

AIST / IEA-GIA seminar on current issues and innovation on GSHP  
application in Asia and Pacific region, Oct 19, 2014

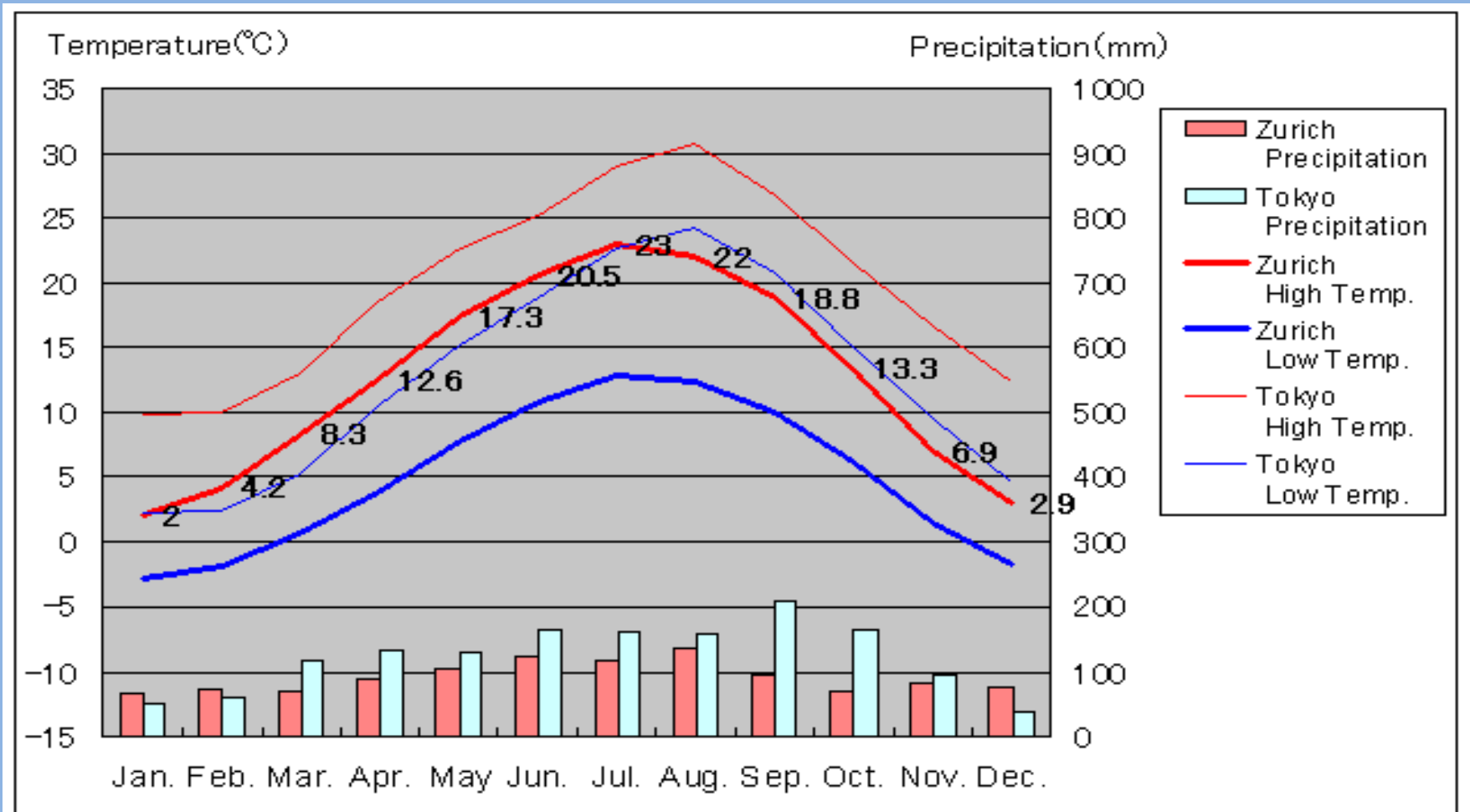
# Innovative GSHP applications in Switzerland

- 1. Introduction**
- 2. Development of GSHP market in Switzerland**
- 3. GSHP sustainability aspects**
- 4. Innovative solutions: some examples**

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Swiss Federal Office of Energy SFOE

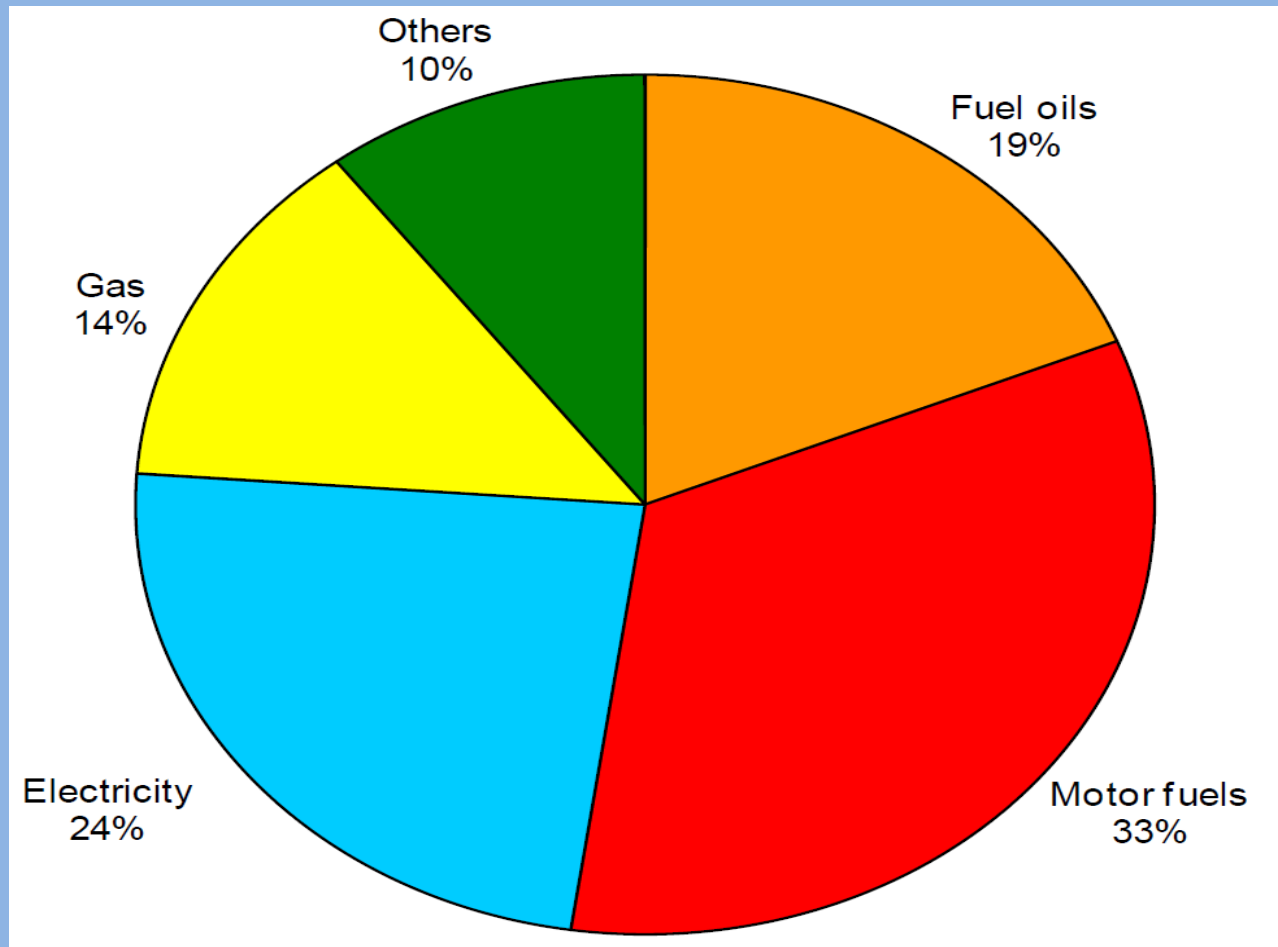
[www.bfe.admin.ch](http://www.bfe.admin.ch) - [rudolf.minder@bluewin.ch](mailto:rudolf.minder@bluewin.ch)

