GreenGas
capture the energy

Geothermal Energy Usage

Research and Business Activities

Green Gas DPB, a.s., Czech Republic, dpb@dpb.cz

Clean energy and climate change mitigation globally

April, 2020|

Company Profile:

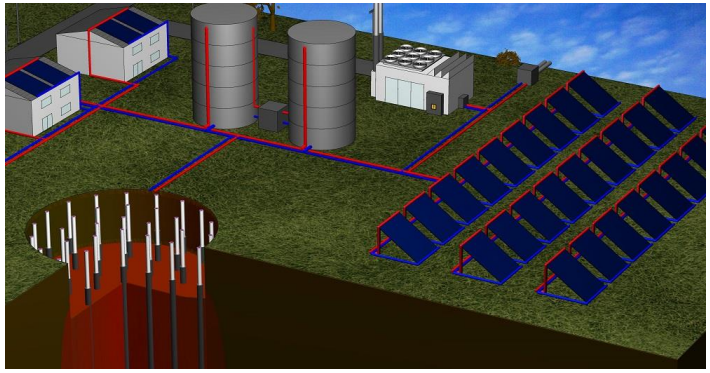
- Based in 1960 as the plant for dewatering and gas drainage of hard coal mines in USCB.
- At present 270 employees.
- Annual revenue 1000 MM CZK (38 MM EURO).
- Since 2008 DPB is the part of Green Gas International B.V.
- Business activities – gas exploitation, energy/heat production, drilling, engineering Services.

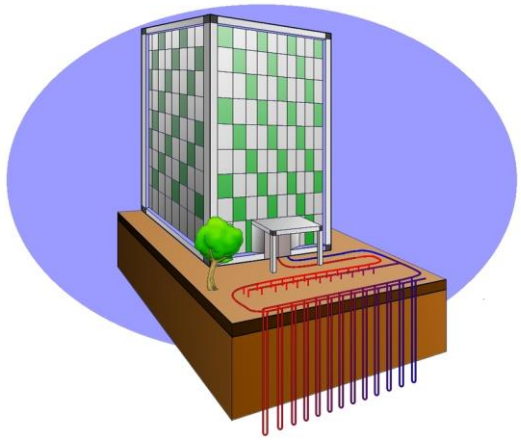
Green Gas DPB, a.s.

Two company´s directions of activities in the field of shallow geothermal energy:

A) Research on utilization of borehole thermal energy storage (BTES)

B) Drilling and installations of ground/water geothermal heat pumps (GHPs)



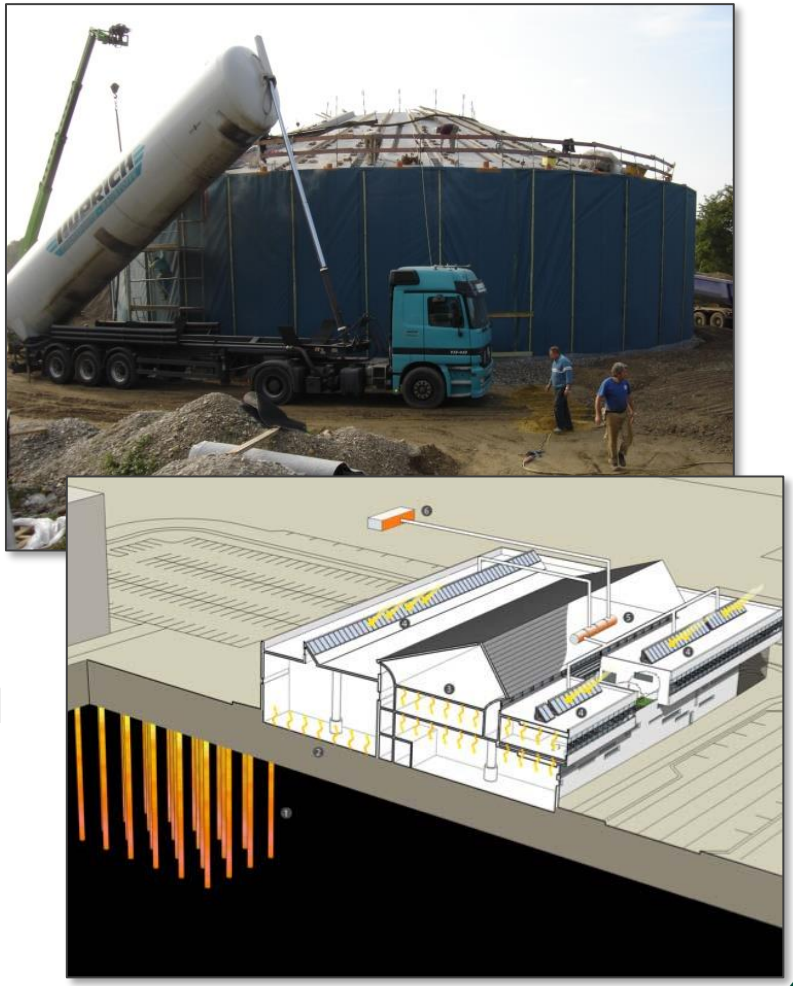


A) Research on borehole thermal energy storage (BTES)

