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## Fact sheet: Olkiluoto 3

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World's largest, first-of-a-kind nuclear reactor is being built in Olkiluoto, Finland by the French company Areva. The construction started in 2005 and was the first nuclear plant ordered in developed countries for more than a decade. The project has been plagued from the onset by quality problems, delays and cost overruns.

### Promises and reality

In Finland, parliament has the final say on nuclear projects. Here is what the parliament was told about the project before their vote by TVO and by the pro-nuclear trade and industry ministry that produced the material that "guided" the parliament in their decision.

Promise: Olkiluoto 3...	Reality
<i>...will cost EUR2.5 billion and take 4 years to build.<sup>1</sup></i>	The contracted price was EUR3.2 billion and the agreed construction time 4.5 years. The cost overrun is EUR1.5 billion so far, putting realized cost at about EUR5 billion. Construction will take at least 7 years. <sup>2</sup>
<i>...is the easiest and cheapest way to reach Kyoto targets.<sup>3</sup></i>	The emission reductions that OL3 was claimed to deliver were overblown. It was supposed to reduce CO2 emissions by 7.5 million tons per year, but now the reductions are expected to be a third of this <sup>4</sup> (see figure 1). The delay of the reactor means that it will not help in reaching the Kyoto target practically at all since it will come to operation only a year before the Kyoto target period ends. A lot of emission reduction options were abandoned because Olkiluoto 3 was expected to deliver the needed reductions. <u>Reaching Kyoto targets would have been easier and cheaper without Olkiluoto 3.</u>
<i>...will deliver cheap electricity, saving consumers EUR0.5 billion a year<sup>3</sup></i>	According to Finnish heavy industry, the delay of OL3 will cost electricity consumers EUR3 billion – or EUR600 per person – in higher prices. <sup>5</sup> <u>Electricity price during 2008-2012 would have been lower had Olkiluoto 3 not been built.</u>
<i>...is a market financed private investment<sup>1</sup></i>	The French export credit agency Coface and several public banks headed by Bayerische Landesbank are involved in ensuring a very low interest rate and favorable terms for the project. <sup>6</sup> About 60 % of direct investment comes from companies controlled by Finnish state and municipalities. <sup>7</sup>
<i>...will offer jobs to Finnish workers. Half of the investment will stay in Finland.<sup>1</sup></i>	All significant subcontracts have been won by foreign companies and even in Olkiluoto itself, about a third of the workforce is Finnish. <sup>8</sup> A maximum of 25% of the investment stays in Finland. There would have been <u>more jobs and business opportunities</u> had Olkiluoto 3 not been built and renewable energy sources be allowed to grow instead. <sup>9</sup>
<i>...is going to reduce Finland's reliance on energy imports from Russia<sup>3</sup></i>	Imported gas is used for district heating and peak load generation – nuclear power cannot provide either. Also electricity is imported mainly in situations of high demand. Because of the failure to increase energy efficiency in buildings as well as the in the housing and services sector, <u>Finland will be more reliant on Russian electricity and gas after Olkiluoto 3 is in use than before the decision to build it.</u> <sup>10</sup>
<i>...will not hinder development of energy efficiency and renewable energy. New policies will be introduced.<sup>1</sup></i>	Development of renewable electricity sources, especially wind, has lagged behind and development of combined heat and power has ceased. <sup>11</sup> Despite huge potentials, Finland is ranked by Ernst&Young the third least attractive country for investments in renewable energy and least attractive for wind. The ranking covers 25 countries. <sup>12</sup> (see also figure 2)

Olkiluoto 3 is often presented as a showcase of an open process in a democratic country. The process might have been democratic but the information that the democratic decisions were based on has turned out to be false and misleading.

## **Safety problems<sup>13</sup>**

Olkiluoto 3 was also supposed to be way safer than present reactors, “set a new standard” for nuclear safety. In early 2007, the Finnish nuclear safety authority STUK had detected 1500 safety and quality problems in the OL3 project, ranging from minor to critical.<sup>14</sup> The authority themselves said that the number of problems is so large that it is possible that all of them are not detected<sup>15</sup>.

It is alarming that there have been problems in manufacturing all the key parts of the primary circuit of OL3. The primary circuit is the subsystem of a nuclear power plant that is probably most crucial to safety. The primary circuit is subject to extreme heat, pressure and radiation for decades. Its components are hard, some impossible, to replace once the reactor is in use.

