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Geothermal mapping – a tool to support development of shallow geothermal energy sources. Example of Polish-Saxon transboundary project TransGeoTherm

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Państwowy Instytut Geologiczny – Państwowy Instytut Badawczy, Oddział Dolnośląski

PolSCA meeting, 06.11.2013, Brussels

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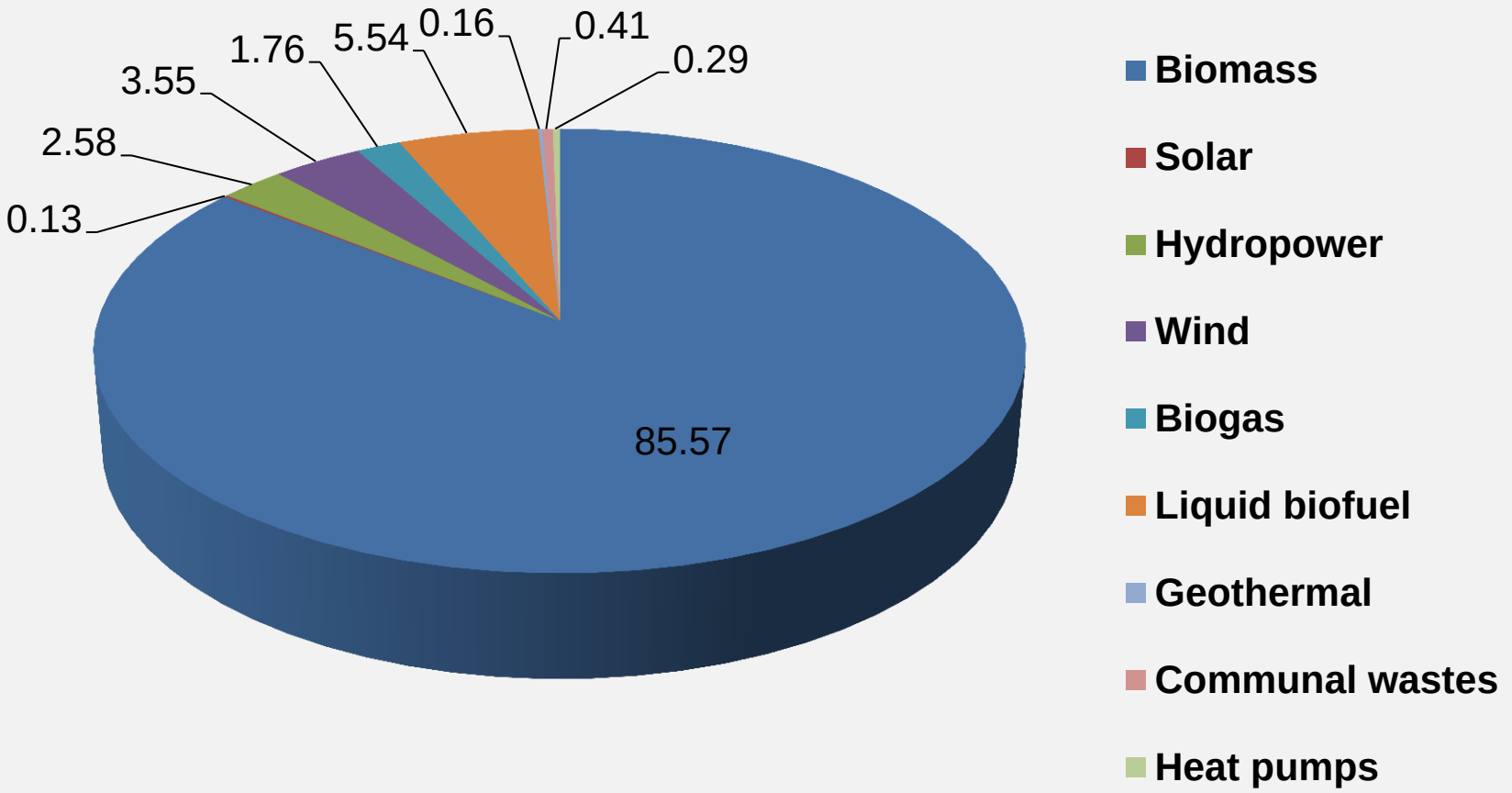
Outline of presentation:

- Renewable energy in Poland
- Low temperature geothermal energy as a renewable energy source
- Geological and hydrogeological settings
- Geothermal mapping
- Basic information about the TransGeoTherm project
- Practical application of project results
- Dissemination of project results

Production of renewable energy in Poland in 2011 in %



In 2011 renewable energy in Poland was 11.2% of total energy production

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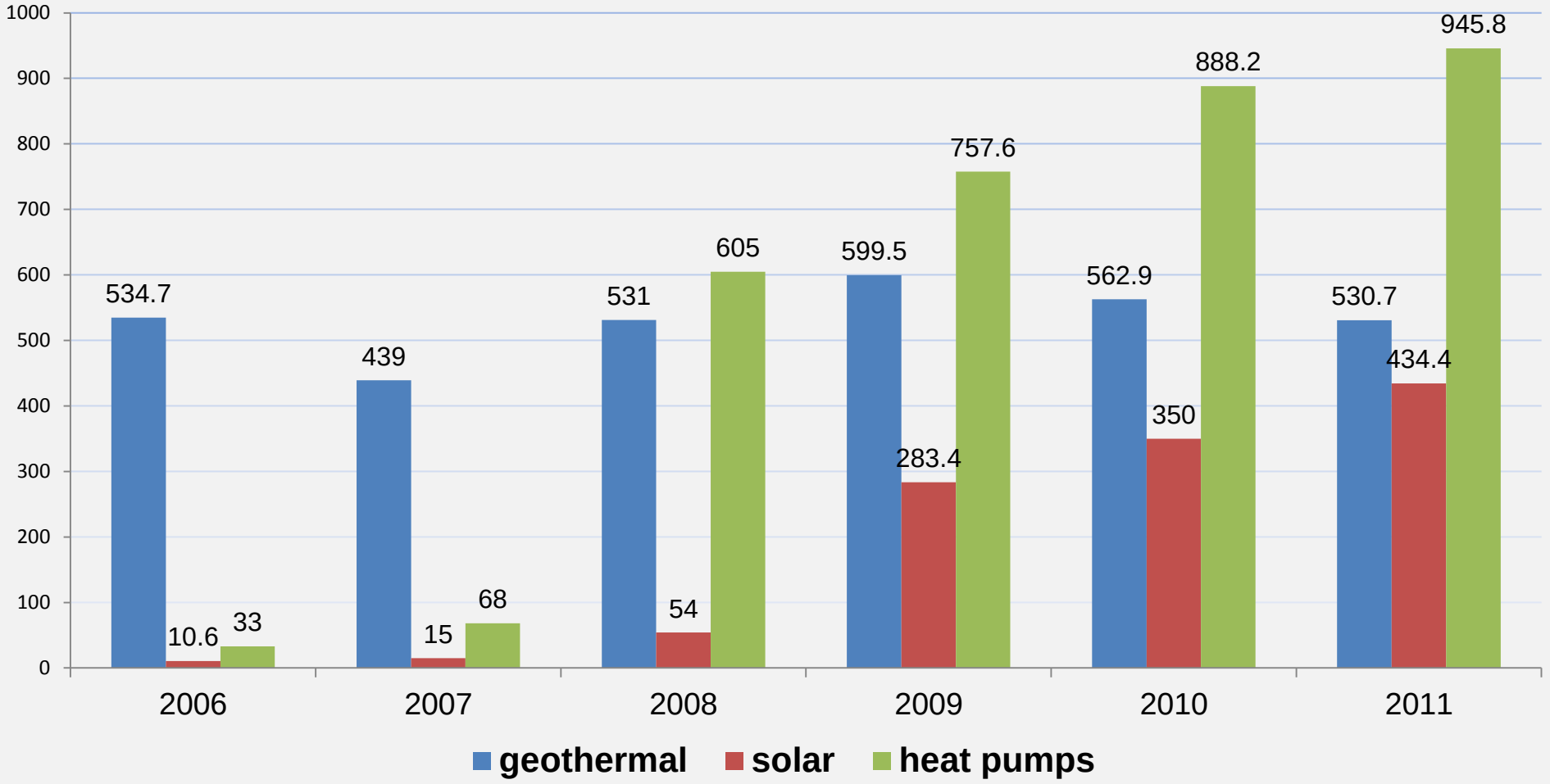
Source: GUS (Central Statistical Office of Poland)