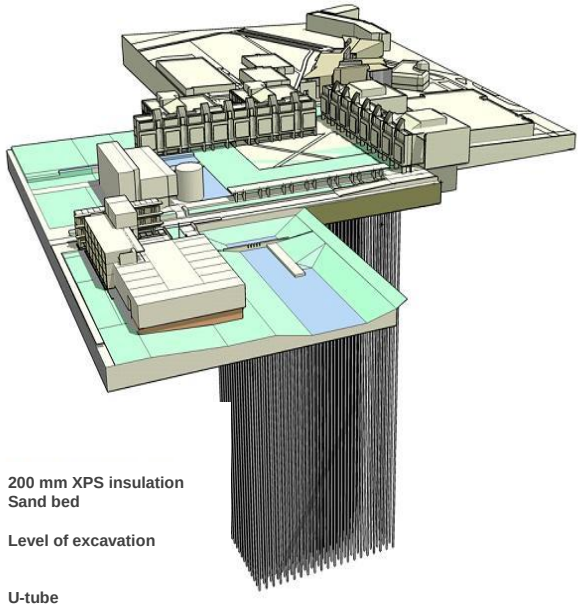
Types of BTES:

- According to temperature
  - Low-temperature, from 20 – 25° C
  - High-temperature, up to 80° C
- According to transfer fluid
  - Water
  - Civil constructions
  - Rock massif
- According to BTES placing in the field
  - Above-ground
  - Underground

(our priorities underscored)

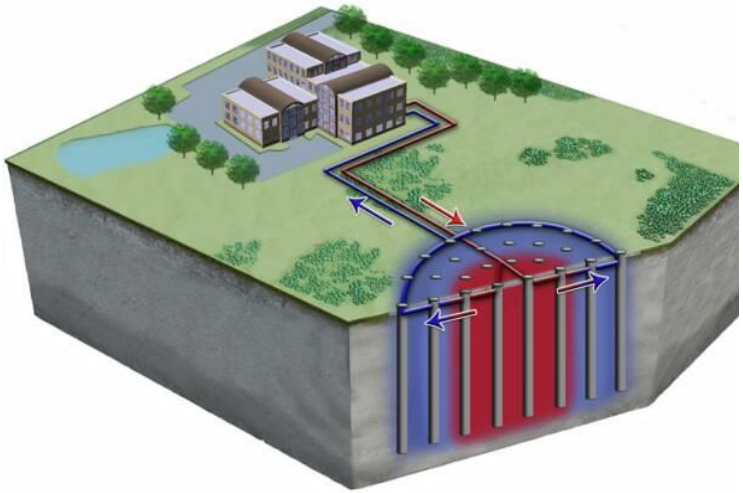


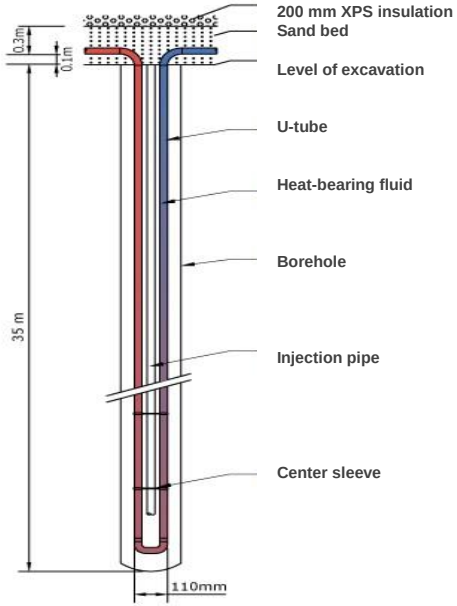
A) Research on borehole thermal energy storage (BTES)



Principle of BTES:

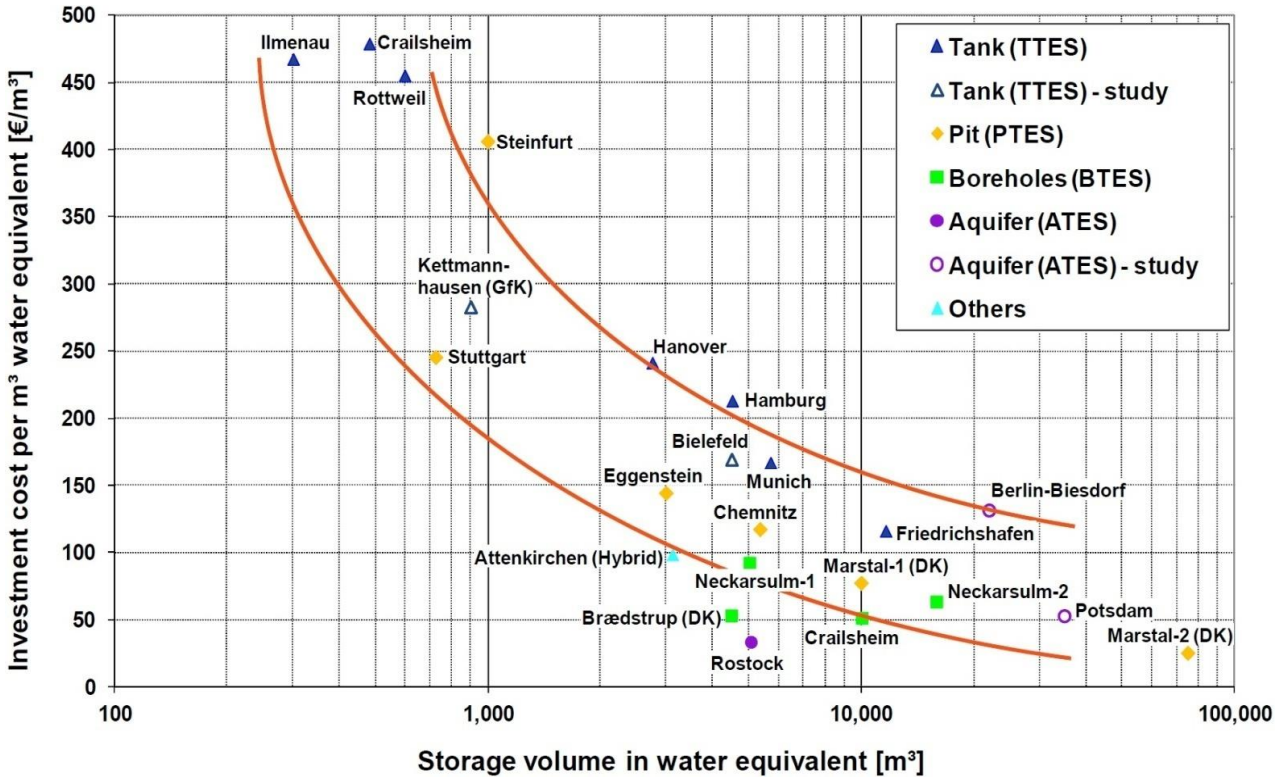
- Up to several hundreds of boreholes drilled into rock massif.
- Regular lay out of boreholes.
- Heat is drained/stored by means of transfer fluid flowing through equipped boreholes.





A) Research on borehole thermal energy storage (BTES)

CAPEX comparison of different BTES projects in Europe

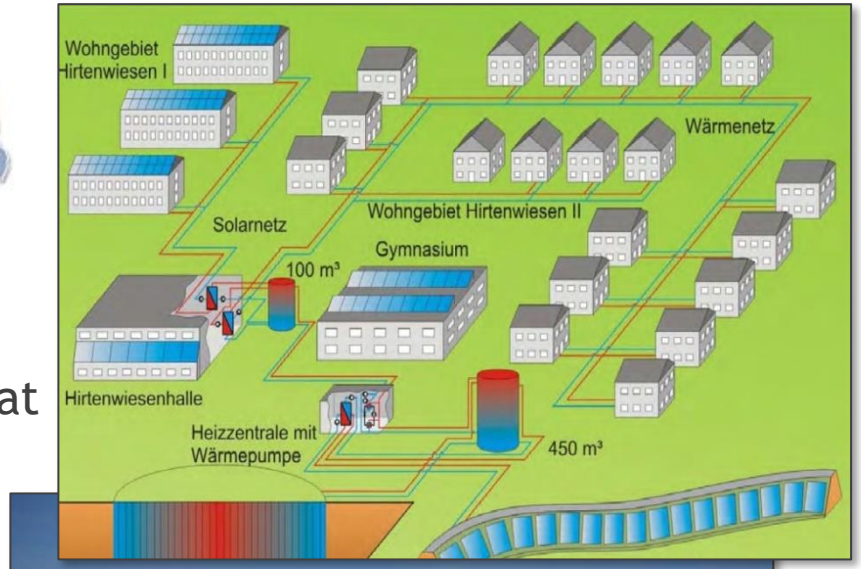


A) Research on borehole thermal energy storage (BTES)

