Subsurface Urban Heat Islands: Characteristics and Geothermal Potential

Dr Peter Bayer
ETH Zurich, Engineering Geology Group

Summary
A major contributor the geothermal energy stored in shallow ground is the atmosphere. In urban environments, the atmospheric temperatures are commonly higher and therefore also the ground temperature. However, urban heat islands beneath cities often are more pronounced and persistent than those in the atmosphere, which is due to additional heat accumulation originating from build-up areas and infrastructures. In our work, we focused on mainly German cities such as Cologne, Berlin and Karlsruhe, to investigate in detail these subsurface heat islands and the governing processes. A significant increase in groundwater temperature by more than 4 K was detected close to the city centre of all studied urban areas. Even locally, hot spots of up to 20 K can be found near insufficiently insulated power plants or reinjection sites of cooling water. This yields a highly variable spatial and temporal pattern of increased ground temperatures. Furthermore, the geothermal potential of the subsurface was calculated for the studied cities. In the city of Cologne, the calculation of the potential heat content in the 20 m thick aquifer shows that by decreasing the aquifer’s temperature by 2 K, the extractable geothermal energy could supply the space heating demand of the whole city for at least 2.5 years. The evolving subsurface heat islands thus represent attractive additional low-enthalpy geothermal resources.

About the speaker
Peter Bayer obtained his PhD at University of Tübingen, Germany, in Hydrogeology and Applied Geosciences. He moved to ETH Zurich in 2008, first as a Marie Curie Fellow at the Institute of Environmental Engineering, then since 2010 as a Senior Research Associate and Lecturer with the Engineering Geology Group, Department of Earth Sciences.
(Any further details at www.bayerpeter.com)

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Jean-Louis Scartezzini, Full Professor
Head of Solar Energy and Building Physics Laboratory (LESO-PB)
Ecole Polytechnique Fédérale de Lausanne (EPFL), Switzerland
Website: http://leso.epfl.ch

*Presentations are followed by drinks & snacks, to give the opportunity to guests and speaker to further discuss the topic.

Organized by Dr Nahid Mohajeri, & Barbara Smith