Views on nuclear power and status of new build in Finland

Atomex Europe, Prague, 25 October 2011

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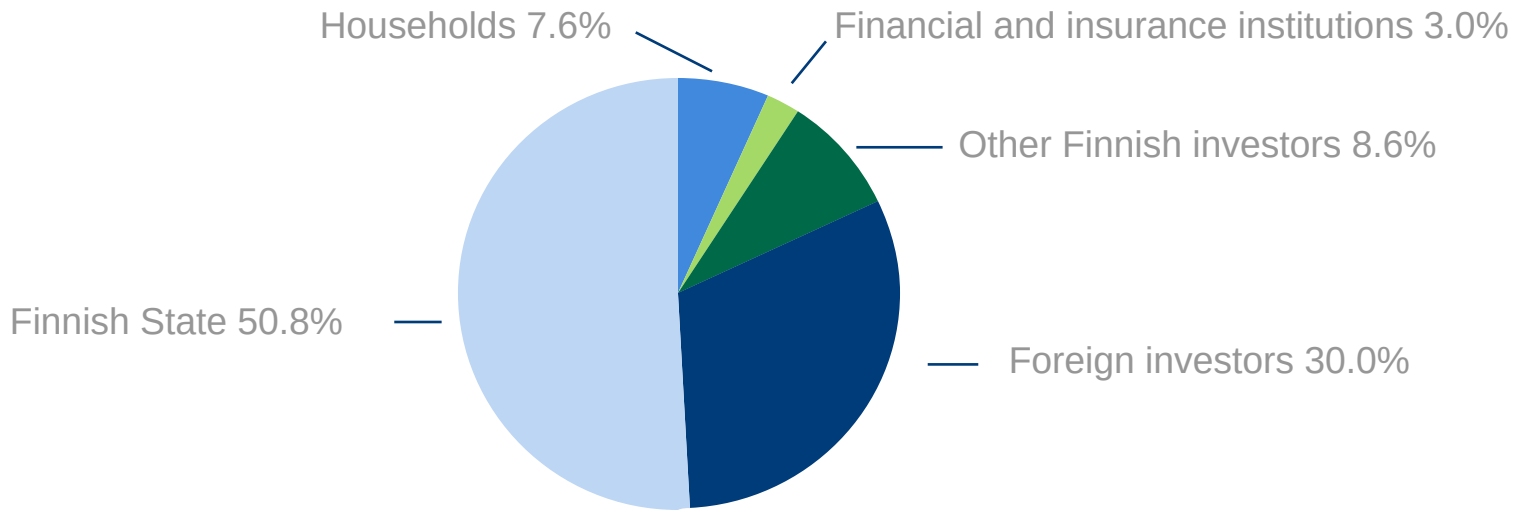
Fortum

Outline

- Fortum and its nuclear assets and capabilities
- Post-Fukushima activities regarding Loviisa NPP
- Views on new nuclear
- Current new build activities in Finland

Fortum is a leading Nordic power and heat company

- Leading power and heat company in Nordic countries
- Listed at the Helsinki Stock Exchange 1998
- 100,000 shareholders
- Among the most traded shares in Helsinki stock exchange
- Market cap ~20 billion euros