Examples of BTES installation:

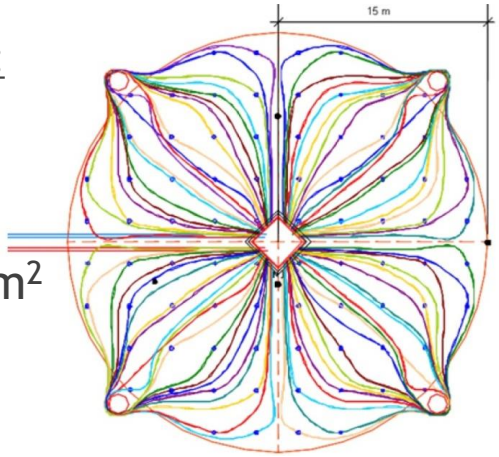
Crailsheim (Germany)

- Central heating system delivering heat into
  - schools
  - gyms
  - 6 residential houses
  - groups of houses
- Annual heat consumption 4.100 MWh



A) Research on borehole thermal energy storage (BTES)

Examples of BTES installation:



Crailsheim (Germany)

- Solar collectors of 7.300 m^2
  - roofs, anti-noise screen
- BTES:
  - since 2008 in operation
  - 80 boreholes to the depth of 55 m
  - BTES temperatures 22 – 65° C
- Water storages for peak balance
  - 100 m^3, 400 m^3

A) Research on borehole thermal energy storage (BTES)

Examples of BTES installation:

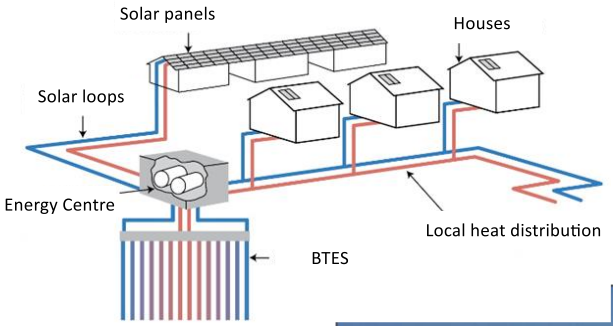
Okotoks (Alberta, Canada)

- 30 km south of Calgary
- Altitude 1084 m
- Winter temperatures up to -30° C
- Summer temperatures up to 25° C
- High percentage of sunny day a year
- Abrupt fluctuation of temperatures

A) Research on borehole thermal energy storage (BTES)

Examples of BTES installation:

Okotoks (Alberta, Canada)



- Extent of installation:
  - 52 houses with wooden construction
  - Solar panels, 800 pcs., 2 300 m^2
  - Energy Centre with balance tanks and control systems
  - Underground BTES - 144 boreholes
  - Hot water pipes network
  - Up to 90 % of self-sufficiency
- Since 2007 in operation

A) Research on borehole thermal energy storage (BTES)

The pilot project of BTES in the Czech Republic

„Utilization of thermal energy from rock massif and verification of possibilities to accumulate heat in rock massif“.

Participants:

- Mining University – Technical University, Ostrava
- Green Gas DPB, a.s., Paskov
- DHI a.s., Praha

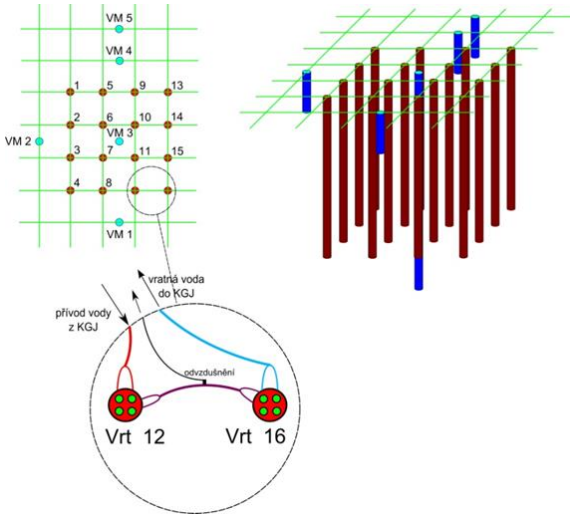
Supported by Technology Agency of the Czech Republic.