# Climate in Zurich compared to Tokyo

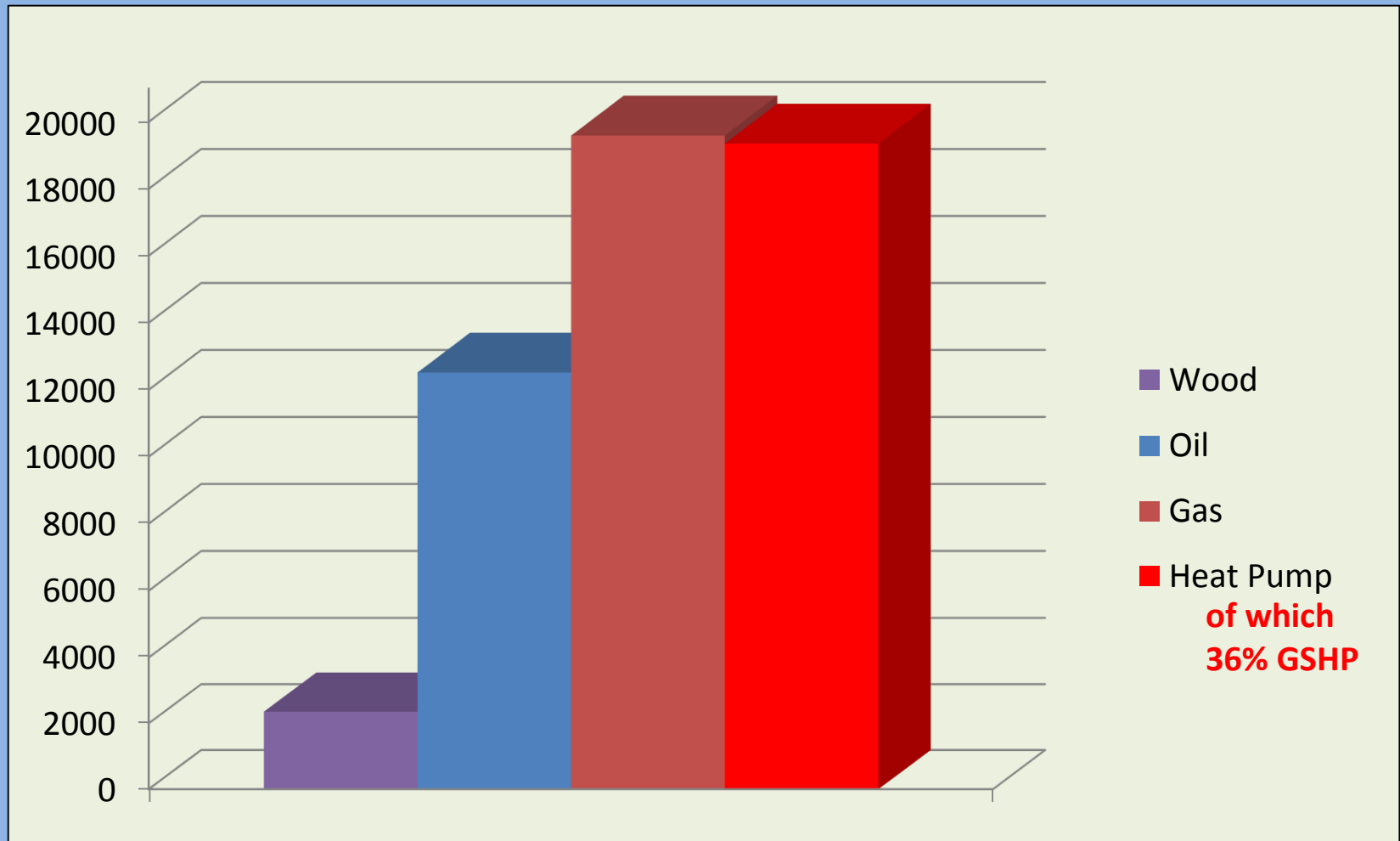


# Final Energy Consumption in Switzerland 2013

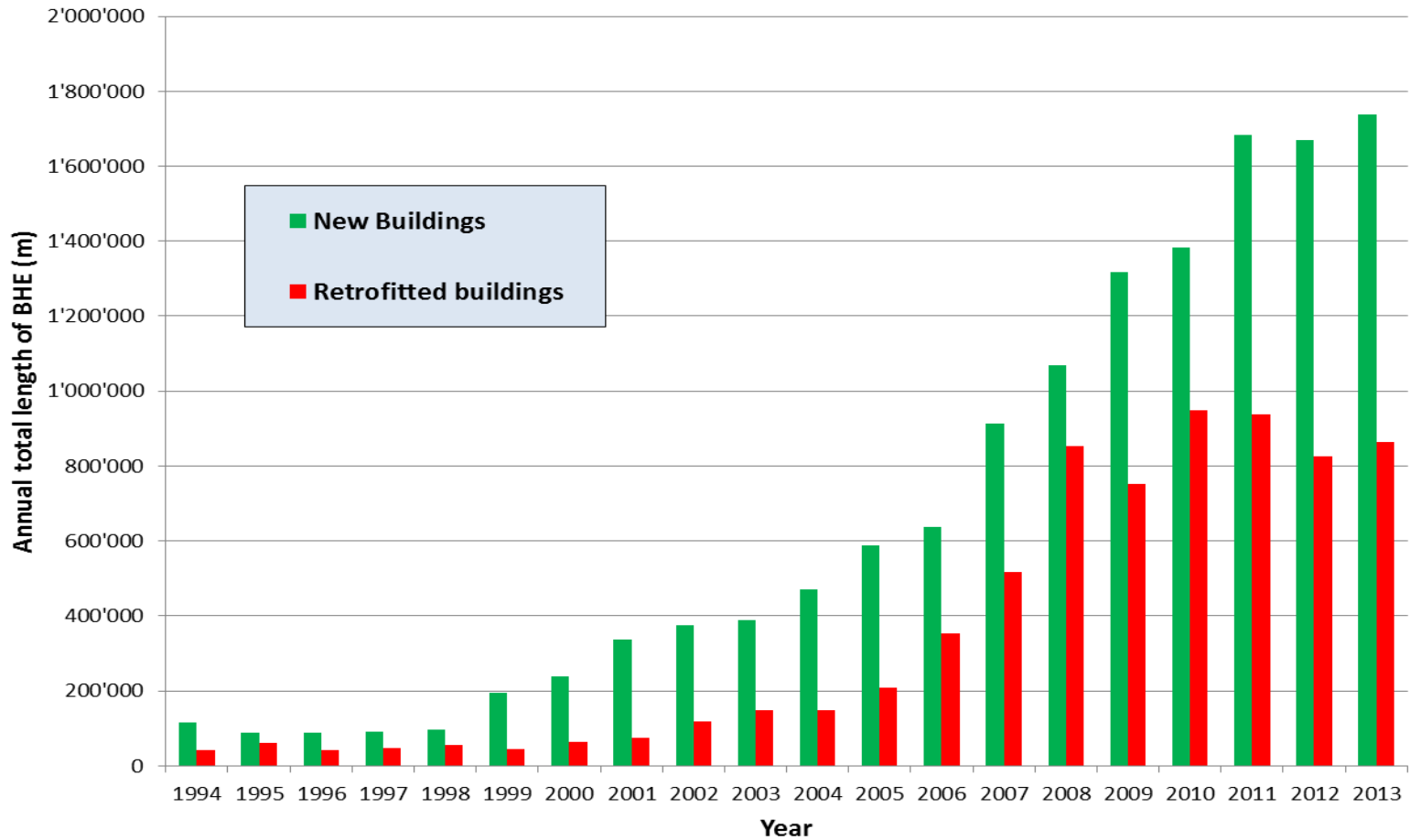
(Total: 896'000 TJ)