Renewable energy in Poland in 2006-2011
Total amount of heat in TJ



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Source: GUS (Central Statistical Office of Poland)

Ground source heat pumps in Poland in 2012

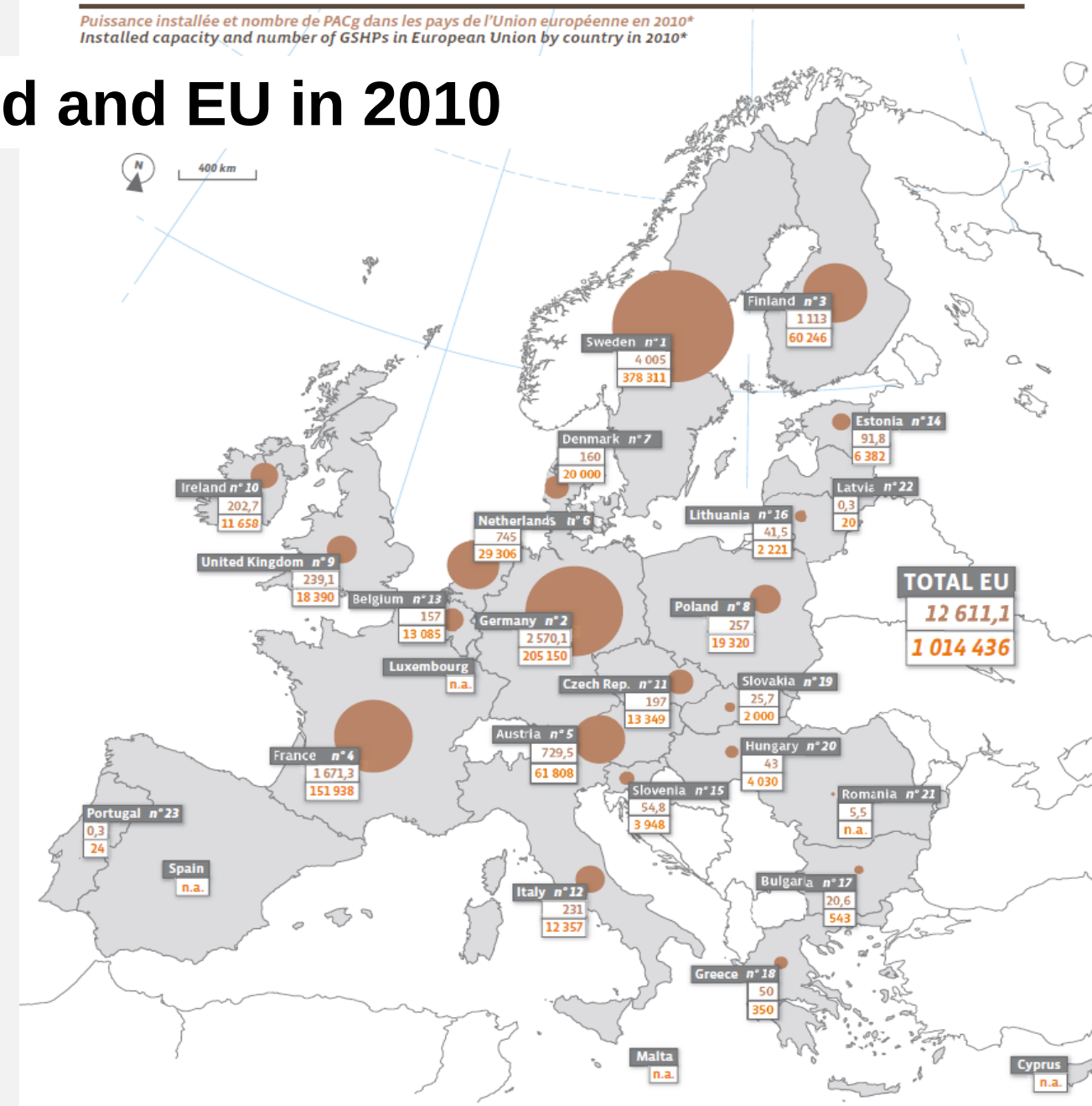
Amount of GSHP installations	Total power [MW]	Total Production [GW / year]	Power per unit [kW / unit]	Annual operating time of an average GSHP unit
ca. 30 000	330,0	470,0	11,0 (est.)	1 424

Source: Ground Source Heat Pumps in Europe in 2012, Antics et. al.. 2013

Heat pumps in Poland and EU in 2010

Total power of 257 MW

19 320 installations



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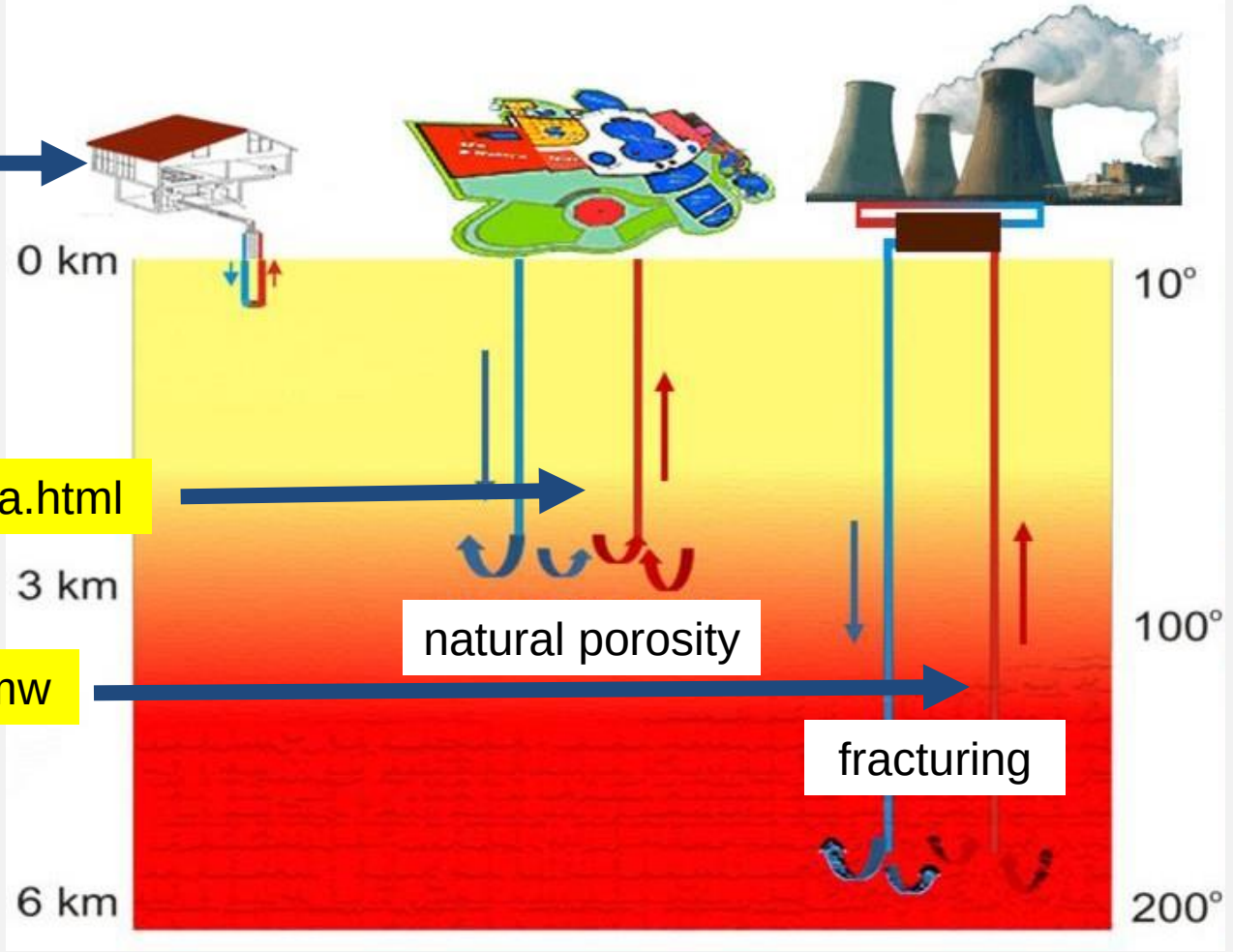
Low temperature geothermal energy

