkiluoto 4.

Spent fuel will be transported within the Olkiluoto power plant area from the reactor buildings to the interim storage facility and from the interim storage further to the final disposal facility in strong steel containers. All transports of fuel in Olkiluoto take place within the closed plant area, and spent fuel does not need to be transported on public roads. Spent fuel from the new plant unit will be placed in the same final disposal facility with spent fuel from the existing plant units and OL3 under construction.

Operating waste

Operating waste refers to low- and medium-level waste arising from the operation of a nuclear power plant, such as ion exchange masses used for cleaning process waters, radioactive wastewater and diverse dry waste from maintenance operations. The new plant unit will produce 100–150 m³ of operating waste per year. The waste is processed and packaged at the plant units and disposed of in a disposal facility located at Olkiluoto site. The existing facilities can be extended to correspond to the needs of the new plant unit.

Decommissioning of the plant unit

The planned service life of the new plant unit is 60 years. After the operation has ceased, the

decommissioning of the plant unit can begin immediately, or it can be postponed. For example, after approximately 20 years, the radioactivity contained in the plant unit's systems has substantially decreased. Most of the waste arising from the decommissioning of the unit is free of radioactive substances. It consists of conventional construction and metal waste that can be utilised through recycling or placed in a landfill. Decommissioning waste containing radioactivity will be permanently disposed of in the bedrock similarly to radioactive waste arising from the operation of the nuclear power plant.

Figure 17 Intermediate storage of spent fuel in a water pool.
Photo: TVO.

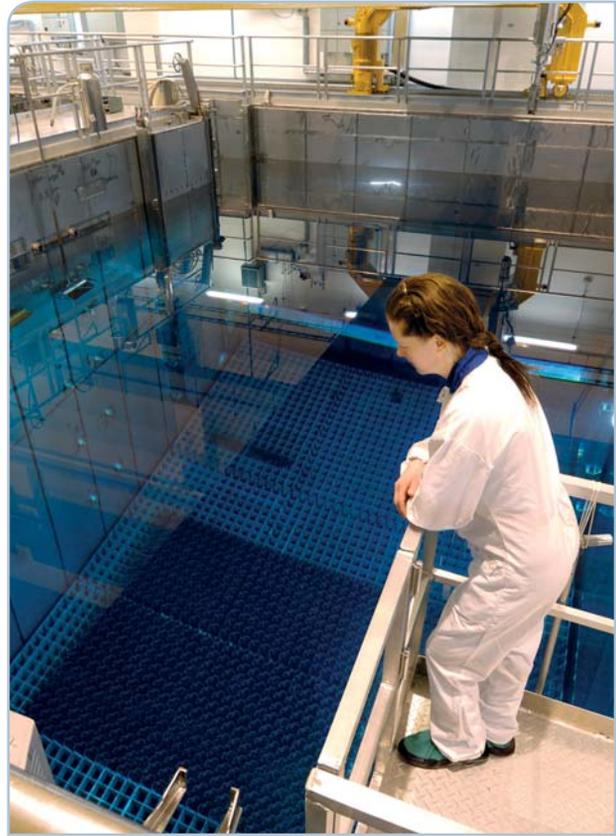
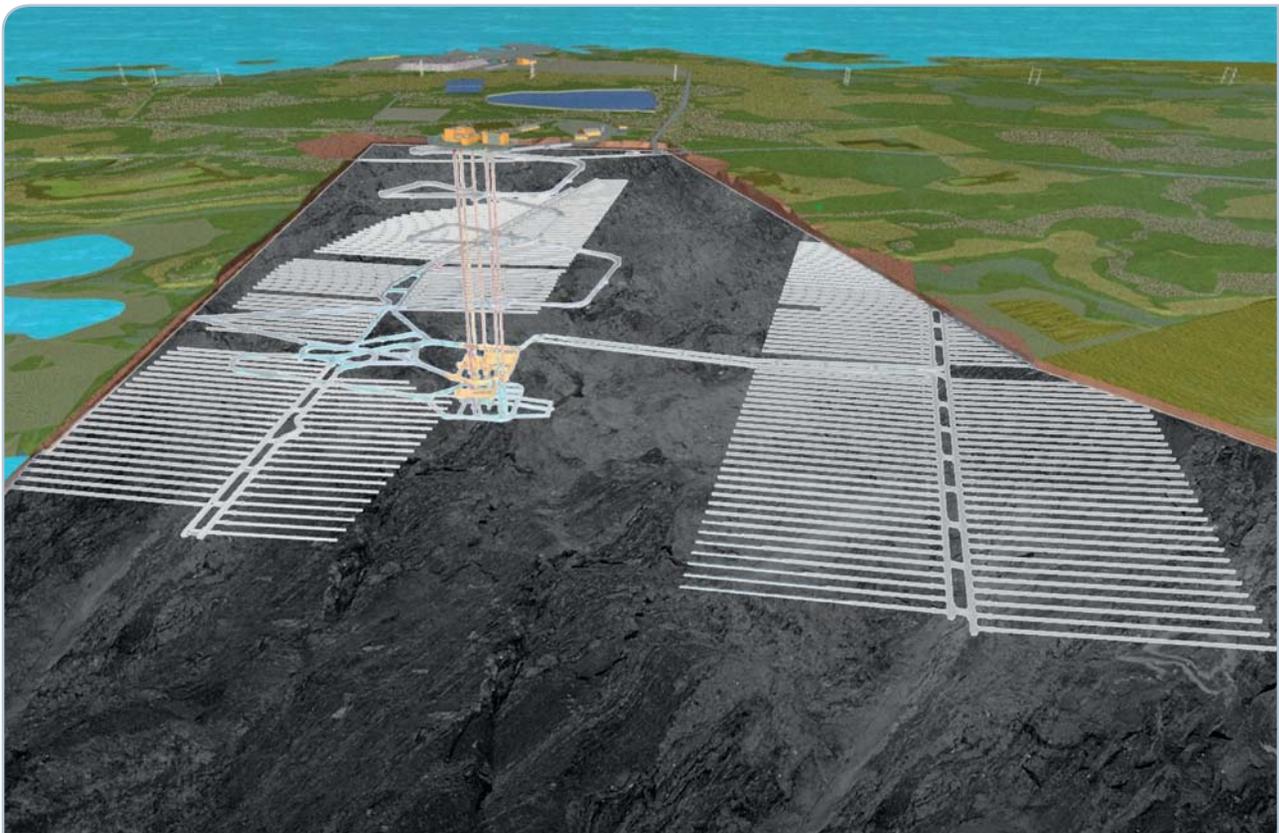


