The Potential for Geothermal Energy Development in Bulgaria & the Perspectives for the Sofia Region

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'The Future of Geothermal Projects in Bulgaria' Conference

Organiser: **Bulgarian Energy & Mining Forum**

Location & date: **NV Tower, Sofia - 12 May 2023**

Introducing the Bulgarian Association Geothermal Energy – 'BAGE'

- BAGE is a non-profit, non-governmental association, established in 2021 by 30 founding members, to bring together expert scientists, business & service-providers working in all parts of the geothermal energy sector
- BAGE is the only association in Bulgaria with a focus on the whole geothermal energy value-chain: from fundamental geoscience work and the evaluation of environmental and climate benefits, though to expert support for legal and financial assessments and the planning and procurement of specialised services & supplies for the construction of geothermal energy projects

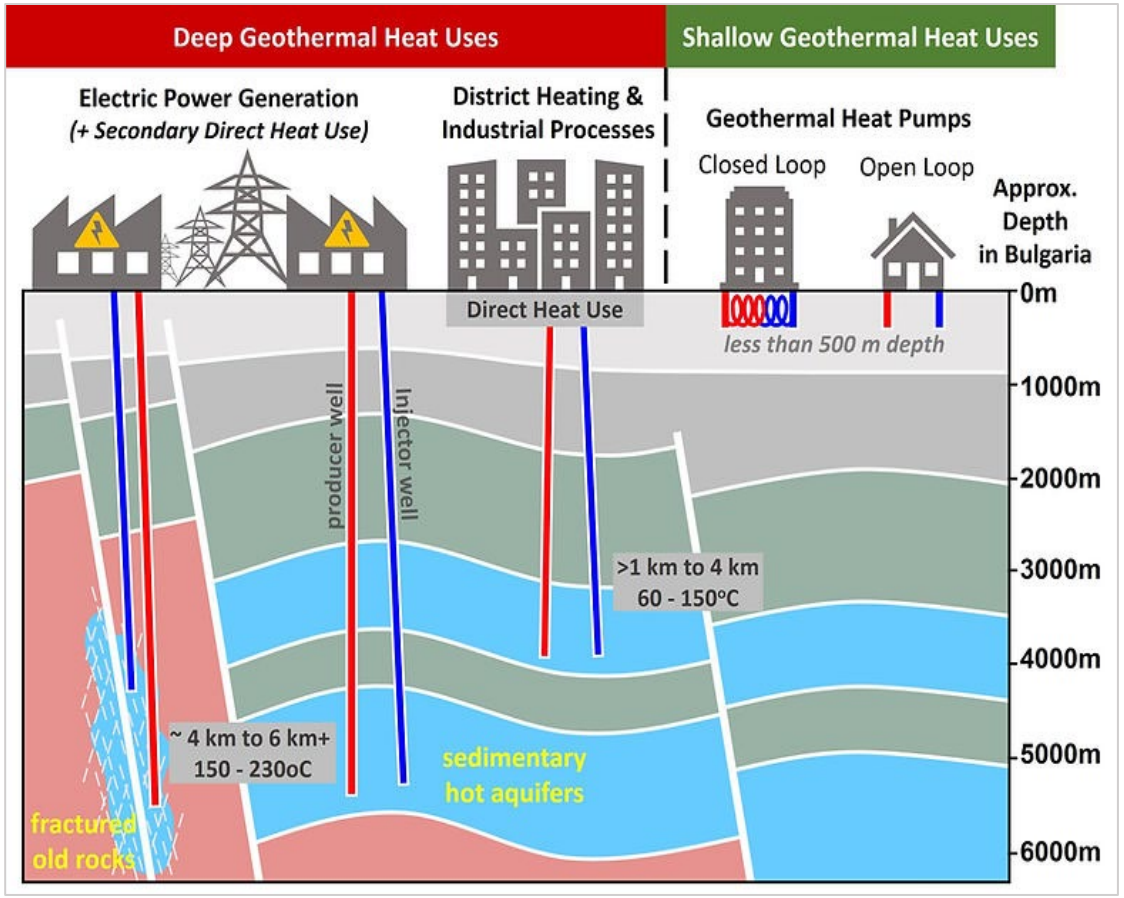
- The goal of BAGE, through the combined efforts of its members, is to motivate & support all stakeholders in the development of modern geothermal energy policies, innovations and practical solutions in Bulgaria, to accelerate the transition of the country to a sustainable energy future
- Since 2022, BAGE is a full member & partner of the European Geothermal Energy Council (EGEC) and the Geothermal Energy Alliance (GGA, IRENA), working together to accelerate growth in geothermal energy use in Bulgaria, Europe & beyond

