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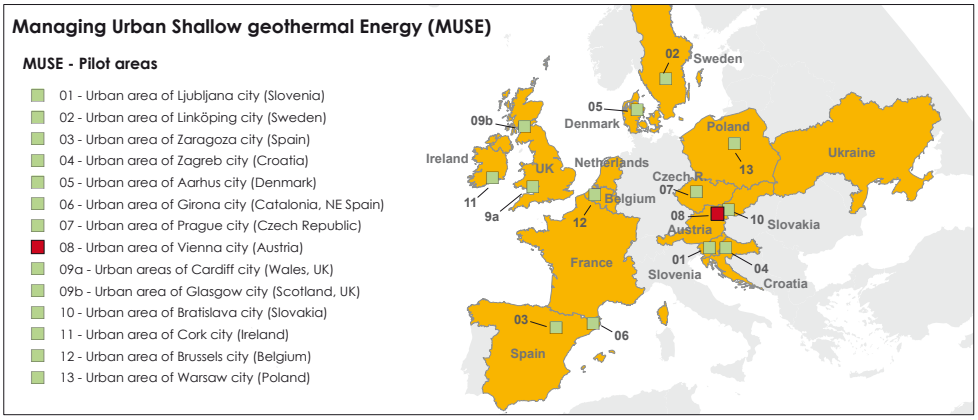
Pilot area information



The pilot area is dominated by the Vienna districts 2 and 20. The main aquifer is located in Quaternary gravels, below there are marly to sandy sediments of the Neogene Vienna basin. The Quaternary aquifer adjacent to both sides of the river Danube plays an important role for shallow geothermal applications. Due to the availability of groundwater in shallow depths, the dominating system of shallow geothermal applications are OLS in the pilot area.
The market of SGE is already well developed in the city of Vienna. It faces strong pressure due to increasing numbers of OLS, which may lead to negative impact on the aquifer. The licensing authorities of Vienna demand monitoring of larger OLS, but instead of applying a harmonized monitoring system, the plants are monitored individually.
Therefore the pilot area is well qualified to develop and test tools to overcome challenges of user conflicts and a harmonized monitoring system for OLS.

Pilot Area	Vienna
Task (MUSE)	T-4.9
Country	Austria
Area (km²)	43.5 km²
Total number of inhabitants (date)	242,000 (2017)
Inhabitants per km²	5563
Level of urbanization	90 % (est.)
Elevation range (m a.s.l.)	150-170

Climatological settings

HDD/CDD data according to EUROSTAT method	
Heating degree days (HDD); [baseline reference values]; (period for data calculations)	2468 [15/18] (2017)
Cooling degree days (CDD); [baseline reference values]; (period for data calculations)	213 [21/24] (2017)
Length of the heating season (days)	Unknown
Length of the cooling season (days)	Unknown

Source of data: Eurostat. https://ec.europa.eu/eurostat/data/database

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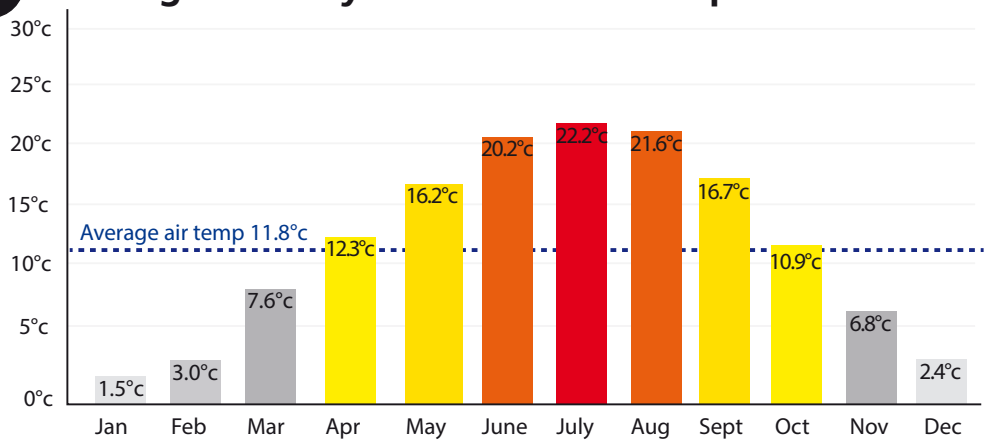
Average monthly and annual air temperature



Market situation

Number of SGE installations in pilot area	OLS V-CLS	83 (OD 2016) 20 (EST 2016)
Current growth rate	No. of Installations	CLS: 3.3% p.a. (period 2013 – 2016) OLS: +0.4% p.a. (period 2013 – 2016) All systems: 1.7% p.a. (period 2013 – 2016)
Estimated share of open loop systems		80%
Estimated share of closed loop systems		20%
Estimated total share of shallow geothermal methods in the heating market	OLS V-CLS	OLS + CLS: 0.53% (referring to produced heat in the year 2015)
Other SGE technologies: Eg. Inter-seasonal heat storage schemes or energy piles	Foundation Piles (energy piles)	
Estimated total share of RES in the heating energy market (%) (specify local or national values)		11.5 % (est. for Vienna)