31 March 2011

Fortum's geographical presence today

Nr 1  Heat

Nr 1  Distribution

Nr 2  Power generation

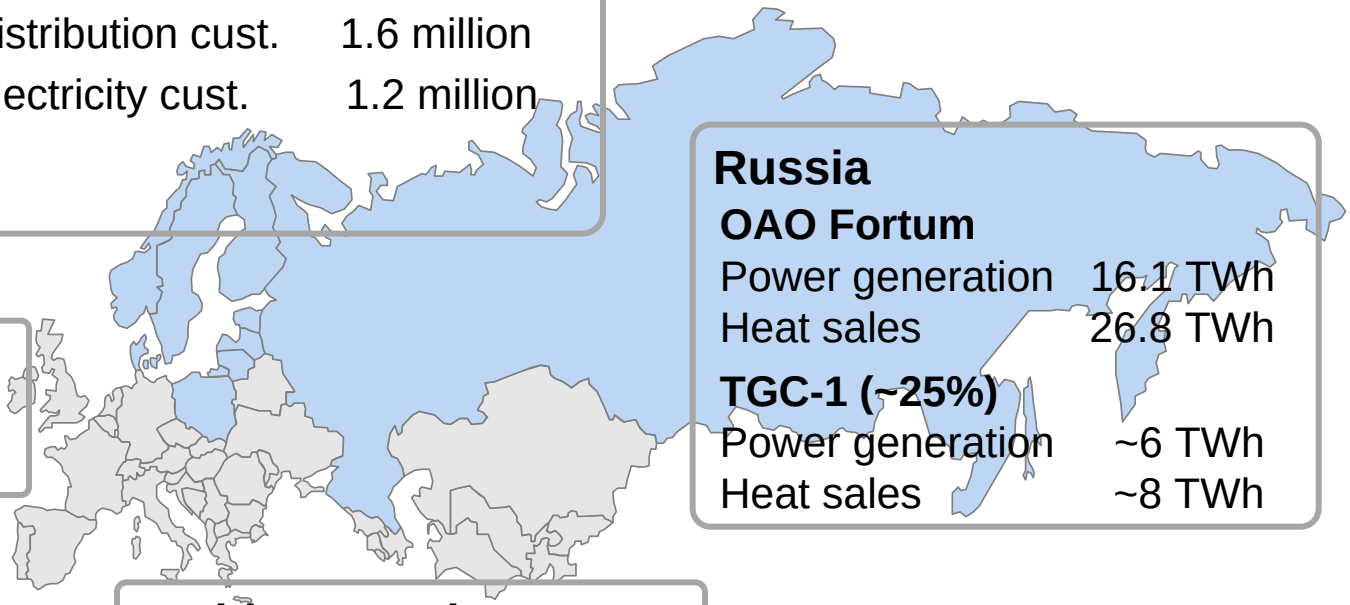
Nr 2  Electricity sales

Nordic countries

Power generation	52.3 TWh
Heat sales	20.7 TWh
Distribution cust.	1.6 million
Electricity cust.	1.2 million

Key figures 2010

Sales	EUR 6.3 bn
Operating profit	EUR 1.7 bn
Personnel	10,600



Russia

OAO Fortum

Power generation	16.1 TWh
Heat sales	26.8 TWh

TGC-1 (~25%)

Power generation	~6 TWh
Heat sales	~8 TWh

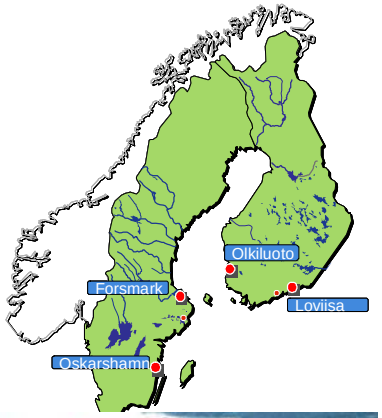
Poland

Heat sales	4.0 TWh
Electricity sales	0.1 TWh

Baltic countries

Heat sales	1.4 TWh
Electricity sales	0.3 TWh
Distribution cust.	~24,000

Overview of Fortum's nuclear fleet



Loviisa

Two units
2 × 498 MW = 996 MW

Fortum's share: 100 %

Yearly production 8 TWh

Share of Fortum's Nordic power production: 18 %

Olkiluoto

Two units, one under construction

880 + 860 MW = 1740 MW
Under construction 1600 MW

Fortum's share: 27 % (463 MW)

Yearly production 14 TWh
Fortum's share: 4 TWh

Share of Fortum's Nordic power production: 9 %

Oskarshamn

Three units
473 + 638 + 1400 = 2511 MW

Fortum's share: 43 % (1089 MW)

Yearly production 17 TWh
Fortum's share: 7 TWh

Share of Fortum's Nordic power production: 16 %

Forsmark

Three units
978 + 990 + 1170 = 3138 MW

Fortum's share: 22 % (696 MW)

Yearly production 25 TWh
Fortum's share: 5,5 TWh

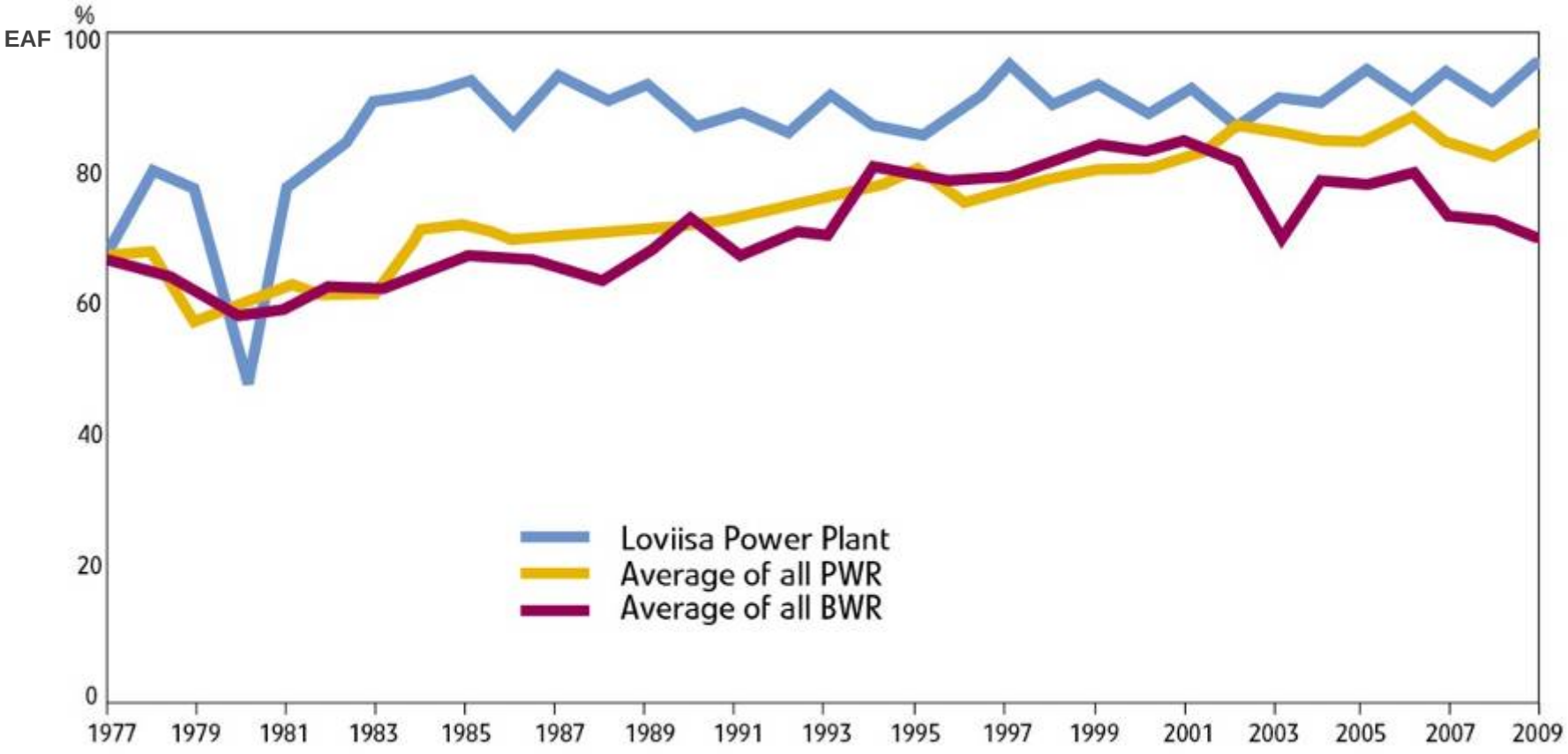
Share of Fortum's Nordic power production: 13 %

