LABORATORIUM

GEO-ENERGETYKI

WYDZIAŁ WIERTNICTWA, NAFTY I GAZU

AGH

Geoenergetics Laboratory AGH University of Science and Technology

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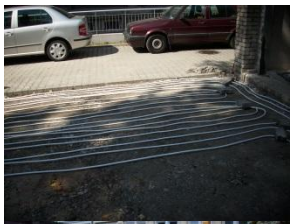
2020

Definitions

- Geothermal
- Geothermal energy
- Geothermics
- Geoenergetics
- UTES
- BTES

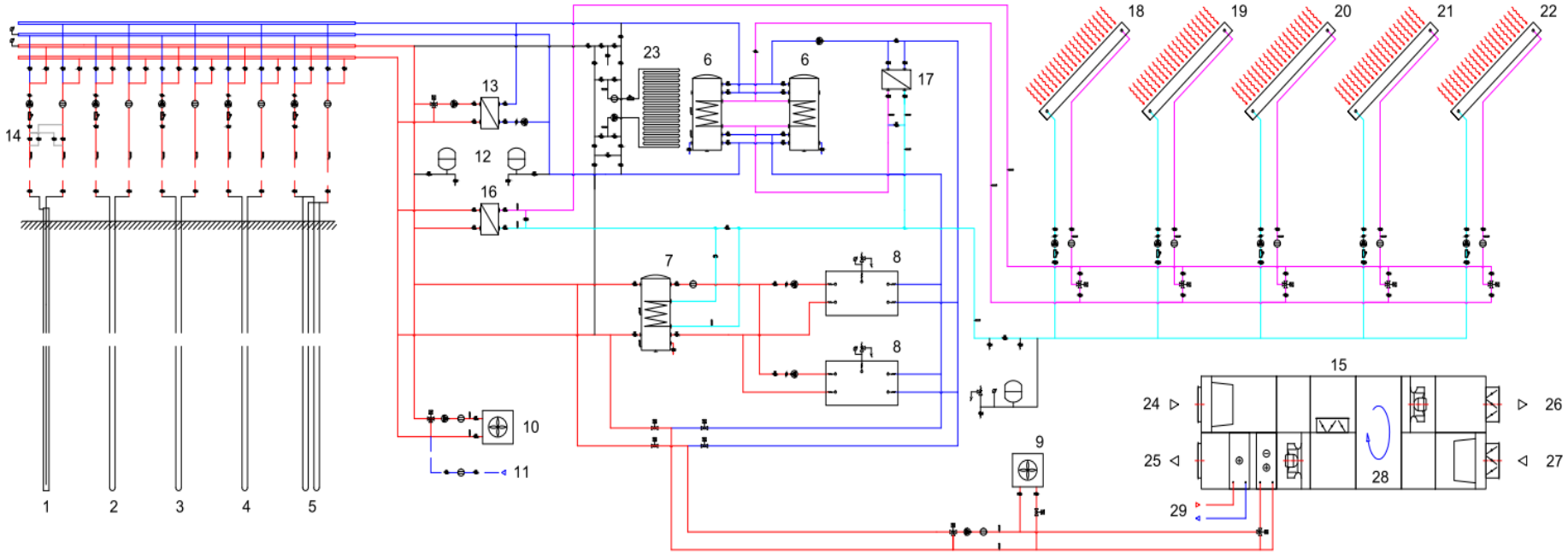


Geothermal utilisation in Poland

Geothermal energy sources in Poland (Tomaszewska et al., 2018)

Geoenergetics Laboratory AGH UST

- AGH University of Science and Technology in Krakow
- Drilling, Oil and Gas Faculty
- Drilling and Geoengineering Department
- Geoenergetics Laboratory