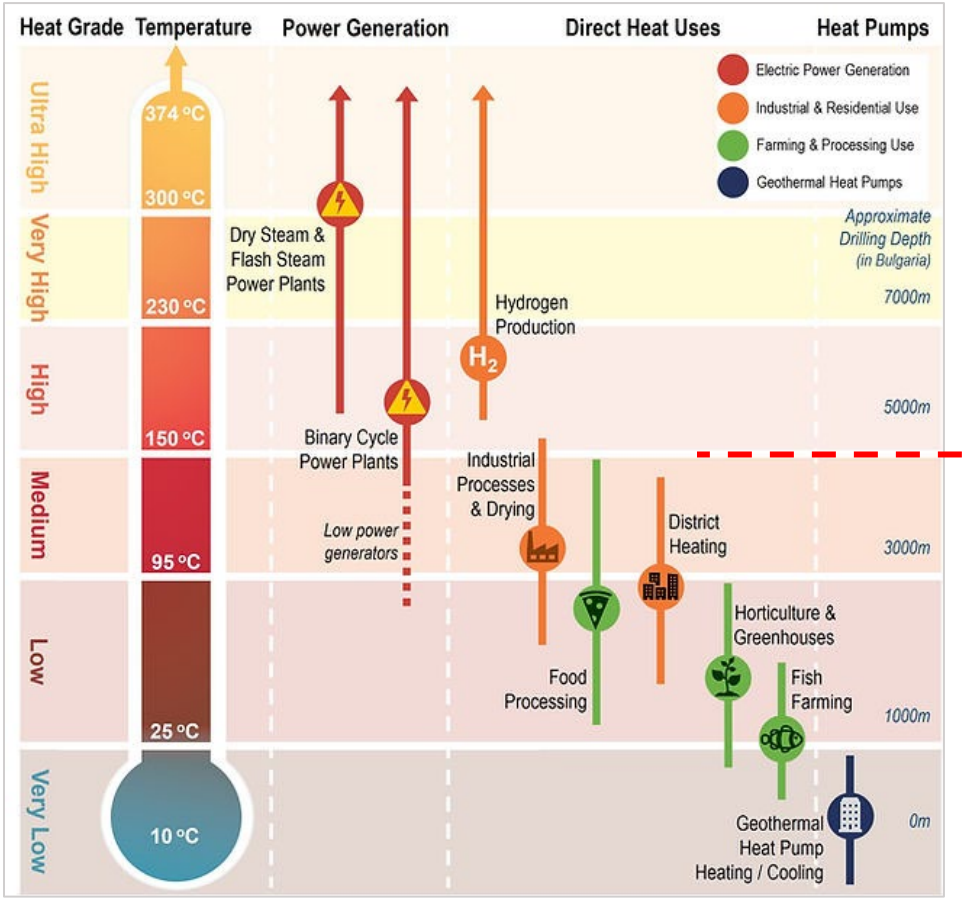
EGEC GEOTHERMAL

GLOBAL GEOTHERMAL ALLIANCE

IRENA
International Renewable Energy Agency

Types of Geothermal Energy in Bulgaria Uses, Temperature & Depth





Higher Temperature

Clean Base-Load Electrical Power Generation Use & Direct Heat Uses

Depth >3-4000m

150 °C

Lower Temperature

Energy Efficiency

Direct heat use
- Industrial processes
- **District heating**

Geo-heat pumps for homes (“GSHP’s”)

Depth 2m to <4000m

Many types & uses of Geothermal Energy - two main groups:

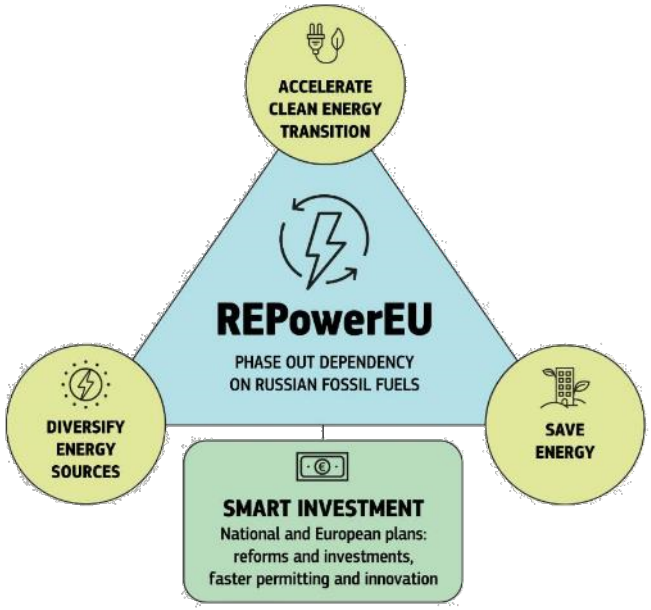
1. Shallow Geothermal Energy < 200m depth – lower temperature ‘direct-heat-use’ utilising **Heat Pumps** (GSHP’s) for homes, business-parks & municipality buildings **heating & cooling**

2. Deep Geothermal Energy >200m depth – direct heat use (up to 150 °C) utilising **industrial-scale heat pumps** for **industry and district heating**; Power Gerneration of electricity (above > 150 °C) + secondary uses of direct-heat

<u>To maxmise geothermal development - All types require their own specific legislation, assessment methodologies & financial instruments</u>

EU Preparing New Strategies to Increase the Utilization & Development of Geothermal Energy

