



Budapest Geothermal Energy Summit:

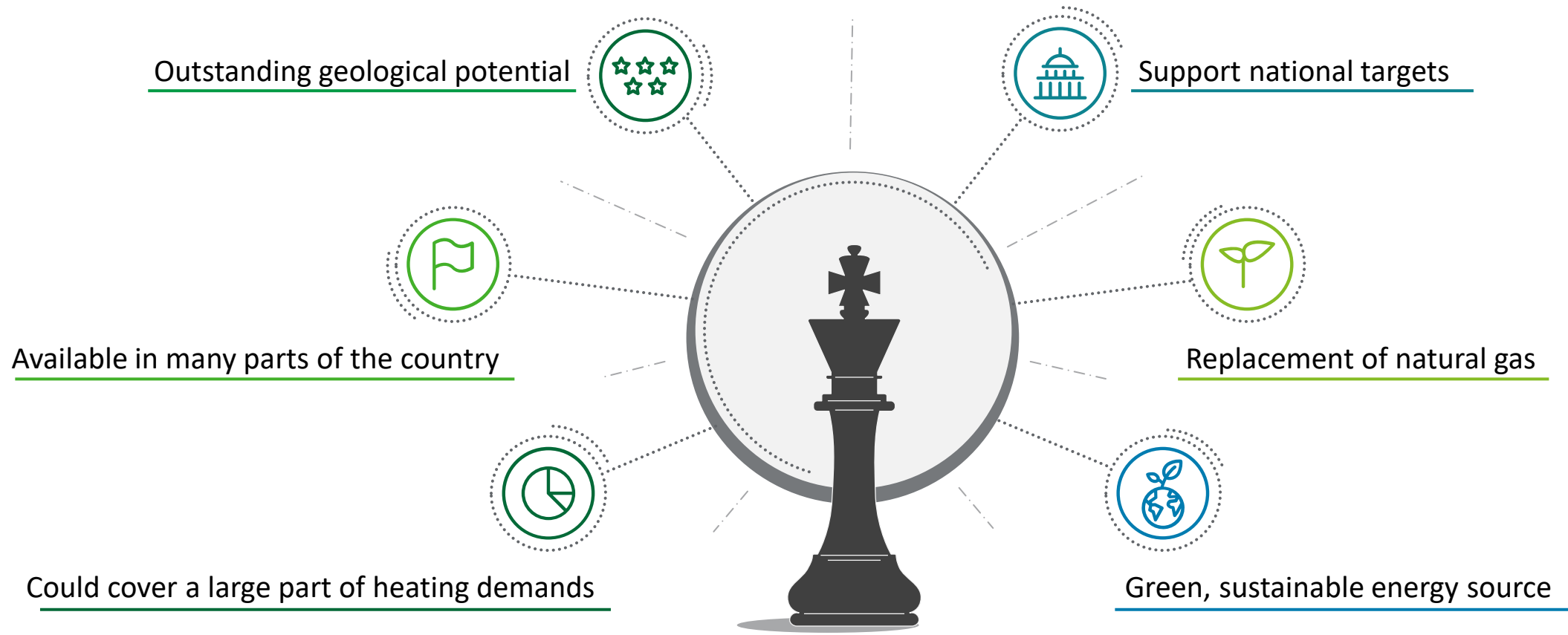
Geothermal opportunities in district and industrial heating in Hungary

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The importance of using geothermal energy

Geothermal developments can contribute meeting national energy targets and some of residential heat demand at a higher level as well as serving industrial energy interests








