



INTRODUCTION TO hybrid GEOTABS

GEOTABS is an acronym for a **GEO**thermal heat pump combined with a Thermally Activated Building System (**TABS**). **GEOTABS^{hybrid}** refers to GEOTABS combined with Model Predictive Control (MPC), which optimises the energy system. This includes heat pumps, distribution and emissions, as well as the integration with other renewables and secondary heating and cooling systems such as biomass boilers and air conditioning.

GEOTHERMAL ENERGY SYSTEMS TABS

Underground temperatures are usually far more constant than those above ground. This heat differential can be exploited in winter for heating, and in summer for cooling.

In a geothermal energy system, the ground's heat is transferred via fluid in a loop of buried metal pipe. This heat passes via an exchanger and pump, to the building's heating system. The relatively low temperatures of this 'baseline' heat make it suitable for use with TABS, which radiate for a long time. Other low-grade resources, such as renewable mixes, may also be used in combination with geothermal systems. Cooling systems transfer excess heat from the building to the ground - reversing the process and maintaining the 'thermal balance' of the ground.

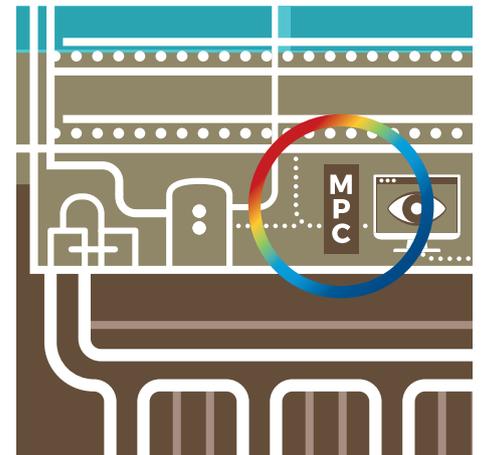
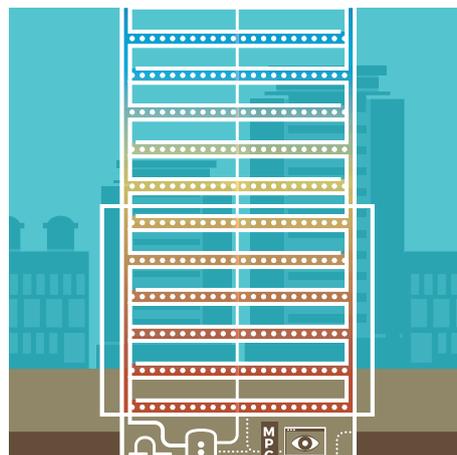
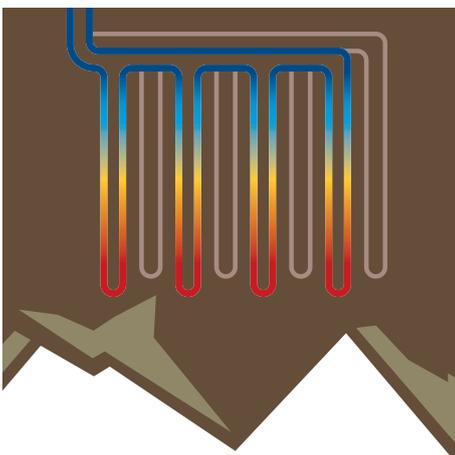
"TABS" (thermally activated building systems) turn ceilings and floors into thermally-active elements with integrated modular pipe loops embedded in the slab structure. When warm/cold water is pumped through the pipes, this activates the whole surface for radiant heating and cooling the building.

TABS can be effectively used in combination with renewable energy sources and a heat pump for:

- **low temperature heating** (22 - 29°C)
- **high temperature cooling** (16 - 22°C)

MODEL PREDICTIVE CONTROL

MPC is a method to control a system based on 'numerical optimization'. A model is developed and used to predict future control inputs and responses, and this is optimised as the system is used in real time. Heating and cooling needs are modelled for each building and MPC is used to improve the performance of the hybrid geothermal and TABS technologies.





BENEFITS OF hybrid GEOTABS

- Suited to offices, apartment blocks, care homes and schools
- Radiant heating/cooling with other systems increase thermal comfort
- Flexible heating and cooling period avoiding the peak electricity cost of using other systems
- Competitive life cycle cost and reduced investment cost compared with air conditioning
- Reduced building height compared to non-TABS buildings
- Reduced need for radiators improves internal building aesthetics

FEATURES OF hybrid GEOTABS

- Average thermal power output of 40-50 W/m²
- Suitable for low and zero energy buildings
- Supplemented by a secondary heating / cooling systems for less efficient buildings
- Best used for zone control, rather than individual room control
- Careful system and control strategies design are required

GEOTABS hybrid TECHNICAL BRIEFINGS

- This paper is one of a series of technical briefings authored by the **GEOTABS hybrid** project
- Other briefings include 'Designing hybrid GEOTABS' and 'Controlling hybrid GEOTABS'
- Find them at www.hybridgeotabs.eu/technology

MORE INFORMATION

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PARTNERS

GEOTABS hybrid 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.