- A major part of the EU's strategic net-zero technology act aims for the **greater use of geothermal energy for power generation and heat pumps** for heating and cooling
- **EU industry** alone accounts for **25% of all consumption of heating & cooling energy**, of which **91%** is **currently provided by fossil fuels**. Yet 50% of this heating + cooling energy is for 'low-temperature' needs (< 200 °C) that could be met by cost-effective renewable technology alternatives that utilise industrial-scale heat pump and other geothermal energy technology solutions that already exist
- **The technologies that utilize geothermal energy are already established and advanced.** In 2021 installed capacity of deep geothermal energy power plants producing electricity reached 14.4 GW. Whilst **REPowerEU forecast** by 2026 around 20 million new heat pumps should be installed across the EU, and by 2030 this number will reach nearly 60 million



- **However, growth in geothermal energy usage within the EU is still lags below global trends.** This is mostly due to three 'barriers' to projects:
  1. Slow, overly complex, or NO suitable legal framework in many EU countries for deep and/or shallow geothermal energy use
  2. Limited reliable subsurface information to quantify geothermal potential and assess risks to justify commercial investments
  3. Insufficient tailored financial instruments to provide financing during supportfor the high up-front development costs
- **EC preparing a new European Strategy** to reduce these barriers to development and promote greater use of heat pumps and other geothermal systems **to be ready by the end of 2023**
- **This strategy will provide geothermal energy with an huge potential for growth in Bulgaria and across the EU in the coming years**

Deep Geothermal Energy Potential for Power Generation & Heat

Territory of Bulgaria is ~111,000 km^2 >50% of this area has geothermal energy potential for heat & power

The geology of the country can be split into two provinces:

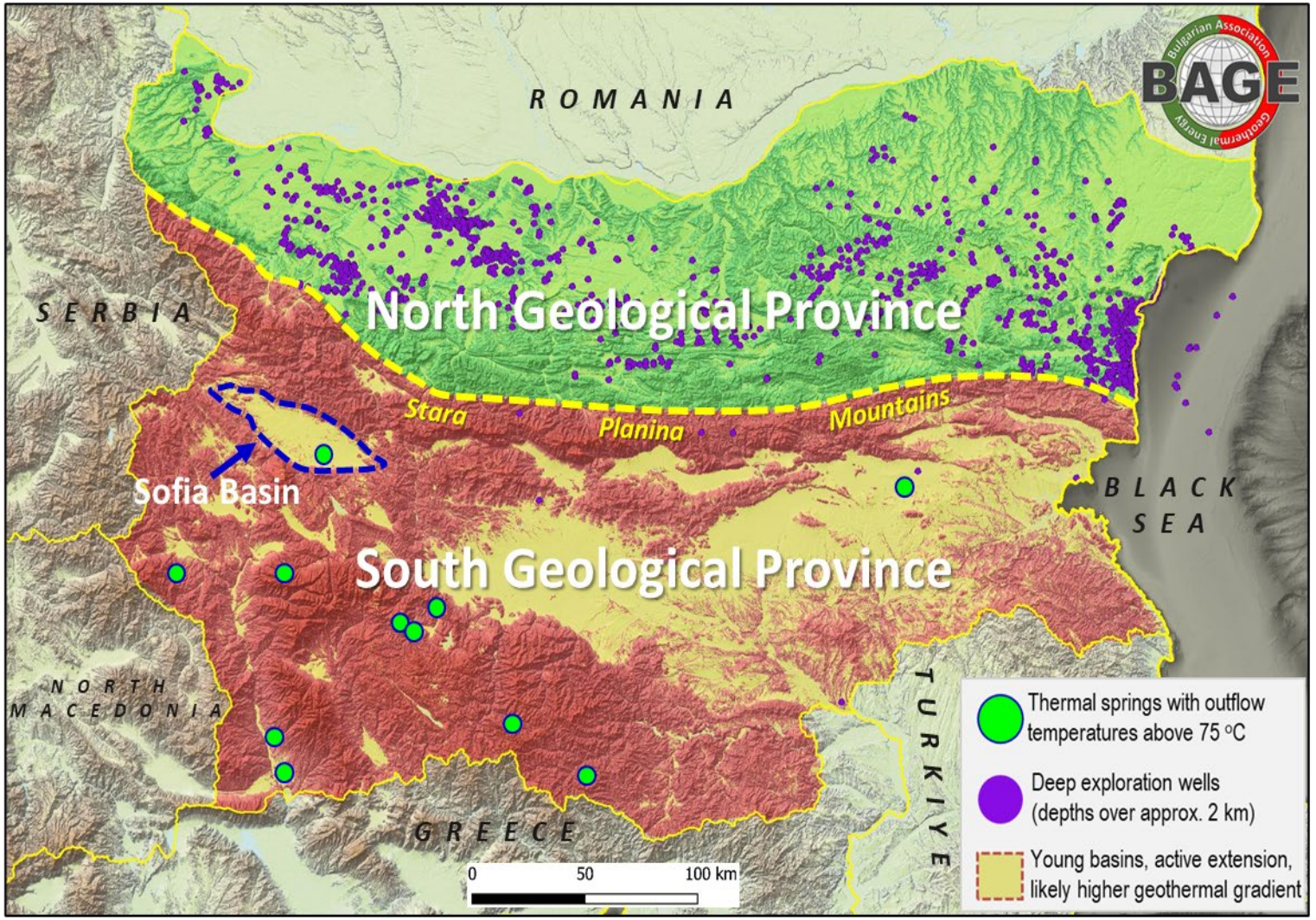
1. North Province "hot sedimentary aquifers"