The potential use of geothermal energy in Hungary

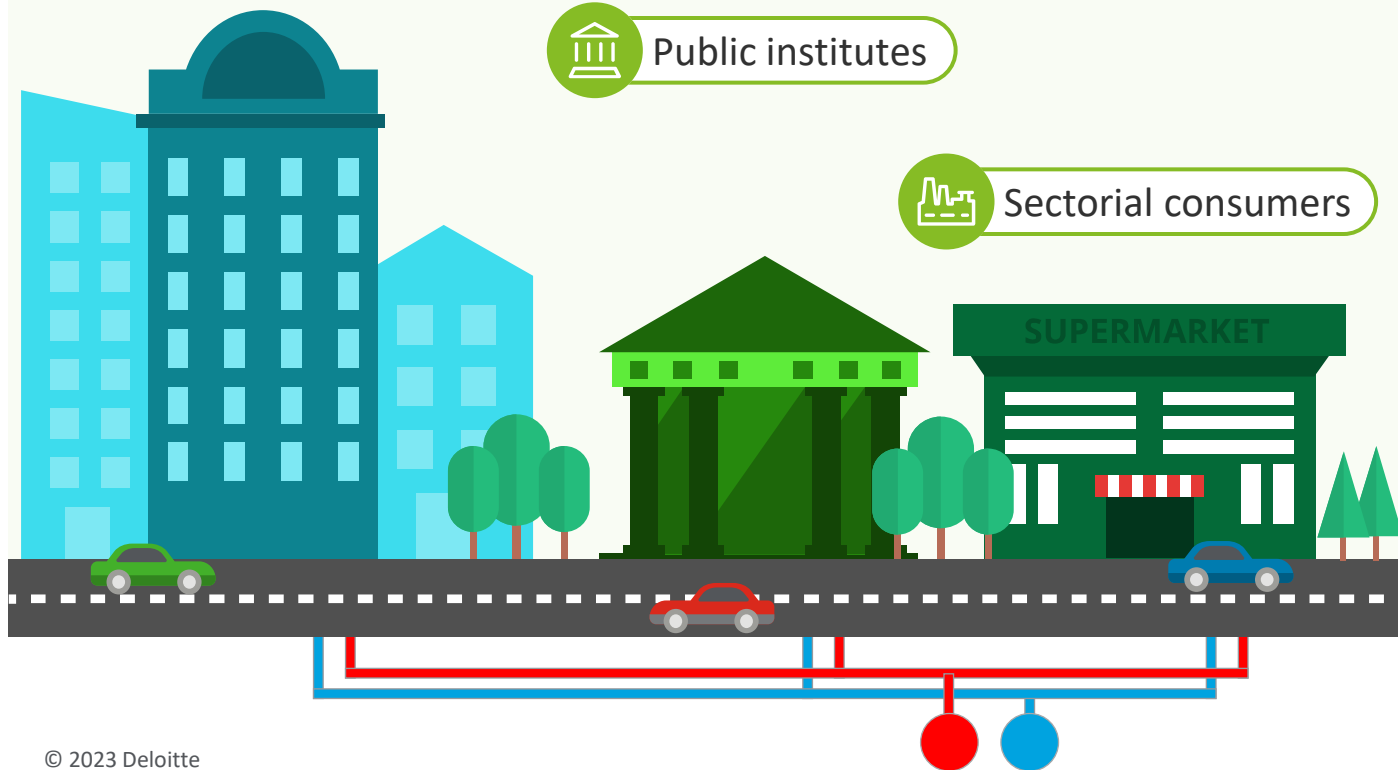
The distribution of geothermal energy for heating purposes can generally be divided into two groups, regulated district heating and individually targeted usage

