Capacity Building in Finland

IAEA National Workshop on Industrial Involvement

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Outline

- 1st New Build -era in 1955 -1983
  - Very first steps, preparations
  - Construction, capacity building *with* policy
- Operation phase 1977 - today
  - Maintaining competencies
  - Role of research –programs
- 2nd New Build –era 2003 –
  - New capacity building *without* policy
  - Case –examples

1st New Build Era 1955 - 1983

Atomic Energy Advisory Commission

- NEPIO kind of an organization
- Established in 1957, industrial and academical leaders
  - Operated within the Ministry
  - Funding of research projects
  - Participation in courses, meetings and conferences abroad
  - Strategic considerations
  - Statements on nuclear issues
- Atomic Energy Advisory Commission → Advisory Committee on Nuclear Energy, permanent advisor to the Government (until 2008)

Kick-off Phase – 15 years

Structures established

- Atomic Energy Advisory Commission
- Regulatory Body
- Research facilities
- NPP operator organizations

Actions taken

- Organizing funding
- Research projects
- Training experts abroad
- IAEA membership
- Co-operation agreements between nordic countries
- Safety requirements determined
- Feasibility studies
- Industrial involvement planned
- Tendering
- Negotiations

Parallel Operators and Construction Sites

Imatran Voima Oy (IVO)

- State owned power utility
- Feasibility study in 1964
  - Local manufacturing industry participated
- IVO and V/O Technopromexport from Soviet Union signed in 1969 a contract on a VVER plant unit LO1 (440 Mwe) and in 1971 a contract on an identical unit LO2

Teollisuuden Voima Oy (TVO)

- Privately owned
- Established in 1969 by 16 industrial companies, presenting mainly pulp and paper industry
- TVO and Asea-Atom from Sweden signed in 1973 a turnkey contract on a (660 Mwe) plant unit OL1 and in 1975 a semi turnkey contract on an identical unit OL2

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Training of Personnel

- Several persons participated in the 1960s in first nuclear training abroad, (mainly in the USA)
- Atomic Energy Advisory Commission (Finnish NEPIO) funded postgraduate studies in the 1970s in nuclear technology for several persons annually.

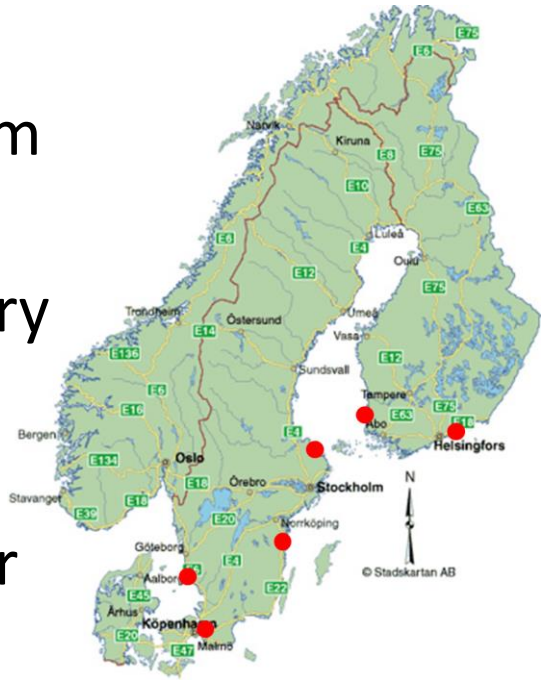
  →key personnel for Lisencees and Regulator
- Initial training related to NPP design and O&M was given by the NPP suppliers, after that learning by doing
  - The first VVER was modified according to Finnish requirements and the future operators, including the supply chain, participated the process
- Hands-on QA training for the suppliers was given during the construction phase by the NPP –vendor and Lisencee

Favourable Conditions for Industrial Capacity Building

- Around the same time 12 units were built to Sweden
- Close, agreed collaboration between neighboring countries (reactors came from Sweden and Russia)
- After the WWII the manufacturing industry had developed greatly
  - Applicable industrial manufacturing capacity

→Favourable conditions to develop nuclear industry and the supply chain

  - For the real fleet of new builds
  - To support the following life-cycle of the plants



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Capacity of Finnish Manufacturing Industry around 1980

Companies involved:

- Ahlström
- Alnor
- Tampella
- Kone
- Ja-Ro
- Wärtsilä
- Rosenlew
- Rauma-Repola
- Valmet
- Huber
- Kalmeri
- etc

