RECENT DEVELOPMENTS OF NUCLEAR POWER IN FINLAND: OLKILUOTO 3, AND MORE…

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OLKILUOTO 3: BASICS

- Fifth nuclear reactor in Finland, ordered by TVO, a private power company.
- TVO already has two units, taken into use in 1978 (OL 1) and 1982 (OL 2). State-owned Fortum has two units in Loviisa, taken into use in 1977 and 1981.
- Attempts for a fifth unit were made jointly by Fortum and TVO in mid-1980s (cancelled after Chernobyl), in early 1990s (rejected in 1993 by the Parliament).
- TVO submitted the OL 3 application in 2000 and it was accepted by the Government and ratified by the Parliament in 2002.
- OL 3 is a new plant design, European pressurized reactor (EPR) by AREVA, 4300/1600 MW.
- The construction license was granted and construction started in 2005.
- Original schedule and budget: In commercial operation in 2009, turnkey contract of €3.2 bn.
2. OLKILUOTO 3: ABOUT TVO

- Teollisuuden Voima Oy (TVO), is a Finnish power company which produces electricity to its shareholders only.
- According to its articles of association, TVO shareholders pay fixed costs in relation to their shares of the stock, and receive corresponding right to the produced electricity.
- TVO Shareholders pay the moving cost in relation to their use of the produced electricity.
- TVO makes no profit as a company, and the shares do not give right to dividends.
- This is called as "Mankala principle", the name refers to a Supreme Administrative Court decision made in 1963 in a case where Oy Mankala Ab (hydropower company) was charged on paying \textit{hidden dividends} to its shareholders.
- Power companies of this type became very common in Finland after this decision.

\begin{table}[h]
\centering
\begin{tabular}{ |c|c|c|c| }
\hline
& A-serie (OL1+OL2) & B-serie (OL3) & C-serie (Meri-Pori) \\
\hline
EPV Energia Oy & 6.5 & 6.6 & 6.5 \\
Fortum Power and Heat Oy & 26.6 & 25.0 & 26.6 \\
Karhu Voima Oy & 0.1 & 0.1 & 0.1 \\
Kemira Oy & 1.9 & - & 1.9 \\
Oy Mankala Ab & 8.1 & 8.1 & 8.1 \\
Pohjolan Voima Oy & 56.8 & 60.2 & 56.8 \\
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\end{tabular}
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\begin{table}[h]
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\begin{tabular}{ |c|c| }
\hline
PVO shareholder groups & \\
\hline
Power companies & 21.4 \\
Municipalities, municipal energy utilities & 7.3 \\
Forest industry & 60.7 \\
Other industry & 6.5 \\
Others & 4.1 \\
Total & 100.0 \\
\hline
\end{tabular}
\end{table}
OLKILUOTO 3: DELAY 1


Delays in schedule characterize the whole project… now up to 4 years behind the schedule according to TVO press releases:

• 11.07.2006: OL 3 into commercial operation in 2010
• 10.08.2007: Demanding safety features delay OL3 civil construction works
• 28.12.2007: AREVA-Siemens estimate OL 3 to start operation in summer 2011
• 17.10.2008: Start-up of OL 3 may be postponed until 2012
• 31.12.2008: OL 3 delay and related costs into arbitration
• 13.01.2009: AREVA-Siemens now estimates OL 3 will be completed in summer of 2012
• 15.10.2009: Start-up of OL 3 nuclear power plant may be postponed further
• 07.06.2010: OL 3 will be in electricity production in 2013
OLKILUOTO 3: DELAY 2

No single reason, rather a range of failures…

- Lacking experience in Finland: TVO’s previous orders, OL 1-2 were constructed 25 years ago
- Lacking experience, in particular: OL 3 is the first order of AREVA’s new reactor design, EPR
- Problems in the quality of work and materials (e.g. welding, concrete), as well as in some equipment
- Delays in detailed parts of plant designs
- Coordination/management/communication problems, between the different actors: vendor (Areva-Siemens), customer (TVO), safety regulator (STUK), and subcontractors,
- Finnish safety requirements (instrumentation & control systems) vs. plant design
- Too optimistic schedule
Original cost range presented for the Finnish Government was €1.7 - €2.5 bn. Estimated costs keep increasing…