# No. of heating systems installed in Switzerland 2013



# Total annual length of GSHP boreholes drilled

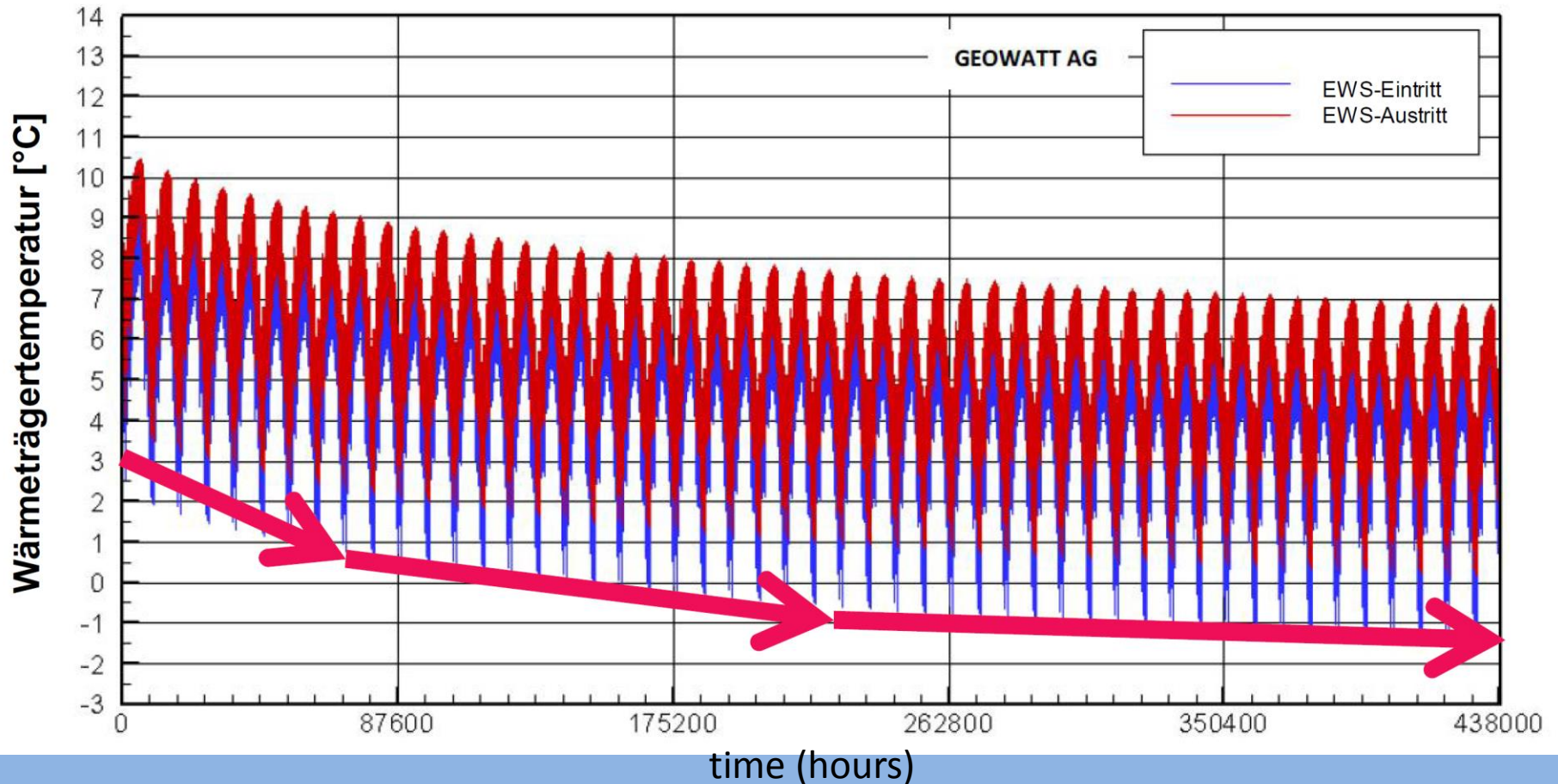


# Map of boreholes in an area of Zurich

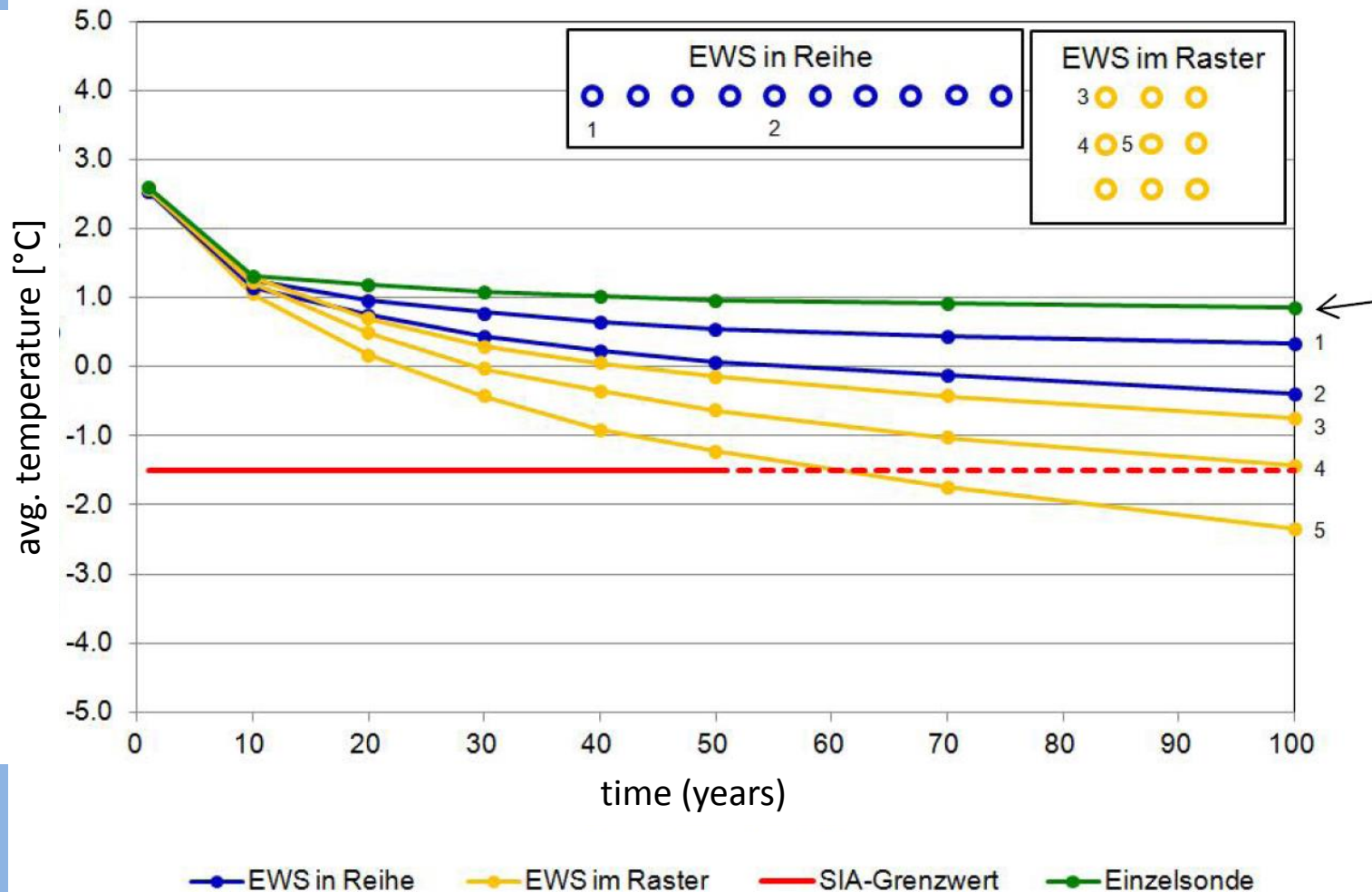
(grid: 1000m x 1000m)