GeoERA

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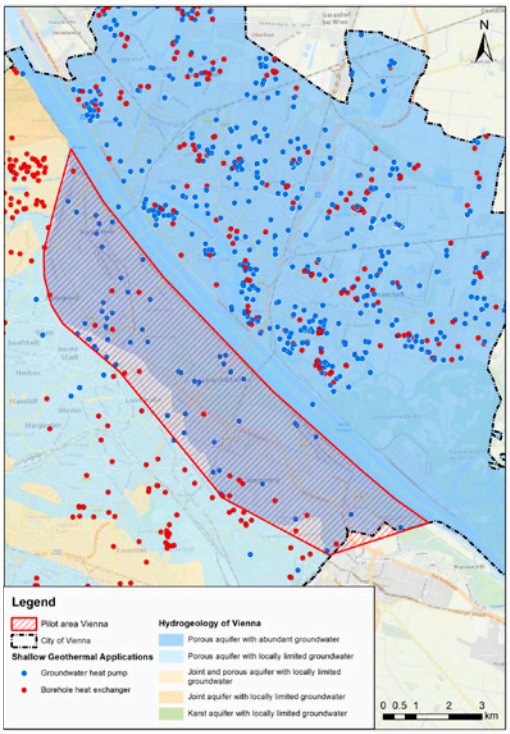
Economic boundary conditions

Estimated average installation costs for shallow geothermal systems (€/kW output) [1]	
Open loop systems	Small scale (10 kW gross capacity): 2000 €/kW Large scale (50 kW gross capacity): 600 €/kW
Closed loop systems	Small scale (10 kW gross capacity): 2400 €/kW Large scale (50 kW gross capacity): 1500 €/kW
Estimated average heating costs (€/kWh)	
Open loop systems	0.084 €/KWh (est.)
Closed loop systems	0.097 €/kWh (est.)
Drilling cost range per meter (€/m) for Open Loop	125 €/m (2500 EUR/well)
Drilling cost range per meter (€/m) for Borehole Closed Loop	50 €/m

Regional geological and hydrogeological characteristics

Pilot area is located in the Vienna Basin
Miocene fault systems formed the pull-apart basin, which remains slightly seismically active until today.
However tectonics are no limitations to shallow geothermal energy.



Basin fillings:
Neogene sediments – Mostly marine, fine grained silts and sands, thickness up to 5000 m.
Quaternary sediments – Fluvial gravel and sands, deposited from river Danube.

Hydrogeology **-** Target aquifer: Southern Vienna Basin – porous aquifer, which is strongly related to the Marchfeld groundwater body in the pilot area.

Quaternary gravel and sands covered by anthropogenic deposits and alluvial sands and silts.
Confining layers cannot be excluded, but mainly free aquifer.
Average Aquifer thickness around 8 m
Hydraulic conductivity: 7*10-3 m/s
Depth to water table around 5 m below surface
General groundwater flow direction NW-SE
One TRT test available
No pumping test available now in the pilot area, but in comparable adjacent areas.

Thermogeology **-** Groundwater temperature: Annual average 12.5 °C

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Summary of works and timeline

Main Objectives	
✓	Evaluation and characterization of geology/ hydrogeology / thermal conditions
✓	SGE assessment resources (for OCS and/or CLS) / and evaluation of UTES-BTES)
✓	Study of conflicts of use (OLS / GWL - OLS/CLS). Hazards/interferences, effects on sub-surface
✓	Strategies and actions for management and local energy plans
Relation of foreseen tasks	
✓	Data collection (TRT, DTRT, rock samples, GWL, T-profile's etc)
✓	New field works (TRT/geophysics /new samples and lab etc)
✓	Monitoring existing SGE/GWL/T etc)
✓	Mapping (in general terms)
	2D/3D Modelling (in general terms)

Detailed summary of works at the Pilot Areas and brief timeline

Data collection of pumping tests, TRTs, groundwater temperatures, groundwater level, existing SGE. Existing conflict maps and resource maps covering entire Vienna.
Data collection: 01/2019 – 04/2019

Groundwater temperature measurements with temperature loggers developed at GBA. Thermal conductivity measurements in the field. Optional: TRT measurements, if BHEs are accessible.
Field measurements: 03/2019 – 03/2020

Resource mapping focusing on open loop systems and closed loop systems including urban heat island effects, using all data collected and generated under objective A1: 03/2020 – 08/2020
Optional: Groundwater temperature monitoring of selected open loop systems, if OLS are accessible.
Measurements: 03/2019 – 03/2020

Mapping conflicts of use for open loop and closed loop systems, based on data from A1. Important possible conflicts: existing SGE, natural reserves, contaminated sites, water protection areas.
Mapping: 05/2019 – 10/2019

Elaboration of strategies to foster integrative management of open loop systems and closed loop systems based on outcomes of resources and conflicts including urban heat island effects.: 03/2020 – 11/2020

Evaluation of licensing and management procedures (guidelines for applicants and authorities).

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Reference

[Nowy, W.; 2001; Schutz von Tiefengrundwässern in Wien – Grundlagen für eine wasserwirtschaftliche Rahmenverfügung – Endbericht; Vienna.

Pfleiderer, S. & Hofmann, T.; 2004; Digitaler angewandter Geo-Atlas der Stadt Wien – Projekt WC 21 – HYDRO-Modul (Pilotphase) Endbericht; GBA; Vienna.

Geological 3D-Model Vienna - https://gisgba.geologie.ac.at/3dviewer/

Contact

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This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 731166

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