• Turn key contract between TVO and Framatome-Siemens joint venture with a fixed price of "around €3 bn" (source: TVO).
• In December 2003, Bayerische Landesbank (BLB) gave a €1.95 bn (60 % of the budget) syndicated loan (interest rate 2.6%) to finance the TVO order with a fixed price of €3.2 bn.
• Export credit guarantee by French Government (€0.6 bn) via COFACE in March 2004.
• After this, the syndicated loan was reduced to €1.35 bn, but it was replaced by a new loan of €1.6 bn. This is nowadays the only TVO credit in place.
• In December 2008, Areva-Siemens filed a request to ICC for arbitration concerning delay in the project and claiming €1 bn to cover the incurred costs. In April 2009, TVO submitted to ICC its answer including a counterclaim of €1.4 billion.
• Most recent cost estimate of OL 3 provided by Areva is €4.7 bn (50 % over budget).
• Siemens pulled out of joint venture with Areva in early 2009 – Areva needs to cover Siemens 34 % share, estimated value €2.05 bn.
• Shortly Finnish anti-nuclear movement estimated the OL 3 cost to be €5.5 bn (70 % over budget).
• Finnish electricity market part of the Nordic electricity market, one of the most competitive in the world. Large number of producers/power companies, and well developed legislation on opened electricity markets
• For Areva, order from Finland was an opportunity to show that nuclear power can survive in the liberalised electricity markets – big boost for nuclear
• In OL 3, everything has gone wrong. What are the consequences? Somebody will suffer; candidates include Areva, TVO and its shareholders, electricity consumers in Finland, French and Swedish taxpayers
• Depends partly on open cases: Results from the arbitration and possibly forthcoming RELATED court case
• OL 3 clearly shows the economic risks of investing in nuclear in the open electricity market in general and economic rísks nuclear in particular
• Nuclear is not a cheap option in liberalised electricity markets
The investigation of OL 3 in relation to EU competition legislation (e.g. state aid) was dropped, but may rise again.

Claims that nuclear power can be implemented without help of the state

Examples of state contribution in OL 3:
- Responsibility of nuclear accidents strongly limited by the state (without it nuclear power had never been built)
- State-owned power company’s (currently Fortum) share in TVO was originally a political prerequisite for realisation of TVO nuclear plans
- Export credits from French and Swedish governments to TVO via export credit agencies is not private aid
<table>
<thead>
<tr>
<th>Application date</th>
<th>TVO: Olkiluoto 4</th>
<th>Fennovoima: Simo or Pyhäjoki</th>
<th>Fortum Power and Heat: Loviisa 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reactor alternative 1</td>
<td>ABWR Toshiba-Westinghouse BWR 4300/1600 MW</td>
<td>ABWR Toshiba-Westinghouse BWR 4300/1600 MW</td>
<td>ABWR Toshiba-Westinghouse BWR 4300/1600 MW</td>
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<tr>
<td>Reactor alternative 2</td>
<td>ESBWR GE-Hitachi (GEH) BWR 4500/1600 MW</td>
<td>KERENA (SWR1000), AREVA BWR 3370/1250 MW</td>
<td>ESBWR GE-Hitachi (GEH) BWR 4500/1600 MW</td>
</tr>
<tr>
<td>Reactor alternative 3</td>
<td>APR1400 Korean Hydro &amp; Nuclear Power PWR 4000/1400 MW</td>
<td>EPR AREVA PWR 4590/1700 MW</td>
<td>AES2006 Atomstroyexport (ASE) PWR 3200/1200 MW</td>
</tr>
<tr>
<td>Reactor alternative 4</td>
<td>EU-APWR Mitsubishi Heavy Industries PWR 4450/1700 MW</td>
<td></td>
<td>APR1400 Korean Hydro &amp; Nuclear Power PWR 4000/1400 MW</td>
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<tr>
<td>Reactor alternative 5</td>
<td>EPR AREVA PWR 4600/1700 MW</td>
<td></td>
<td>EPR AREVA PWR 4590/1700 MW</td>
</tr>
<tr>
<td>Estimated costs</td>
<td>3-4 billion €</td>
<td>4-6 billion €</td>
<td>4-6 billion €</td>
</tr>
<tr>
<td>Specific</td>
<td>Mankala principle</td>
<td>1-2 reactors; Mankala principle</td>
<td>Option for district heating included</td>
</tr>
<tr>
<td>Government decision-in-principle</td>
<td>Benefits the society as a whole, Parliament ratified, votes 120-72</td>
<td>Benefits the society as a whole, Parliament ratified, votes 171-21</td>
<td>Doesn’t benefit the society as a whole,</td>
</tr>
</tbody>
</table>
SHAREHOLDERS