*Examples of problems (see also page 5)*

- The primary coolant circuit was found to have too large and irregular grain size. The problem was caused by an attempt by the subcontractor to save time and reduce costs. All eight pipes have been recast but it is unclear whether the new methods have actually resolved the problem or caused new ones. Failure of the primary coolant circuit can initiate a severe nuclear accident.
- Steel liner of reactor containment was manufactured by a Polish machine yard that had no earlier experience of nuclear projects. Safety standards were violated in welding and holes were cut in wrong places. The bottom of the liner is wavy and it was damaged during storage. The substandard quality of the liner can lead to higher radioactive releases in case of an accident.
- Concrete base slab of the reactor is more porous than was allowed, making the structure more vulnerable to chemically reactive substances. This can lead to long term deterioration of the reactor containment building. The concrete has a high water content, which could, under certain accident conditions, lead to rapid formation of cracks.

*What caused the problems?*

- Olkiluoto 3 is constructed under a tight schedule, with considerable cost pressure. The same is likely to hold for any future nuclear projects. The unrealistic price and timetable of Olkiluoto 3 have been a strong incentive for Areva to cut down prices and to refuse to perform time-consuming corrections when problems arise. Areva’s attempts to reduce costs led the company to select cheap, incompetent subcontractors, overlook safety related problems and not to provide nuclear safety training to workers.
- Construction of Olkiluoto 3 was allowed to commence before the design of the reactor was finalized (“fast track licencing”), even though this should not be legal in Finland. Nuclear industry has high hopes of cutting down lead times through this procedure and governments in e.g. the US and UK are under pressure to legalize it. Because of fast track licensing, Olkiluoto 3 subcontractors have used outdated blueprints and Finnish authorities have been at times unable to supervise work as they haven’t had the design documents.
- New reactor designs are inherently harder to build and control because of larger size and fuel burn-up, which places high demands on construction.
- The stagnation of nuclear construction over the last decade or two has caused a lack of competent personnel and companies. Together with complicated project structures (Olkiluoto 3 involves over 1000 subcontractors from over 25 countries) and long control chains, this makes quality assurance prone to failures.

## **Waste storage**

In Olkiluoto, nuclear waste company Posiva is conducting a research project on the possibility of burying highly radioactive nuclear waste permanently underground. No permission to build a nuclear waste storage site has been granted and at least five years of more research is needed before the company is even ready to apply for a permit. There are several concerns and open questions that have not been addressed.

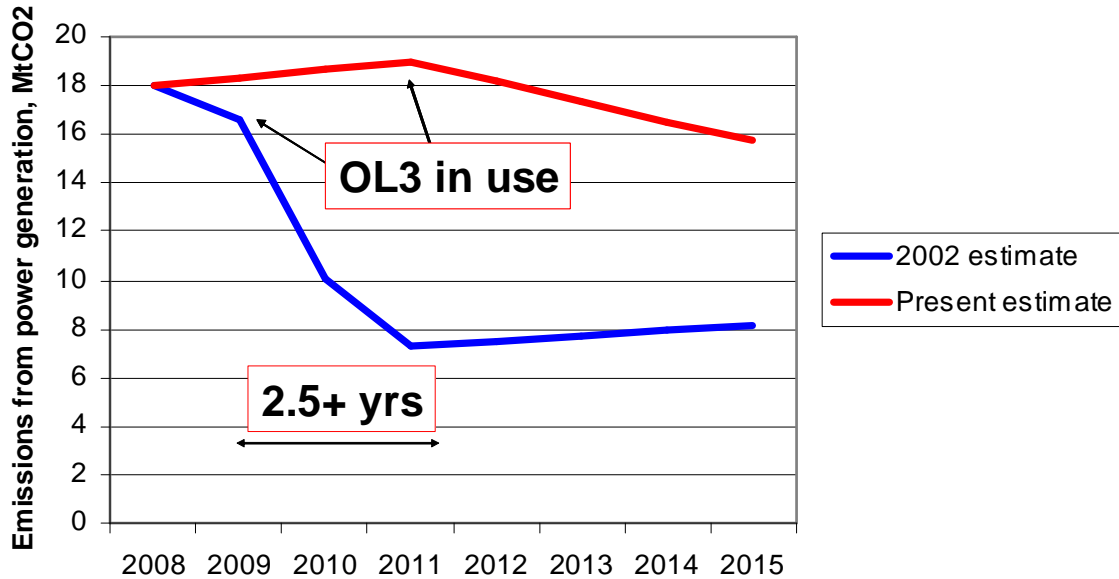
### *The status of the project<sup>16</sup>*

- The government has made a decision in principle that construction of a waste dump in Olkiluoto would be in the overall interest of the society if the environmental requirements can be met. The decision allows the construction of an underground rock characterization facility which is now underway.
- Little site specific research was undertaken before the decision, that's why the decision is "in principle". The only stance that government authorities have officially taken so far is that they cannot without further research exclude the possibility that the requirements can be met.