Low temperature geothermal energy 20-30 deg. C	High temperature hydrogeothermal energy up to 100 deg. C	Hot Dry Rock

Low temperature geothermal energy is used in heat pumps installations equipped with a vertical heat exchanger and closed circulation system

http://mineralne.pgi.gov.pl/geotermia.html

http://www.pgi.gov.pl/pl/wstep-hdr-mw



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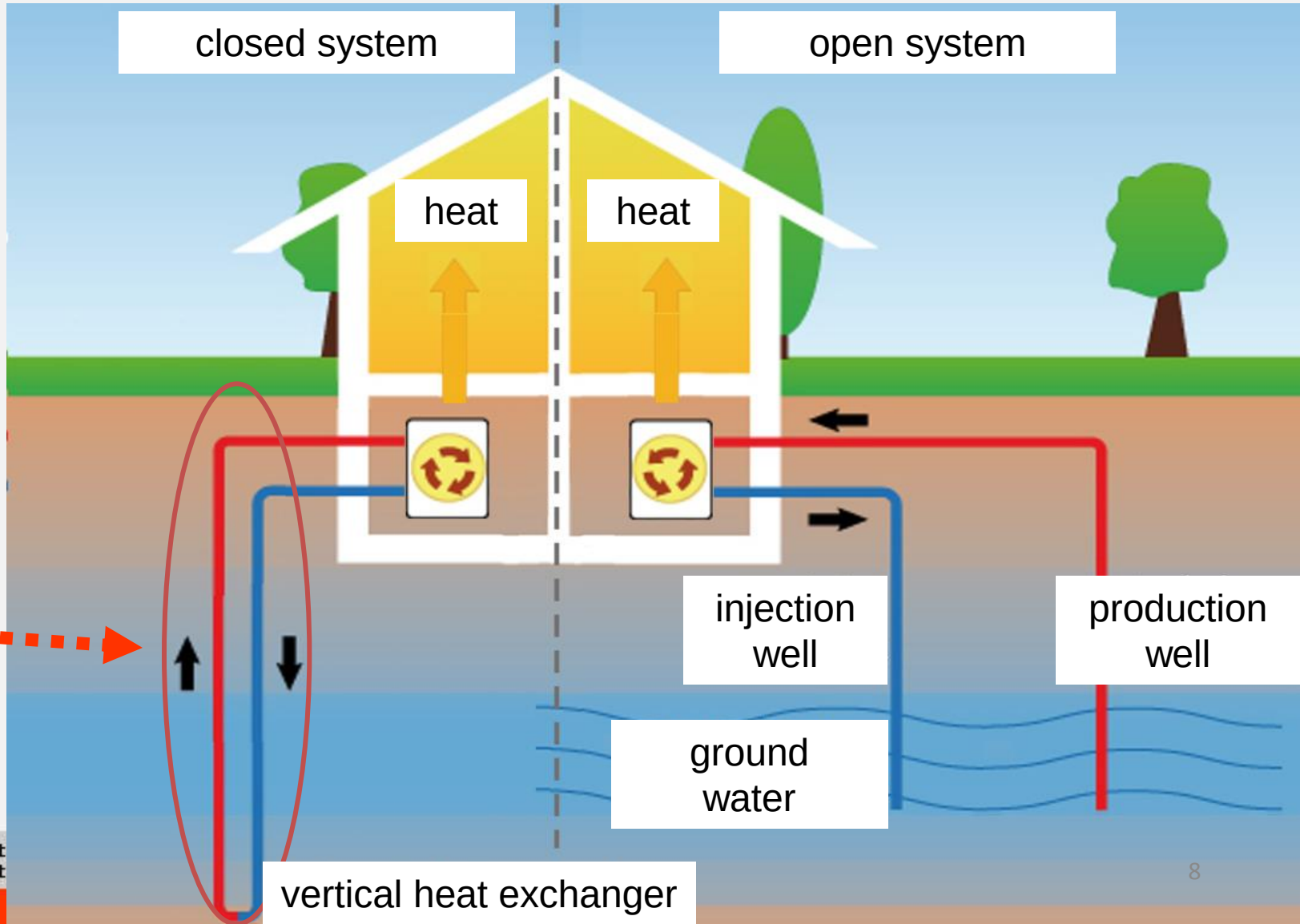
Types of heat pump installations

Attention!

For the closed system the most crucial factors are: type of rock and its physical properties and presence of groundwater



Geological and hydrogeological settings

Basic geothermal property of a rock is its **THERMAL CONDUCTIVITY**. Calculation of this property has a crucial meaning for setting a heat pump installation.

Values of **THERMAL CONDUCTIVITY** of rocks vary normally between 0.4 to 7.0 **W/m*K**. These values are normally calculated based on laboratory analyses of the selected rock samples.

The highest values of **THERMAL CONDUCTIVITY** show the rocks with high quartz content as well as the heavily groundwater saturated rocks.

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Geological and hydrogeological settings

A valuable practical indicator of geothermal properties of underground (rocks) is so-called **COEFFICIENT OF GEOTHERMAL HEAT EXTRACTION** as obtained from 1 meter of a borehole and expressed in **W/m**.

The **COEFFICIENT** is calculated with respect to average annual operating time of a heat pump installation in a family house per year – 1 800 hours (hot water) or 2 400 hours (hot water and heating)

Type of rock	Geothermal power coefficient W/m / Average annual operating time of a heat pump	
	1 800 hours	2 400
Dry gravels and sands	<25	<20
Clays, tills	35-50	30-40
Magmatic rocks (i.e. basalts)	40-65	35-55
Limestones	55-70	45-60
Water saturated gravels and sands	60-80	55-65
Sandstones	65-80	55-65
Acid magmatic rocks (i.e. granites)	65-85	55-70
Gneisses	70-85	60-70
Heavily water saturated gravels and sands	80-100	80-100