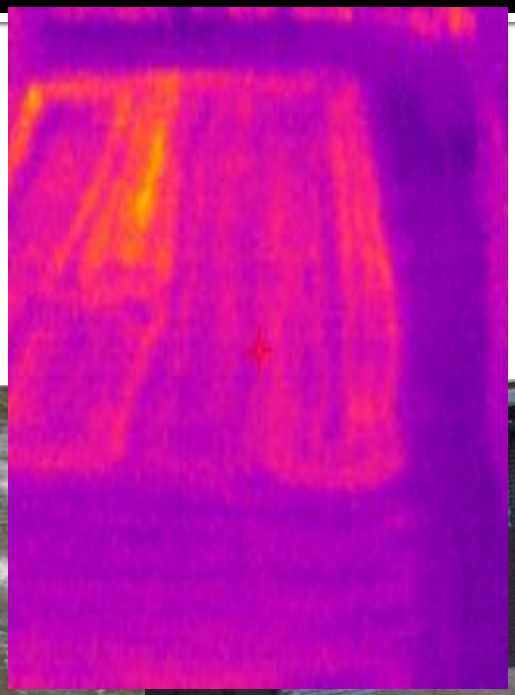


BHEs

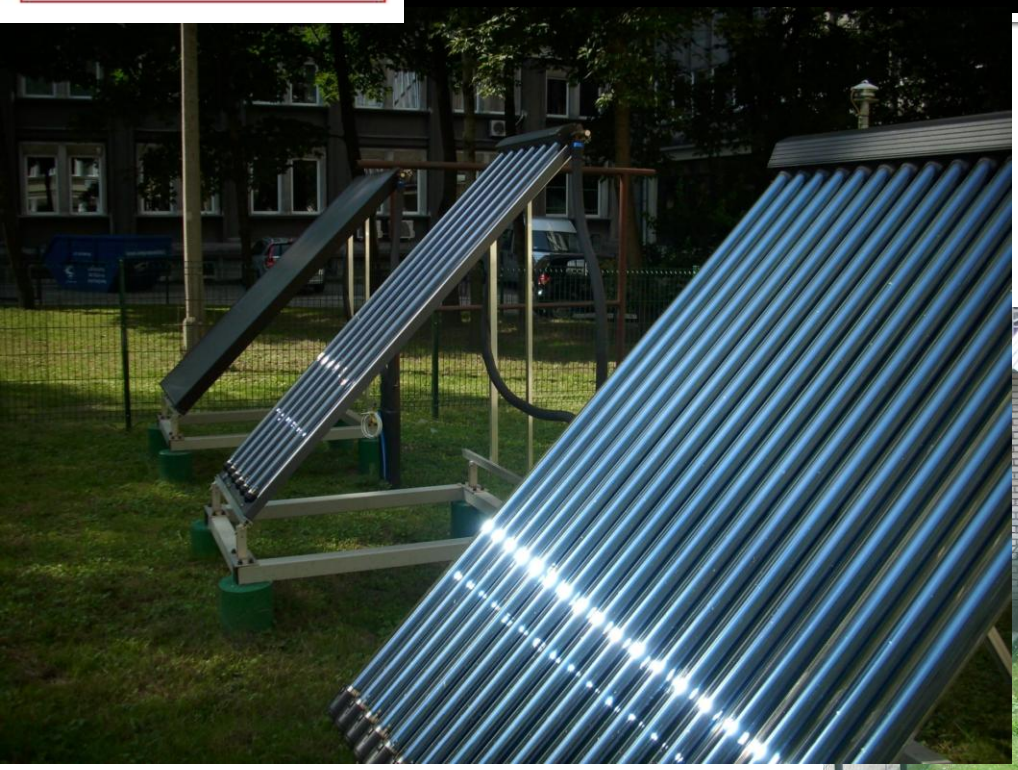
Direction of water filtration in the interval 3-15 meters below the surface
BHE-4
2,4 m
8,1 m
BHE-3
7,8 m
BHE-1
BHE-5
2,4 m
BHE-2
Geoenergetics Laboratory Building

