SAPHEA – Developing a single access point for the market uptake of geothermal energy use in multivalent heating and cooling networks across Europe

The challenge

SAPHEA addresses the market uptake of geothermal energy and underground heat storage supplied multivalent heating and cooling networks ('geoHC networks'), which operate at temperatures of less than 30°C and up to around 100°C. The range of applications of geoHC networks starts at local scale networks with capacity levels of at least 500 kWth, including sub- and peri-urban regions across Europe. SAPHEA will address the installation of new geoHC networks (greenfield installations or replacement of individual heating and cooling solutions), as well as the retrofitting of existing, fossil fuel-supplied heating networks. The EU Commission stated repeatedly that heating and cooling ('HC') plays a crucial role in the transition towards a carbon-neutral economy by 2050 as it accounts for half of the energy consumption in Europe from buildings and industry. Across all energy carriers, renewable energy sources (RES) account for 18% of the primary energy supply for HC in the EU-27, and IEA forecasts that at the global level the RES share of heat consumption will rise from 11% in 2020 to 13% in 2026. Whilst the EU has set higher sectoral targets for the increase of RES-HC share by 2030 (2018/2001/EU), still growth is hindered by a lack of policy, financial incentives, and public funding for renewable heat. District heating and cooling ('DHC') has a great potential to decarbonize the HC sector, yet it registers a limited penetration in several European countries, supplying on average only 8% of the total final energy demand for HC, mainly in the residential (55%) and tertiary (30%) sectors.

Project name: SAPHEA - Developing a single access point for the market uptake of geothermal energy use in multivalent heating and cooling networks across Europe

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Catalogue of scenarios

One of the first results of SAPHEA is a Catalogue of Scenarios developed by the project team to identify existing basic and complex scenarios for the integration of shallow and deep geothermal energy into heating and cooling networks (HC networks) of different scales. These settings were complemented by new developments, which are not state of the art now, but could be promising scenarios for the future. The networks cover all categories of grid generations used for heating and cooling. Based on these scenarios the SAPHEA project will work on providing information about the potential to implement geothermal Energy into heating and cooling networks in Europe.

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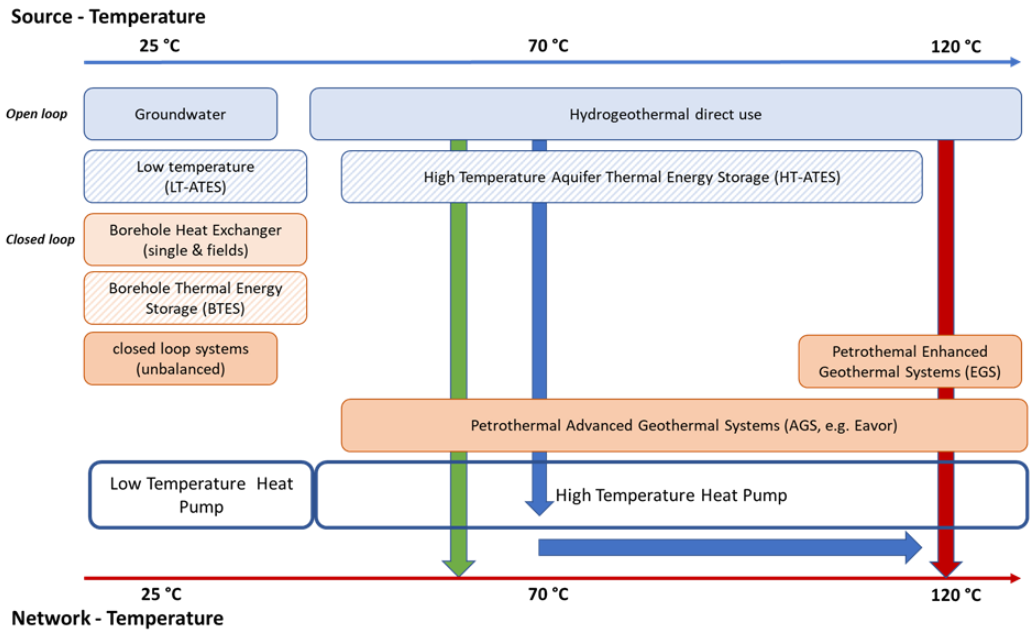

Figure 1: Simplified Scheme combining the available geothermal sources and their source temperature range with the network inlet temperature. The arrows show examples of possible scenarios explained in the catalogue.

B 04 Hydrothermal Direct Use – MT Network

	T Source [°C]	T Grid [°C]	aquifer / ground	storage	heating / cooling	type
	40 – 90	40 – 60	Aquifer	no	Heating	Basic

Technology
- Hydrogeothermal Well Doublets
- 2G DHC-3G DHC grid

Description
Hydrogeothermal well doublets extract groundwater with a temperature range of 40 - 90 °C from geothermal reservoirs at depths of some 1,500 m and below. A heat exchanger transfers the heat directly to the district heating network. The network transports hot water 40 - 60 °C to the end user.

Parameters
- Location of aquifer
- Temperature
- Volume flux (defined generally by permeability and aquifer thickness)
- Hydrochemistry

Limitations
- Nature/water protection
- Seismic activity

Examples

Lendava, Slovenia [10]

Local community Lendava covers 123 km2 in the Pomurje region. In Lendava there is one of the few Slovenian geothermal district heating systems. Production borehole Le-2g was drilled in 1994 and reinjection borehole Le-3g in 2007. At a district heating system with a length of about 3200 m school, kindergarten and multi-dwelling houses are connected. The installed capacity is about 2.7 MW_{th}. The production temperature of the well is 74°C and the operation temperature of the network is about 40-66 °C.

Mórahalom, Hungary [10]

Mórahalom has 6 100 inhabitants A geothermal cascade system was developed to reduce dependency on natural gas by using a renewable heat source. This system consists of two drilled wells, a 1.26 km-deep outflow well and a 0.9 km injection well. Within the project a new district heating system of 2.85 km was established to supply public buildings. The GHG emission is now reduced by 80%. A capacity of 1.5 MW_{th} is produced by the three production wells. The operating temperature of the district heating network is about 69-40°C. The maximum production temperature of the wells is about 70°C.

Trnava Sereď, Slovakia [10]: about 6 MWth, about 3760 apartments, Production Temperature 66°C; Operating District Heating temperature: 65°C; combined with natural gas

Figure 2: Example from the scenario catalogue.