Fortum Power – Loviisa Nuclear Power Plant

- Loviisa NPP includes two PWR units VVER-440, 2 x 488 MWe (net)
- Loviisa 1 started operation in 1977 and Loviisa 2 in 1980
- Renewed operational licenses for 50 years lifetime (LO1, 2027 and LO2, 2030)

- Load factor 2010: 91,1 %
- Production 2010: 7,7 TWh.

Loviisa 1&2 availability factors



Loviisa PWR EAF, energy availability factor

Fortum's Nuclear Engineering Capabilities

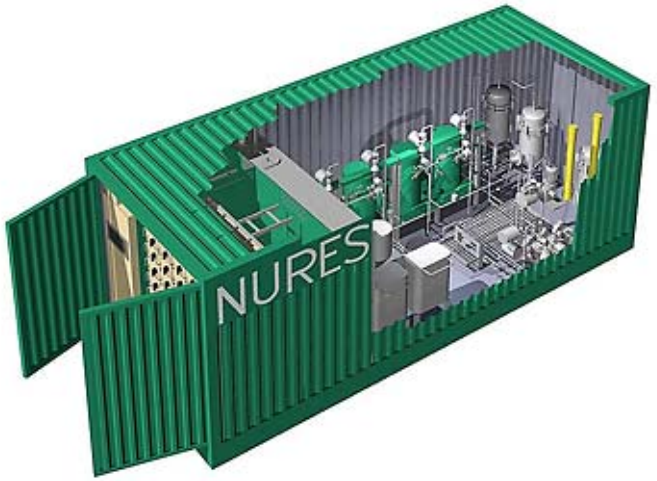
- Technical Support unit within the Nuclear Competence Center
- high level expertise in the technologies of nuclear power and management of radioactive waste
- supports safe and economical operation of Loviisa nuclear power plant and other nuclear assets and growth of Fortum
- consultant and engineering services and system supplies
- other clients: power companies, nuclear power plants and waste management facilities in other countries etc.
- staff ca. 180
- network of partners and consultants

Fortum Power Solutions

Nuclear safety and waste management

Areas of expertise

- Nuclear safety
- Waste technologies
- Engineering
- New plant projects
- Instrumentation and control
- Electrical systems
- Radiation safety