Figure 18 Diagram showing the principle for a final disposal facility located at Olkiluoto, Source: Posiva.



Ensuring safety

Experience as a foundation for safety

Strict safety regulations have been enacted for nuclear power plants in Finland, and the licence-holder is always responsible for nuclear safety. TVO has 30 years of experience with the operation of a nuclear power plant. The company has developed high-level expertise that emphasises the significance of safety. The Olkiluoto 3 project has made it possible to recruit new professionals, and the project has further increased the extensive nuclear power competence of the company's experts. The accumulated experience will be utilised in the design, construction and operation of the new plant unit.

Regulatory control

The Nuclear Energy Act and government decisions issued by virtue of it constitute a foundation for the safe use of nuclear power and its supervision. The authority responsible for the safety supervision of nuclear power is the Radiation and Nuclear Safety Authority, the safety regulations of which specify detailed requirements for the construction and operation of a nuclear power plant.

It is the task of the Radiation and Nuclear Safety Authority to conduct supervision to ensure that the

Figure 19 The amount of reinforcement steel in Olkiluoto 3 is 52,000 tonnes. Photo: TVO.



use of nuclear power in Finland complies with the applicable safety requirements. This supervision covers the entire life span of a nuclear power plant, from design and construction, through the entire service life of the plant, to the decommissioning and the disposal of nuclear waste.

Advanced safety technology

The modern safety arrangements of the new plant unit provide preparedness for even the most severe situations that could ultimately lead to reactor fuel damage and meltdown. Similar situations at the Olkiluoto units 1 and 2 have been managed by technical backfittings.

The containment building around the nuclear reactor is constructed to withstand the impacts of reactor core meltdown. The purpose of the containment is to prevent radioactive substances released from the reactor in potential accident situations from entering the environment. No health hazard to nearby residents is allowed, even in the most severe situation. Releases from accidents are not allowed to cause any long-term restrictions on the use of land and water areas.

The new nuclear power plant unit will be designed to endure weather conditions, such as seawater level fluctuations, storms and temperature increase, that are expected to be very rare or improbable at the plant site, and the possibility of an earthquake will be taken into account in the design of components important to the safety of the plant.

Physical separation of the safety systems and their location in well-protected spaces protect the safety functions so that no external or internal event can render all of them inoperable.