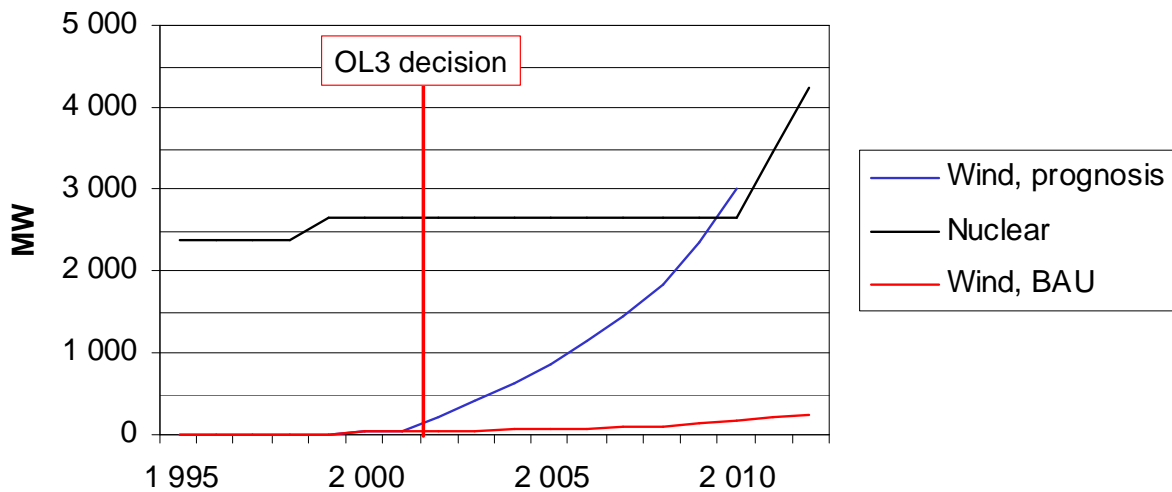
### *Concerns*

- Basically all research at the site is conducted by the waste disposal company itself without real independent review. The Finnish authorities have commissioned independent experts to give a second opinion and they have raised exactly the same concerns as environmental organizations – too much haste and too few observations, problems being overlooked. The recommendations of these experts have not been followed in most cases though.
- When the storage site would be closed it would be fully at the responsibility of the society. There are no plans or money set aside for monitoring the site or retrieving the waste and cleaning up the mess in the case of leakage.
- The bedrock in Olkiluoto is very old and full of cracks, and most importantly the groundwater there flows directly to the Baltic sea, which dramatically aggravates the possible impacts of any leaks in the repository (see figure 3). Olkiluoto was chosen for waste storage because of political reasons – the population living near the reactors is much less critical because of decades of intense "education" by the nuclear operator.
- The plan is to pack the waste in copper canisters, because copper is the most corrosion resistant metal after gold and silver. It was assumed that the canisters would last thousands or tens of thousands of years, but new peer-reviewed research published in the Science magazine shows that the canisters could be corroded in a century.
- The understanding of the long term dynamics of the bedrock has advanced hugely after the waste disposal concept applied in Olkiluoto was put together. The bedrock is much more dynamic than previously believed, for example there can be strong earthquakes associated with ice ages, which undermines the whole idea of stable bedrock.

