European Technology and Innovation Platform on Renewable Heating and Cooling

Challenges and solutions for a 100% renewable heating and cooling (RHC) sector in Finland

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St1 – Nordic energy company

- Net Sales: 6,588 MEur
- Investments: 136 MEur
- R&D expenditure: 15 MEur
- Personnel: 770 employee
- Presence in Finland, Sweden, Norway
- HQ in Helsinki

Main operations

- Ca. 1300 service stations
- Refinery in Gothenburg
- Biorefineries in Finland & Sweden
- Operates ca. 485 MW of wind power
- Operates 130 GSHP plants and R&D project for deep geothermal plant
Deep geothermal Heat

Shallow ground source heat pump

Mid-Deep ground source heat pump
Otaniemi St1 Deep Geothermal R&D project

- Two worlds deepest geothermal wells completed
  - Injection well OTN3 6.4 km in target depth and stimulated
  - Production well OTN2 6.1 km in target depth and stimulated

- Piping & equipment installation works ongoing

- Cross Flow test to follow

- Otaniemi project has enabled a valuable knowledge of drilling & bit-technologies, controlled stimulation and 3D-modelling artificial water reservoirs & flow
District heating - Finland

- Fading energy sources (combustion based)
  - Oil, fading
  - Coal, out by 2029
  - Peat, out by 2040 / St1 est.
  - Gas, 20XX
  - Biomass, 20XX
- Waste incineration, tba

- Amount of buildings attached to DH steadily growing

- Finland 45% of DH production fossil based, > 80% combustion based
- EU abt. 50% of all energy consumed is in Heating & Cooling
- EU H&C production > 60% fossil based
- Geothermal EUR/MWh progressing to be competitive (high CAPEX / Low OPEX)
- Energy taxation needs to drive change toward non-fossil (taxes incl. above)
- Electricity taxation changes needs to contribute electricity based production
GeoHeat – The challenge

- Conventional GSHP shallow well systems continue to grow (< 1000 mtr)
  - Trend is positive, political climate is favorable
  - Technology is well known, still room for improvement
  - Challenge to get the electricity taxation and city planners/permitting inline with the potential and target (f.ex. Helsinki target from 1 % -> 15 % by 2035)

- Mid-deep well GSHP technology emerging (>1000 mtr)
  - Growing interest within cities, municipalities, RE developers/investors
  - Optimizing land usage for buildings enhances opportunity for mid-deep wells tech (from 600 mtr wells to 1000 mtr -> half of the wellfield space required)
  - Challenge to speed up the technical R&D to be commercially viable (mainly collectors tech, but also drilling speed)

- Deep geothermal plants (EGS) in a pilot phase in the Nordics (>3000 mtr)
  - Proof of concept how to drill, stimulate, analyze water reservoir done
  - Continuous R&D and pilot plants required to lower the investment risk & costs
  - Challenge to get all stakeholders openly to develop the various areas of Geothermal
  - EU and GO’s should take a strong role in enabling the R&D development & support mechanisms
St1, Solving global energy challenges!