BHEs heating and cooling of auditorium

Snow melting

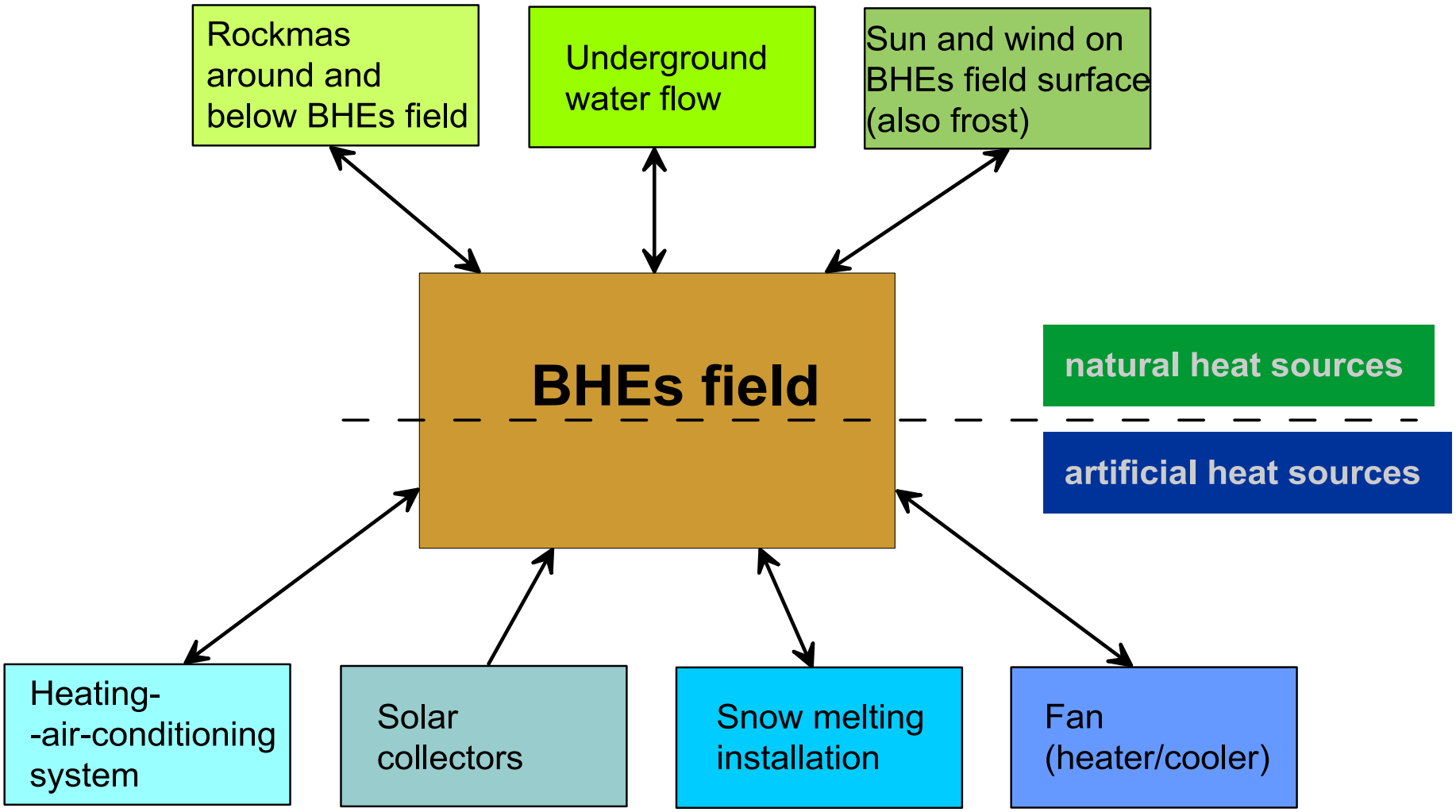


Solar panels



14 New BHEs in 2017

UTES BTES


Rockmas around and below BHEs field
Underground water flow
Sun and wind on BHEs field surface (also frost)
BHEs field
natural heat sources
artificial heat sources
Heating--air-conditioning system
Solar collectors
Snow melting installation
Fan (heater/cooler)

