Ground-source heat pumps and hybrid systems - Factsheets

Ground-source heat pumps (GSHP), or commonly known as *Geothermal heat pumps* (GHP), is a widely used term for HVAC systems, that use the environment energy from the ground, groundwater, wastewater or any surface water as a heat source and sink.

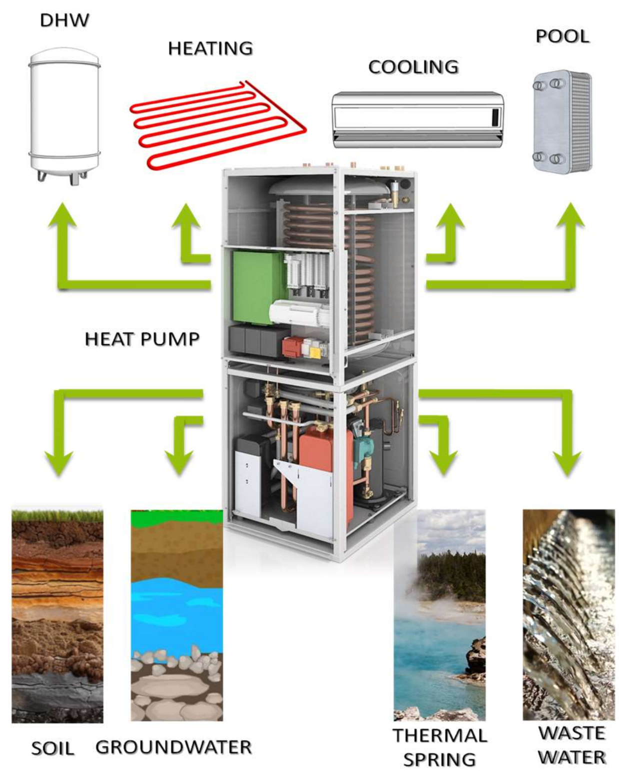
GSHPs are often subdivided by the type of exterior heat exchange system. This includes ground-coupled heat pumps (GCHPs) that are closed-loop piping systems in boreholes or trenches, groundwater heat pumps (GWHPs) that are open-loop piping systems with water wells and surface-water heat pumps (SWHPs) that are closed-loop piping coils or open-loop systems connected to sea, lakes, rivers, wastewater or thermal springs.

Advantages of ground-source heat pumps/water wells	Disadvantages of ground-source heat pumps/water wells
Usage of relatively small plots of ground (not applicable to horizontal systems)	Higher capital costs due to drilling costs
Contact with underground or groundwater (varies very little in temperature and thermal properties)	
Small amount of pipes and pumping energy	
Most efficient system performance	

During the preliminary stages of any project, **three considerations** must be evaluated to determine what type of system is optimal for the building and the site:

- Geological and hydrogeological characteristics and land availability of the site;
- Local, state and federal regulations and cost of permitting;
- Building energy requirements and layout, which dictate the most appropriate HVAC system.

For more information visit: https://interreg-danube.eu/projects/**danube-geoheco**



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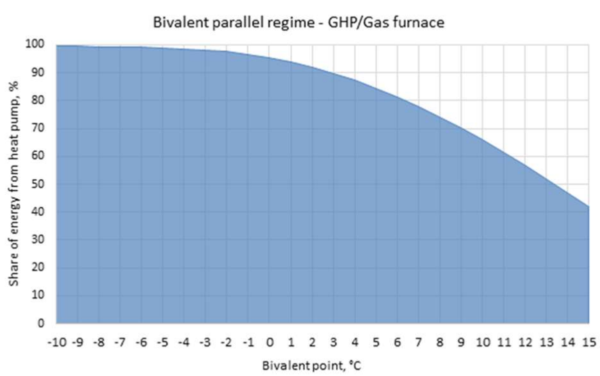
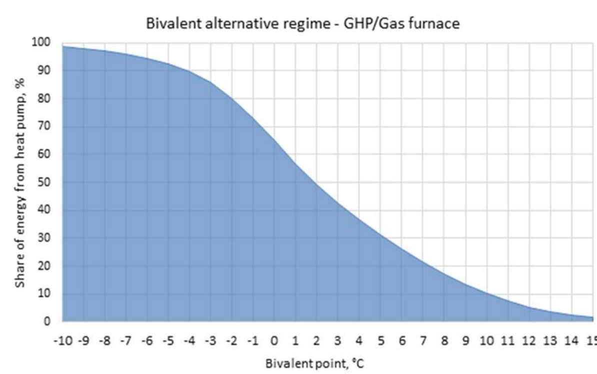
Bivalent hybrid geothermal systems feature heat pump and an external geothermal heat exchanger coupled with some secondary heat source, like gas boiler. These kind of systems are especially suitable in retrofit projects where insulation levels of the building are not adequate and for the heat pump to meet peak heating load would be capital intensive.

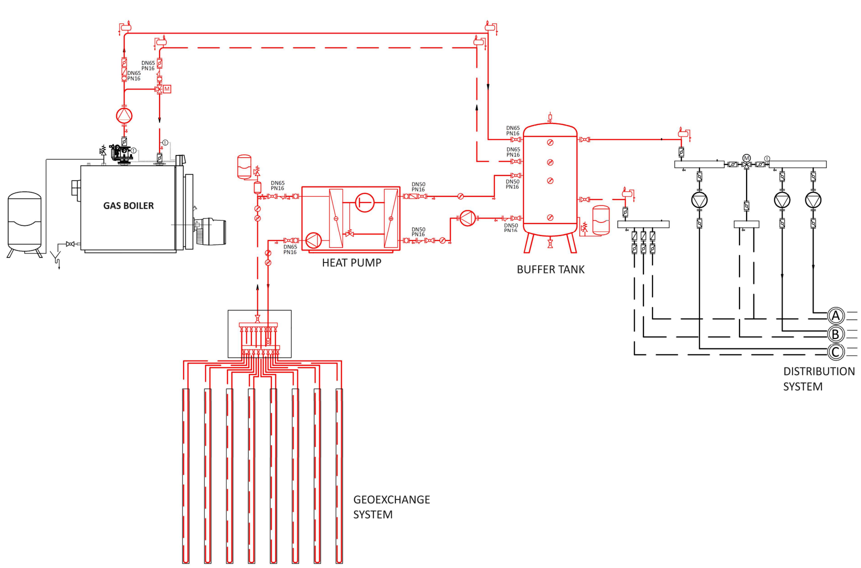
Bivalent systems are usually considered to deliver **optimum payback period** for otherwise capital intense geothermal systems.

Bivalent parallel system considers the heat pump running independently to a certain outside air temperature set-point, at which an auxiliary system like gas boiler is turned on and both systems operate in parallel mode to cover peak loads during coldest days.

Bivalent alternative regime is the simplest from control logic perspective, it presumes the heat pump being switched off below certain change-over point, with auxiliary system providing full load during the coldest days.







Choosing the right bivalent air temperature point and type of hybrid system is most suitable for retrofit projects in older buildings where a distribution system (radiators or fancoils) and gas boiler is kept (black lines on Figure) and a hybrid system with a heat pump is employed inside the existing engineering room (red lines on Figure).

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