FENNOVOIMA

SHAREHOLDERS:

- Boliden Harjavalta Oy 1%
- Boliden Kokkola Oy 8%
- Kesko Oyj 4%
- Outokumpu Oyj 14%
- Ovako Bar Oy Ab 2%
- Rautaruukki Oyj 4%
- Suomen Osuuskauppojen Keskuskunta SOK 5%
- Majakka Voima Oy 7%

- Jyväskylän Energia Oy 2%
- Kuopion Energia Oy 2%
- Lahti Energia Oy 4%
- ESV Tuotanto Oy 8%
- Etelä-Savon Energia Oy 2%
- Haminan Energia Oy 2%
- Keravan Energia Oy 2%
- KSS Energia Oy 2%
- Mäntsälän Sähkö Oy 2%
- Nurmijärven Sähkö Oy 2%
- Porvoon Energia Oy 2%

- Rauman Energia Oy 5%
- OyTurku Energia Ab 3%
- Vantaan Energia Oy 5%
- Pohjois-Suomen Voima Oy 5%
- Itä-Lapin Energia Oy 2%
- Kemin Energia Oy 2%
- Kotkan Energia Oy 2%
- Keskusosuuskunta Oulun Seudun Sähkö 2%
- Rantakarjan Sähkö Oy 2%
- Rovakarjan Tuotanto Oy 2%

- SPS Tuotanto Oy 5%
- Kokemäen Sähkö Oy 2%
- Käylön-Säkylän Sähkö Oy 2%
- Lankosken Sähkö Oy 2%
- Leppäkosken Sähkö Oy 2%
- Panelianskosken Voima Oy 2%
- Saillia Energia Oy 2%
- Vatajankosken Sähkö Oy 2%
- Vakka-Suomen Voima Oy 2%

- Voimajunkkarit Oy 5%
- Alajärven Sähkö Oy 2%
- Hirikosken Energia Oy 2%
- Jylän Sähköosuuskunta 2%
- Kuoreveden Sähkö Oy 2%
- Lehtimäen Sähkö Oy 2%
- Seinäjoen Energia Oy 2%
- Vimpelin Voima Oy 2%
- Ääneveden Energia Oy 2%
OL 4 AND FENNOVOIMA CONCLUSIONS

- Participating in a power company as a shareholder has gained increasing popularity in Finland – Fennovoima with new shareholders including E.ON
- Finnish Governments always been pro-nuclear
- In political discussion, nuclear considered as necessary for replacing the retiring capacity and reaching the EU targets relating to climate policy
- Economic risks of nuclear and the OL 3 problems have not become a big issue of political or even public discussion in Finland. Why?
- Nuclear still an important reference in comparison of electricity production alternatives
- Government decision-in-principle is valid for 5 year
THANK YOU!

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