Proposed supply from finnish Industry for the BWR-plant Akkuyu in Turkey

		MFIM
1.0	Reactor internals	
	- Moderator tank	
	- Moderator tank cover	
	- Steam dryer assembly	
	- Steam separators	
	- Core grid	
	- Feedwater sparger	
	- Trial assembly	
2.0	Tubular Components	
	- Control rod housings	
	- Guide and piston tubes	
	- Neutron detector guide tubes	
	- Flow meter guide tubes	
	- Control rod guide tubes	
	- In core instrumentation housings	40
)	Fuel Service System	
	- Fuel handling machine	
	- Pool linings	
	- Fuel pool gates and frames	
	- Fuel channel replacement equipment	
	- Fuel service equipment and tools	20
)	Turbine equipment	
	- Lp Preheaters	
	- Condenser details	
	- Turbine housings LP	
	- Main cooling water pumps with motors	
	- Turbine hall crane	
	- Pressure vessels, tanks	
	- Feedwater tank	
	- Condensate pumps with motors	30
)	Electrical Equipment	
	- Main transformer	
	- Aux transformers	
	- Switchgears AC, DC 10 - 0,1 kv	
	- Electrical motors HV, LV	
	- Cables	
	- Inverters	
	- Diesel generatorsets	
	- Control Voltage feeder	
	- Instruments	80
)	Specific Components	
	- Pressure vessels	
	- Heat exchangers	
	- Pumps with motors	

Operation Phase, 1977 - today

Maintaining Competencies to Secure Life-cycle of NPPs

Personnel of operators and regulator

- Systematic training programme
- Challenging real projects (f.ex capacity expansions)
- Continuous research programs
- University level education programs
- Participating into international networks and nuclear communities

Supply chain supporting O&M and the new builds

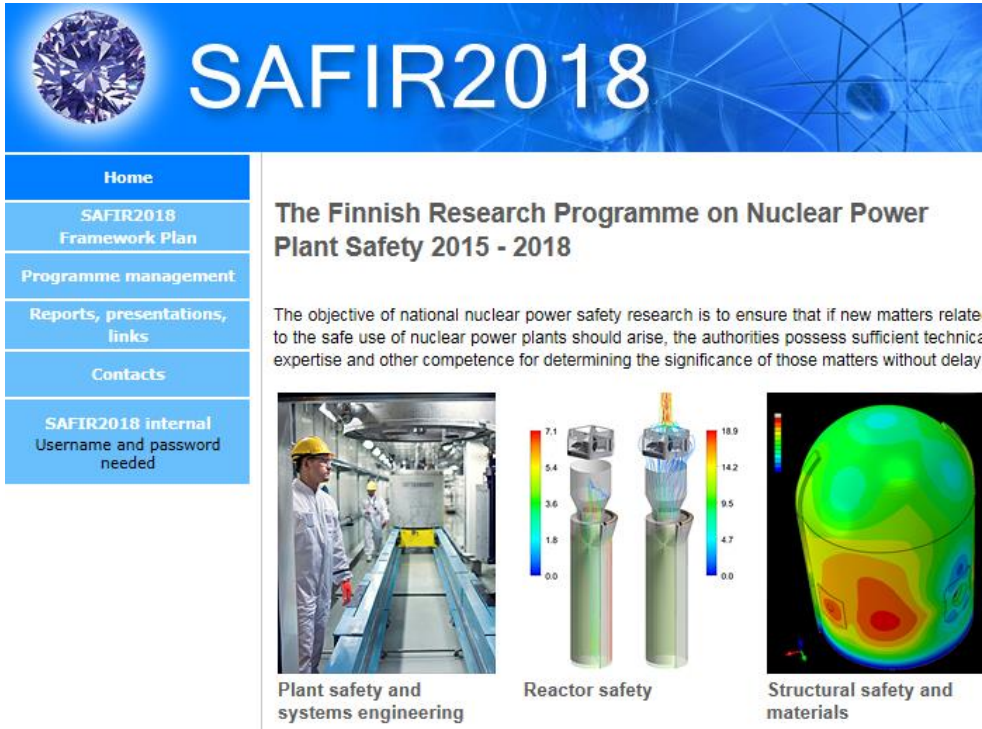
- Many have entered the nuclear programme in early years, during construction projects
  - Contractual agreements with the NPP vendors in 1970ies, mutual interest
- Regularly outsourced services for annual outages and modernizations
- Long-term contracts
- BUT: No systematic national strategy for any later new builds → competence building support by private nuclear industry association (FinNuclear)

