Pertti Sakari Simola,
TVO, President and CEO, Finland

- Graduated from the Lappeenranta University of Technology, Finland, in 1973
- Worked for UPM-Kymmene Corp as Vice President, Energy for seven years
- In 2004, P. Simola was appointed in TVO President and CEO.
- Title: Proactive PLiM - One of TVO'S Key Success Factors
Proactive Plant Life Management - One of TVO’s Key Success Factors

IAEA, Second International Symposium on Nuclear Power Plant Life Management
Shanghai, China, 15-18 October 2007

Pertti Simola
President and CEO
TVO, Finland
Index

• Company Profile
• Outage Planning
• Life Management Strategy
Company Profile
Nuclear Power Plants in Finland

Population 5.2 million
Power Demand 90 TWh/a

Olkiluoto
OL1 BWR 860 MW 1978
OL2 BWR 860 MW 1980

Loviisa
LO1 PWR 488 MW 1977
LO2 PWR 488 MW 1979

Helsinki
Teollisuuden Voima Oy

Company
- Privately owned generating company
- Established in 1969
- Personnel about 670
- Annual turnover about million 230 €
- Sells electricity only to the shareholders at cost

Existing Nuclear Power Plant Units (Olkiluoto 1 and 2)
- 2 x 860 MW, BWR, Westinghouse Atom
- Commercial operation 1979 and 1982

New Nuclear Power Plant Unit (Olkiluoto 3)
- 1 x 1,600 MW, PWR, AREVA NP-Siemens consortium
- Commercial operation in 2011
VISION
A world-class nuclear power generating company highly valued by the Finnish society

MISSION
Producing electric power to shareholders safely, reliably, economically while preserving the environment

VALUES
Responsibility
Continuous improvement
Proactivity
Transparency

Key Success Factors

- Safe, good-as-new plant units
- High safety culture
- New, modern plant units
- Skilful and motivated personnel
- Excellent cost competitiveness
- Highly valued by the society and stakeholders
TVO - Leading Nuclear Power Generator in Finland, covering about 18% of Energy Supply in Finland

- strict safety culture: safety and reliability of the plant units never compromised
- highly valued company worldwide
- advanced and modern plant units with excellent track records
- competitive and widely accepted nuclear waste management concept
Olkiluoto 1 and 2
Electric Power Production (TWh) and Capacity Factor (%)
Outage Practices
Outage Policy

• Fuel cycle length 12 months

• Outages always in spring time because of power market situation

• Short and long outage cycling
  • Short refueling outage, 7 days
  • Long service outage, 14-21 days including refuelling and modernization activities
Outage Planning

• Long and medium term planning
  • 3-10 years

• Detailed planning of two next outages
  • 1-2 years
  • careful study of the critical path activities
  • well prepared modification and improvement projects

• Planning during outages
  • during the outage found new defects
  • high-priority modifications
  • schedule revising
# Outages in 2007-2012

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Length of Annual Outages

Year: 1990-2007

OL1
OL2
Total

Total:
- 1990: 22
- 1991: 17
- 1992: 14
- 1993: 16
- 1994: 13
- 1995: 11
- 1996: 10
- 1997: 11
- 1998: 15
- 1999: 14
- 2000: 13
- 2001: 8
- 2002: 7
- 2003: 9
- 2004: 7
- 2005: 8
- 2006: 8
- 2007: 8

OL1:
- 1990: 19
- 1991: 14
- 1992: 14
- 1993: 13
- 1994: 11
- 1995: 10
- 1996: 11
- 1997: 14
- 1998: 15
- 1999: 13
- 2000: 14
- 2001: 10
- 2002: 10
- 2003: 16
- 2004: 16
- 2005: 21
- 2006: 22
- 2007: 17

OL2:
- 1990: 19
- 1991: 14
- 1992: 14
- 1993: 13
- 1994: 11
- 1995: 10
- 1996: 11
- 1997: 14
- 1998: 15
- 1999: 13
- 2000: 14
- 2001: 10
- 2002: 10
- 2003: 16
- 2004: 16
- 2005: 21
- 2006: 22
- 2007: 17
Life Management Strategy
Limiting Factors of Plant Life Time

• **Technical Life Time**
  • Components which are demanding, expensive or very time consuming to change, e.g. containment
  • Difficulties to modify the NPP to fulfil the newest safety regulations

• **Economical Life Time**
  • Costs of plant modifications become bigger than replacement costs with same technical properties (new power plant)

• **Strategic Life Time**
  • New political decisions
  • Remarkable changes of the energy business environment
  • Availability of the nuclear fuel
Development Principles of TVO NPP’s

• Power plant units are improved continuously instead of one-time major investments

• Technical development is exploited
  • new safety requirements
  • advanced design solutions

• Own and other plants operational experiences and best practises are utilized

• PSA-, cost-benefit -, and probabilistic availability analysis methods are applied

• Well-functioning contacts to vendor and consulting companies as well as to research institutes and to regulatory body

• The modifications are implemented during normal service outages

⇒Goal: Rolling 40 years lifetime
Responsibilities of Long Term Planning

- On Line Maintenance
- Next Outage
- Medium Range Planning
- Long Term Planning
- Plant Life Time Management

Focus of Maintenance Planning
Focus of Plant Life Time Management

Operation
Engineering

Technical Responsibilities (Eng. dpt)
Maintenance Activities
Working Groups (Oper./Eng.)
Olkiluoto 1 and 2 – Annual Maximum Net Electrical Power