District heating


 Household consumers

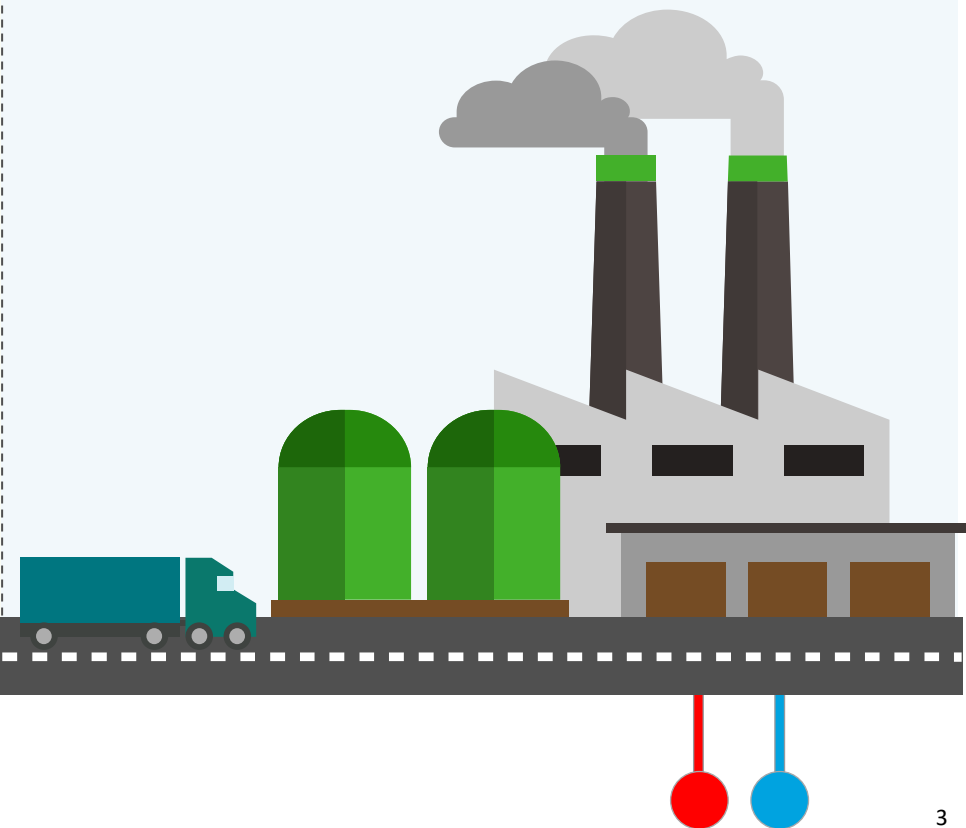
 Public institutes

 Sectorial consumers



Specific/targeted usage

 Industrial / Commercial areas





Overview of the Hungarian district heating system 1/2






The Hungarian district heating system supplies 17% of the country's households with heat and hot water

Towns supplied with district heating



Source: HEPURA: Data of the Hungarian district heating sector 2021

The Hungarian district heating system provides

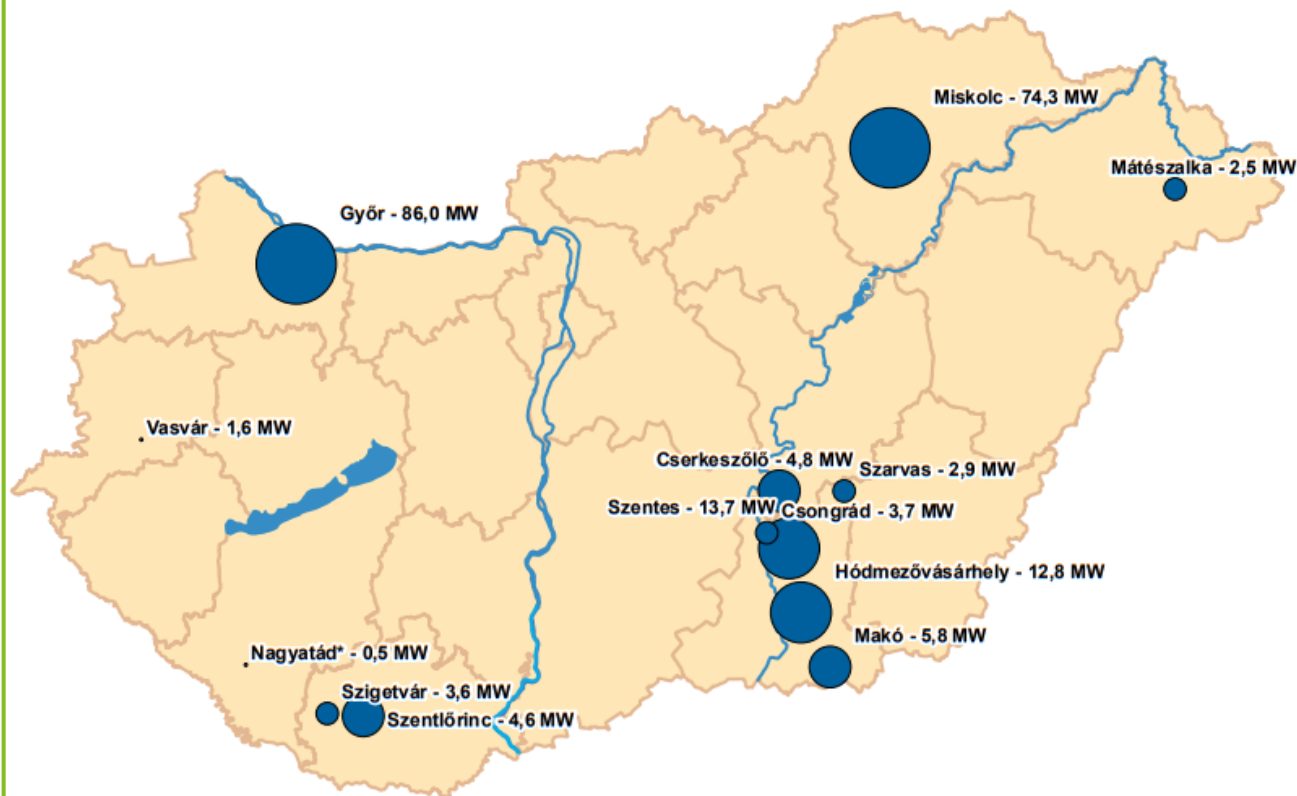
-  90 towns
-  700 000 households
-  (about 17% of the total households)
-  highly Budapest-centric
-  also concentrated in major towns