Training and Education

- M.Sc programme in reactor physics and technology is offered by the Aalto University and the Lappeenranta Technical University.
- Training program in nuclear safety and technology is arranged and funded annually since 2003 through national cooperation between the operators, STUK, the universities and the research institutes
- Some safety culture training is given to the participating industries
  - No national training arrangements for nuclear manufacturing
  - Nuclear industry association organizes courses for subcontractors

Research for Nuclear Safety

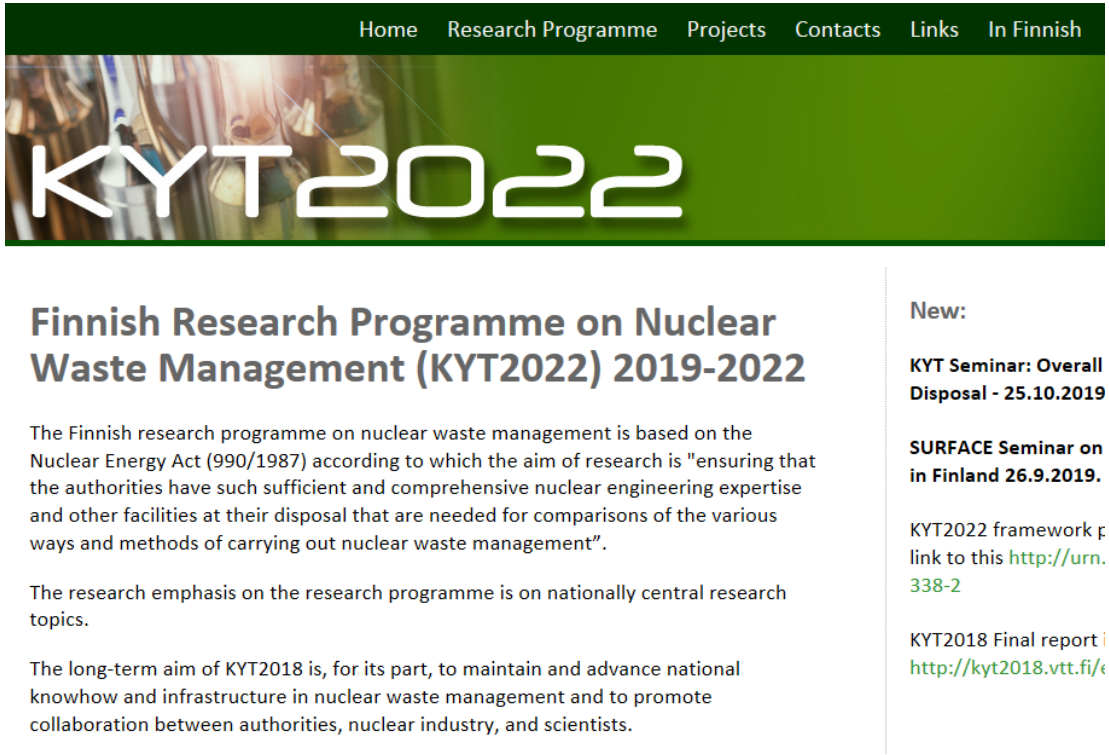
- National nuclear safety research has been organized since the 1980's as research program Safety of nuclear power plants - Finnish National Research Programme (SAFIR)
- Programs are planned and conducted in co-operation between MEAE, STUK, operators, Research Institutes and Universities
- Programs were financed initially mainly by the Government but nowadays mainly by the operators
- Facilitates obtaining new experts and developing national nuclear technological competence