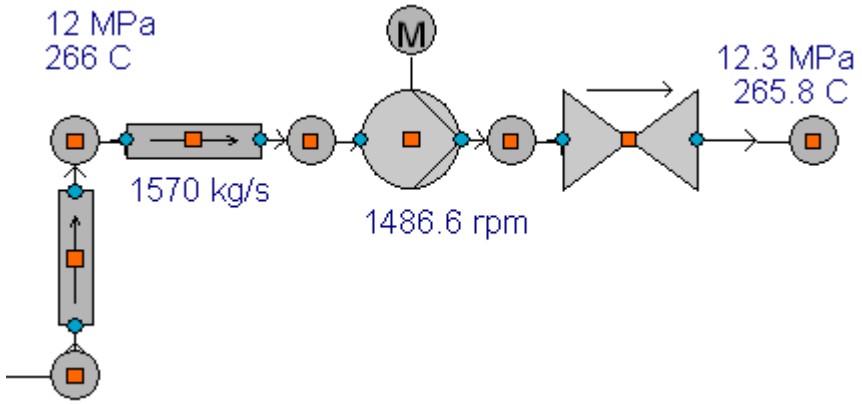
Primary products

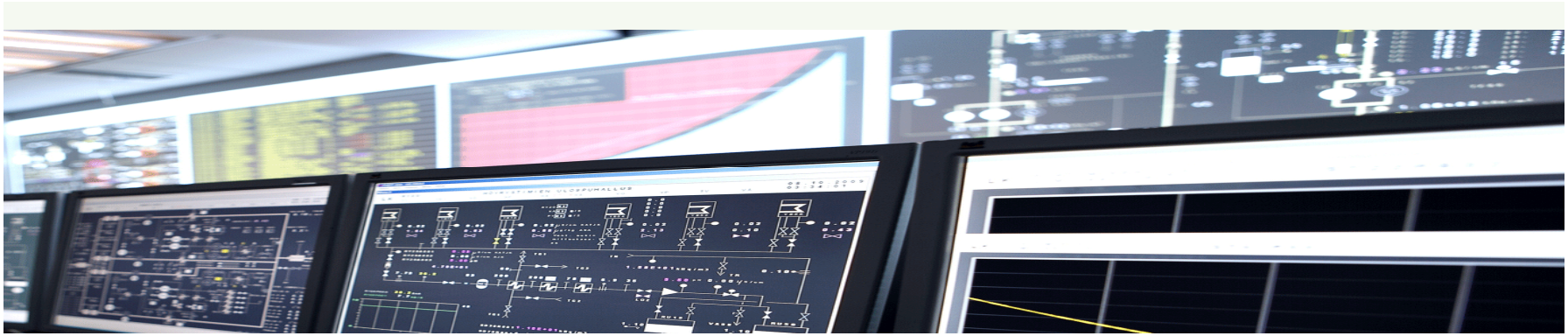
- Apros - simulation software
- Nures - nuclide removal system

Apros simulation software

- Multipurpose simulation software for dynamic modeling of processes, thermal hydraulics, neutronics, electrical and automation systems.

- Nuclear & Thermal power plant modeling:
  - Safety analyses
  - Engineering tool
  - Training simulators
  - Automation testing



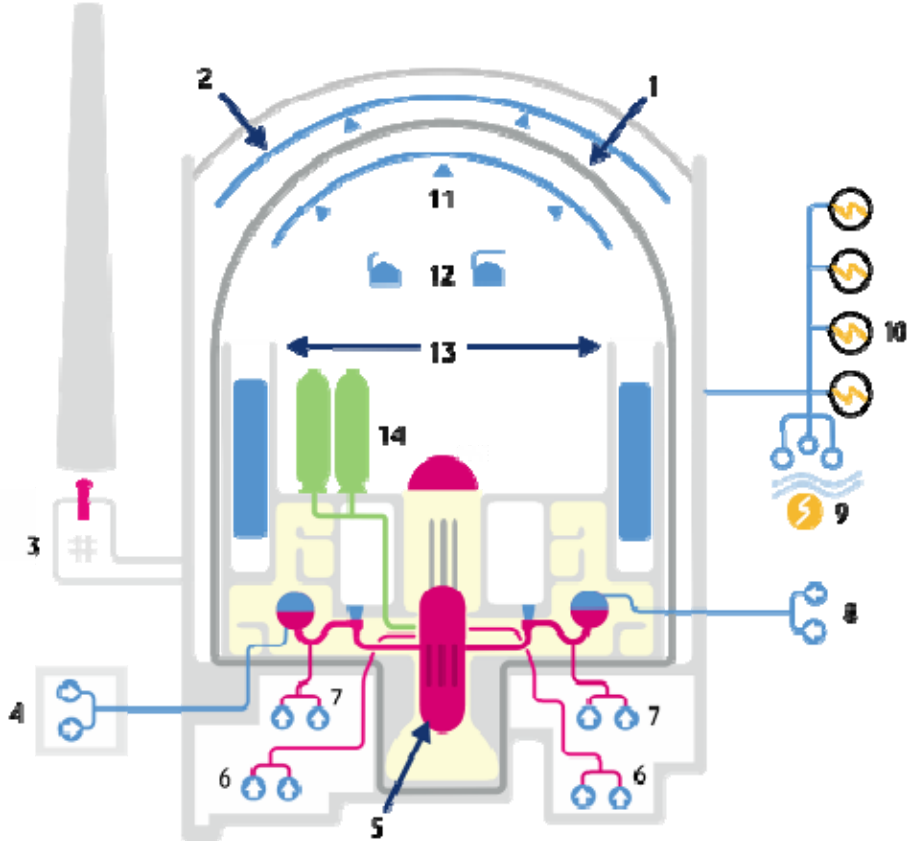


Loviisa NPP safety assessments due to Fukushima accident

- Finnish Ministry of the Employment and the Economy requested in March 2011 assessment, how Loviisa NPP can cope with natural events and loss of electrical power. Fortum has sent this assessment April 15th.
- No major issues identified in the assessment of the Loviisa NPP nor any immediate actions requested by STUK. However, as a continuation of the assessment, STUK has sent a request for further assessments and actions in selected areas regarding natural events and loss of electrical power
  - The report is to be submitted to STUK by 15th December 2011
- These national safety assessments have lots of similarities with WANO SOER and EU stress tests
  - Fortum is currently finalizing the EU stress test report on Loviisa. The report is to be submitted to STUK by the end of October 2011