- Geothermal gradient +30^{0}C to 40^{0}C /km
- +150^{0}C from >4000 - 5000m depth
- Proven Mesozoic reservoirs with high flow rates down at all target depths
- Big and accessible database of seismic and wells

2. South Province, 'Actice rift-basin terrain'

- Geothermal gradient +35^{0}C to ?99^{0}C /km
- Common surface hot-springs with outflow temperatures of 40^{0}C to >100^{0}C
- Shallow Tertiary and Mesozoic reservoirs proven, but deeper reservoir potential un-tested
- Limited subsurface database, very few wells drilled deeper than 1000m

Almost the whole of Bulgaria is potentially highly prospective for geothermal energy - exploration is more advanced in the North but shallower, higher temperature target may also be widespread in the South



Bulgaria Has Country-wide Opportunities for Growth of All Types of Geothermal Energy

1. Shallow Ground Sourced Heat Pumps use for Heating and Cooling:

Shallow geothermal resources may also be exploited across Bulgaria

Ground Sourced Heat Pumps could be installed in most existing buildings (up to 3.9 million) and all new building buildings to improve efficiency – (COP 3 to 7)

2. Shallow Direct Heat Use for District Heating + other industrial/agricultural uses:

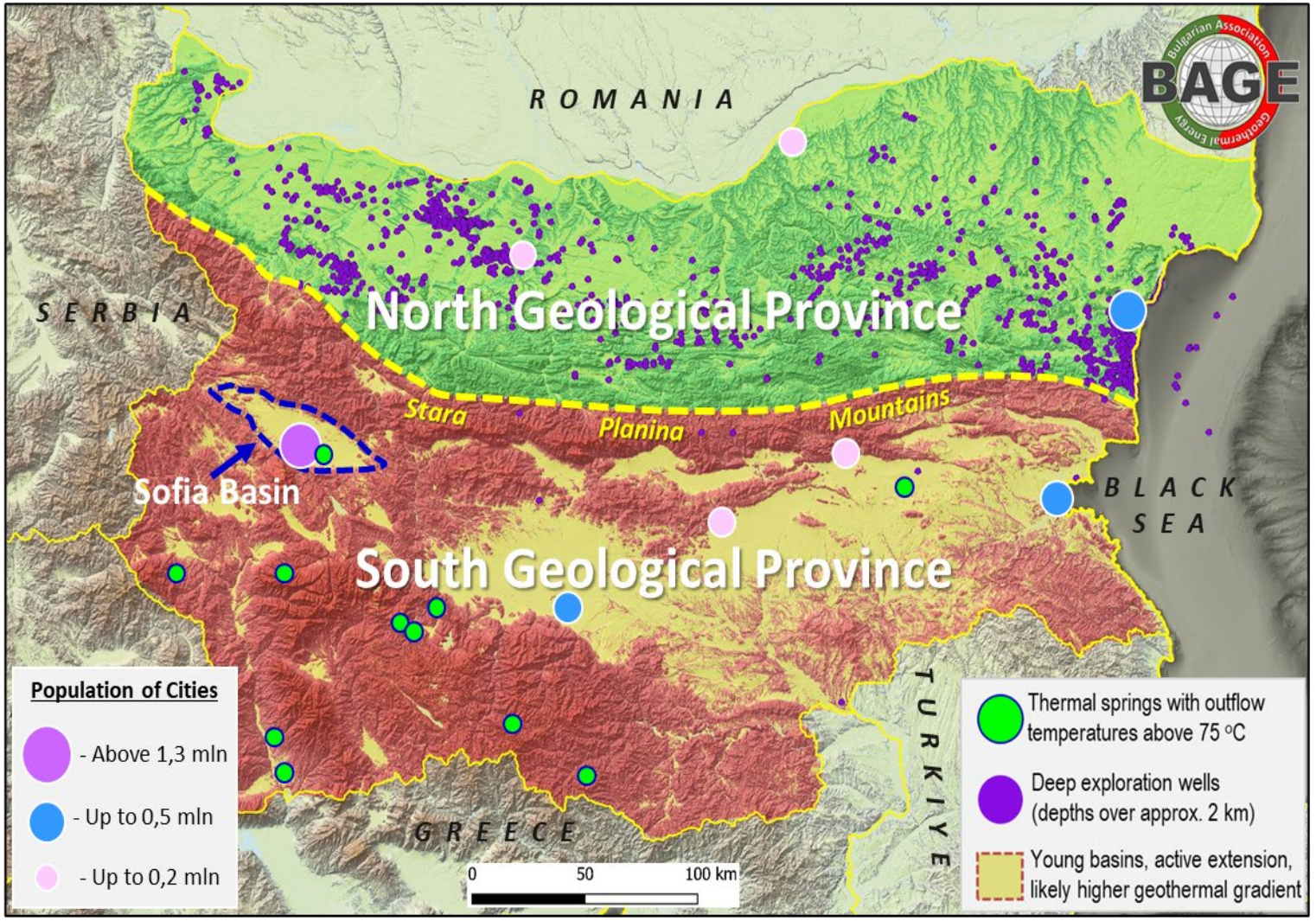
North & South: proven temperatures +30 to + 60^{0}C can be found at depths of 500m to 1000m