# Long-term (50 years) simulation of a single borehole heat exchanger



# Comparison of single borehole with borehole groups and SIA guideline

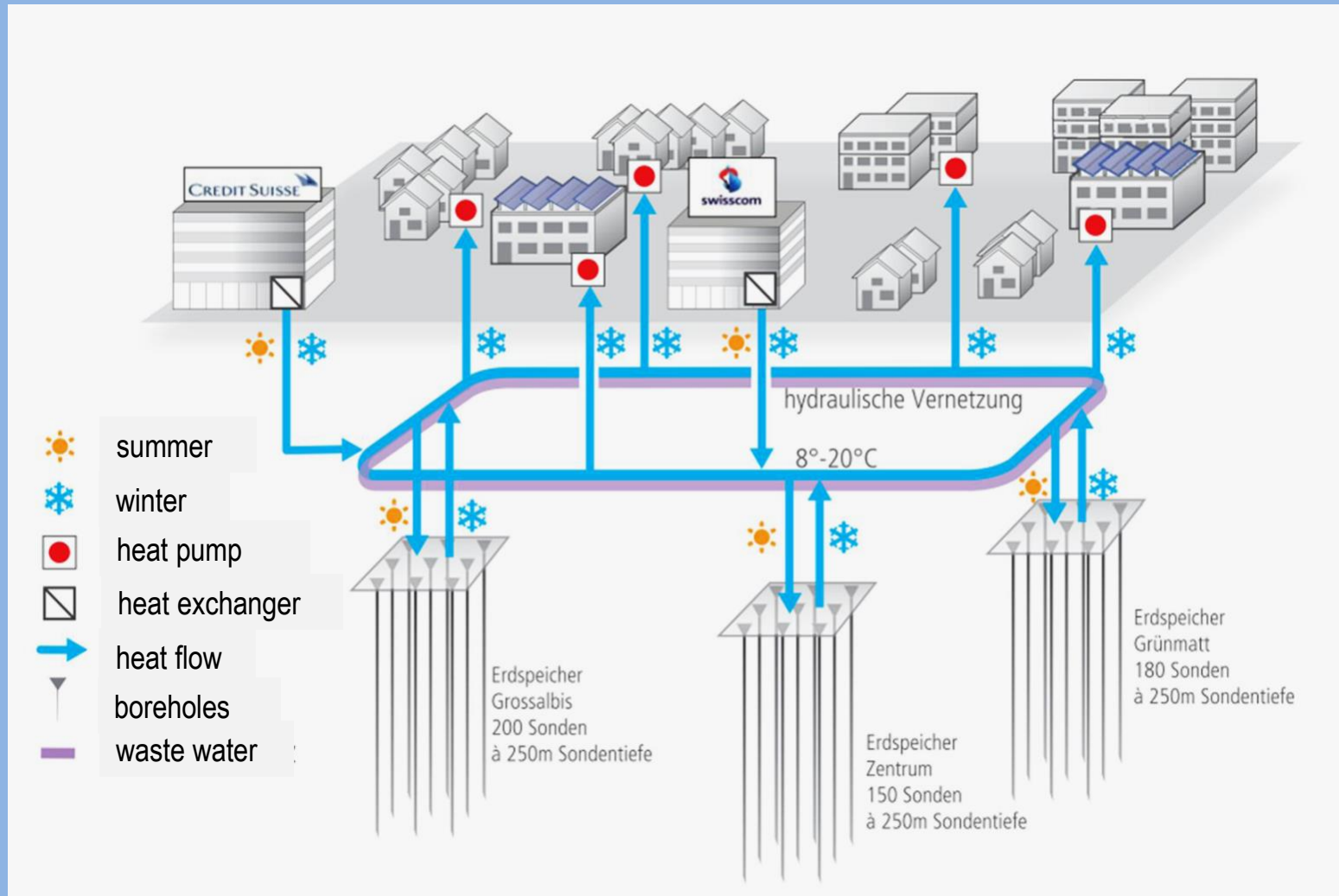




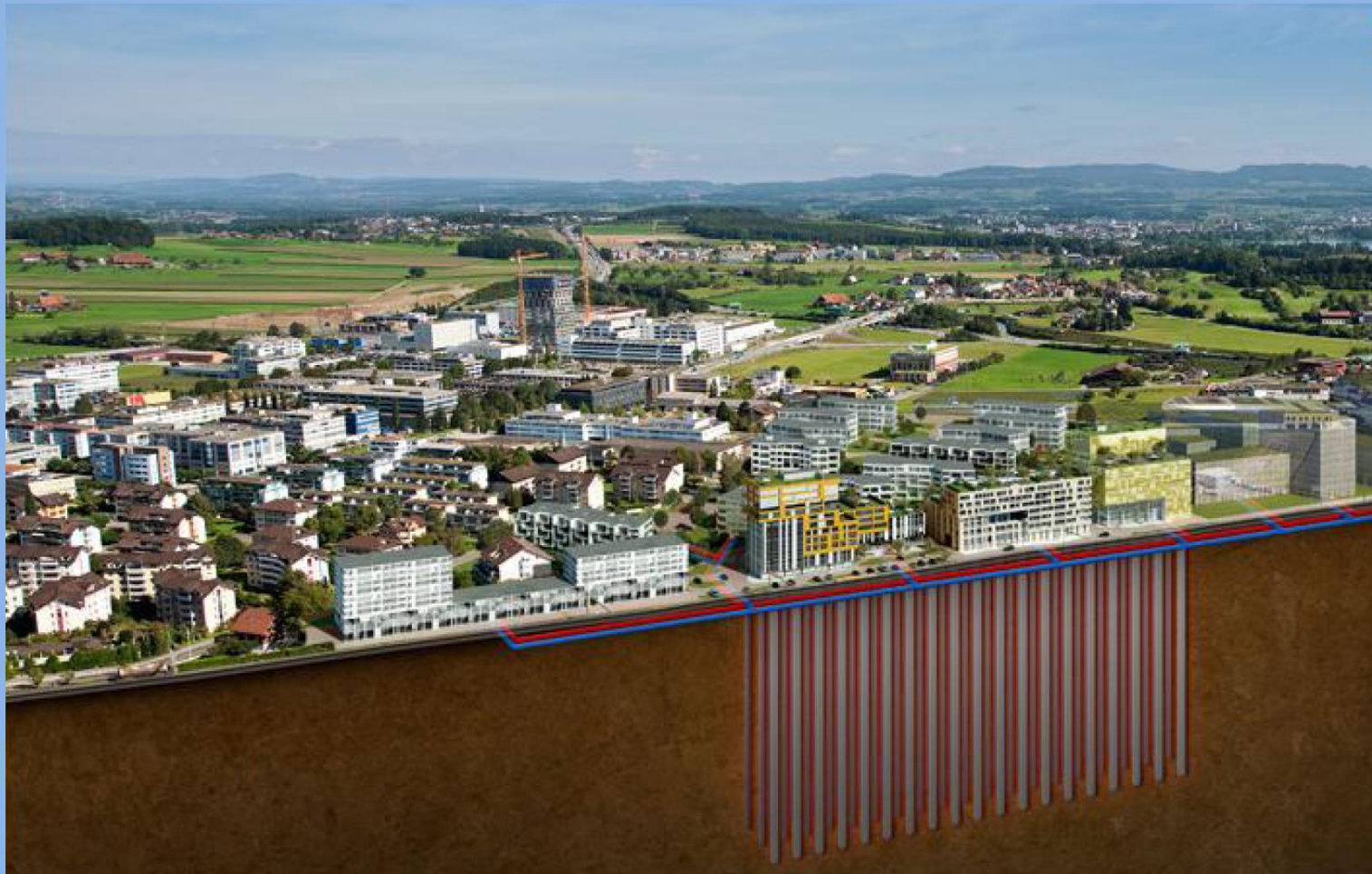
# Example of a combined heating/cooling system for the Dolder grand hotel in Zurich using 70 boreholes of 152m depth