Overview of the Hungarian district heating system 2/2

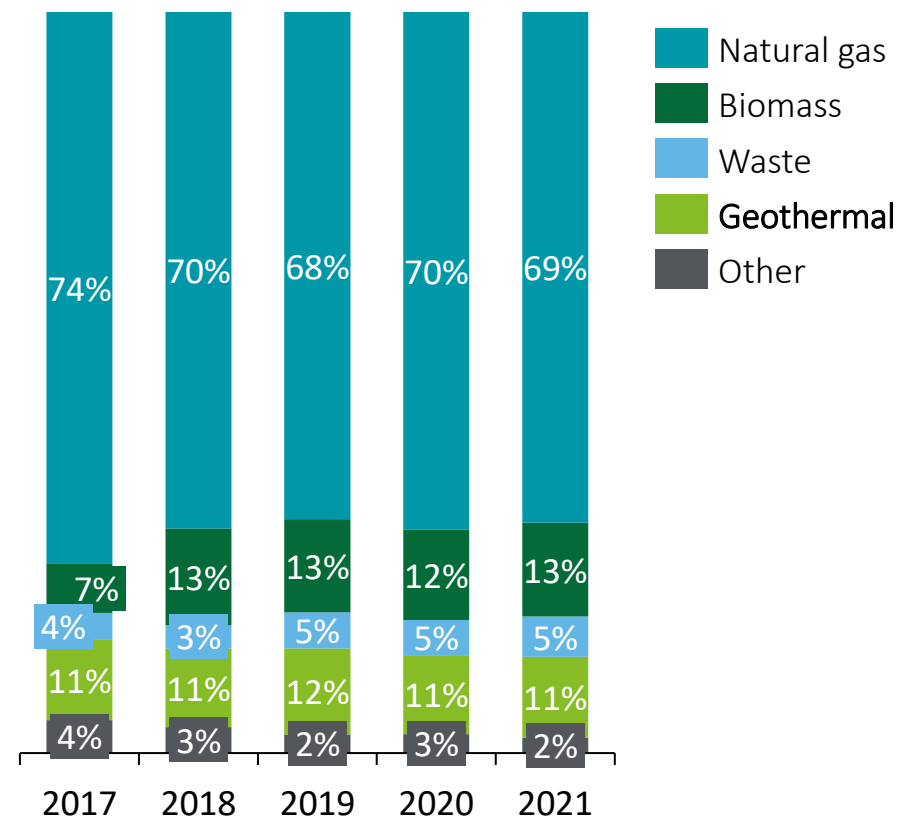
Domestic district heating production relies heavily on natural gas, but there are already good examples for geothermal solutions in district heating