Project duration: 1/2011 – 12/2014.

A) Research on borehole thermal energy storage (BTES)

BTES as the one of many results of project solution. Basic parameters:

- Built in area of Green Gas DPB
- High-temperature
  - Input temperature into boreholes up to 95° C
- Total length of boreholes 1.100 m
  - Energy boreholes 16 pcs x 60 m
  - Monitoring boreholes 1 x 80 m, 1 x 15 m
- Temperature monitoring of
  - Transfer fluid in boreholes
  - Rock massif
- Monitoring of intake and return heat/temperature



A) Research on borehole thermal energy storage (BTES)

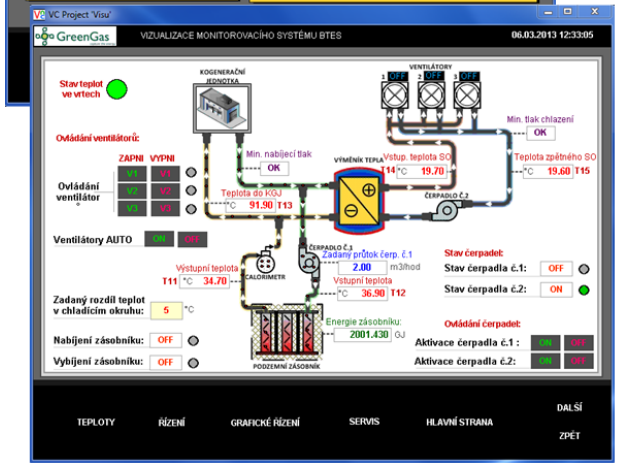
BTES in pictures - from drilling to finalizing

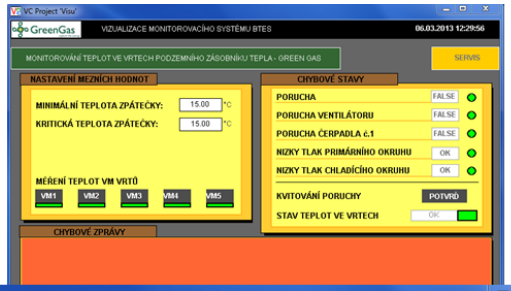
A) Research on borehole thermal energy storage (BTES)

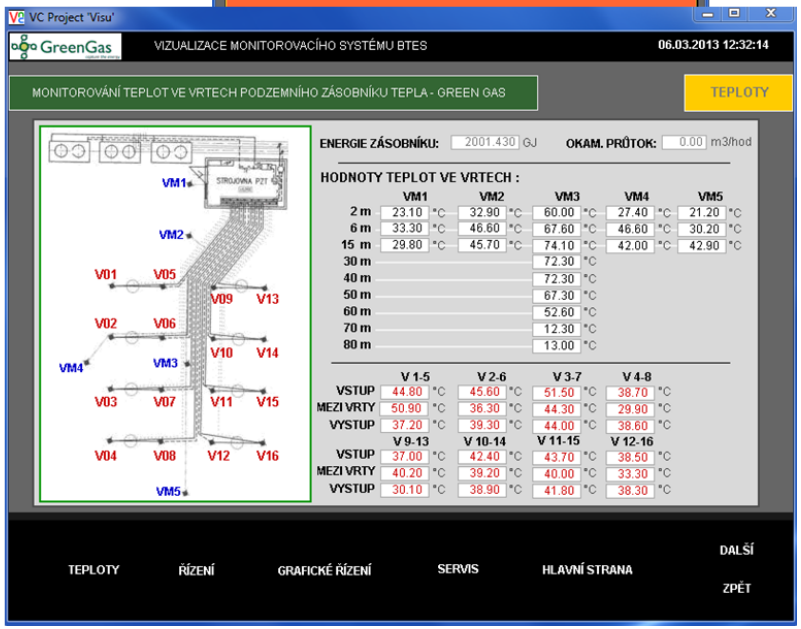
BTES in video

A) Research on borehole thermal energy storage (BTES)