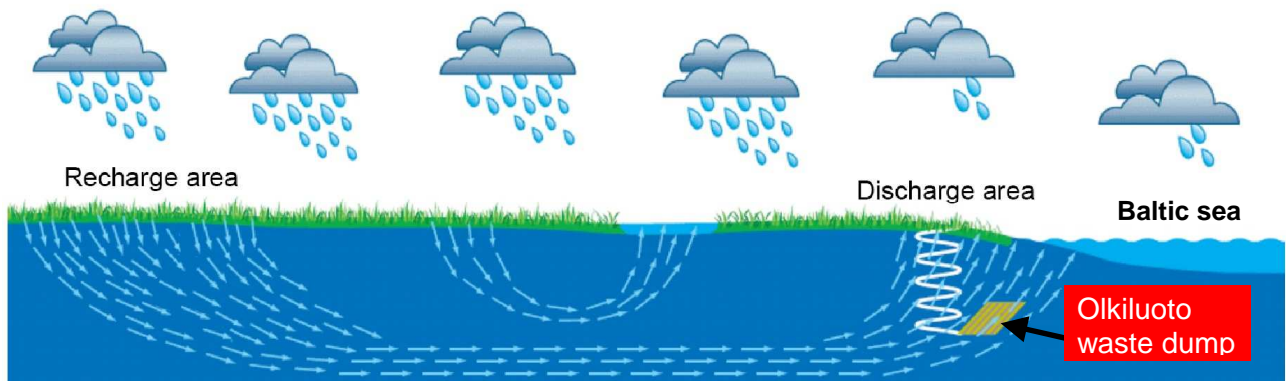
The waste disposal project has proceeded faster than anywhere else in the world and that has led to overlooking some expert recommendations and too much haste in initial phases of site characterization. There is no real need for the hurry, since the waste will have to cool down in intermediate storage sites for decades after the reactors are closed down. The nuclear industry, however, desperately needs to be able to say that they have a "solution" to the problem of nuclear waste – in order to get to build more reactors and accumulate even more waste.



**Figure 1.** In a new scenario commissioned by Finnish energy industry<sup>4</sup>, the emission reductions achieved by Olkiluoto 3 are a third of what the Finnish parliament was told in 2002<sup>3</sup>. In addition, the 2-3 year delay means that the reactor is practically of no help in fulfilling the Kyoto target that covers years 2008-2012.



**Figure 2.** In 2001, Wind power capacity in Finland was projected to reach 3000 MW by 2010 (blue curve), which could have created 10 000 jobs. After the decision on OL3, made in 2002, interest in renewables evaporated and the prospects for wind power look bleak (red curve).