- Reactor Power Uprating
  - 2000 MWth -> 2160 MWth
    - 100% - 108%
  - 2160 MWth -> 2500 MWth
    - 100 (108) % - 115.7 (125) %
- Modernization Project
  - New LP turbines +35 MWe
- Turbine Island Improvements
  - * Turbine Condenser
  - * HP turbine
  - * Optimization of reheating
  - * Moisture Separators (MOPS/SCRUPS)
  - * Main Steam Line Draining
  - * LP Preheaters

- Turbine Island Modernization
  - 2005/2006 ca +19 MWe
  - Reactor Power +25%
  - Totally ca +30%
Olkiluoto NPP – Modernization 1980-1993

**1980-1993 Modernization Projects**

- **660 MWe -> 710 MWe**
- Replacement of 1.5 km CS piping to SS due to erosion-corrosion
- Replacement of LP preheaters and flash boxes to SS
- Modification of condensate clean up system
- Replacement of turbine condenser to titanium
- Coating of MSR and cross under pipes
- New steam dryers to MSR cross under pipes (MOP/SCRUPS)
- Installation of one new safety/relief valve
- Installation of SAM System
- Replacement of reactor core grid
- Replacement of 300 m piping because of stress corrosion risk to Nuclear Grade SS
- New safety analyses, upgrading of safety systems
- 1984: Reactor power 2000 -> 2160 MWt
Olkiluoto 1 and 2 – Annual Maximum Net Electrical Power

Reactor Power Uprating 2000 MWth -> 2160 MWth
100% - 108%

Reactor Power Uprating 2160 MWth -> 2500 MWth
100 (108)% - 115.7 (125)%

Turbine Island Modernization
2005/2006 ca +19 MWe

Modernization Project
* New LP turbines +35 MWe

Turbine Island Improvements
* Turbine Condenser
* HP turbine
* Optimization of reheating
* Moisture Separators (MOPS/SCRUPS)
* Main Steam Line Draining
* LP Preheaters

Turbine Island Improvements
2005/2006 ca +19 MWe

Reactors
- Olkiluoto 1
- Olkiluoto 2

Power Output
- 2000 MWth
- 2160 MWth
- 2500 MWth

Timeline
- 1980
- 2007

Net Electrical Power
- 600 MWe
- 710 MWe
- 840 MWe
- 860 MWe
Olkiluoto NPP – Modernization 1994-1998

- New LP-turbines (ca +35 MW)
- Modifications of reheaters
- New generator
- New generator circuit breaker
- New main transformer
- Strengthening of the outer grid
- New moisture separators (SCRUPS) to cross under pipes and process modifications
- Modifications of preheaters
- Modifications of condensate and feed water pumps
- Improvement of waste and waste water treatment systems
- New HP-control/stop valves
- New HP-control/stop valves
- New loading machine automation
- New steam separators/scroud head
- New type of fuel (10x10)
- 2 new safety/relief valves
- Upgrading of boron system
- New electrical systems of reactor internal pump
- New neutron flux measuring system
- New safety analyses, upgrading of safety systems
- Reactor power 2160 -> 2500 MWt
- Reactor power 710 MWe -> 840 MWe
- New neutron flux measuring system
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- Reactor power 2160 -> 2500 MWt
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15.10.2007
Pertti Simola
Olkiluoto 1 and 2 –
Annual Maximum Net Electrical Power

Reactor Power Uprating
2000 MWth -> 2160 MWth
100 % - 108 %

Reactor Power Uprating
2160 MWth -> 2500 MWth
100 (108) % - 115.7 (125) %

Turbine Island Modernization
2005/2006 ca +19 MWe

Turbine Island Improvements
* Turbine Condenser
* HP turbine
* Optimization of reheating
* Moisture Separators (MOPS/SCRUPS)
* Main Steam Line Draining
* LP Preheaters

Modernization Project
* New LP turbines +35 MWe

Reactor Power +25%
Totally ca +30%

840 MWe
860 MWe
Olkiluoto NPP – Turbine Island Modernization

Olkiluoto 2: 2005  Olkiluoto 1: 2006

New 2-stage reheaters with new type of moisture separators

New HP turbine with additional extraction

Steam moisture: 0.3% -> 0.01%

Reactor: New Steam Dryer

Process modifications

Exchange of MV (6,6 kV) switchgears, Relay protection and Fast changeover automation (400->110 kV)

Exchange of LP preheater 1 Modif. of LP drain pumps and condensate clean up connection Olkiluoto 2: 2003, Olkiluoto 1: 2004

New turbine process automation and contollers

840 MWe -> 860 MWe

Exchange of the drywell-wetwell sealing

Simulator modifications in 2004
Olkiluoto NPP - Modernization 2009-2011

860 MWe -> 885 MWe

LP Turbine Retrofit
Replace Steam Valves
New Generator
New Turbine Instrumentation
Replace Extraction 1 Piping
Modify HP-Heaters
Cooling Water Pump Upgrade

>> Installation
Success Story of TVO

- Uncompromising safety culture
- Professionally executed O&M without any deviations
- Continuous improvement of reliability and competitiveness
- Focused upgrading and development of the units
- Ensure availability of skilled and talented personnel
- Transparent communication policy aiming at increased public image and acceptance
- Advanced waste management solution
Thank you!  www.tvo.fi