Available heating capacity of geothermal heat producers by towns



Source: HEPURA: Data of the Hungarian district heating sector 2021

Share of energy sources used in heat production



Source: HEPURA: Data of the Hungarian district heating sector 2021



The advantages of district heating and geothermal district heating

The key advantages of geothermal heat generation are the low cost of heat production and the green and sustainable nature of the energy source

Advantages of the district heating



Community heating solution



Economies of scale



Easier to increase the share of renewables



Comfortable for residential use

Advantages of the geothermal district heating



Support national strategic targets



Weather independent



Low and predictable operating costs



Safe and predictable energy supply



Marketable expertise

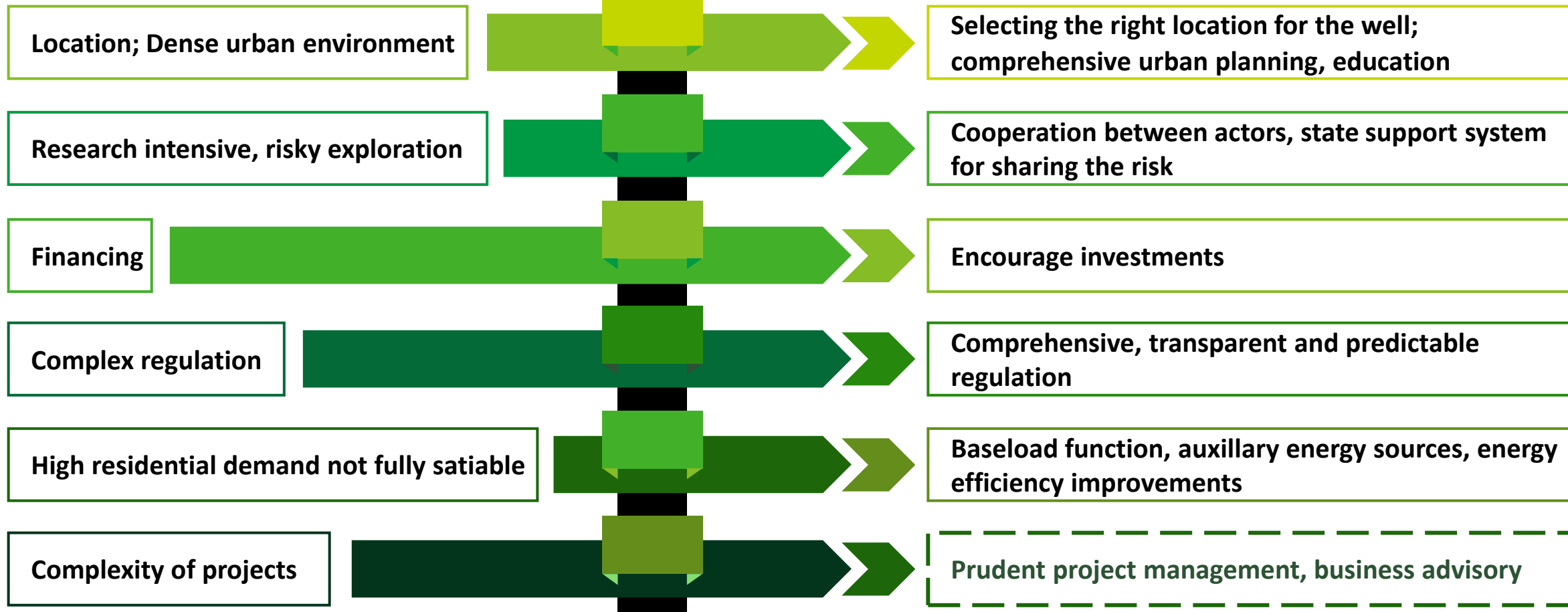


Challenges for geothermal district heating

The main challenge for district heating system is the complexity of development, but when in operation, operating costs of a geothermal power plant are extremely low, and long-term prices are competitive