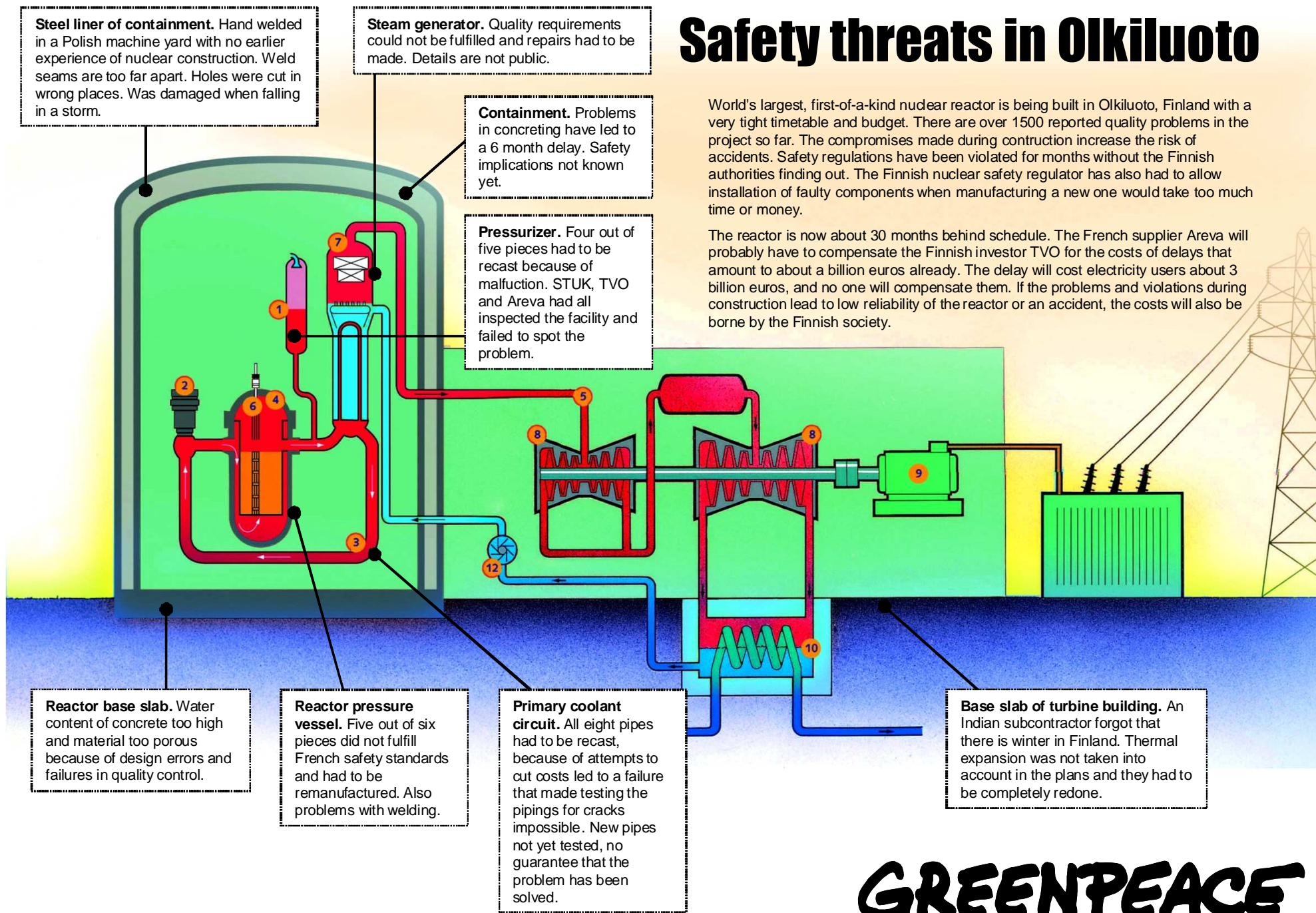
Source: MKG/Mikael Kärelind

**Figure 3.** The proposed waste repository in Olkiluoto is on the coast of the Baltic sea, in a place where the groundwater flows from the bedrock directly into the sea.

# Safety threats in Olkiluoto

World's largest, first-of-a-kind nuclear reactor is being built in Olkiluoto, Finland with a very tight timetable and budget. There are over 1500 reported quality problems in the project so far. The compromises made during construction increase the risk of accidents. Safety regulations have been violated for months without the Finnish authorities finding out. The Finnish nuclear safety regulator has also had to allow installation of faulty components when manufacturing a new one would take too much time or money.

The reactor is now about 30 months behind schedule. The French supplier Areva will probably have to compensate the Finnish investor TVO for the costs of delays that amount to about a billion euros already. The delay will cost electricity users about 3 billion euros, and no one will compensate them. If the problems and violations during construction lead to low reliability of the reactor or an accident, the costs will also be borne by the Finnish society.



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## For more information

For briefings, background information etc, see: [www.olkiluoto.info](http://www.olkiluoto.info)

### On safety problems

Hirsch H., Neumann W. Progress and Quality Assurance Regime at the EPR Construction at Olkiluoto - Safety Implications of Problems Encountered. May 2007. <http://www.greenpeace.org/raw/content/finland/fi/dokumentit/progress-and-quality-assurance.pdf>

Finnish Radiation and Nuclear Safety Authority STUK 2006: Management of safety requirements in subcontracting during the Olkiluoto 3 nuclear power plant construction phase.

[http://www.stuk.fi/stuk/tiedotteet/2006/en\\_GB/news\\_419/files/76545710906084186/default/STUK%20Investigation%20report%201\\_06.pdf](http://www.stuk.fi/stuk/tiedotteet/2006/en_GB/news_419/files/76545710906084186/default/STUK%20Investigation%20report%201_06.pdf)

### On financing

The EREF welcomed today's decision by the European commission to respond to part of the federation's complaint to open a full state aid investigation into French export guarantees for the construction of a new nuclear reactor in Finland. (24.10.2006)

[http://www.eref-europe.org/dls/pdf/2006/eref\\_pr\\_241006.pdf](http://www.eref-europe.org/dls/pdf/2006/eref_pr_241006.pdf)

### Global reports from Greenpeace

Thomas s. Antony F. Bradford P. Milborrow D. The Economics of Nuclear Power. May 2007. Greenpeace International. [www.greenpeace.org/raw/content/international/press/reports/the-economics-of-nuclear-power.pdf](http://www.greenpeace.org/raw/content/international/press/reports/the-economics-of-nuclear-power.pdf)

Energy [R]evolution - Global energy scenario commissioned by European Renewable Energy Council and Greenpeace: <http://www.energyblueprint.info/>

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<sup>1</sup> Finnish cabinet of ministers, January 2002 – decision-in-principle on the construction of OL3. <http://www.tem.fi/files/13606/tvo1401.pdf>

<sup>2</sup> AFX News Limited, 28 Sep 2007: TVO says won't share nuclear reactor cost overruns with Areva.