Multiple opportunities to use direct heat **for large scale district heating projects in most cities could** service more than 2,500,000 customers – by both conversion of existing networks & new hub creation

3. Deep Power Generation:

North: + 150^{0}C from c. 4000m to 6000m, with proven reservoir potential at those depths

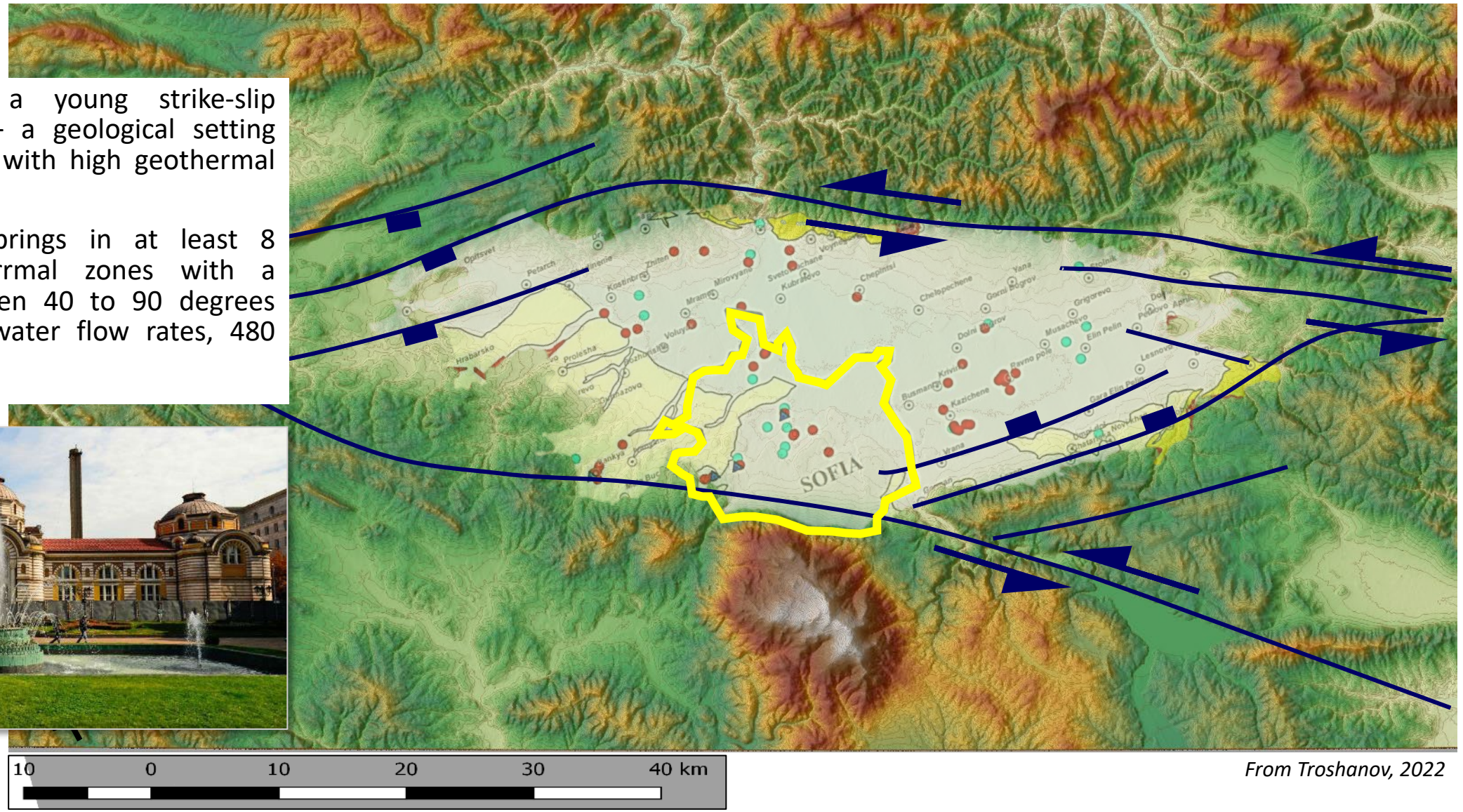
South: possible +150^{0}C from c. 3000m, or less if very high deeper geothernal gradients are confirmed to be present in the young basins



Perspectives For the Sofia Region: Geological Setting of the Sofia Graben

Sofia Graben is a young strike-slip extensional basin – a geological setting typically associated with high geothermal temperatures

42 hot mineral springs in at least 8 different hydrotherrmal zones with a temperature between 40 to 90 degrees Celsius. And high water flow rates, 480 liters per second.