First TRT in Poland 2007

Geoenergetics Laboratory AGH UST

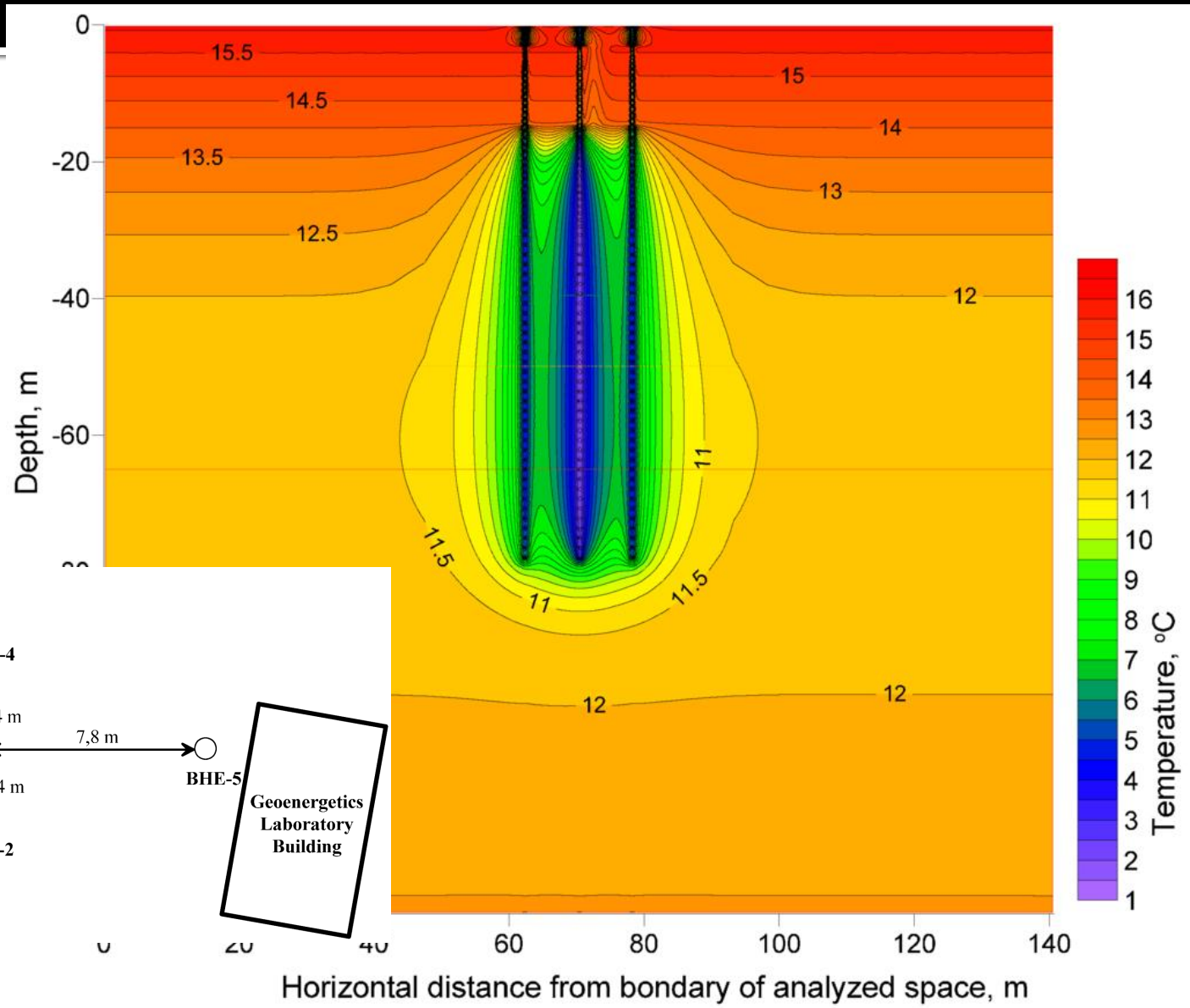
The Laboratory of Geoenergetics is equipped with 17 survey stands:

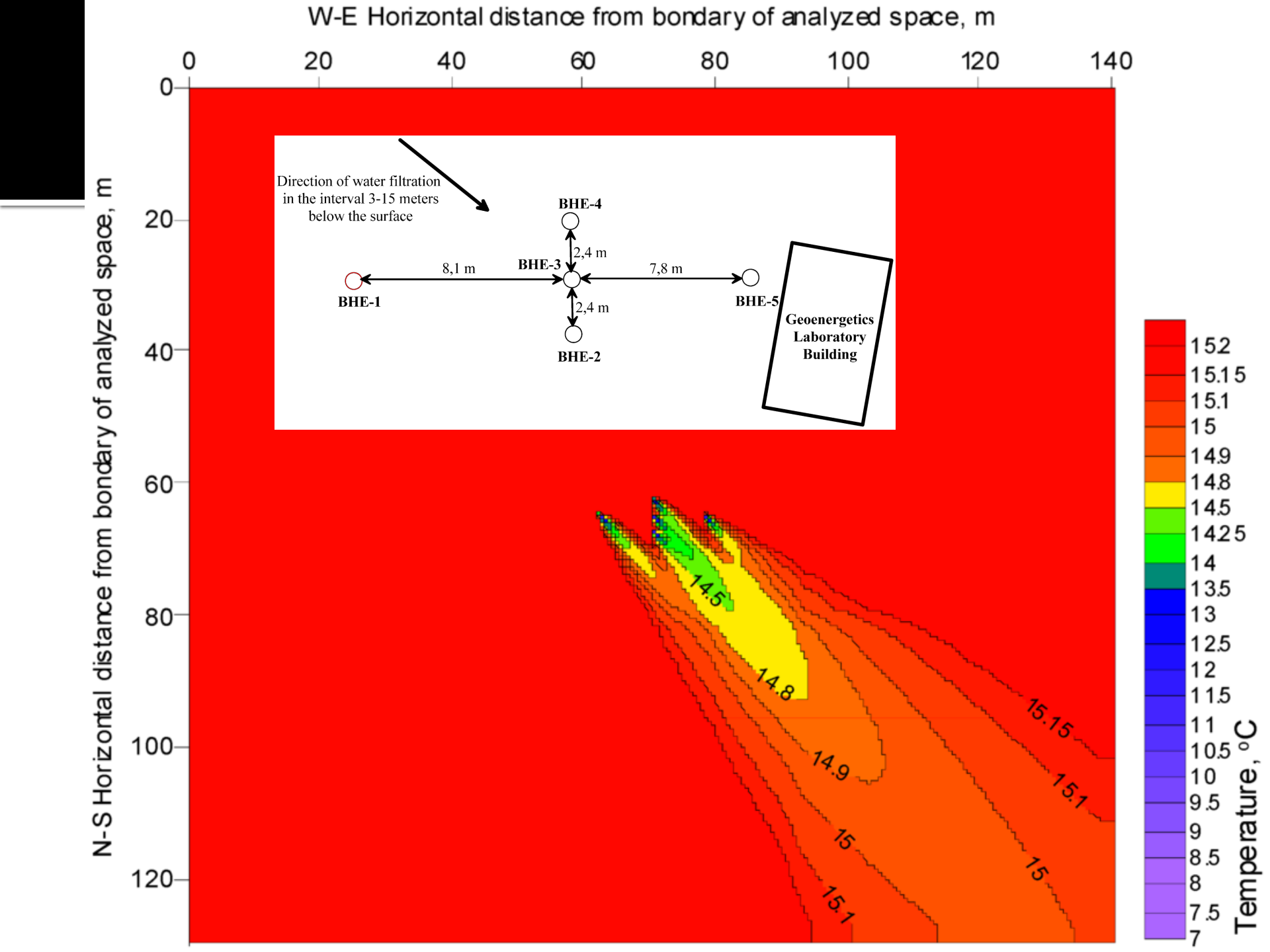
1. heating-cooling system of the FDOG Auditory,
2. apparatus for thermal response test (TRT),
3. heat pumps with bi-directional heat flow in the rock mass (heating and cooling),
4. borehole heat exchangers of various designs, each 78 m deep,
5. laboratory model of coaxial heat exchanger,
6. apparatus for measuring thermal power (teaching),
7. λ-meter for measuring thermal conductivity of rocks and materials (hardened sealing slurries, grouts),
8. apparatus NIMO-T for temperature logging in borehole heat exchangers,
9. meteo mini-station for measuring external temperature, speed and direction of wind and intensity of solar radiation,
10. five solar collectors for regeneration of heat in the rock mass with individual measurement,
11. heating/cooling system for snow melting of the parking before the Laboratory,
12. pressure meter for measuring location of the water table in the borehole,

and computer stands for calculations:

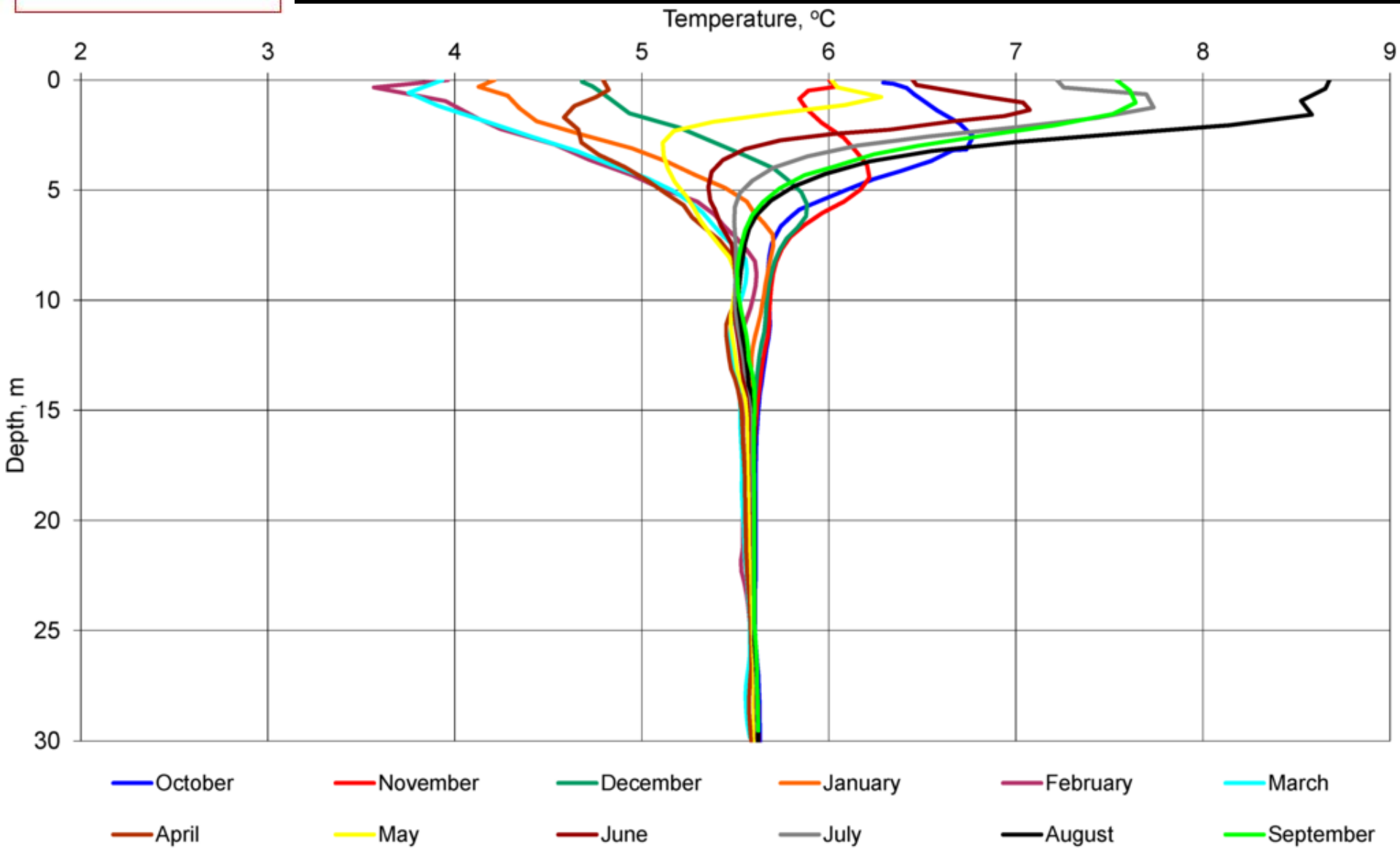
13. numerical simulator **BoHEx** for predicting exploitation in borehole heat exchangers in heating, cooling and heating/cooling systems,
14. RETScreen® International package for technical and economic analyses of renewable energy sources and determining their environmental impact,
15. **TOUGH2.0** numerical simulator for modelling exploitation in geothermal reservoirs with **PetraSim** pre- and postprocessor package,
16. BIES (Buildings' Integrated Evaluation System) computer program for analyzing the environmental impact of buildings,
17. AUDYTOR OZC program for determining buildings' heat demand.