<http://www.forbes.com/markets/feeds/afx/2007/09/28/afx4165822.html>

<sup>3</sup> Valtioneuvosto 27.3.2001: Kansallinen ilmastostrategia VNS 1/2001. [Finnish cabinet of ministers 27 March 2001: National climate strategy.]

<sup>4</sup> Finnish Energy Industries 2008: Sähköntuotantoskenaariot vuoteen 2030. <http://www.energia.fi/>

<sup>5</sup> Kauppalehti (Finnish financial newspaper) 11 Sep 2007: Olkiluodon myöhästymisen maksaa kolme miljardia euroa.

<http://www.kauppalehti.fi/avar/plehti/index.jsp?xid=2546439&date=2007/09/11>

<sup>6</sup> European renewable energies federation press release 24 Oct 2006. [http://www.eref-europe.org/dls/pdf/2006/eref\\_pr\\_241006.pdf](http://www.eref-europe.org/dls/pdf/2006/eref_pr_241006.pdf)

<sup>7</sup> TVO Ownership and finances. <http://www.tvo.fi/www/page/261/>

<sup>8</sup> Finnish Broadcasting company YLE 11 Oct 2007: Ydinvoimalan kotimaisuusaste voi jäädä tavoitteista. <http://www.yle.fi/uutiset/24h/id72082.html>

<sup>9</sup> Wind power alone could have created 10000-20000 jobs: Tuulivoima Suomessa - Vientinäkyimiä ja päästövähennyksiä. CLIMTECH 2/2002. [www.vtt.fi/pro/climtech/material/climtech\\_2-02\\_fin2.pdf](http://www.vtt.fi/pro/climtech/material/climtech_2-02_fin2.pdf)

<sup>10</sup> Energy scenario report commissioned by the Finnish government as a basis for the 2005 energy strategy. Forsström, J. and Lehtilä, A. 2005: Skenaarioita ilmastopolitiikan vaikutuksista energiatalouteen. VTT Processes. <http://www.vtt.fi/inf/pdf/workingpapers/2005/W36.pdf>

<sup>11</sup> See for references and graphs Lauri Myllyvirta 2007: Real, nuclear-free energy solutions for Finland. <http://www.olkiluoto.info/en/18/3/127/>

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<sup>12</sup> Ernst&Young 2007: Renewable Energy Country Attractiveness Indices Q3.

[http://www.ey.com/GLOBAL/content.nsf/International/Oil\\_Gas\\_Renewable\\_Energy\\_Attractiveness\\_Indices](http://www.ey.com/GLOBAL/content.nsf/International/Oil_Gas_Renewable_Energy_Attractiveness_Indices)

<sup>13</sup> For a detailed analysis and references, see Hirsch H., Neumann W. Progress and Quality Assurance Regime at the EPR Construction at Olkiluoto - Safety Implications of Problems Encountered. May 2007.

<http://www.greenpeace.org/raw/content/finland/fi/dokumentit/progress-and-quality-assurance.pdf>

<sup>14</sup> Helsingin Sanomat international edition 11 Aug 2007: Further nuclear reactor construction delays could lead to electricity shortage.

<sup>15</sup> Finnish Radiation and Nuclear Safety Authority STUK 2006:

Management of safety requirements in subcontracting during the Olkiluoto 3 nuclear power plant construction phase.

[http://www.stuk.fi/stuk/tiedotteet/2006/en\\_GB/news\\_419/files/76545710906084186/default/STUK%20Investigation%20report%201\\_06.pdf](http://www.stuk.fi/stuk/tiedotteet/2006/en_GB/news_419/files/76545710906084186/default/STUK%20Investigation%20report%201_06.pdf)

<sup>16</sup> The decision in principle by the Government concerning Posiva Oy's application for the construction of a final disposal facility for spent nuclear fuel produced in Finland. 2001.

[http://www.stuk.fi/ydinturvallisuus/ydinjatteet/loppusijoitus\\_suomessa/en\\_GB/luvat/files/73810747422542880/default/decision\\_in\\_principle.pdf](http://www.stuk.fi/ydinturvallisuus/ydinjatteet/loppusijoitus_suomessa/en_GB/luvat/files/73810747422542880/default/decision_in_principle.pdf)