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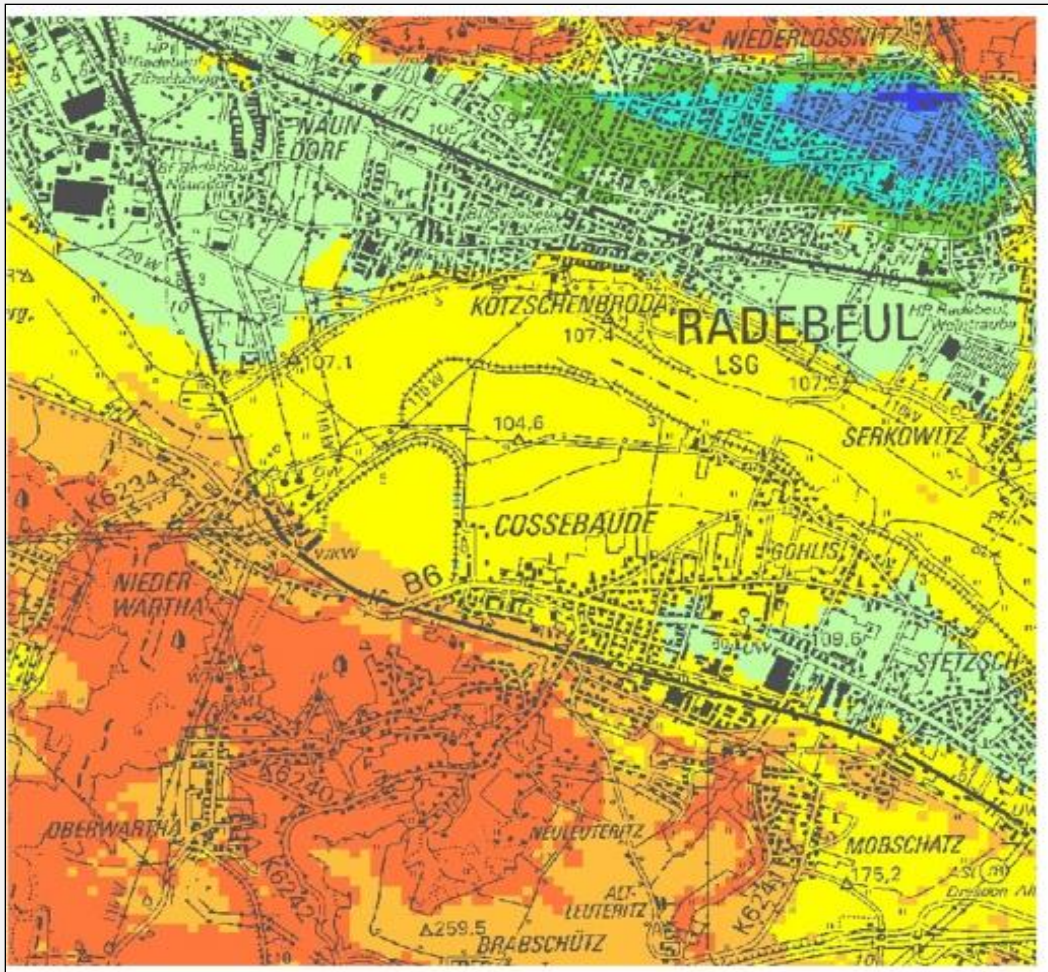
source: www.hakagerodur.ch.

Geothermal mapping in Saxony



Geothermisches Kartenwerk 1:50.000 (GTK 50)

Blatt L4946 Meißen

Herausgeber:
Sächsisches Landesamt
für Umwelt, Landwirtschaft
und Geologie

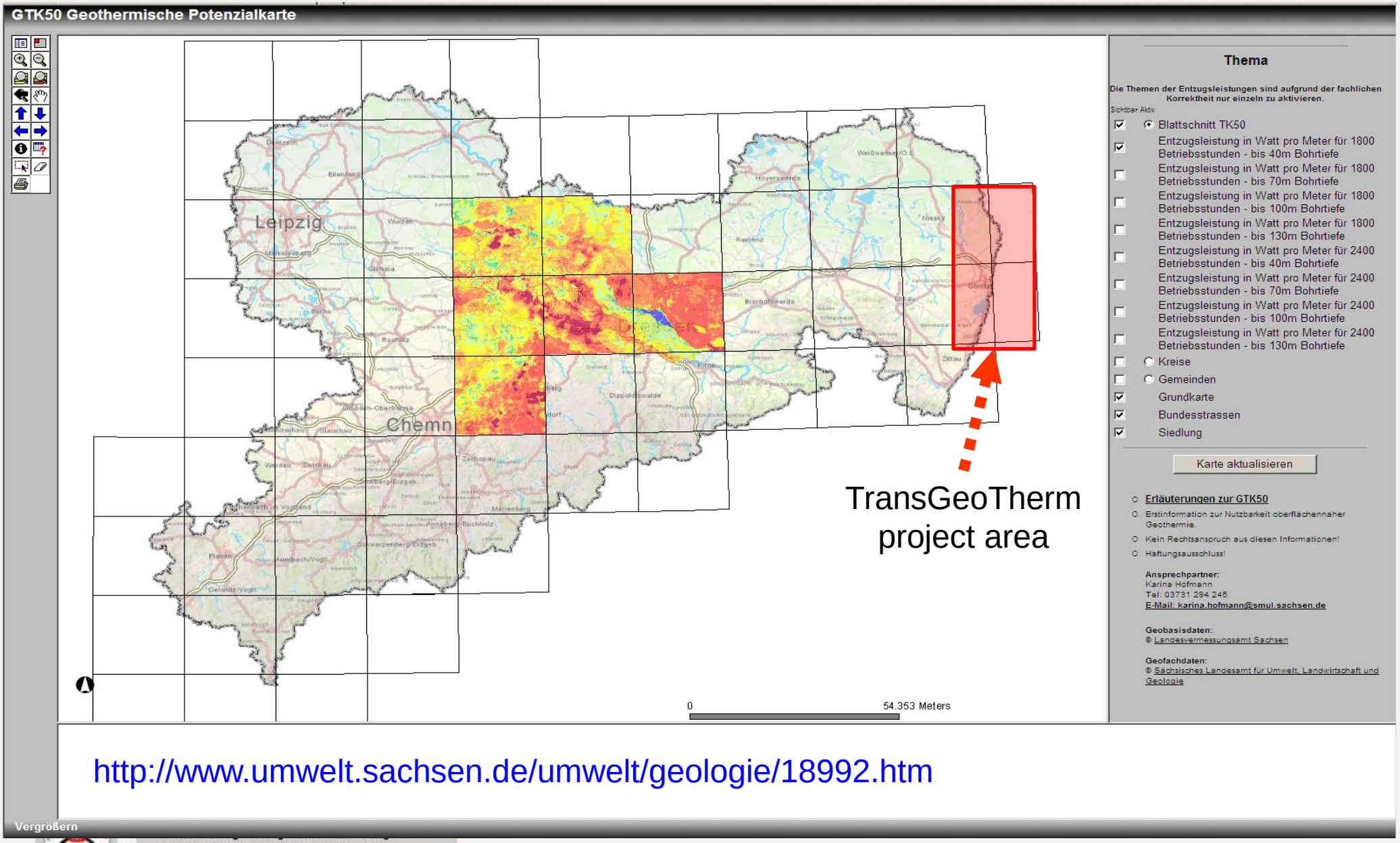
0 0,5 1 2 Kilometer

Mean geothermal heat extraction in watts per meters (W/m)
Depth: 0 to 40 m
Annual operating time of heat pump: 1800 h

- >= 60,1
- 57,6 - 60,0
- 55,1 - 57,5
- 52,6 - 55
- 50,1 - 52,5
- 47,6 - 50
- 45,1 - 47,5
- 42,6 - 45
- 40,1 - 42,5
- <= 40,0