BTES – on-site visualization

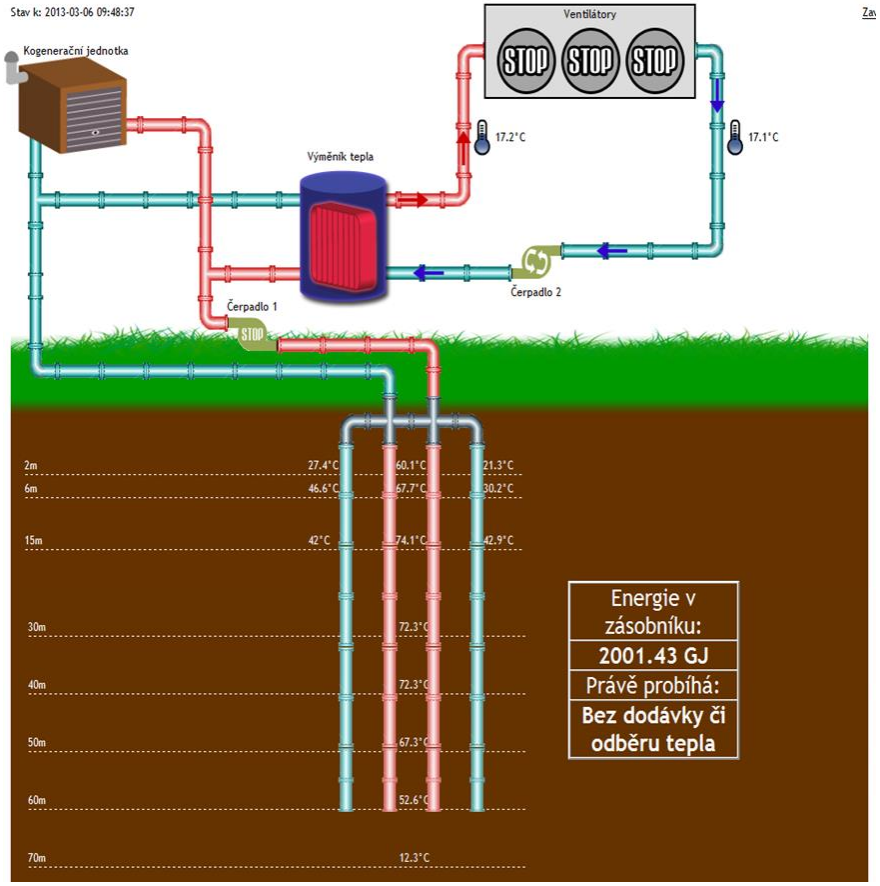






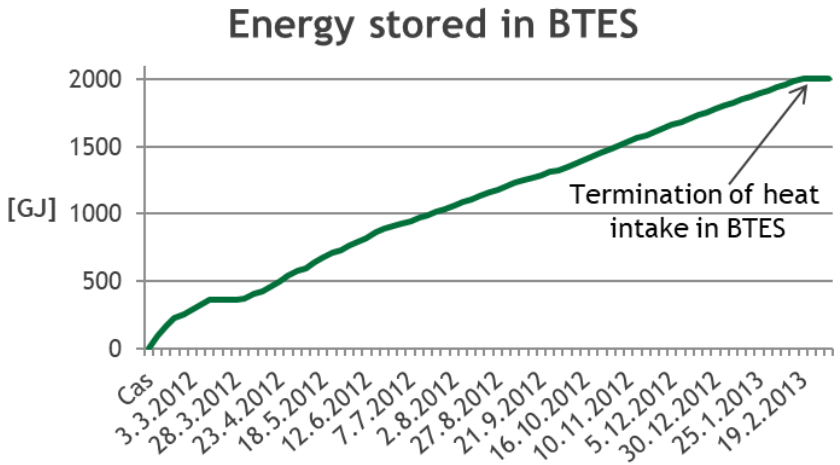
A) Research on borehole thermal energy storage (BTES)