Research for Nuclear Waste Management

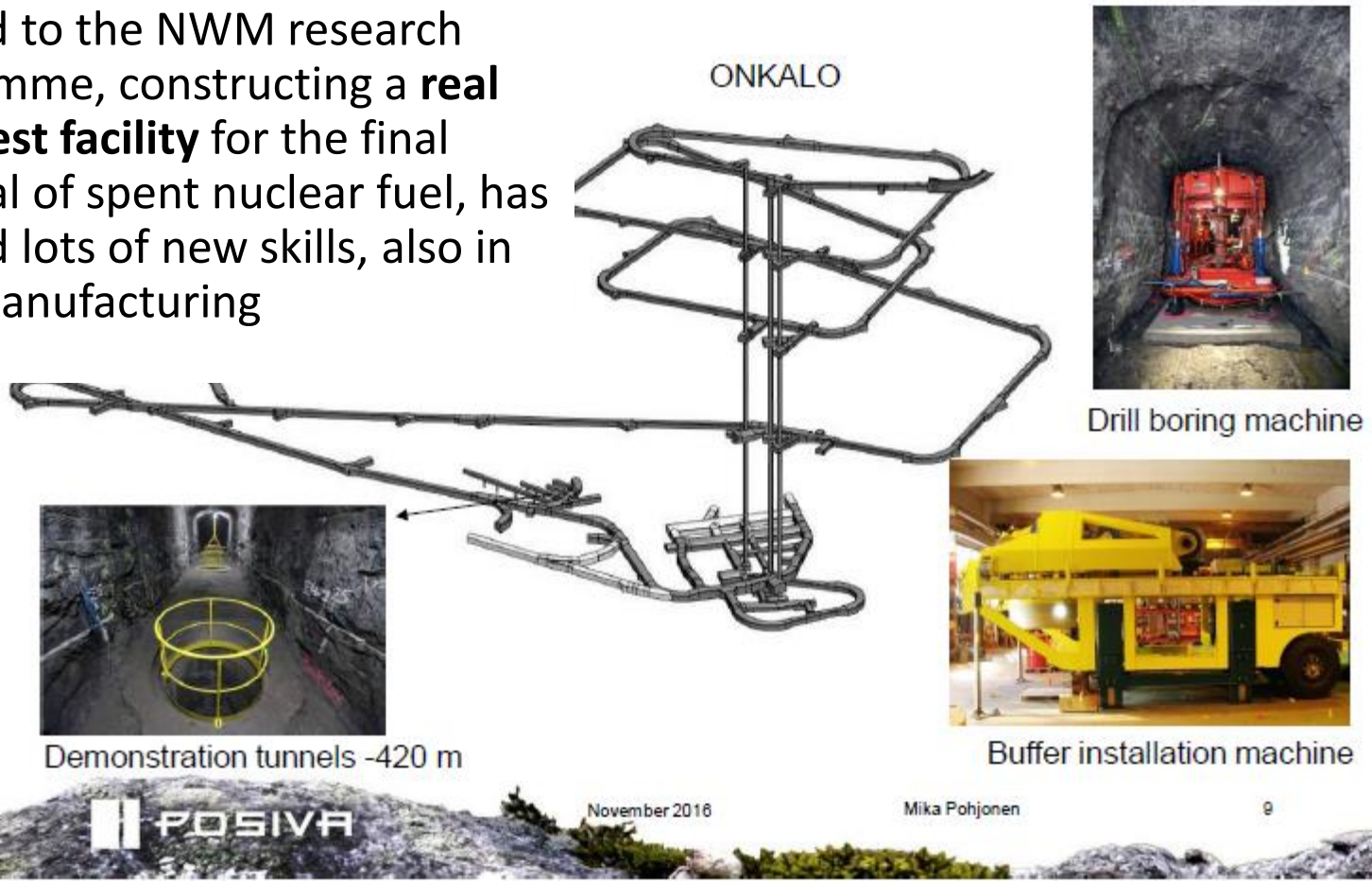
- The NWM research programme is based on the Nuclear Energy Act (990/1987) according to which the aim of research is "ensuring that the authorities have such sufficient and comprehensive nuclear engineering expertise and other facilities at their disposal that are needed for comparisons of the various ways and methods of carrying out nuclear waste management”

- Aim is also to maintain national knowhow in nuclear waste management and promote collaboration between authorities, nuclear industry, and scientists.



Real Scale Research Facility

Related to the NWM research programme, constructing a **real scale test facility** for the final disposal of spent nuclear fuel, has created lots of new skills, also in local manufacturing



- Construction of the real facility is now on-going
- Finland is exporting the technology

Final disposal facility around 2120's

- Repository capacity is 6500 tU (about 3250 canisters)
- Depth of the tunnel system -400-450 m and the extent is about 2 km²
- Construction and operating time approximately 100 years
- The volume of the cave about 2 million.m³
- Tunnel length about 60-70 km

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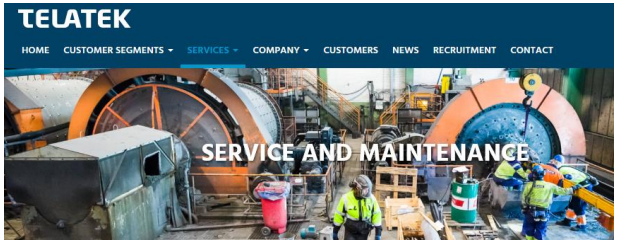
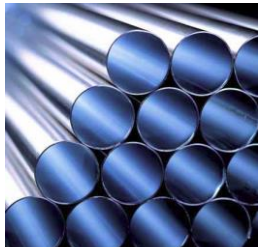
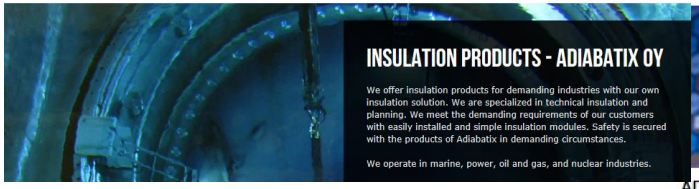
Spin-Offs