# Schematics of seasonal storage using waste heat



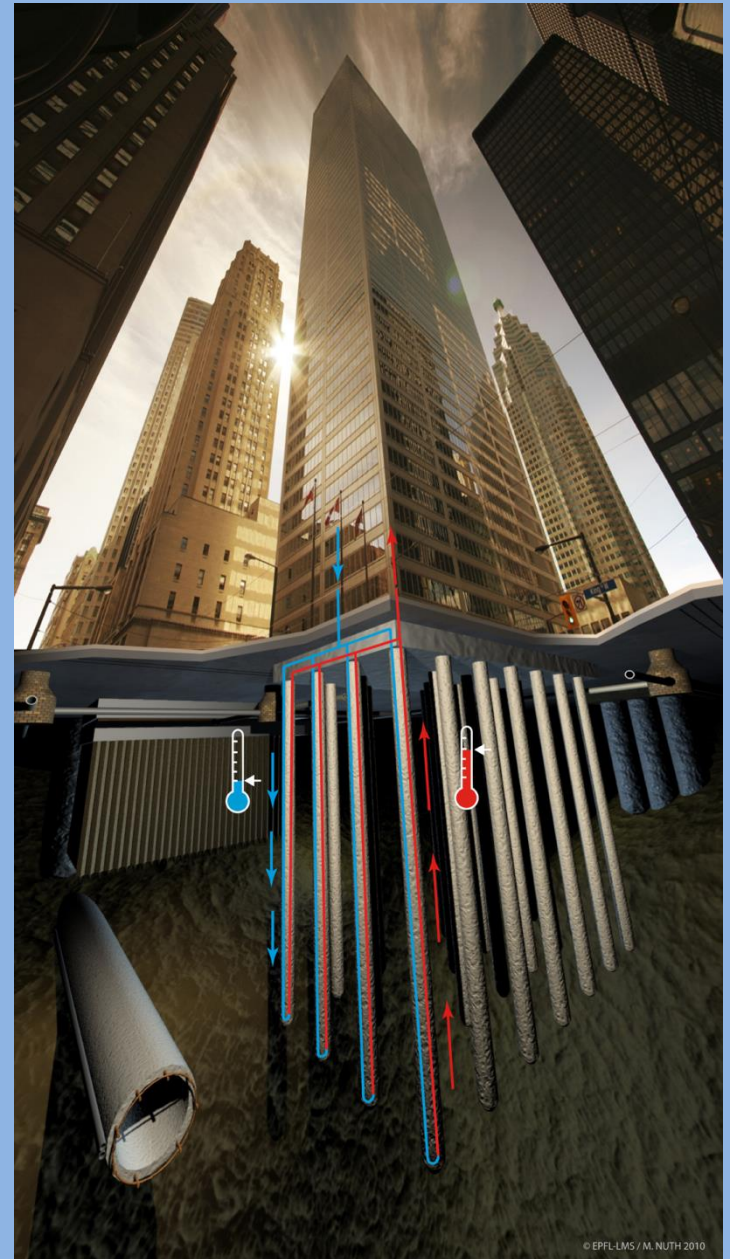
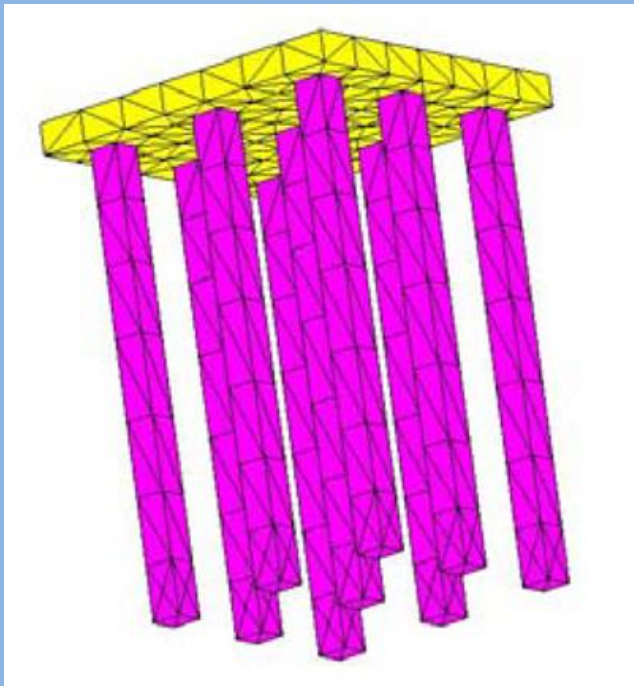
# Energy-efficient buildings with seasonal underground storage using 220 boreholes



# Energy piles: a