Finnish Exceptionalism: Drivers of nuclear new build

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Outline for my lecture

1. Introduction
2. Energy policy in Finland
3. An exception – In what sense?
4. Drivers of nuclear new build
5. One special background factor facilitating nuclear new build
6. Conclusion
University of Jyväskylä

- 1863 Jyväskylä Teacher Seminary
- 1934 Jyväskylä College of Education
- One of the largest universities in Finland
- Rector Matti Manninen
- 7 faculties
- 15,000 students
- Staff 2,600
Why I became interested in nuclear technology?

- In 1960s and 1970s hardly anyone was able to close their ears on nuclear arms race, peace movements and environmental movement.
- During my studies I was inspired by sociology of science and technology, but also on social movement research.
- Nuclear power companies suggested nuclear waste repository to my home municipality in 1987.
- I started to study local anti-nuclear groups in 1988.
- Here I am, still studying nuclear technology.
Why a sociologist is interested in nuclear power?

- Instability in nuclear power’s societal status created by
- The ambiguous nature of the technology itself
- Changing public opinion
- The fluidity of political judgements
- The flow of cultural meanings attaching to nuclear power
- The unpredictability of media processing
Note: Importance of cultural factors

The early history of nuclear power begins in 1896, with the discovery of radioactivity. “Then Marie Curie discovered the new metal radium, whose rays, compared with the whisper from uranium, were like a piercing shout.”

Century the imagery of nuclear energy has consisted not only of positive and optimistic symbols and meanings but also of dark, pessimistic and fearful images.

Apocalyptic visions of doomsday created by mad scientists are images as permanent as those of a peaceful and prosperous Golden Age or new Eden of humankind.
Energy policy in Finland
Decentralised and diversified energy system

Total energy consumption in Finland 2008

Total Energy Consumption 2012

Total energy consumption 1970-2012
Electricity production by energy source  
2000–2011

- Nuclear power: 32%
- Hydro power: 17%
- Wind power: 1%
- Black liquor: 7%
- Other wood fuels: 7%
- Other renewables: 1%
- Peat: 7%
- Oil: 1%
- Natural gas: 13%
- Hard coal: 13%
- Other fossil fuels: 1%
- Other energy sources: 1%
- Renewables total: 33%

Electricity production 70.4 TWh

Electricity consumption by sector 1970–2012

Source: Statistics Finland, Energy supply and consumption
Electricity consumption by sector 2012

- Services and public consumption: 22%
- Industry and construction total: 47%
- Households and agriculture: 28%
- Forest industries: 24%
- Metal industry: 10%
- Chemical industry: 8%
- Other industries: 5%
- Losses: 3%

Renewable Energy Sources Policy

- One of the world leaders in utilising bioenergy
- RES TARGETS
  - Mandatory targets set by EU’s Directive on the Promotion of the use of energy from renewable sources
- 38% share of RES on the final consumption of energy in 2020
- At least 10% share of renewable energy in final consumption of energy in transport by 2020
Poor performance in reducing CO2 emissions

N. Valkila, A. Saari / Renewable and Sustainable Energy Reviews 17 (2013) 283–290

Finland's per capita emissions of carbon dioxide are fairly high

In 2003–2005 the average annual emissions were 12.7 t of CO2 per capita
  as against the 9.0 t of CO2 per capita for all the EU-25 countries

Poor performance is explained by

Geography: a northern European climate

Population density: sparsely populated (17 inhabitants per sq. km)

Structure of industry: energy intensive
An exception

In what sense?
Overall picture in Finland

- Finland has four nuclear reactors providing nearly 30% of its electricity
- A fifth reactor is now under construction
- Two more are planned
- Provisions for radioactive waste disposal are advanced
Nuclear power plants in Finland

Total electricity supply 84.7 TWh in 2011

Fortum:
- Loviisa 1 4.0 TWh
- Loviisa 2 4.0 TWh

TVO:
- Olkiluoto 1 7.4 TWh
- Olkiluoto 2 6.9 TWh
  (OL3 – est. 13 TWh)
  (Olkiluoto 4)

Fennovoima:
- (Hanhikivi 1)

Fuel: no front-end facilities, potential uranium extracting (Talvivaara Sotkamo Oy) from 2012

No reprocessing of spent fuel – ban to import/export nuclear waste (since 1994)
Finland and selected other European countries’ nuclear power reactors, plans and uranium requirements (adopted and modified from WNA 2012).