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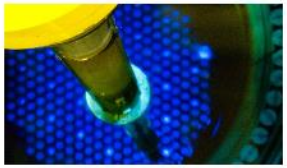

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2nd New Build Era 2003 -

Starting Point of the Localization

- Strong competencies with the operators and regulator
- Private investments → no industrial involvement policy
- *Assumed* capacities with the supply chain, but:
  - Nuclear manufacturing capacity that created in 1970ies was practically "vanished"
    - After the 1st New Build -era there were no markets for a long time
    - Three mile island 1979
    - Chernobyl 1986
  - Companies focused and specialized little by little on other types of products
    - Globalization impact on the supply chain competitiveness
  - In Finland ICT boom thanks to Nokia had had a huge impact on the industrial structure
  - Remaining nuclear-focused: engineering, o&m –support, inspections, testing etc

Capacity Building without Policy 1/3

- Many projects:
  - Olkiluoto 3 (foreseen OL4)
  - Hanhikivi 1
  - ONKALO spent nuclear fuel facility

- Impacts:
  - In the absence of state incentives companies must evaluate carefully whether to invest or not in the development actions to break the potential gap in skills
  - Open competition from other countries and NPP vendors favoring for their own known suppliers → local share may end up being low

- SMEs may however apply public funding for the development actions

Capacity Building without Policy 2/3

In this case the localization expectations with turn-key contracts depend on:

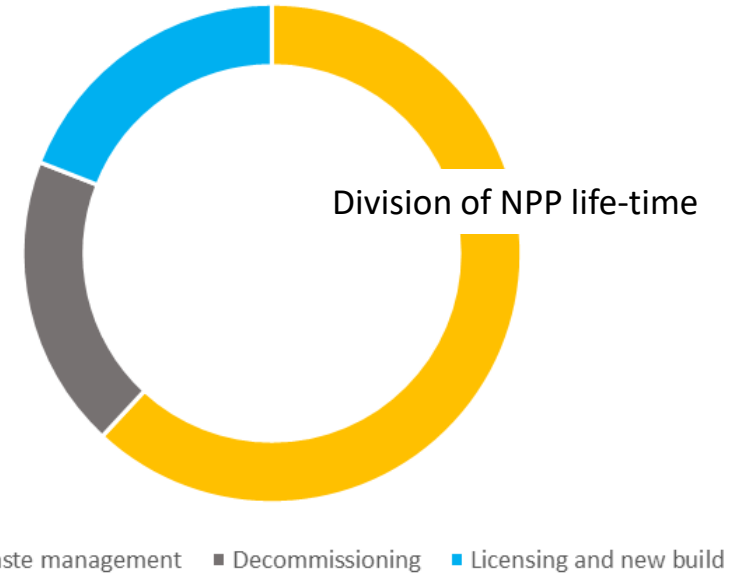
- **Readily competitive suppliers** that also may involve their own supply chains
- **Achievable competitiveness** of local companies, that
  - have a small gap to go for nuclear energy business
  - can afford themselves to invest in development
- Companies that have **references** from O&M of existing plants or abroad
- Need of resources that **understand local requirements**
  - Many parts of engineering and consulting
  - Licensing

Capacity Building without Policy 3/3

- Services that are **not sensible to import**, such as:
  - Infra construction (roads, channels, phonelines, HVAC, various non-nuclear construction and “small works”)
  - Scaffolding, weather protections
  - Concrete
  - Logistics, hauling
  - Documentation services
  - Cleaning
- Greenfield –**site preparations**
- **Commissioning** followed by **O&M** phase where local competencies are latest needed, if the outage strategy is to have external local outage support team

Conclusions, based on Finland Experiences

- Success does not necessarily depend on the industrial involvement policy, *but*
- Capacity building can essentially be supported by carefully planned and resourced national industrial involvement policy
- Management strategies over the whole NPP life-cycle define the intensity needed for the capacity building



Attention to the needs of
- Governmental organizations
- Owner/operator
- Regulator
- Research organizations
- Inspection organizations
- Supply Chain
- Education, training institutions

Methods
- External sourcing
- Education and training
- International collaboration
- Knowledge and technology transfer arrangements with organizations that master the chosen technology

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Thank you!