research activity at EPF Lausanne

Study of thermal and mechanical behaviour

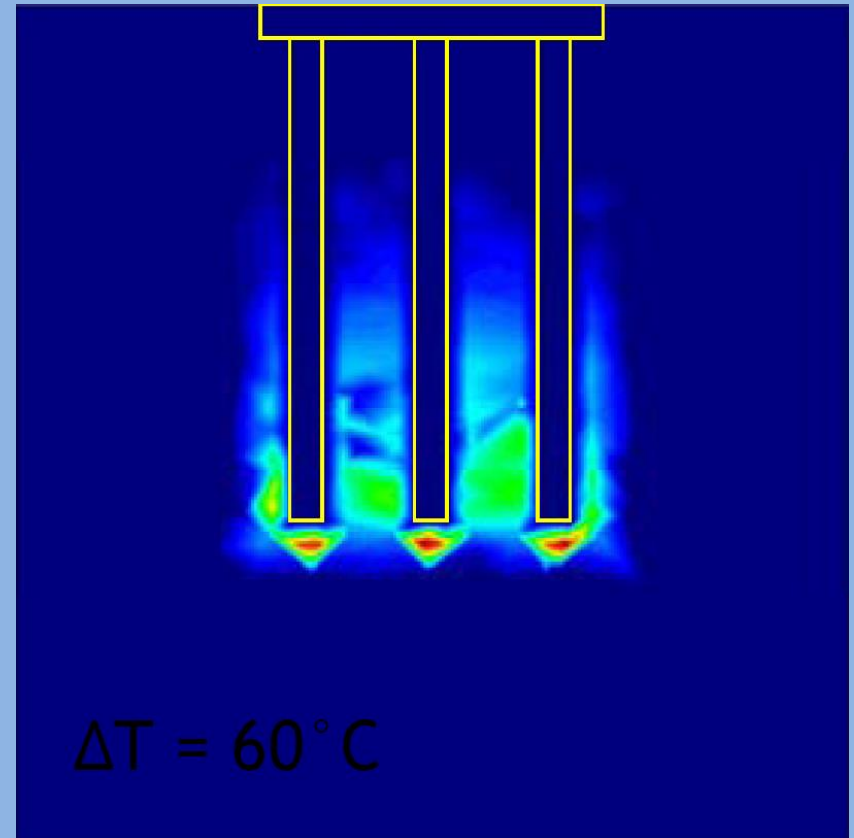
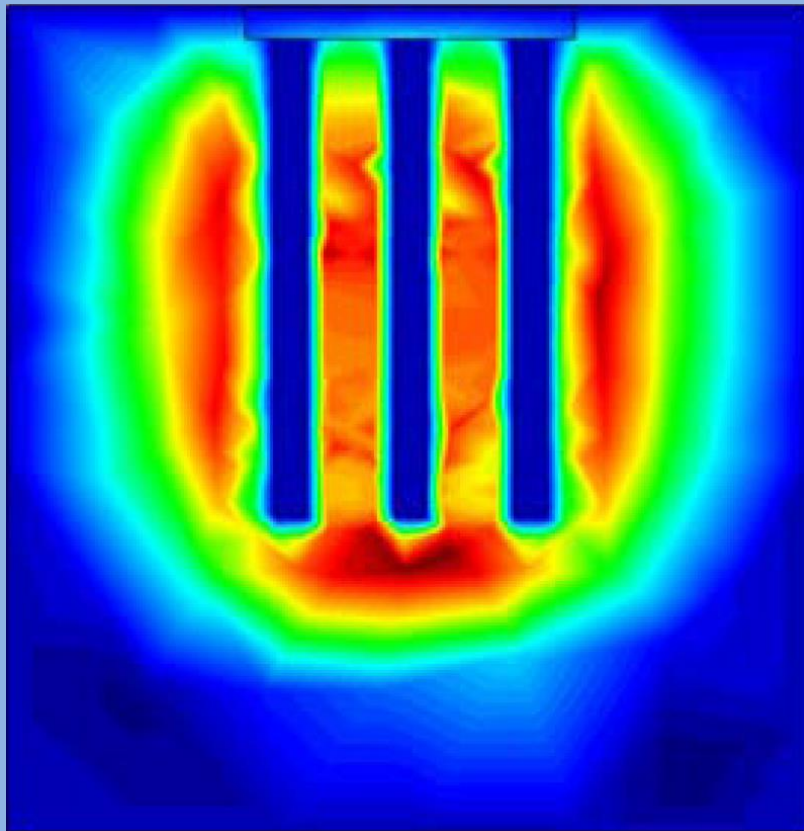
<http://lms.epfl.ch/research/research-fields/energy-geostructures-thermal-piles>