Most important safety systems at Loviisa NPP

1. Steel containment
2. Containment's external spray system
3. Air filters
4. Reserve emergency feed water pumping station
5. Reactor pressure vessel
6. Low-pressure safety injection pumps
7. High-pressure safety injection pumps
8. Emergency feed water pumps
9. Electric connection from hydro power plant + gas turbine
10. Emergency power diesel generators
11. Containment spray
12. Hydrogen recombiners and igniters
13. Ice condensers
14. Hydro accumulators



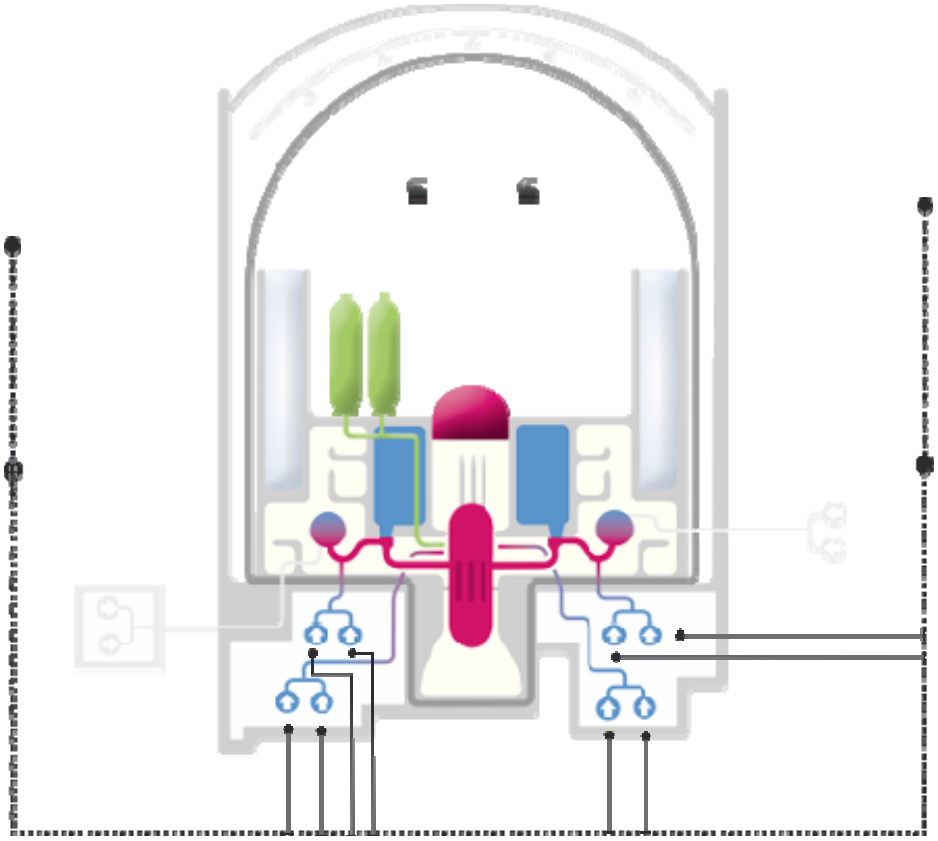
External electricity supply

Two grid connections

400 kV

One grid connection