The design of the new plant unit will also take into account from a large airliner collision or by illegal activities.

Rescue service

In accordance with the Rescue Act, authorities have prepared plans for accident preparedness. The new power plant unit will be added to plans drafted for the existing plant units. The authorities' plans include monitoring the state of the environment in an accident situation and communication to the public about potential actions to minimise the impact of an accident.

Figure 20 Containment is protected with a reinforced concrete collision shield (left). Photo: TVO.



Summary

TVO has applied to the government for a decision-in-principle on whether the construction of a fourth plant unit at Olkiluoto is in line with the overall good of society.

TVO produces electricity at the Olkiluoto nuclear power plant in the municipality of Eurajoki, the production of which accounts for approximately one sixth of the demand for electrical power in Finland.

The planned plant unit will have an electrical power output on the order of 1,000–1,800 MW and will be based on light-water reactor technology. The unit will enter operation in the late 2010s, and its planned service life is 60 years.

The land use of the site of the new plant unit is in harmony with other land use on Olkiluoto island and relies on the existing Olkiluoto infrastructure. The new unit may utilise supporting functions, premises and structures built for the existing plant units. Fuel management for the new unit will be arranged on the same principles applicable to the existing units.

The construction work for the new unit, including preparatory work, will take approximately six to eight years. At its peak, the construction work will involve approximately 3,500 people. The direct and indirect employment effects during the construction stage will be almost 30,000 man-years. At the plant unit operation stage, the direct employment effect will be approximately 300 people per year, and the indirect employment effect will be several hundred annually. The number of operation personnel will be some 200.

The environmental impacts of the planned nuclear power plant unit have been assessed in accordance with the act concerning the environmental impact assessment procedure.

The intermediate storage and the disposal of nuclear waste from the new unit will rely on nuclear waste management arrangements serving the existing nuclear power plant units, which have accounted for the possibility to expand capacity for Olkiluoto 4.

Additional information on the application and the presentation of opinions

On 12 September 2008, The Ministry of Employment and the Economy will make a public announcement concerning the project to build a new nuclear power plant unit, Olkiluoto 4. The announcement includes information such as:

A copy of the application for a decision-in-principle and its attachments shall be available for viewing from 12 September 2008 to 12 November 2008 during office hours at the following municipal offices:

- Eurajoki municipal office, Kalliotie 5, Eurajoki
- Eura municipal office, Sorkkistentie, Eura
- Kiukainen municipal office, Kunnankuja 3, Kiukainen
- Lappi municipal office, Kivisillantie 6, Lappi
- Luvia municipal office, Kirkkotie 17, Luvia
- Nakkila municipal office, Porintie 11, Nakkila
- Rauma environmental authority, Kanalinranta 3, Rauma

The application and other documents related to its processing are also available on the Web pages of the Ministry of Employment and the Economy, at <http://www.tem.fi/>.

Opinions on the project can be presented in writing by submitting them to the registry office of the Ministry of Employment and the Economy (address: Ministry of Employment and the Economy, P.O. Box 32, FI-00023 VALTIONEUVOSTO; visiting address: Aleksanterinkatu 4, Helsinki) or by e-mail to kuuleminen@tem.fi by 12 November 2008, at the latest. When expressing opinions and issuing statements, kindly refer to the diary number of the matter: 1384/815/2008.

The public hearing required pursuant to Section 13 of the Nuclear Energy Act will be held on Monday, 13 October 2008, starting at 6:00 pm, at the Eurajoki municipal office (address: Kalliotie 5, Eurajoki). The hearing is open to the public.

More information on the project and the application for a decision-in-principle is available from Teollisuuden Voima Oyj, telephone +358 2 83 811, address: Olkiluoto, FI-27160 EURAJOKI.

More information about the processing of the application in the Ministry of Employment and the Economy is available from Senior Engineer Jorma Aurela, at the telephone number +358 10 606 000.



Teollisuuden Voima Oyj
Olkiluoto
FI-27160 EURAJOKI, FINLAND
Telephone +358 2 83 811
Fax +358 2 8381 2109
www.tvo.fi

Teollisuuden Voima Oyj
Töölönkatu 4
FI-00100 HELSINKI, FINLAND
Telephone +358 9 61 801
Fax +358 9 6180 2570

Teollisuuden Voima Oyj
4 rue de la Presse
1000 BRUSSELS, BELGIUM
Telephone +32 2 227 1122
Fax +32 2 218 3141

www.tvo.fi