Numerical modelling




W-E Horizontal distance from bondary of analyzed space, m
0
20
40
60
80
100
120
140
N-S Horizontal distance from bondary of analyzed space, m
Direction of water filtration in the interval 3-15 meters below the surface
BHE-4
BHE-3
BHE-1
BHE-2
BHE-5
2,4 m
8,1 m
7,8 m
2,4 m
Geoenergetics Laboratory Building
14.5
14.8
14.9
15
15.1
15.15
15.2
15.15
15.1
15
14.9
14.8
14.5
14.25
14
13.5
13
12.5
12
11.5
11
10.5
10
9.5
9
8.5
8
7.5
7
Temperature, °C

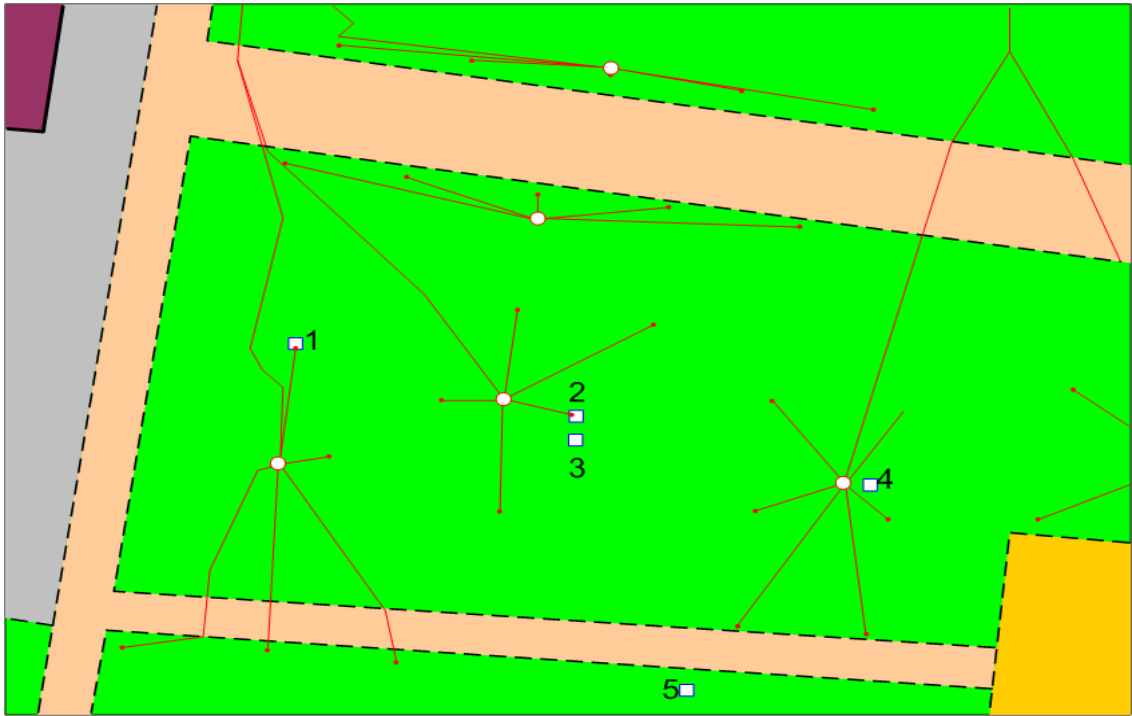
Testing ground in Pałecznica



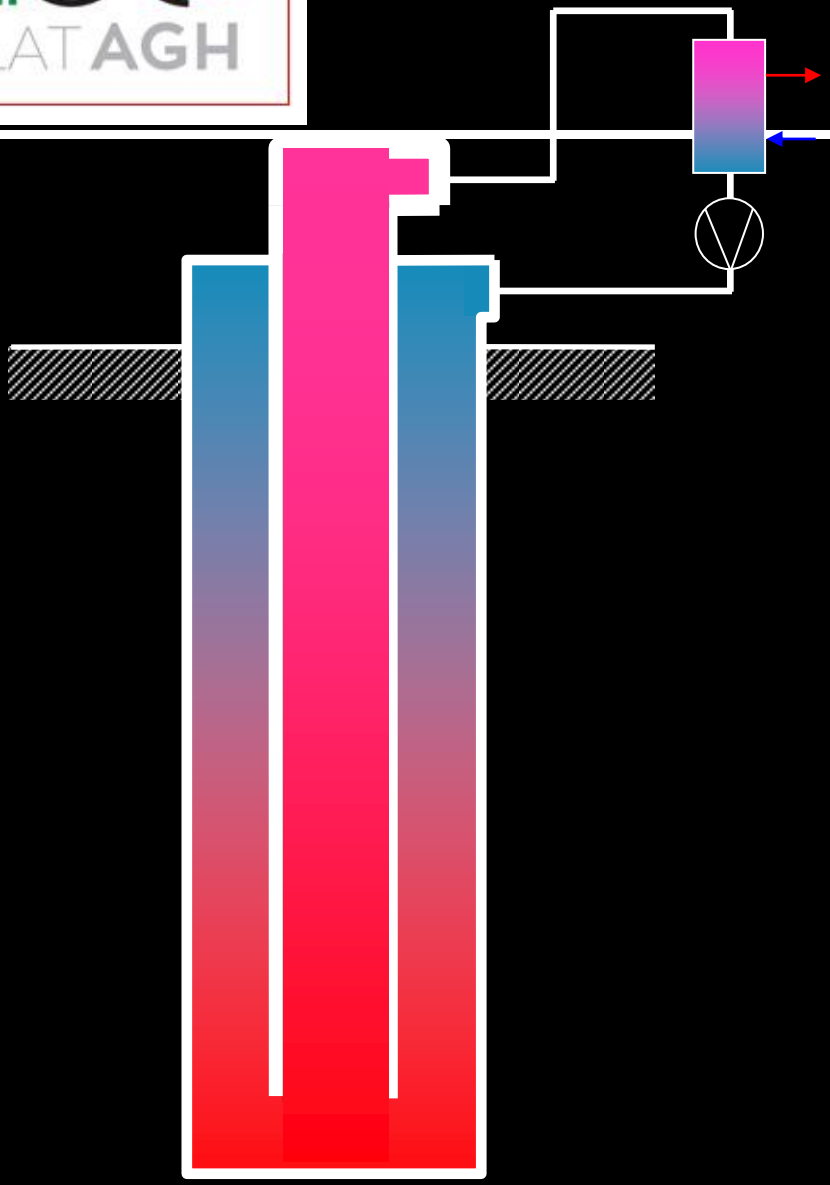
Testing ground in Pałecznica

Budynek	Moc grzewcza, kW	Liczba otworów	Sumaryczna głębokość wierceń, m	Moc jednostkowa, kW/m	Wymagana głębokość dla jednostkowej mocy, m/kW
1	2	3	4	5	6
A	44,4	20	600	74,00	13,51
B	29,3	12	360	81,39	12,29
C	11,1	5	150	74,00	13,51
Razem	86,8	37	1110	78,20	**12,78**

Direct evaporation BHEs



Deep BHEs



Heat carrier circulation in deep BHE

Construction of BHE in deep well

Cementing plug

Isolated inner pipe

Centralisers of inner pipe

Heat carrier

Circulating pump

Heat pump

We have currently…

13 years of research and teaching

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University of Science and Technology
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