



## Demo & Case Study Building - Elementary School, Libeznice



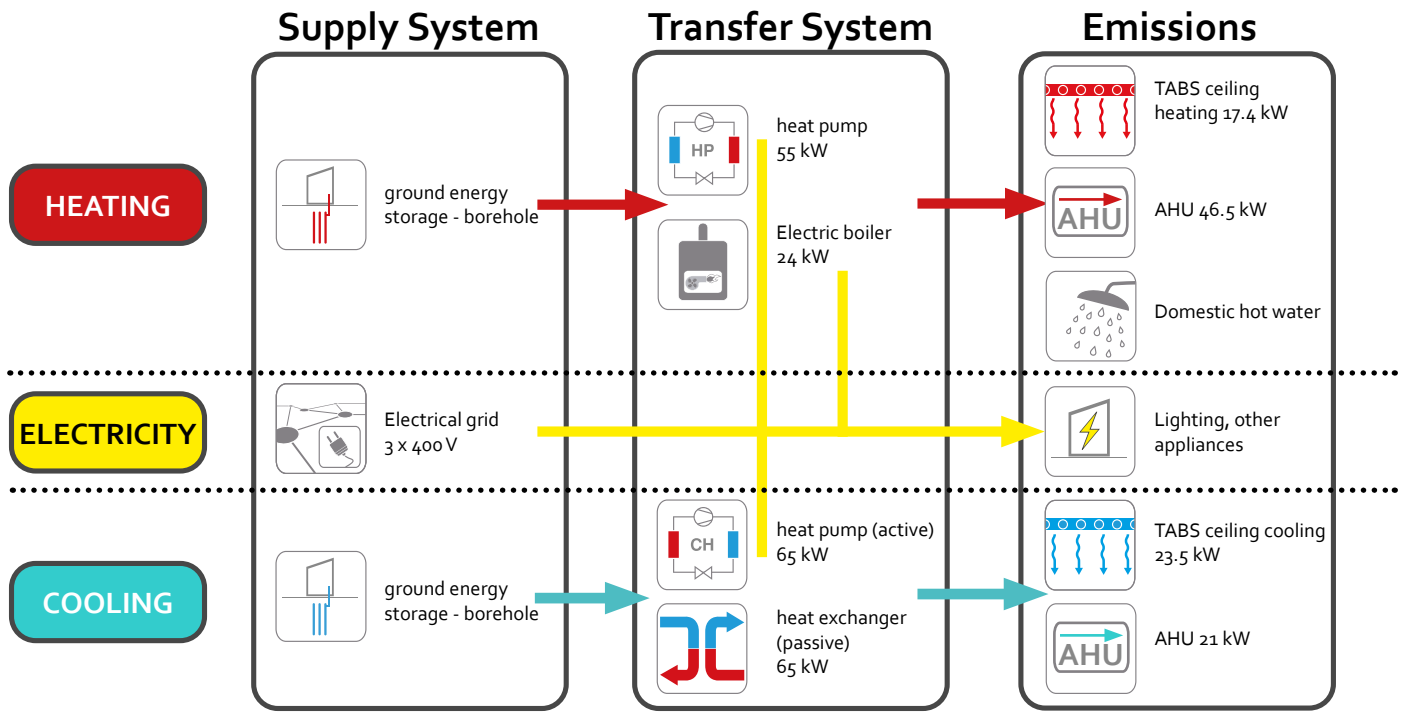
Building Location	Libeznice, CZ
Owner	Libeznice Village
Architect	Ing. Arch. Adam Halíř, Projektil Architekti s.r.o.
Engineers	Techorg s.r.o.
Building Type	School
Certifications	Not at present
Date Completed	September 2015

### DESCRIPTION

An elementary school for 240 pupils in 8 classrooms, which also has after-school activities. The building is a single-storey annular shape with an eccentric round atrium, surrounded by a multifunctional foyer, integrating a corridor, children’s lockers and a common area. The annular shape is inspired by the solar system. The school’s cafeteria layout allows easy rearrangement, creating space for performances, or lectures with film screening. The building is equipped with TABS heating and cooling system (one circuit in the ceiling of the building), independent low-temperature ventilation units for each classroom and hot water circuit. The source of energy is ground coupled heat pump with heating power of 55 kW and cooling power of 65 kW. There are 6 boreholes on the primary side of the heat pump. The heat pump is operated in the three regimes i) heating, ii) passive cooling, iii) active cooling (compressor active). The GEOTABS system is controlled by a predictive controller (MPC) that takes into account weather forecast, model of thermodynamics of the heat pump and TABS. Moreover, spot market electricity prices are included in the MPC problem formulation which results in a higher consumption in situations when the price of electricity is low (surplus of the electricity in the grid) and lower consumption in other moments (demand side management). The algorithms benefit from the huge thermal capacity of the TABS system.

### GENERAL BUILDING DATA

Number of spaces	8 classrooms, canteen and staff room
Number of occupants (design)	240 pupils and staff
Gross floor area	990 m <sup>2</sup> (690 m <sup>2</sup> net)
Conditioned floor area	690 m <sup>2</sup> (area that is heated or cooled)
Type of ground source	Borehole Thermal Energy Storage (BTES)
Total annual thermal energy use	92 MWh heating, 10 MWh cooling
Heating	Heat pump providing heat for both TABS and domestic hot water (DHW)
Ventilation	Decentral
Ventilation characteristics	Mechanical supply, mechanical exhaust, heat recovery
Net volume	2,080 m <sup>3</sup>
Building envelope:floor area ratio	2.92 (gross), 4.19 (net)



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**LIBEZNICE SCHOOL ENERGY EMISSION SYSTEMS**

Heating	Main: TABS, Secondary: Air handling unit (AHU)
Cooling	Main: TABS, Secondary: Air handling unit (AHU)

**BUILDING FEATURES**

Building construction type	Heavyweight
Average U-value for opaque elements (roof, walls, floors)	0.27 W/m <sup>2</sup> ·K
U-value of glazing	1.2 W/m <sup>2</sup> ·K
G-value of glazing	0.7
Glazing area (% of facade)	50 %
Air tightness level / n50 air change rates	2.5 1 /h
Orientation of main facade	Circular roundel building
Type of shading (e.g. manual)	No shading
Net space heating demand (kWh/(m <sup>2</sup> ·annum))	50.7 kWh/(m <sup>2</sup> ·annum)
Net space cooling demand (kWh/(m <sup>2</sup> ·annum))	10.3 kWh/(m <sup>2</sup> ·annum)

**PARTNERS**

GEOTABS<sup>hybrid</sup> brings together a transdisciplinary team of SMEs, large industry and research institutes, experienced in research and application of design and control systems in the combined building and energy world.

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