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<tbody>
<tr>
<td>Finland</td>
<td>22.3 % electricity</td>
<td>4</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>3,000 471</td>
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<tr>
<td>France</td>
<td>423.5 % electricity</td>
<td>58</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1,000 9,254</td>
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<tr>
<td>Sweden</td>
<td>58.1 % electricity</td>
<td>10</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0 1,394</td>
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<tr>
<td>Germany</td>
<td>102.3 % electricity</td>
<td>9</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1,934 1,934</td>
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<tr>
<td>UK</td>
<td>62.7 % electricity</td>
<td>16</td>
<td>0</td>
<td>4</td>
<td>9</td>
<td>12000 2,096</td>
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**Globally nuclear reactors "under construction" (as of 1 July 2013)**

World Nuclear Industry Status Report, 19

<table>
<thead>
<tr>
<th>Country</th>
<th>Units</th>
<th>MWe</th>
<th>Construction start</th>
<th>Grid Connection</th>
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<tbody>
<tr>
<td>India</td>
<td>7</td>
<td>4,8242002-2011</td>
<td>2002-2011</td>
<td>2013-2016</td>
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<td>South Korea</td>
<td>5</td>
<td>6,322008-2013</td>
<td>2008-2013</td>
<td>2013-2017</td>
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<tr>
<td>USA</td>
<td>3</td>
<td>3,3991972-2013</td>
<td>2002-2013</td>
<td>2015-2017</td>
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<tr>
<td>Taiwan</td>
<td>2</td>
<td>2,6</td>
<td>1999-2000</td>
<td>2014-2015</td>
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<tr>
<td>UAE</td>
<td>2</td>
<td>2,692012-2013</td>
<td>2012-2013</td>
<td>2017-2018</td>
</tr>
<tr>
<td>Argentina</td>
<td>1</td>
<td>692</td>
<td>1981</td>
<td>2013</td>
</tr>
<tr>
<td>Brazil</td>
<td>1</td>
<td>1,245</td>
<td>1981</td>
<td>2013</td>
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<tr>
<td>Finland</td>
<td>1</td>
<td>1,6</td>
<td>2005</td>
<td>2016</td>
</tr>
<tr>
<td>France</td>
<td>1</td>
<td>1,6</td>
<td>2007</td>
<td>2016</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>66</strong></td>
<td><strong>63,4431972-2013</strong></td>
<td><strong>1972-2013</strong></td>
<td><strong>2013-2019</strong></td>
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</table>
66 reactors are under construction, **BUT**
- 9 have been under construction over 20 years and 4 over 10 years
- 45 do not have an official planned start-up date
- At least 23 have encountered construction serious delays, from other 43 reactor units it is difficult to assess whether they are on schedule or not

Two-thirds (44) of the units under construction: China, India and Russia.

The average construction time of the 34 units that started up in the world between 2003 and July 2013 was 9.4 years.
Nuclear reactors and operating capacity
(The world nuclear industry status report 2013)
World Electricity Production 2008

Total: 20,269 TWh

Source: IEA Electricity Information 2010
Share of electricity produced by NPPs

World’s current NPPs

http://nuclearinfo.net/Nuclearpower/CurrentReactors --

International Nuclear Safety Center at ANL, Aug 2005
World's NPPs and active earthquake zones

United States Geological Survey & IAEA

NPPs in Europe
Drivers of nuclear new build
Recent nuclear power policy-making
(Litmanen & Kojo 2011)

- We have distinguished three different policy arrangement periods
- 1) rejection 1986–1993
- 2) revival 1994–2002
- 3) renewal 2003–2010

Before recent favourable nuclear decisions in 2002 and 2010, nuclear power was rejected by the Parliament in 1993
Decades of determined pro nuclear lobbying

- The rejection period, 1986-1993:
  - characterized by opposition to nuclear power

- The revival period, 1994-2002:
  - a slight increase in public support for nuclear power
  - presumably because the nuclear industry lobbied for its new NPP application and the anti-nuclear power movement lost strength

- The renewal period, 2003-2010:
  - the support for the expansionist decision has increased
  - around 40% of Finns agreed with the policy and opposition dropped to under 30% in 2003
How Finns view nuclear power should be developed in Finland?

Source: Ylönen, Litmanen, Kojo & Lindell 2013
Strong pro nuclear coalition

- Relatively close relationships between the state and the nuclear industry
  - but also between the state, export industry and labour unions
  - The National Coalition Party, the Social Democratic Party, the power companies, labour unions and business organisations (+ ministry of employment and economy)

- The energy-intensive pulp and paper industry (UPM Kymmene and Stora Enso)
Follow the money!

The current owners of TVO
- EPV Energia (6.5%), Oy, Fortum Oyj (26%), Karhu Voima Oy (0.1%), Kemira Oyj (1%), Oy Mankala Ab (8%), and Pohjolan Voima Oy (58%)

Fortum owns nearly 26% of TVO;
- thus, the interests of the state of Finland are also indirectly represented in TVO, as the state owns just over 50% of Fortum Consortium

Owners of PVO
- 21 shareholders, which include paper makers UPM-Kymmene Oyj (42% of shares) and Stora Enso Oyj (15.6%) as well as locally owned energy companies
Effective change of pro-nuclear discourse

The pro-nuclear coalition reconsidered their message after their defeat in 1993

- Coalition ended up emphasising softer values such as
- the importance of the defense of the welfare state
- combating climate change with nuclear power and
- the safety of nuclear power
Anti-nuclear coalition was powerful in the 1980s

