SMRs as a district heat source in Finland

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Contents

Finnish energy system and its challenges

Challenges identified on nuclear district heating

Current discussions on nuclear district heating
Finland

- Finnish electricity supply in 2015

- Image source Energy Industry

VTT 2018
Finnish energy system

- Electric power fairly clean and cheap
  - Especially after completion of OL3 and FH1 NPPs – addition of 2.8 GW
- Most of the remaining fossil fuels are CHP (district heating) and industrial use (steel, refinery, cement)
- Coal ban being proposed by 5/2029 by government
  - Coal CHP in large cities

### Company
<table>
<thead>
<tr>
<th>Company</th>
<th>Tons of CO2 emitted in 2015</th>
<th>Field</th>
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<tr>
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District heating

- Large seasonal variation a big issue for district heating (example modelling assumptions for large Finnish city in 2030)

- Foreseen electricity prices in sub-40€ range
  - Retirement of CHP plants in favour of heat only plants
Interest in the potential for nuclear providing heat for cities’ district heating

- Initiatives from city councils to find out prospects of nuclear heating
  - Helsinki
  - Espoo
  - Nurmijärvi
  - Kirkkonummi
  - Turku

- The use of small modular reactors for district heating supply has been going on for a year
- Currently coal is being replaced by biomass at a large scale, and its sustainability is being questioned
  - SMR district heating supply seen as an alternative along with enhanced geothermal, large scale heat pumps, etc
Technoeconomical studies

- VTT has performed preliminary feasibility studies on the integration of nuclear heat supply to district heating network
- Summer demand low, in principle capital area would have reasonable heat demand
  - Or, a very small, light reactor?
Challenges

- Stakeholder awareness, understanding options and limitations
- Vendor readiness
- Integration to system and regulation
- Public awareness and acceptance
Many small district heat providers
Need for several 10s MWth scale heat source?

Annual district heat use by DH company (GWh), indicative

Data source Energy Industry
VTT’s project to collect Finnish actors into domestic “SMR ecosystem”

- Aim to scope near term potential for SMRs
  - Heat for various uses
  - Finnish industrial capability and willingness

- Reactor concept
  - Either existing commercial reactor or Finnish heat reactor

- Use case
  - What is needed by user? Technical details, demands, limitations

- Business case
  - What are commercial, regulatory, social requirements plant needs to fulfil

- Business case
  - Global potential demand for the solution

- Finnish business
  - Potential Finnish supply? Manufacturing, project management, etc
Non-electric nuclear applications

Opportunities in industry and heating

Technology, regulatory, industry readiness

Public awareness