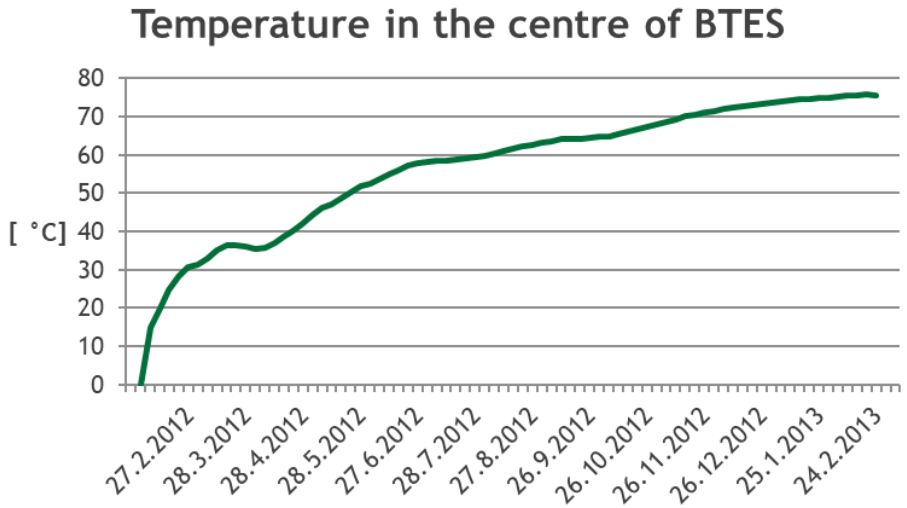
BTES - on-line visualization



A) Research on borehole thermal energy storage (BTES)

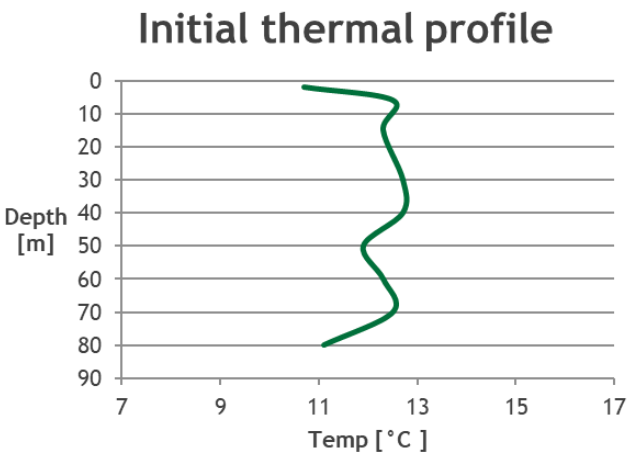
BTES in pictures – outputs

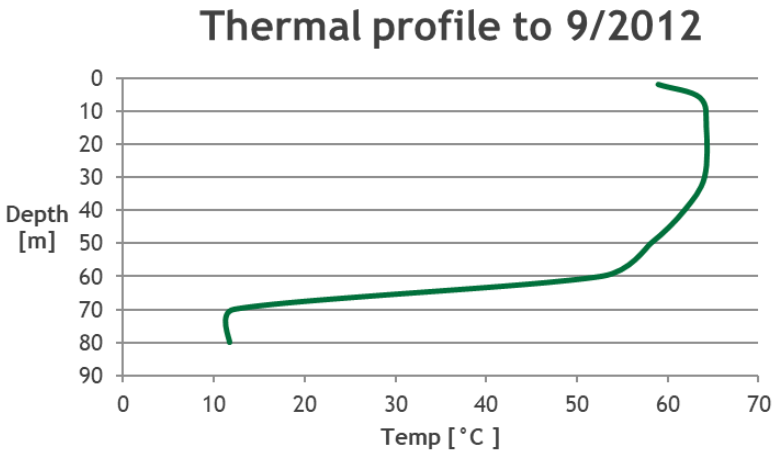


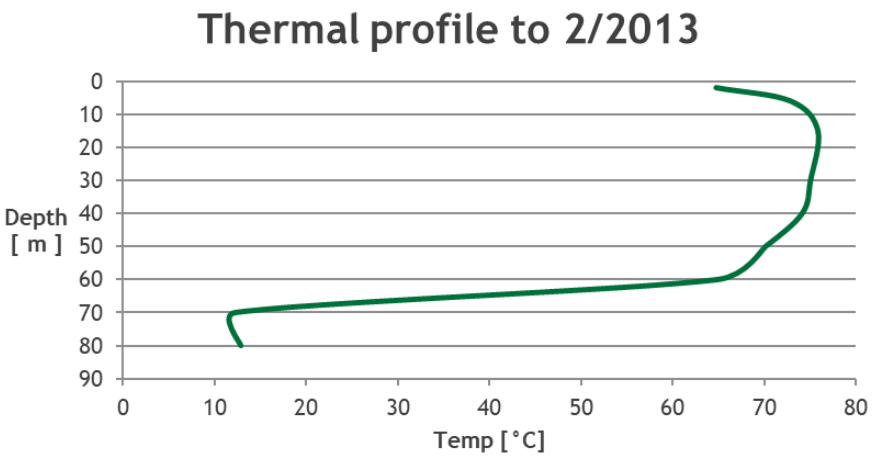


A) Research on borehole thermal energy storage (BTES)