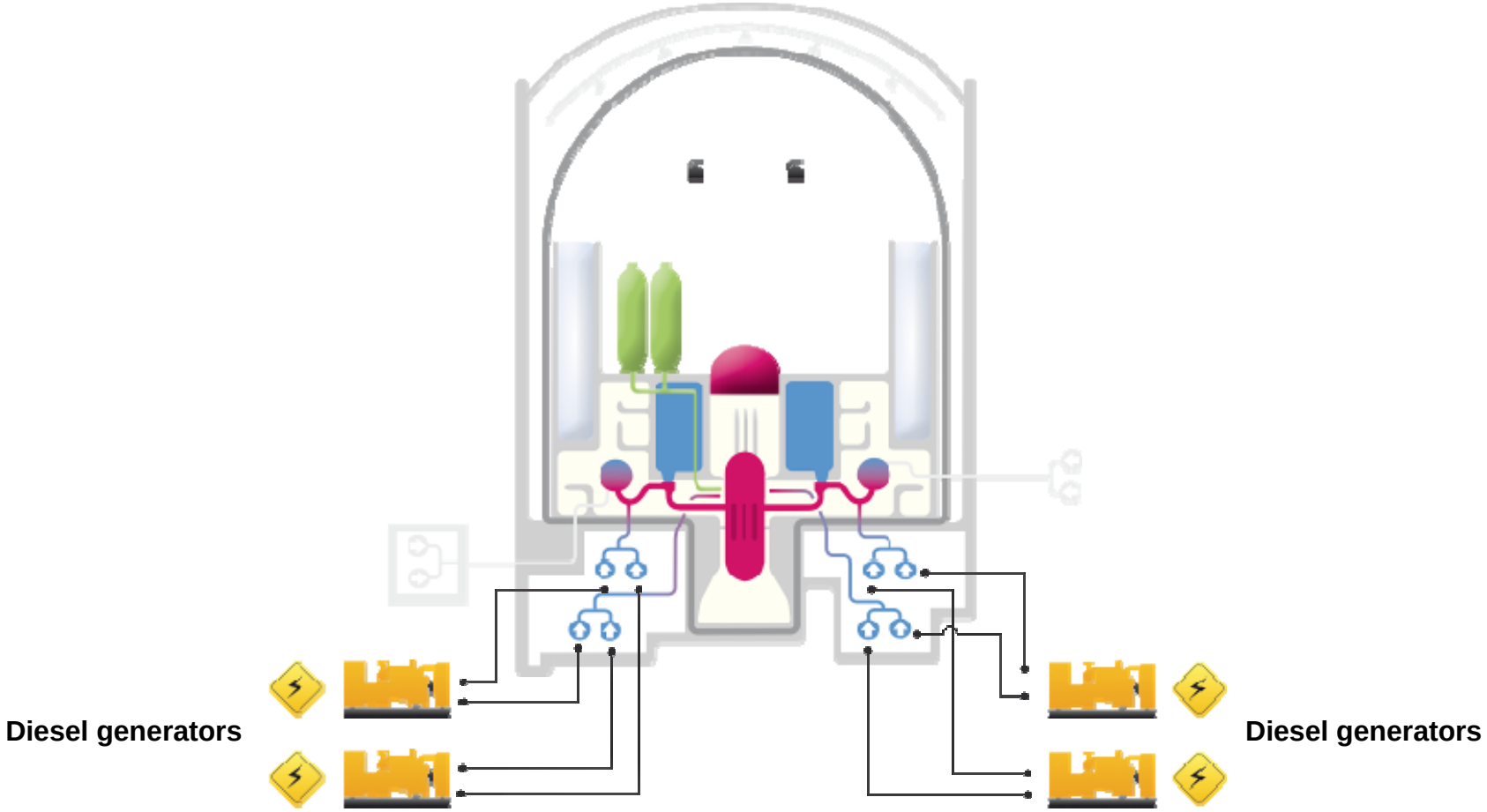
110 kV



Connection to Ahvenkoski hydro power plant

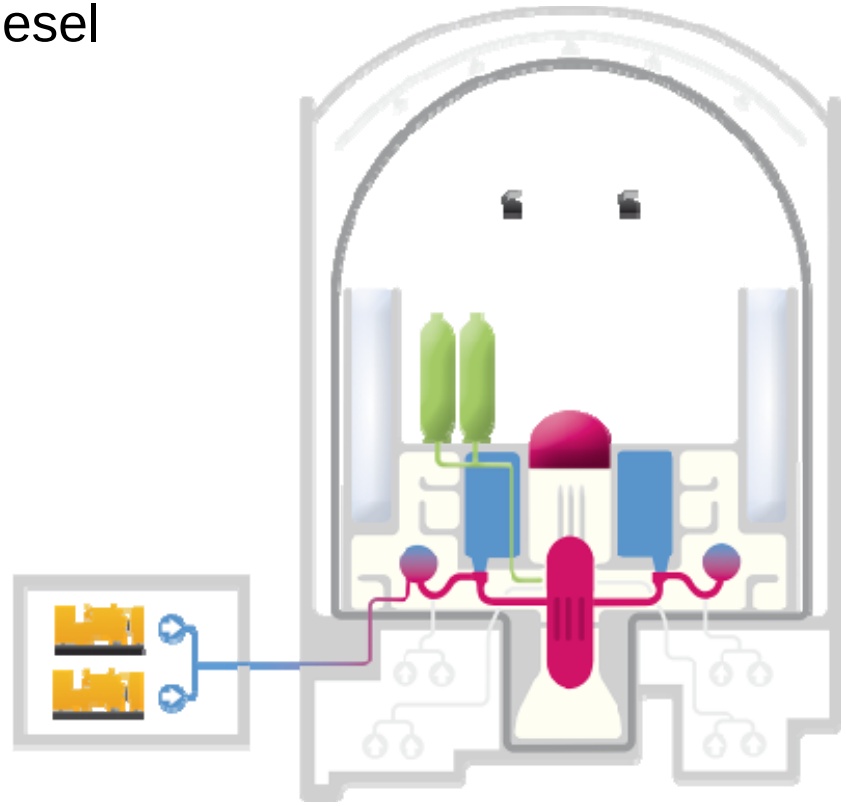
Gas turbine, which will be replaced with new diesel generator

External electricity supply is secured with four emergency diesel generators per unit



Reserve emergency feed water pumping station

In case of total loss of power, residual heat from the reactor can be removed with diesel driven reserve emergency feed water pumps



The bunkered reserve pumping station is capable of operating autonomously after external or internal hazards have violated the supply of emergency feed water

Severe Accident Management (SAM)

