



GeoERA MUSE – Managing Urban Shallow Geothermal Energy

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The shallow subsurface comprising groundwater bodies as well as solid rock formations in the uppermost tens to hundreds of meters below surface offer significant resources for renewable heating, cooling and seasonal underground heat storage. Shallow geothermal energy (SGE) comprises the technologies to exchange heat between the subsurface and surface via closed loop or open loop heat exchangers. Although SGE just covered around 2% of the renewable heat production in the EU in 2018, its huge potential for low temperature heating and cooling supply is expected to lead to a significant market growth across Europe in the upcoming decade. Especially as SGE offers the unique possibility to supply heating, cooling and storing waste heat with one technology. SGE offers advantages especially in urban areas. It does not produce waste heat if applied for cooling, which can be considered as an important measure to mitigate urban heat islands. It consumes low amount of surface space for its installation and applying SGE is free of emissions in terms of aerosols or noise. Moreover, it can be combined with other renewables such as solar and waste heat or excess energy. In these cases, SGE acts as a seasonal heat storage.

The increasing interest in SGE in urban areas, however, puts pressure on the subsurface, especially on shallow groundwater bodies. In that context, SGE systems may compete with each other as well as with water supply and subsurface installations. In many European countries,

management approaches of SGE are either lacking or follow the first come first serve approach. Integrative management approaches follow an information and decision cycle, starting and ending at collecting, processing and providing geoscientific data on subsurface conditions to stakeholders, such as authorities, investors and city planners.

GeoERA MUSE addresses integrative management approaches for the use of SGE by harmonizing concepts and testing them in 14 European cities facing different climatic, hydrogeologic and socio-economic boundary conditions. MUSE deals with mapping resources and limitations of SGE resources and displays them in modern web-based interfaces. Knowing resources and limitations referring to interference with other SGE systems or other shallow subsurface installations is the starting point for integrative management approaches, which include summation effects and abandon first come first serve. MUSE pilot areas follow the whole management cycle from creating subsurface data (e.g. subsurface temperatures, thermal rock properties), deriving resource models (amount of energy available for use), limitations of use (contaminated areas, problematic chemical composition of groundwater) and displaying the information gained at the EGD web platform of EuroGeoSurveys. Furthermore, MUSE interacts with local stakeholders to transfer geoscientific data models into managing strategies. In that sense, the pilot areas act as role model for other urban regions in Europe. Additionally, MUSE creates joint concepts and standards to strengthen the role of Geological Survey Organisations towards a key player in managing an efficient and sustainable use of urban subsurface in general and SGE in urban areas in detail. MUSE has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 731166.

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