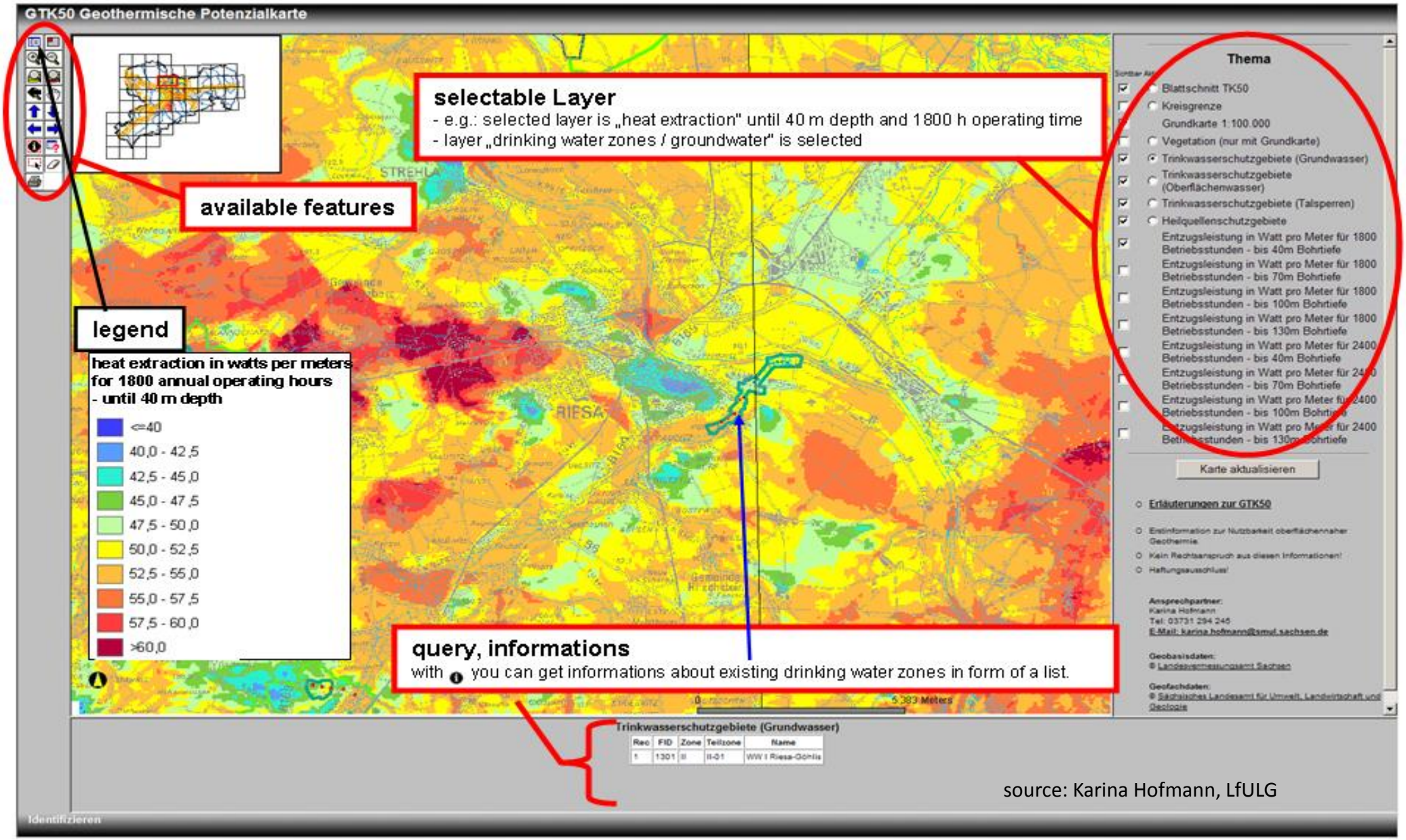
source: Karina Hofmann, LfULG

Geothermal mapping in Saxony



http://www.umwelt.sachsen.de/umwelt/geologie/18992.htm

Geothermal mapping in Saxony



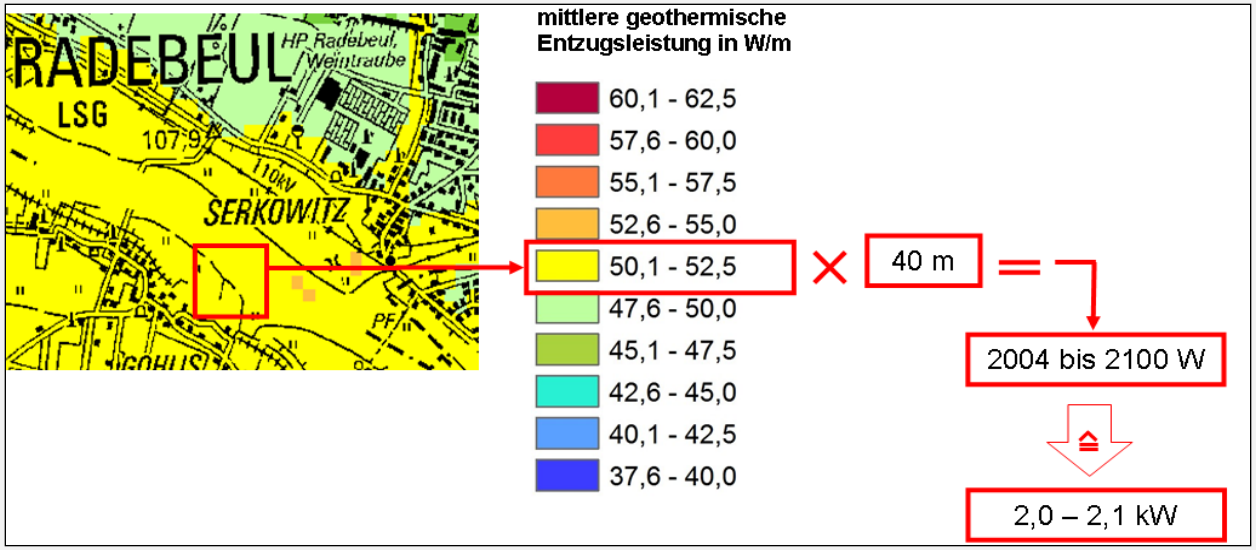
source: Karina Hofmann, LfULG

Geothermal mapping in Saxony

example: one family house,
12 kW heating demand, only heating

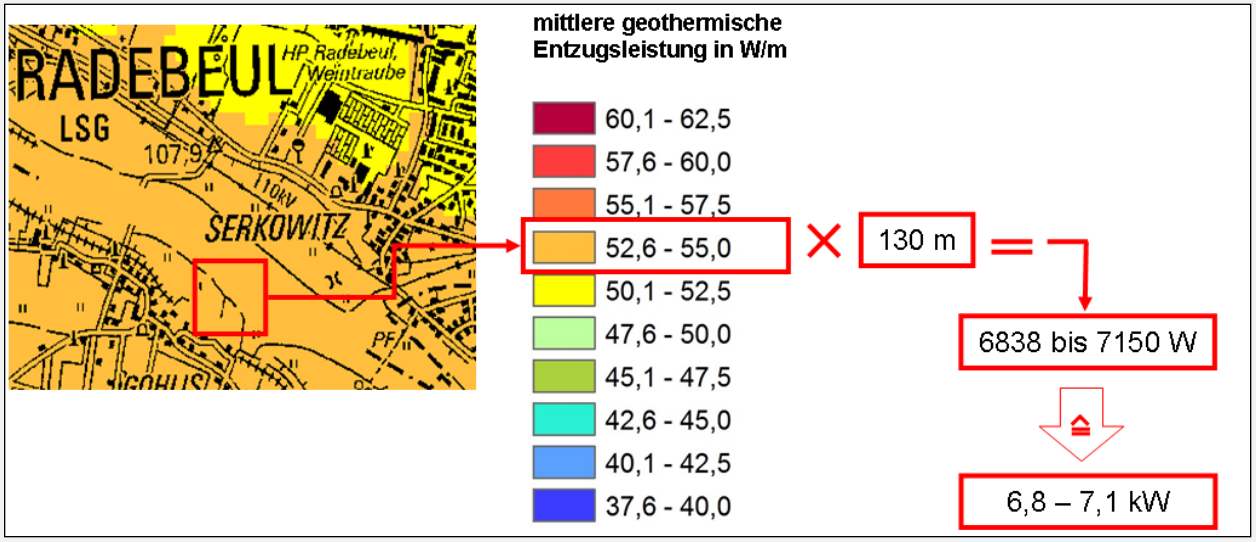
6 boreholes with 40 m depth

1800 annual operating hours, until 40 m drilling-depth



2 boreholes with 130 m depth

1800 annual operating hours, until 130 m drilling-depth



source: Karina Hofmann, LfULG

Basic information about the project

Title: **TransGeoTherm – Geothermal energy for transboundary development of the Neisse region. Pilot project**

Co-operation of two partners:

***Lead partner*: Polish Geological Institute – National Research Institute**
Lower Silesian Branch

***Project partner*:** LANDESAMT FÜR UMWELT, LANDWIRTSCHAFT UND GEOLOGIE | Freistaat SACHSEN

Project is co-financed from the EU financial sources within the framework of the

Operational Programme for Transboundary Co-operation Poland-Saxony 2007-2013

• agreement no: 100114097

• project life time: 01.10.2012 – 30.06.2014

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Project personnel:

Wiesław Kozdrój*, Maciej Kłonowski*, Adam Mydłowski*, Małgorzata Ziółkowska-Kozdrój, Janusz Badura*, Bogusław Przybylski*, Dorota Russ*, Karol Zawistowski*, Ottomar Krentz, Karina Hofmann**, Peter Riedel**, Silke Reinhardt**, Mario Bretschneider****

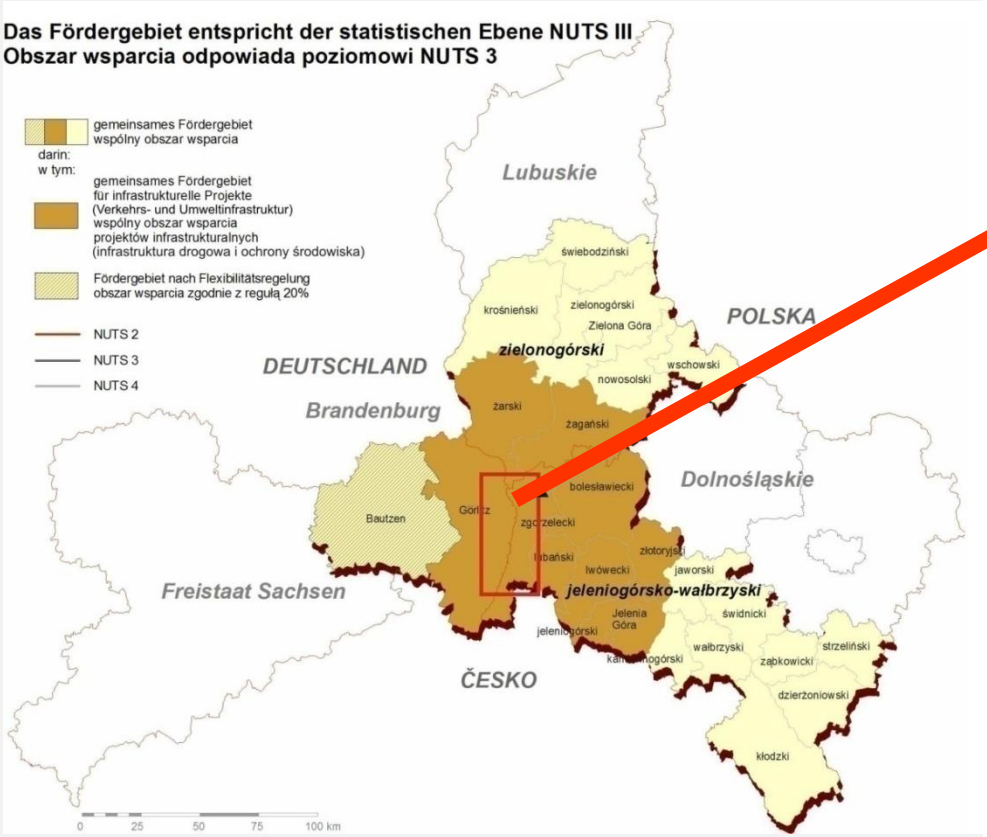
Project goals:

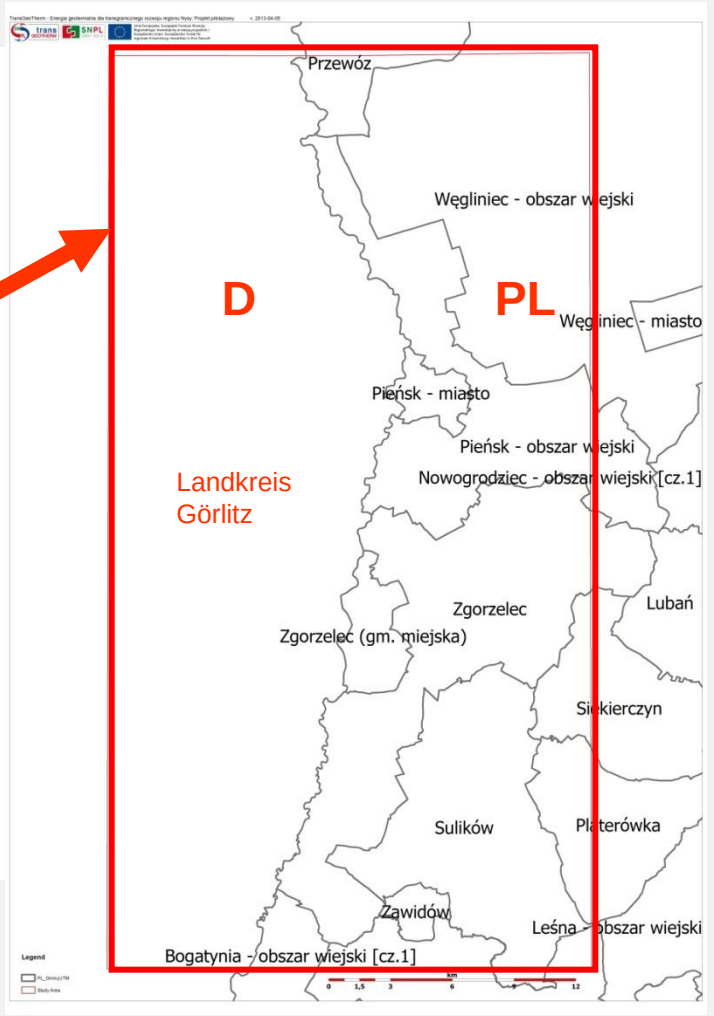
- The main goal is to made available the results of geothermal modelling and mapping as a tool to support development of low temperature geothermal installations
- Secondary goal is to increase and popularise use of the low temperature geothermal energy as one of the sources of renewable energy with respect to reduction of CO_2 emissions
- Accomplishment of the project is based on innovative and advanced technology of analysis and interpretation of geological, geothermal and hydrogeological data as well as preparation of a 3D numerical model of subsurface

Planned results:

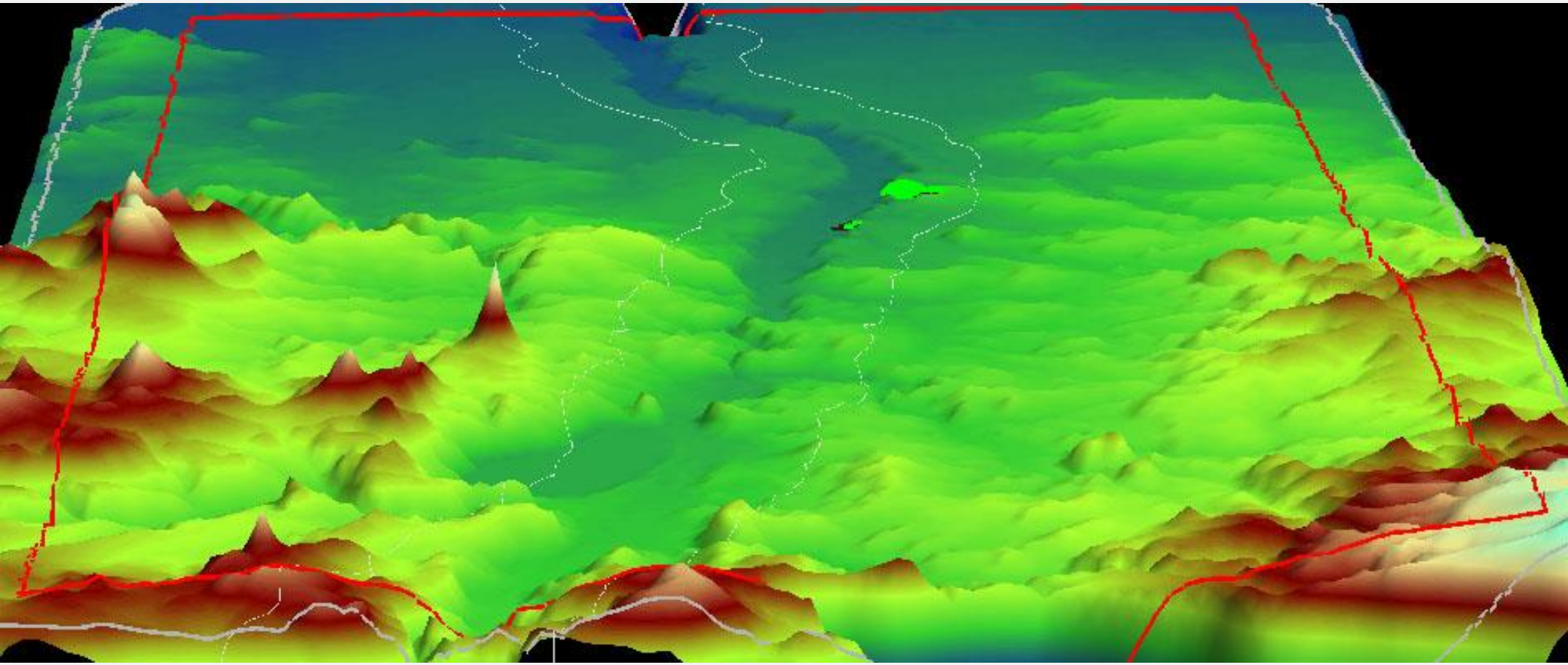
- A series of geothermal maps for the depths of 40, 70, 100 and 130 m
- A project website with embedded map browser