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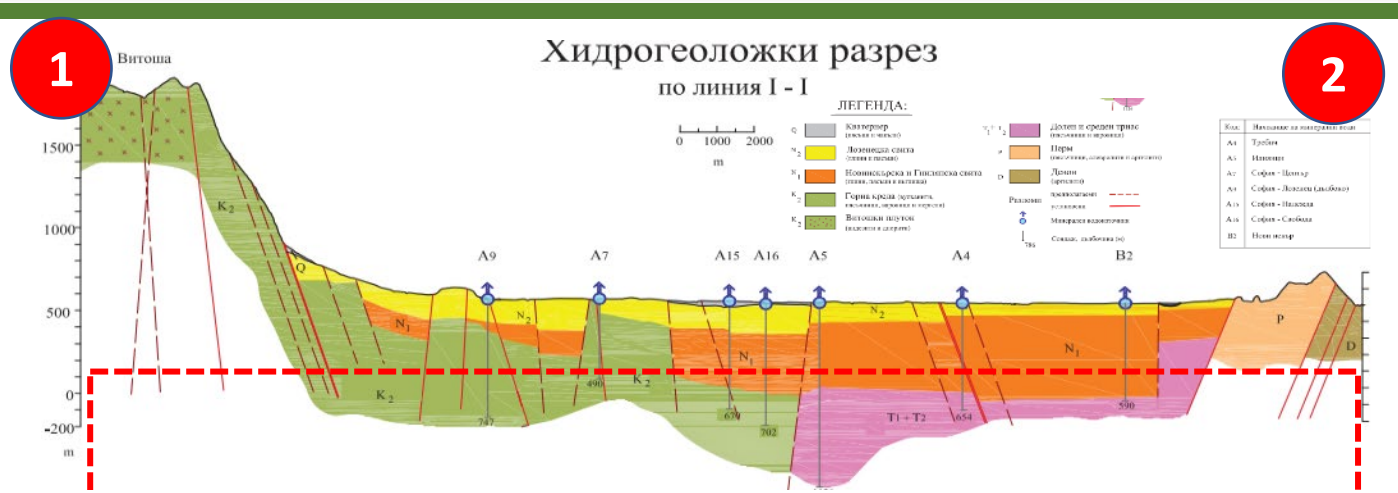
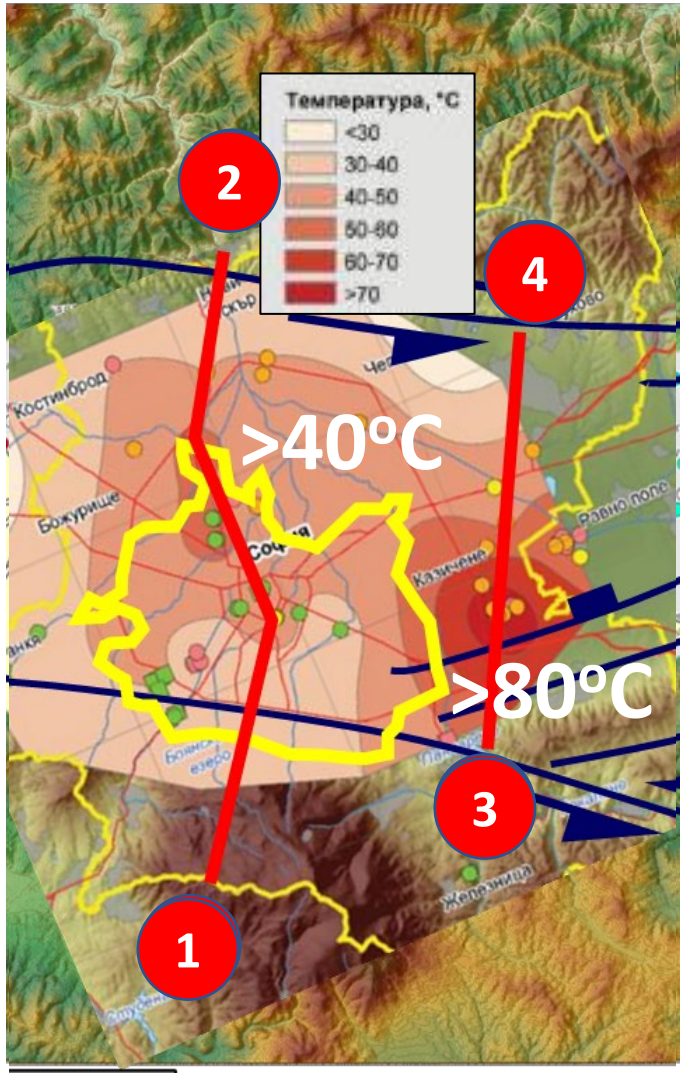
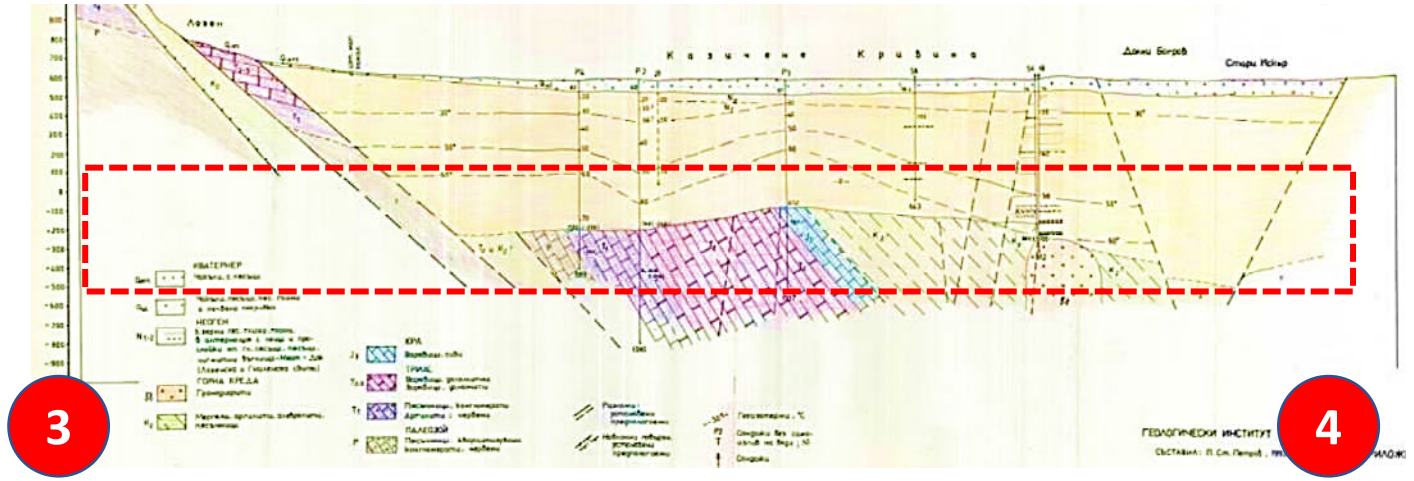
Perspectives For the Sofia Region: Shall Resources For Direct Heat Uses