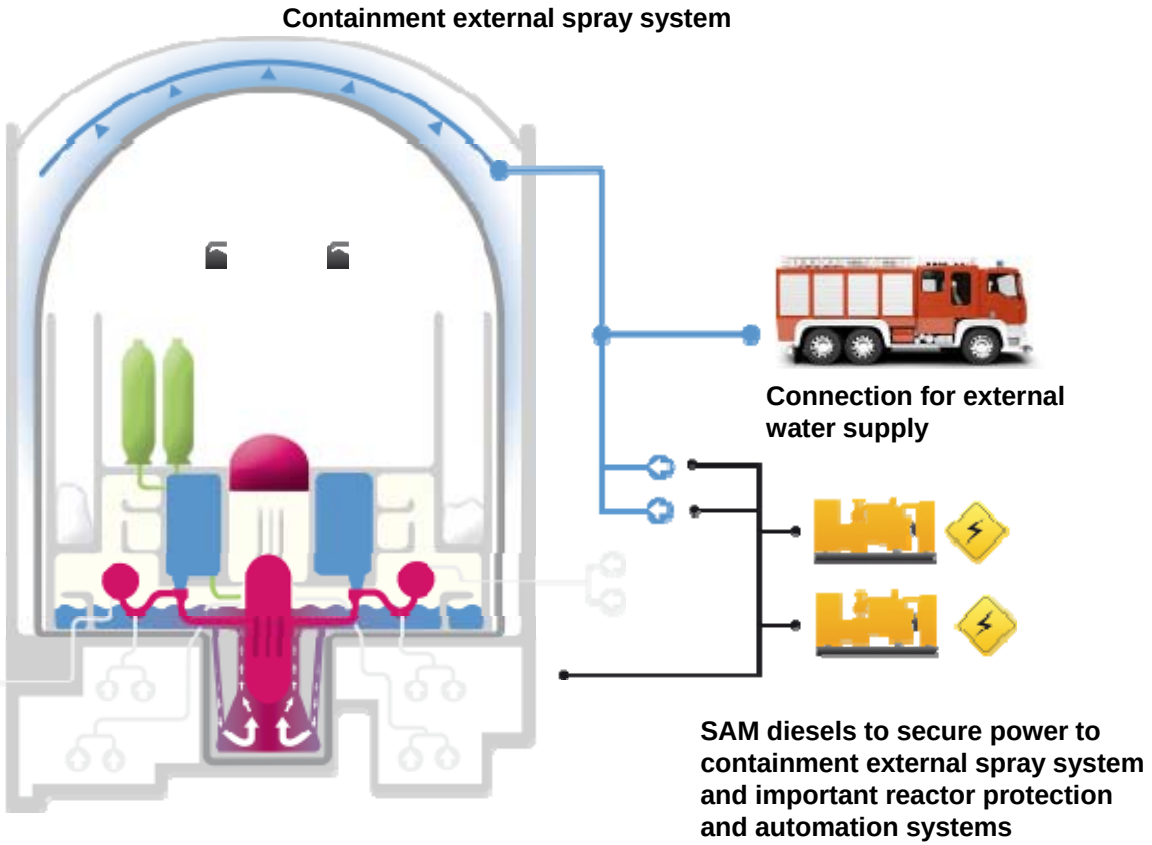
If all cooling systems and power supply are lost, the fuel starts to melt in the reactor core. The **reactor pressure vessel can be cooled from outside** with water melting from ice condensers, thus retaining molten core inside the vessel.

Heat is removed from the containment by **outside spray cooling** (autonomous system).

With these arrangements the reactor pressure vessel and containment are kept intact.

Dedicated, radiation protected **SAM control room** has been constructed.

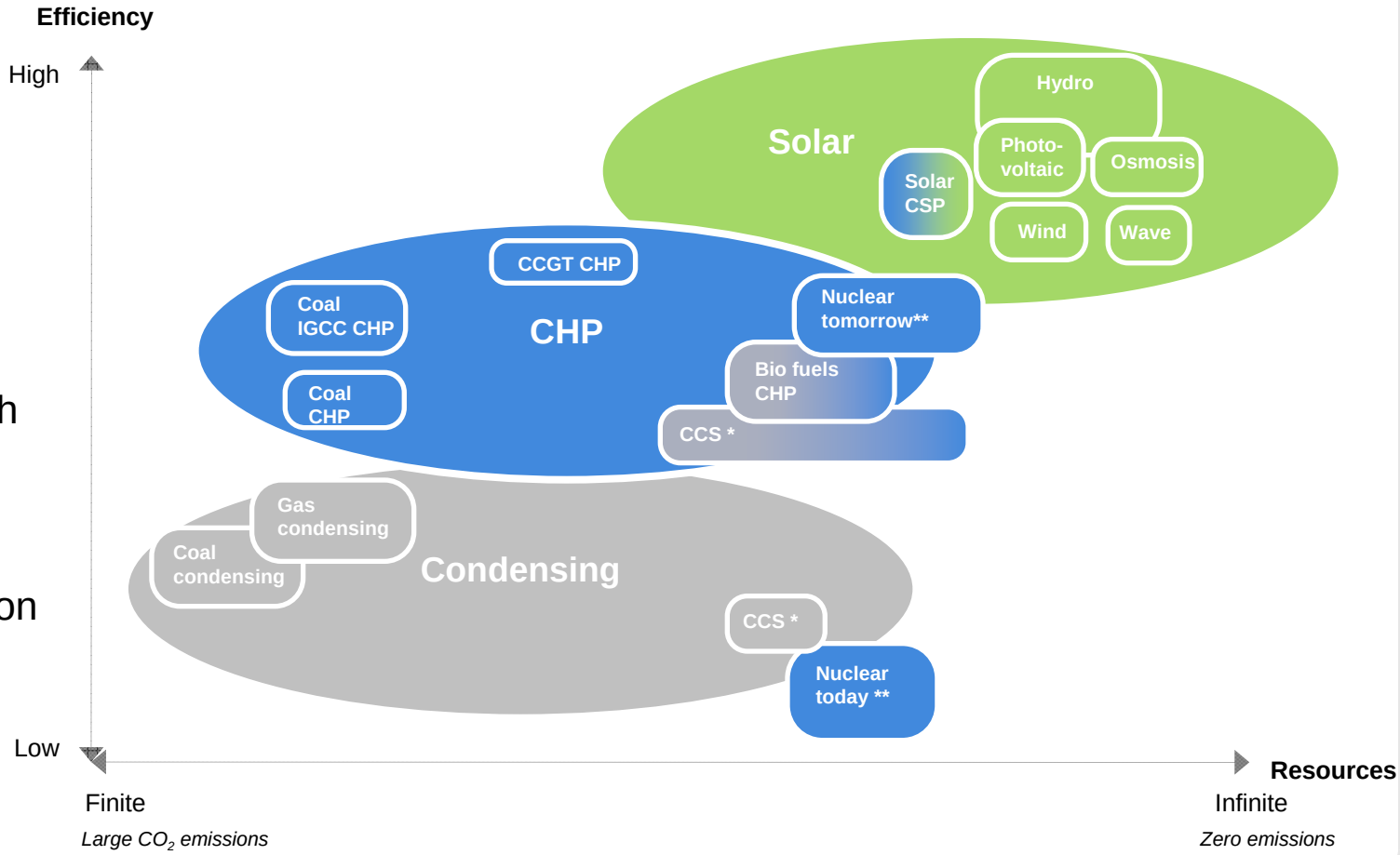
To **prevent hydrogen explosions**, the containment is equipped with passive recombiners and igniters.