Project area:





3D numerical modelling with GOCAD software – first results



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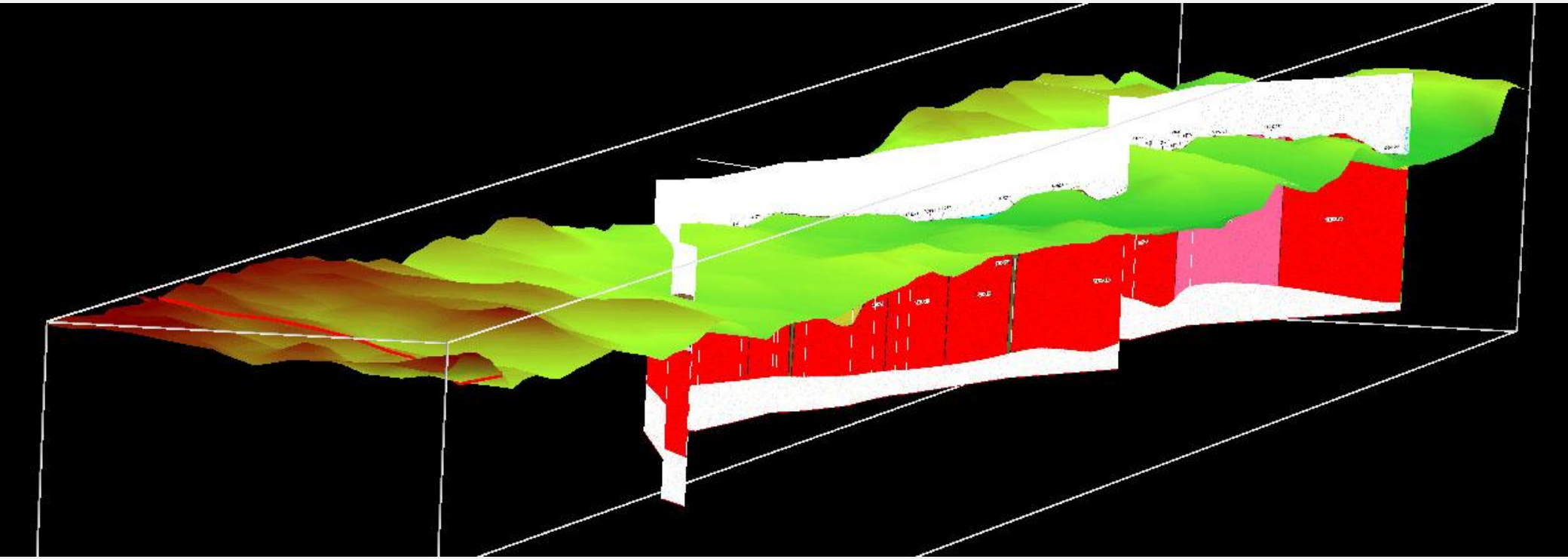

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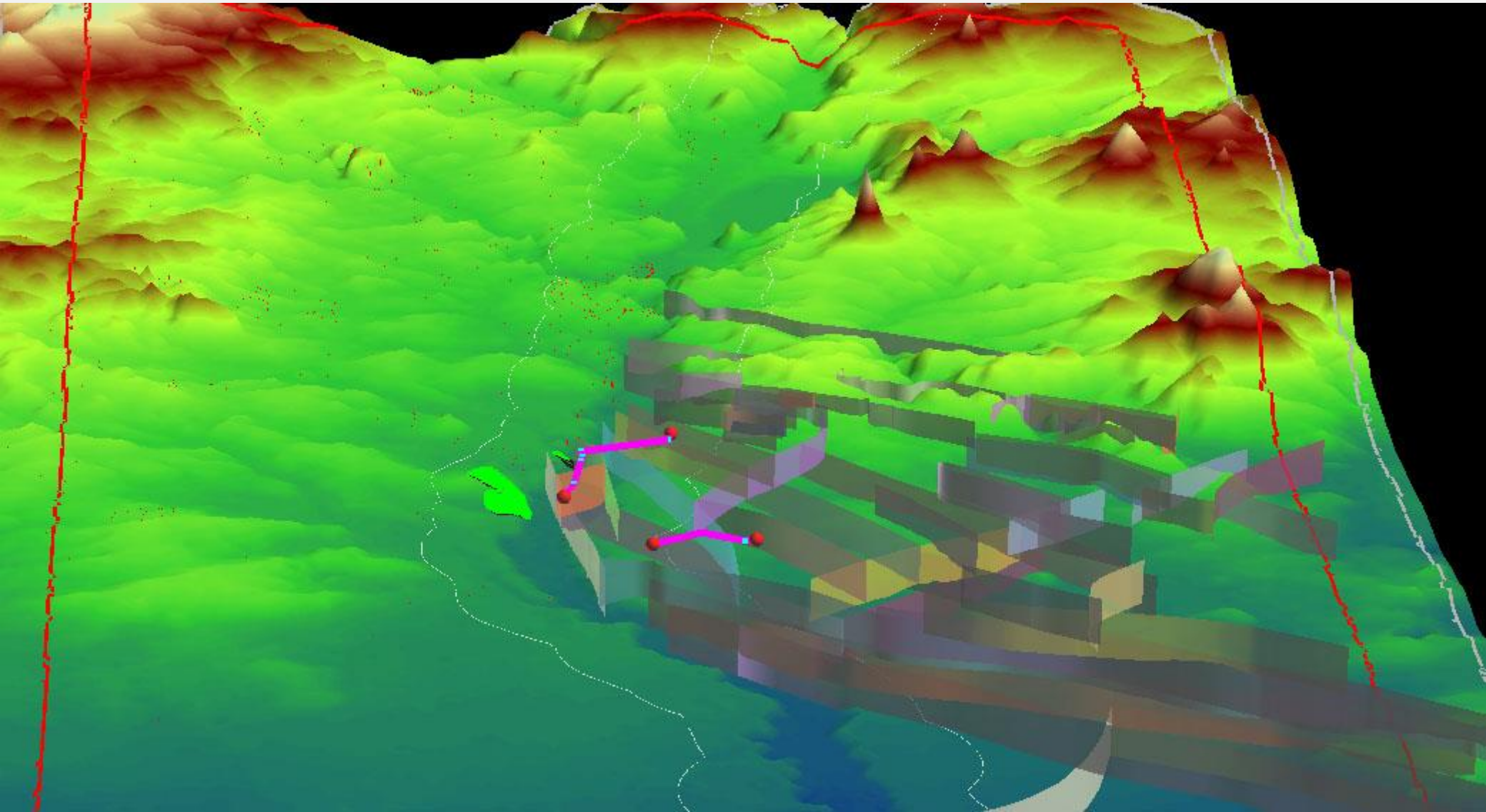