- **Shallow geothermal resources widespread across Sofia Region at depths of 500m and 1000m**
- **<u>Temperatures of 40°C to >80°C are recorded</u>**
- **Sofia Region has high potential to use thse resources for large-scale district heating & industry**



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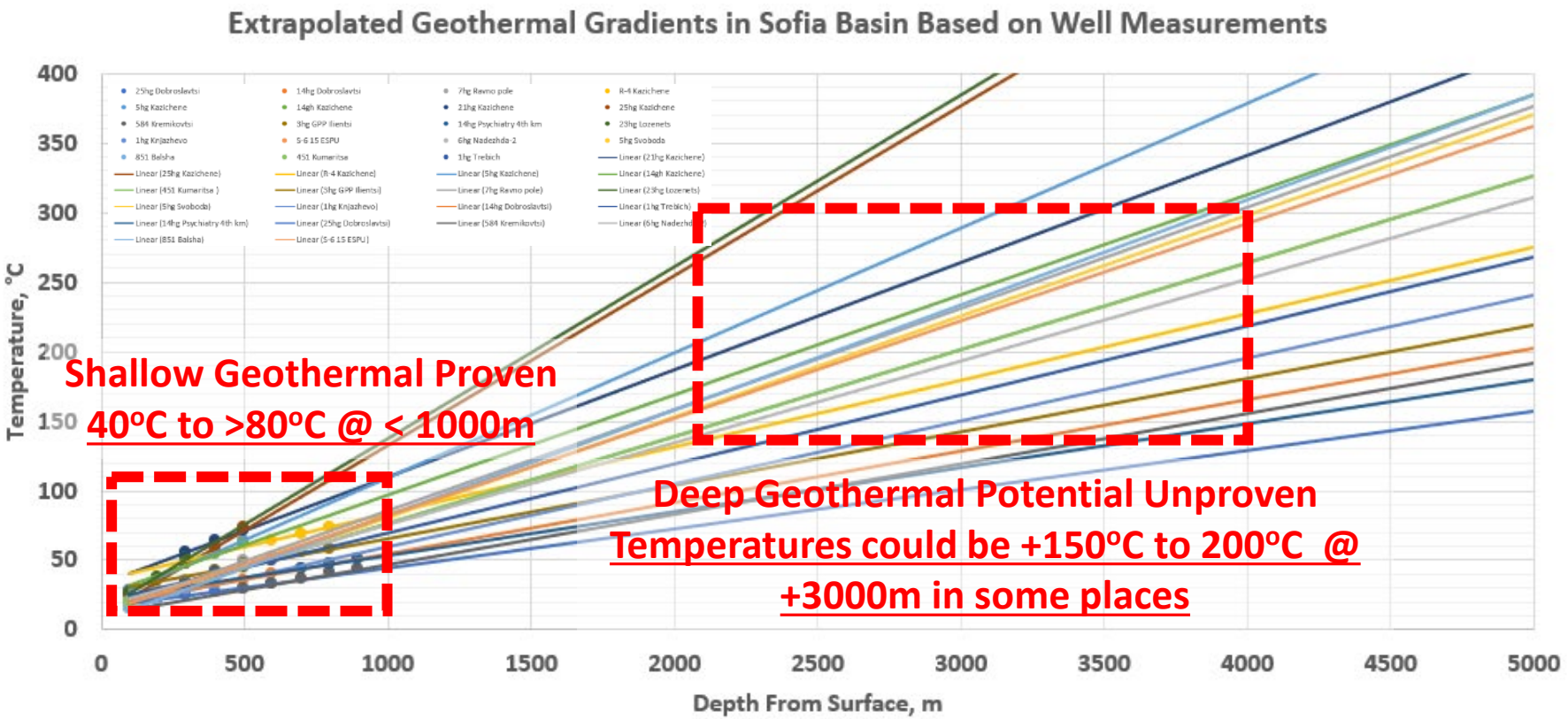
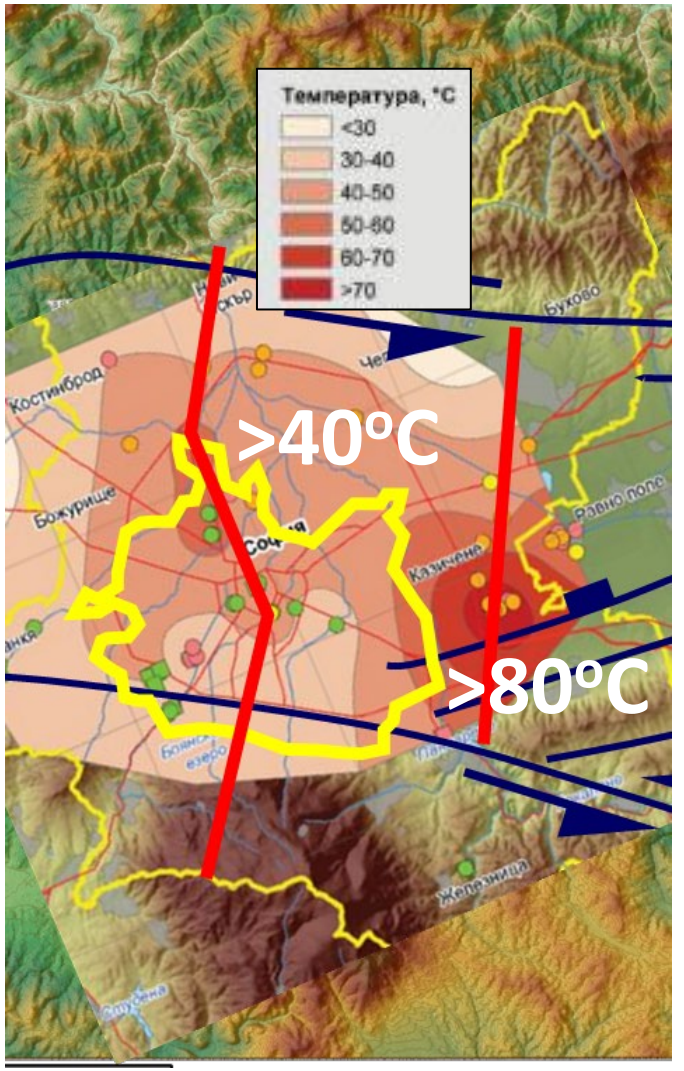
Perspectives For the Sofia Region: Geothermal Gradients infer More Potential





- **Shallow geothermal resources** widespread across Sofia Region at depths of 500m and 1000m Temperatures of 40°C to >80°C are recorded
- **Deep geothermal potential** still unproven by drilling., but data suggest temperatures could exceed 150oC at depth of more than c. 3000m
- **Sofia Region has high proven geothermal potential for large-scale direct heat uses and could have additional significant potential Power generation if un-explored deep basin is 'hot'**

From Troshanov, 2022

BAGE Working to Accelerate Geothermal Energy Development in Bulgaria

BAGE 2023 priorities and targets for the Geothermal Energy – '**addressing barriers to geothermal development**' :

1. **Changes to the legislation of the Republic of Bulgaria** – comprehensive recommendations to integrate shallow and deep geothermal energy into the existing regulations for exploration and energy production - to fully open the door in Bulgaria for the licensing and long-term development of these resources

   - ***Target for completion and recommendations – end-Q2 2023***
   - *Legal definition of geothermal energy for the Law for Renewable Energy Source* ***adopted by the 48th National Assembly on January 12, 2023 and promulgated on January 27, 2023:***

2. **Creation of an up-to-date Geological 'Atlas' and models for the geothermal energy potential of the Republic of Bulgaria** – collating all valuable historic data & with new analyses to identify the most attractive areas for the viable use of geothermal resources across Bulgariaf for power generation, direct-heat-use and heat-pump technologies

   - ***Target for establishing research cluster and beginning work – Q3/Q4 2023***

2. **Continual work with existing and new members, partner organisations and state institutions and all stake holders to raise awareness and accelerate the growth of Bulgaria's geothermal energy resources** – the creation of events and other opportunities to establish and maintain ongoing dialogue between all groups with interests in developing Bulgaria's geothermal energy potential

Bulgaria has both the potential and the opportunity to be at the fore-front of geothermal energy develop in Bulgaria, Europe and beyond

Thank you for your attention!

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