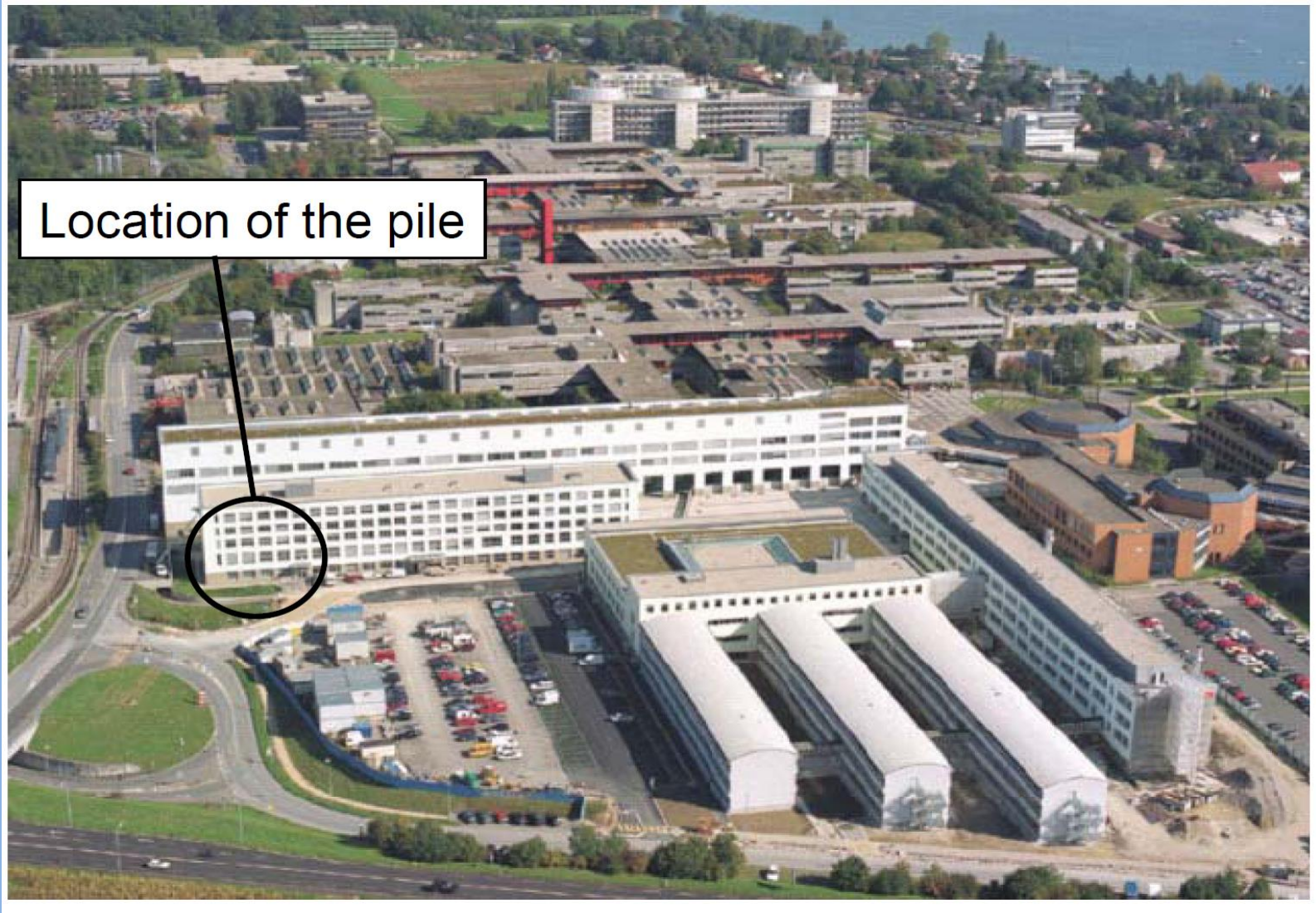
# Energy piles modelling:

left: temperature distribution

right: simulation of irreversible ground movements



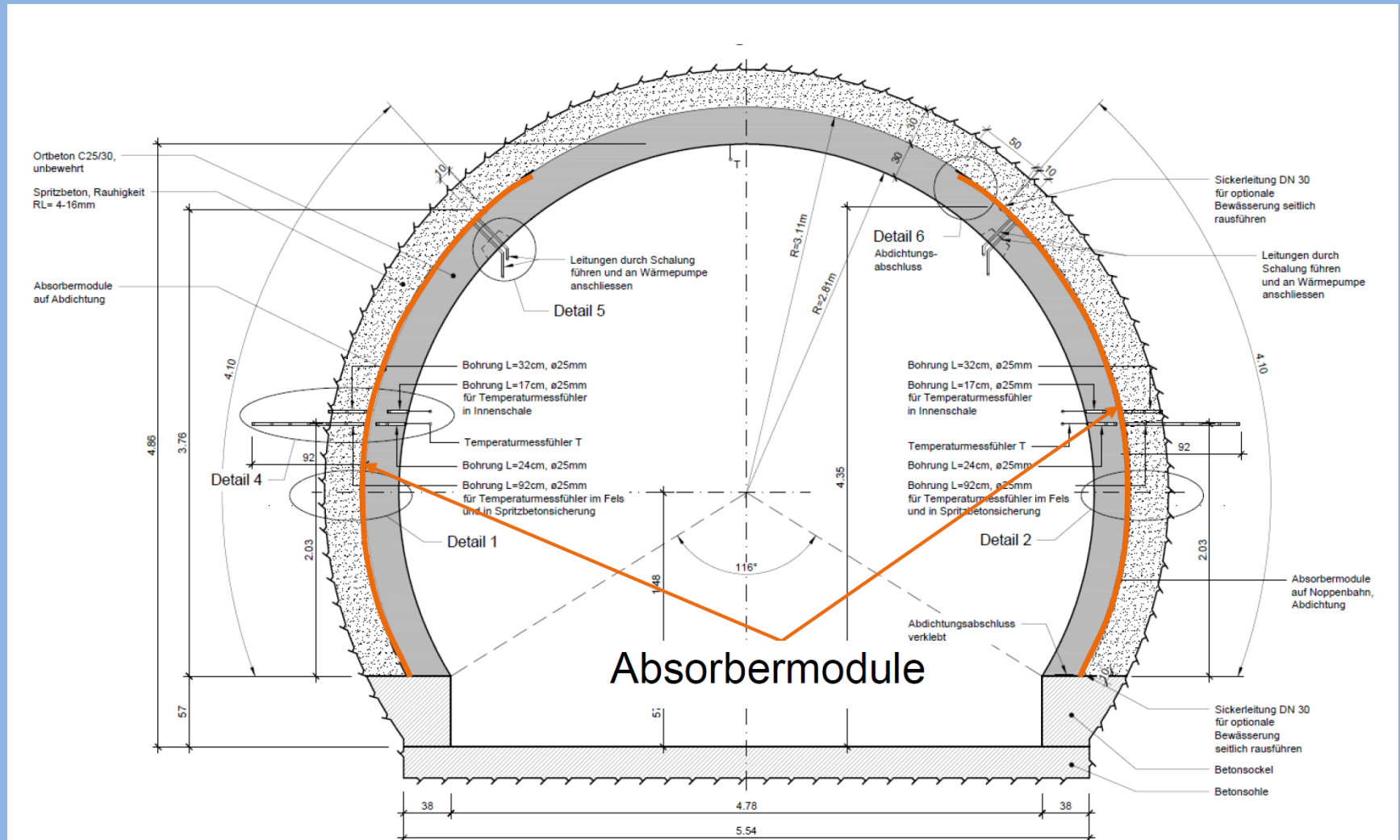
# Location of energy pile test facility at EPFL campus



# Energy piles used in a combined heating/cooling system at Zurich airport terminal E



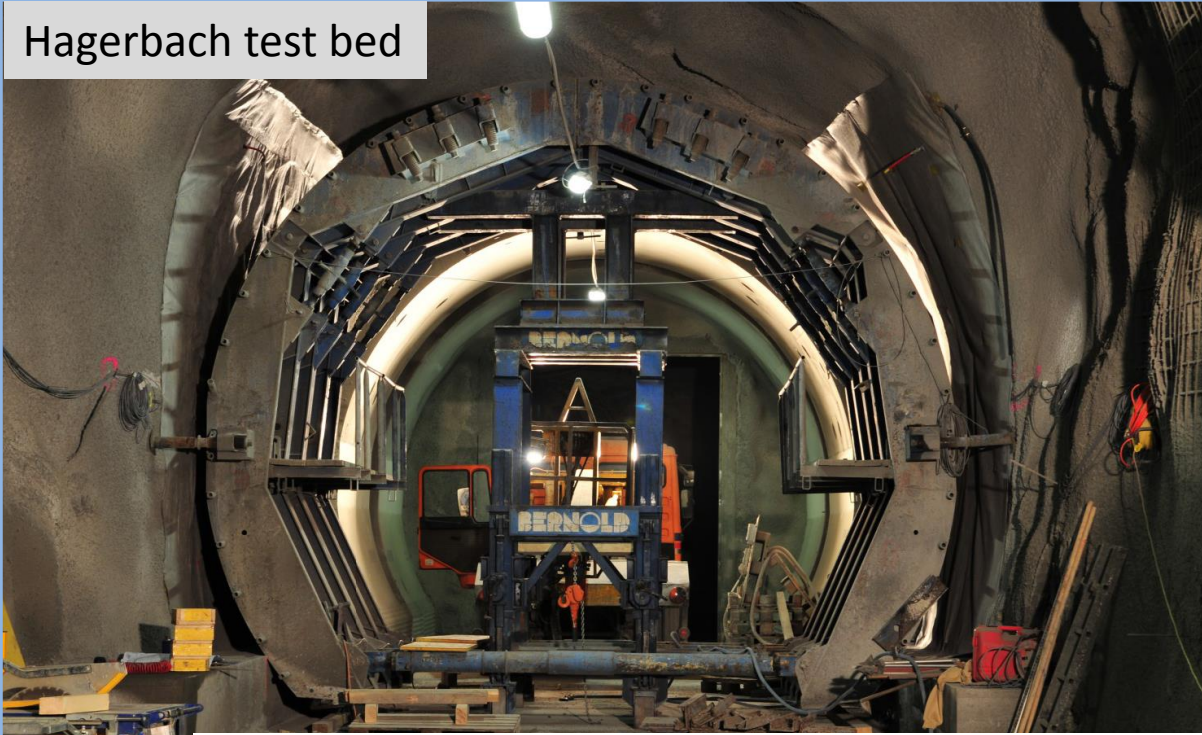
# Heat production from urban tunnels



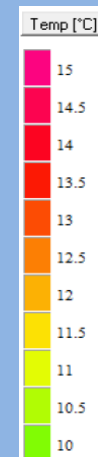
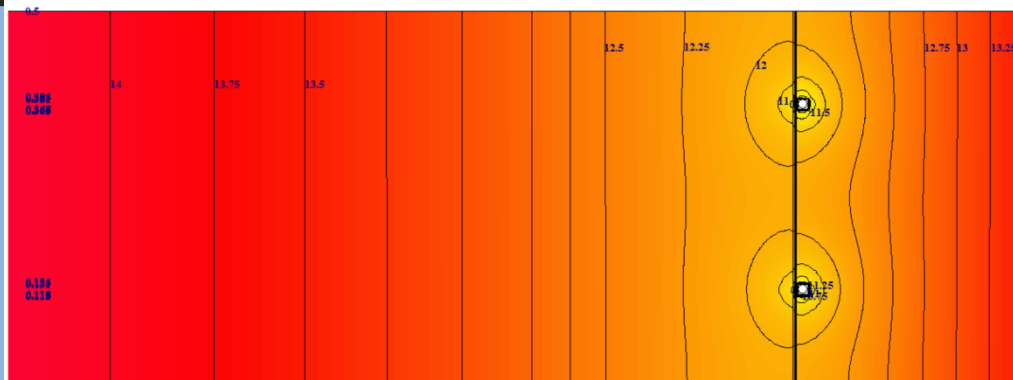


# Heat production from urban tunnels

Hagerbach test bed



absorber structure



5 day extraction test  
with 5°C water

Thank you for your  
attention!