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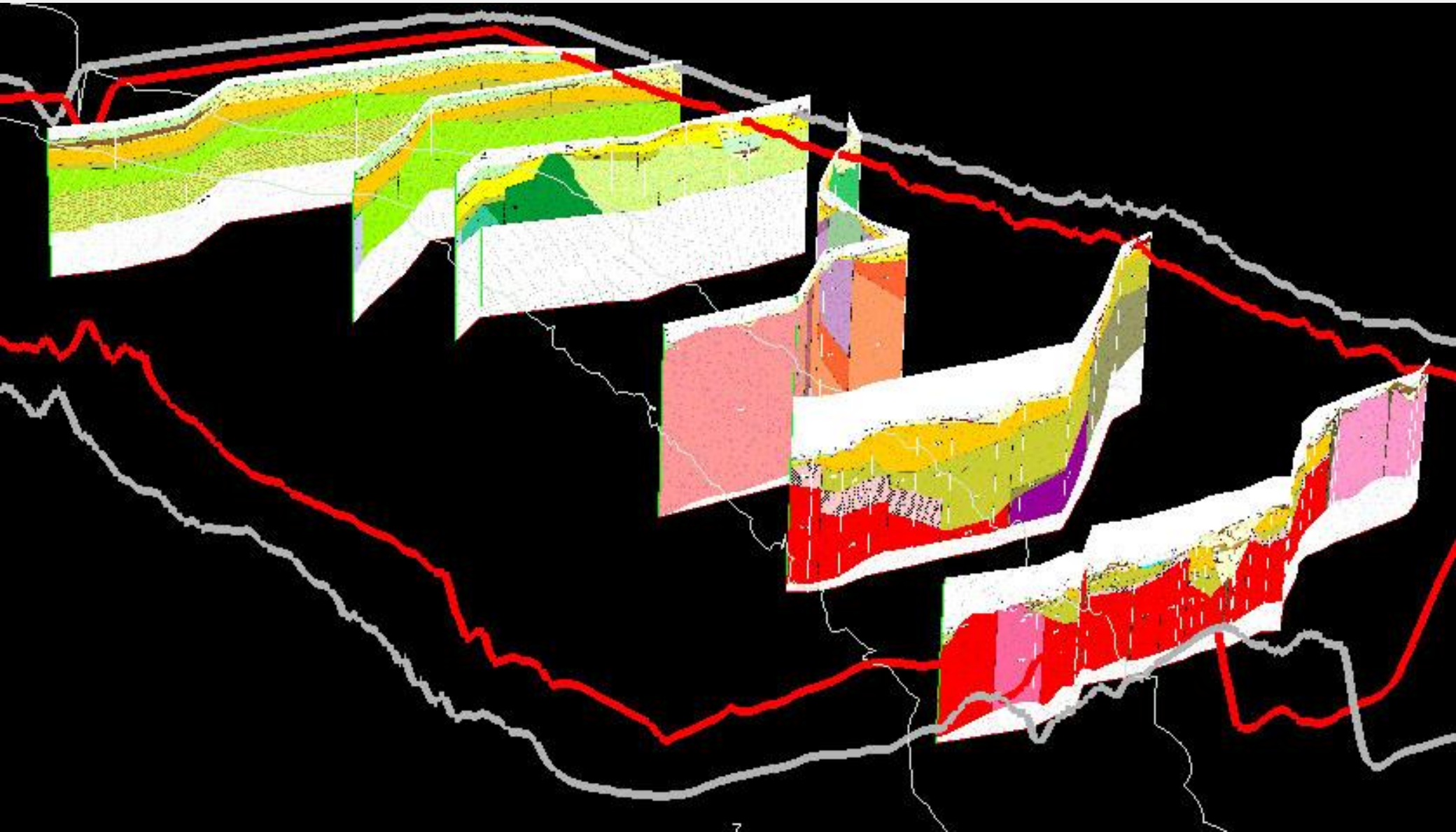

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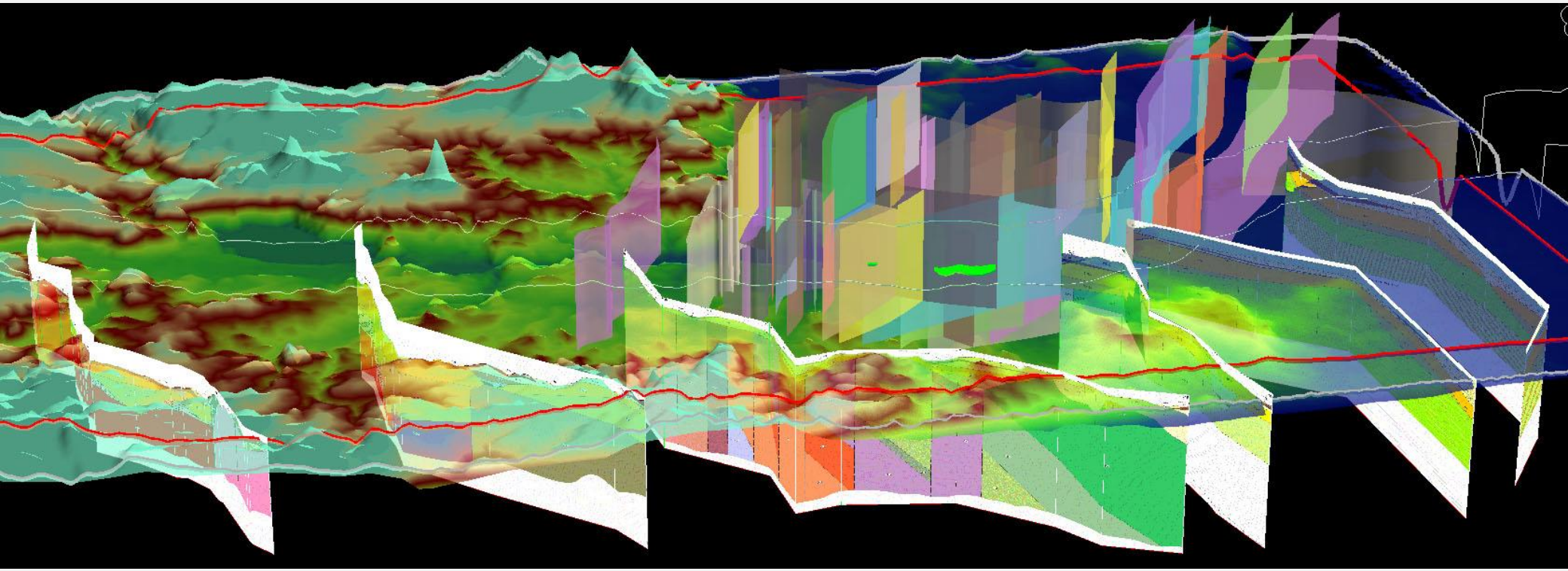

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Dissemination of the project results – selected activities:

- Project website: www.transgeotherm.eu
- Websites of the project partners: www.pgi.gov.pl and www.smul.sachsen.de/lfulg/
- Project flyer
- Press announcements
- Papers and posters
- Mid-term seminars including the study visits to the heat pump installations:
  - ✓04.06.2013, Zgorzelec, Miejski Dom Kultury
  - ✓24.09.2013, Görlitz, Senckenberg Museum
- Final seminar:
  - ✓06.2014, Görlitz, Senckenberg Museum

Thank you very much for your attention

Any questions?

Contact:

transgeotherm@pgi.gov.pl

www.transgeotherm.eu