Challenges

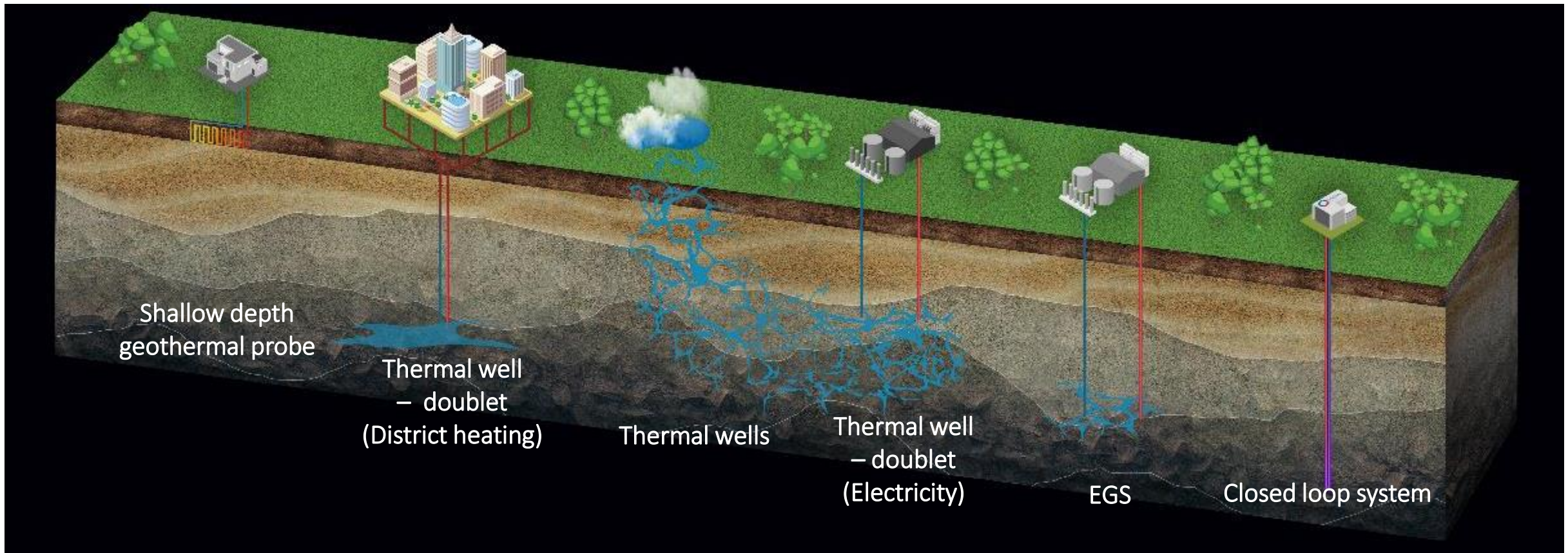
Mitigation





Targeted use of geothermal energy for industrial / commercial heating

Geothermal energy is not suitable for the production of technological heat, but it can be used to meet other industrial heating needs, with a choice of different solutions, coupled with optimal use



Source: MS Energy Solutions Kft.