The ‘shock event’ of Chernobyl mixed up the policy arrangement of the 1980s

- For example, the supporting coalition was temporarily paralysed,
- the political effectiveness of discourses changed
- the anti-nuclear coalition found new resources
Liberalisation of electricity markets

- From the mid-1990s, liberalisation and deregulation of electricity markets altered the rules of the game

- The latest period from 2003 onwards
  - political interests aimed at further increasing nuclear power production capacity
  - debate over liberalisation of the licensing process
Rationale for Nuclear Power Expansion in Finland

Arguments stated by the Government for the positive DIPs (July 2010)

- Reaching the climate and energy strategy targets
  - including electricity supply and environmental effects

- Self-sufficiency as a goal
  - electricity import from Russia and other neighboring countries

- Reduce green house gas emissions
Rationale for Nuclear Power Expansion
Arguments stated by the Government for the positive DIPs

- The seven units might cover almost 60% of Finnish power demand in 2020's
- Increase competitiveness of Finnish industry
  - which is very energy intensive
- Both companies produce electricity at cost to their owners
Political power: geopolitics

- National security: Fuel for the economic engine!
- To ensure energy security countries tend to use energy diplomacy
- Or more rude geopolitical actions, e.g., military presence and/or domination
- How geopolitics affects in Finnish energy policy?
The Scope of the Issue: Gas

David Dusseault's pp-slides

Russia: Main Natural Gas Export Pipelines
The Scope of the Issue: Oil

David Dusseault's pp-slide

Russia: Main Oil Export Pipelines
Electricity generation in the Nordic Countries 2004 (Source: Nordel)

- Hydro power: 49%
- Nuclear power: 25%
- Thermal power: 24%
- Wind and geothermal power: 2%

Total electricity generation: 388 TWh
Planned Fennovoima NPP at Pyhäjoki
One special background factor facilitating nuclear new build
An ambiguous reputation as a pioneer of nuclear waste management

- Posiva, nuclear waste company, suggested Olkiluoto to be a final disposal site
  - In May 1999

- The municipal council of Eurajoki made a positive statement on the decision in principle
  - In January 2000

- The Government made the decision in principle
  - On the 21st of December 2000

- The Parliament ratified the decision
  - On the 18th of May 2001
Underground repository for the spent nuclear fuel
The nuclear waste management system

- Spent nuclear fuel is managed by Posiva Oy
  - set up in 1995 as a joint venture company – 60% TVO and 40% Fortum

- Deep geological repository for encapsulated used fuel at the Olkiluoto island in Eurajoki
  - some 400 metres down in 2 billion-year-old igneous rock

- Plans do not include accommodation for used fuel from Fennovoima's new plant
  - But the government can use its legal authority to ensure that Fennovoima fuel would be included
Opinions regarding safety of final disposal into Finnish bedrock

Based on data from annual Finnish energy attitudes study (1983–2008).
Residents of Eurajoki disagreeing and agreeing with the view that final disposal in the Finnish bedrock is safe (%). Based on data from the annual Energy Attitudes of the Finns (1983) study (Kari et al. 2010, p.9)
Risk perception in Eurajoki and its neighbouring municipalities
Perception of the threat posed by the nuclear waste disposal facility, felt at least explicitly (%) (M. Kojo et al. / Progress in Nuclear Energy 52 (2010) 168–176)

<table>
<thead>
<tr>
<th>Dimension of risk perception</th>
<th>%</th>
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<tbody>
<tr>
<td>General safety</td>
<td>34</td>
</tr>
<tr>
<td>Own or family’s safety</td>
<td>32</td>
</tr>
<tr>
<td><strong>Safety of future generations</strong></td>
<td>55</td>
</tr>
<tr>
<td>General health</td>
<td>45</td>
</tr>
<tr>
<td>Own or family’s health</td>
<td>42</td>
</tr>
<tr>
<td><strong>Health of future generations</strong></td>
<td>56</td>
</tr>
<tr>
<td>General well-being</td>
<td>39</td>
</tr>
<tr>
<td>Own or family’s wellbeing</td>
<td>37</td>
</tr>
<tr>
<td><strong>Well-being of future generations</strong></td>
<td>52</td>
</tr>
</tbody>
</table>
Conclusions
Finnish exceptionalism

“In Finland we have the most stable bedrock in the world and we can produce nuclear energy safer than the others. We have plenty of cold cooling water which promotes maximum production of energy and we have skillful engineers, not to mention the widely acknowledged high level of technology. Radiation and nuclear safety authority’s control ensures that industry does not build seconds.” (Anonymous writer, HS, 14 March 2011).

“All the recognizable threats have been analysed and they can be controlled.” (Himanen, Nuclear Safety manager of Olkiluoto, HS 26 March 2011).
Many factors behind nuclear new build

- Strong pro nuclear coalition
- Effective pro-nuclear discourse
- Industrial structure of Finland
- State’s and local municipalities’ ownership in energy companies
- National energy and climate policy strategy
- Liberalised electricity markets
- Geopolitical realism
- Solutions for the problem of nuclear waste: final disposal
Some new publications


Thank you for your attention!

Questions, comments?