BTES in pictures - general results



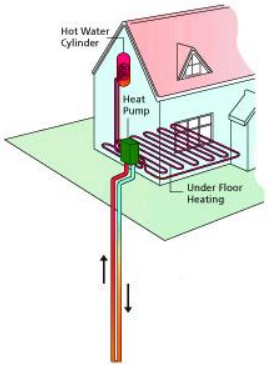


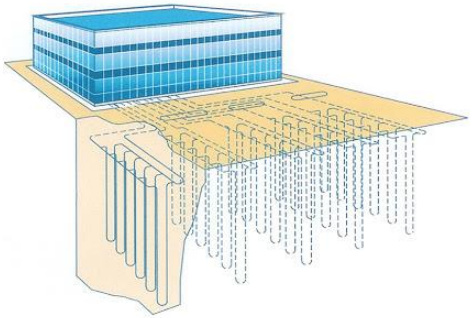


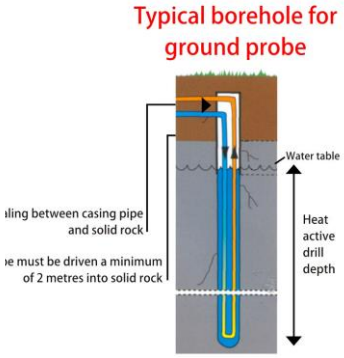
B) Ground/Water geothermal heat pumps (GHPs)

Our business activities:

- **Drilling of vertical boreholes for capturing/storage of heat from/to rock massif.**
- **Cooperation with partners in installation of heat pumps - from domestic installations up to large installations for industrial, sport, cultural and many other halls and buildings.**





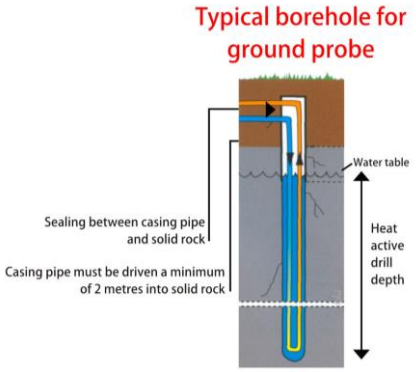


B) Ground/Water geothermal heat pumps (GHPs)

Drilling of vertical boreholes for capturing/storage of heat from/to rock massif

Basic steps:

- *Thermal response test – confirmation of borehole parameters.*
- *Drilling of sufficient length of boreholes - vertically up to 200 m.*
- *Drilling diameter of 152/120 mm – drilled by hammer under air drilling fluid.*
- *Installation of HDPE loops 4x32mm/2x40mm into boreholes.*
- *Sealing of HDPE loops in borehole by cement/bentonite mixture.*

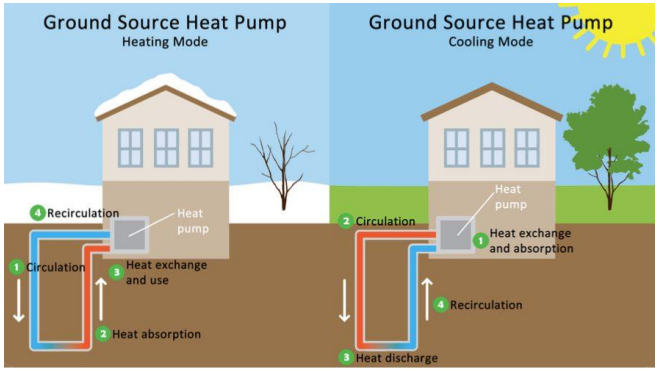


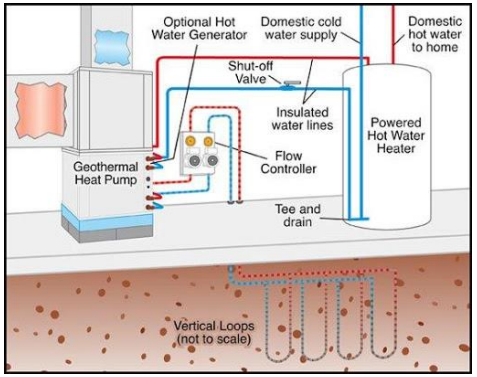
B) Ground/Water geothermal heat pumps (GHPs)

Installation of heat pumps

Basic steps:

- *Primary part – borehole connection into HDPE pipe network up to heat pump.*
- *Secondary part – connection of heat pump into internal heating system of the building.*
- *Applicable for cooling system too.*





www.dpb.cz

www.teplozezeme.cz