The advantages of targeted geothermal industrial / commercial heating

Using geothermal energy for heating creates predictable and affordable costs and contributes to companies' green objectives

Advantages



Predictable heating costs



Security of energy supply



Meeting corporate ESG objectives



Several technologies are available



Less regulated than district heating

Challenges



Financing



Complex, risky exploration



Find the right technology solution



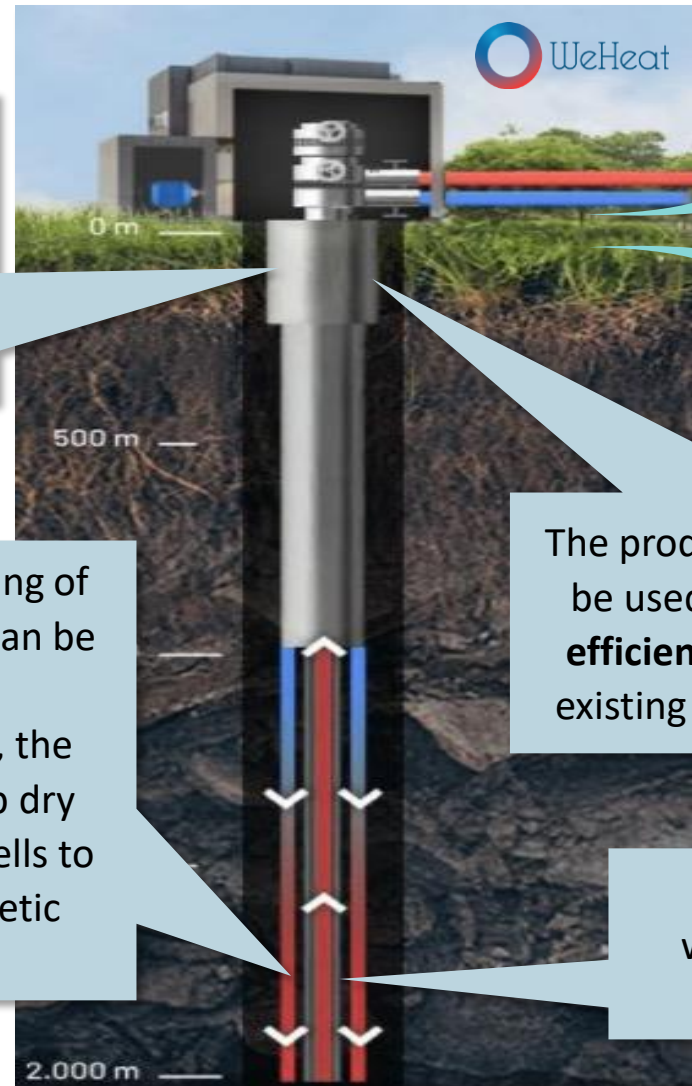
Technology fit for purpose



Closed loop system

The WeHEAT technology is a DEEP geothermal probe operated in a fully closed loop system, implemented in the wellbore structure of deep dry holes or specially designed new deep drills

300-900 kW automatic and programmable heating system with modern control, providing green energy without CO2 emissions



Heating of large buildings and industrial halls



Heating of sports facilities and residential parks



Greenhouse heating, agricultural heating

No need for expensive drilling of new wells, the technology can be installed in existing 1.5-2.5 km idle deep wells, the technology allows for deep dry holes and depleted deep wells to be reused again for energetic purposes.

The produced geothermal heat can be used for heating with a **>90% efficiency** and can be adapted to existing and new heating systems.

It is a **fully closed system** with normal water circulation and without extraction of the underground water.