Longer term, the electricity generation system will develop from a “Carnot world” towards a “Solar economy”

Driven by

- Global energy demand growth
- Increasing environmental problems
- Increasing resource scarcity
- New consumers with new demands, aspirations and attitudes
- Changes in regulation and regulatory influence
- Technology advances



** CCS decreases plant output (energy efficiency), while at the same time reducing CO_2 emissions dramatically. If applied to bio-CHP, “negative” emissions = removing CO_2 from the atmosphere*

*** Extremely low utilization (<5%) of uranium energy content in LWR with final deposition of spent fuel. However, huge improvement potential both with CHP mode and Generation IV (breeder) technologies*

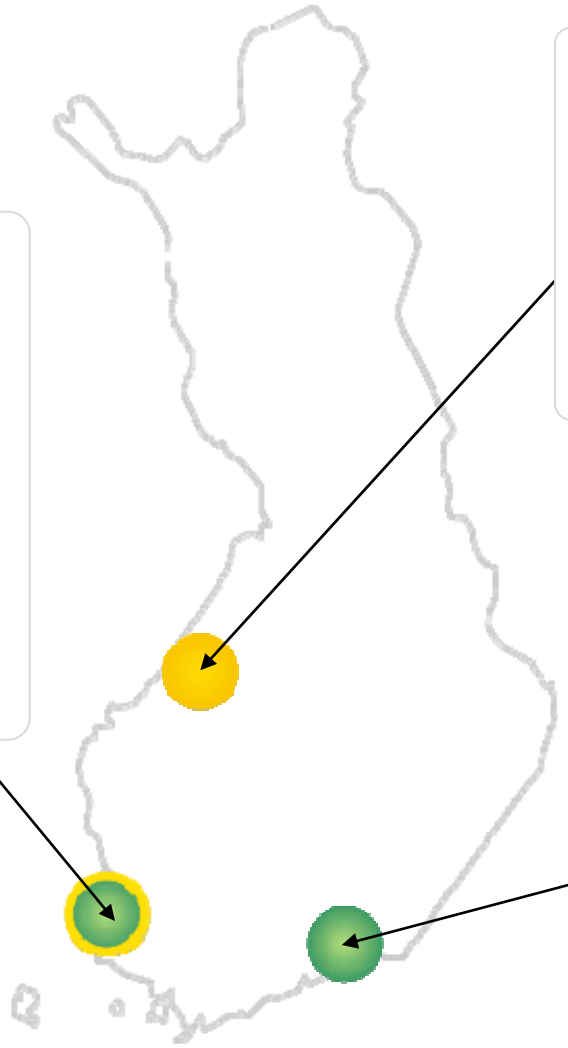
Nuclear in the strategic core of Fortum also in the future

- Power upgrades and Olkiluoto 3: approximately 700 MW new nuclear capacity
- Olkiluoto 4: additional 400 MW
- Acting as an industrial partner in attractive nuclear investments in Europe
- Increasing the use of Fortum's nuclear competence at co-owned power plants
- Developing nuclear CHP concept further

Nuclear power plants in Finland

Olkiluoto NPP

- 2 operating units - ABB BWRs
- OL 1: 860 MW, 1978
- OL 2: 860 MW, 1980
- OL 3: (EPR) under construction
- OL 4: Decision in Principle 2010



FENNOVOIMA

New utility, no operating reactors

- Decision in Principle for FV1 in 2010
- Site selected in Oct 2011: Pyhäjoki

Fortum

Loviisa NPP

- 2 operating units – VVERs
- LO 1: 1977, 488 MW
- LO 2: 1980, 488 MW

Source: STUK