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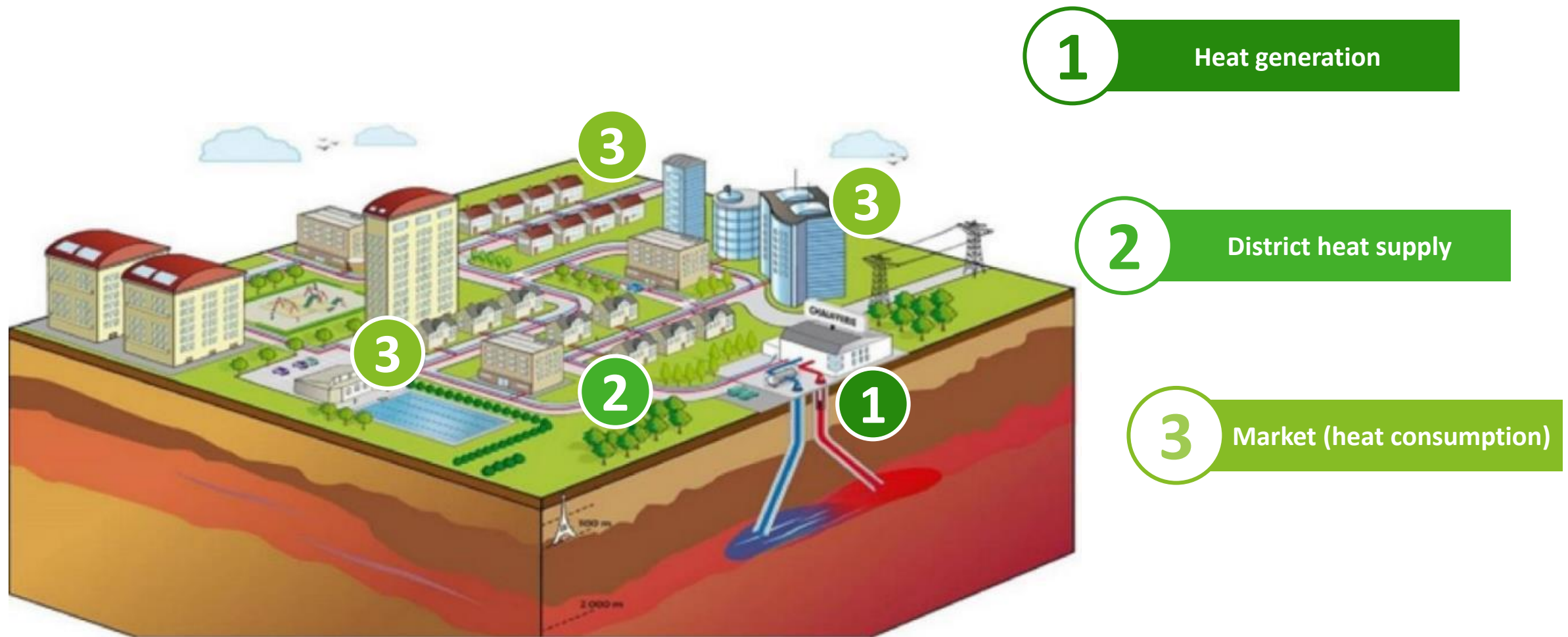
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Operating scheme of the geothermal district heating system

Location of production and consumption is key for geothermal district heating supply



Source: MS Energy Solutions Kft.

Technological options for the use of geothermal energy for heating

| <u>Technology</u> | Conventional geothermal system (shallow geothermal, thermal water utilization) | | Enhanced Geothermal System (EGS) | Closed loop heat circulating system |
|--|---|--------------------------------------|---|---|
| <u>Factors</u> | | | | |
| Unit cost - CAPEX (USD/kW) | 1 500 – 2 400 USD/kW (existing well) | 4 000 – 4 500 USD/kW (new drills) | 1 500 – 4 500 USD/kW (new drills) | 700 – 1 000 USD/kW (per existing wellbore)* |
| System deployment lead time w/o licensing | < 1 year (6-12 months) | > 1 year (18-24 months) | > 1 year (1-3 years) | < 1 month (3-7 days) |
| OPEX (USD/annum) | Moderate (3 500 – 17 000 USD) | | Significant (35 000 – 70 000 USD) | Minimal (150– 200 USD) |
| Environmental impact | Significant (drilling, water extraction, -treatment, - injection) | | Moderate (deep drilling, hydraulic fracking, filling and treatment, closed loop) | None (no drilling, water extraction and usage of hazardous chemicals, closed loop) |
| Available heat output (MW) | Moderate (1,5 – 4 MW) | | High (10-15 MW) | Moderate (0,3 – 0,9 MW) |
| Administrative procedures, licensing | Mining inspectorate and other authorities | | Mining inspectorate and other authorities | Building permitting only |
| Utilization | Heating (heating and hot water) | | Electricity generation and heating | Heating (heating and hot water) |
| Geological risk (geological probability) | Low | Moderate | High | None |