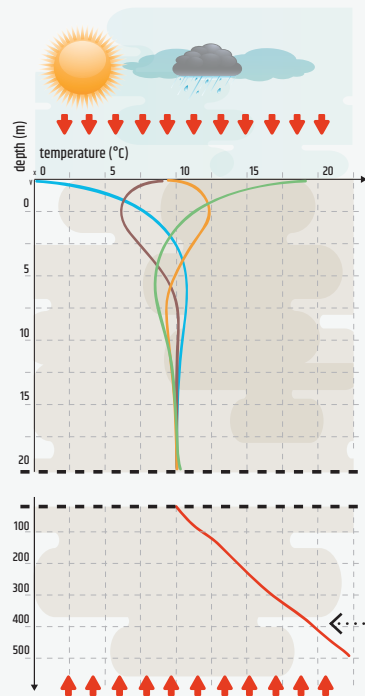




# Heat below our cities

Shallow geothermal energy is the heat stored in the ground, available everywhere and anytime



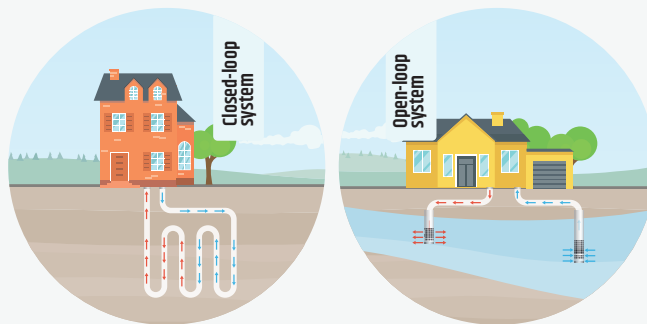
The heat of the ground originates from the Sun and from inside the Earth.

The four seasons influence the ground temperatures to a depth of around 15 metres.

With every 100 metres depth increase, the temperature increases by about 3°C.



This renewable technology uses either open-loop (OL) or closed-loop (CL) systems to provide heating, cooling, domestic hot water or thermal energy storage.



In CL systems, heat carrier fluids circulate in pipes to harness heat from or store heat in the ground. OL systems use surface or groundwater as a heat carrier. After extracting heat from the water it is usually injected into the water body. There are many other configurations available.

Both systems are coupled with heat pumps to increase the temperature level for the heat distribution inside the building. In this way the ground source heat pump typically turns one portion of electricity into four portions of thermal energy.

## Benefits



**Reliable**  
Shallow geothermal energy is stable and capable of providing heating and cooling 24/7 throughout the year. It does not depend on weather conditions like wind or daylight.



**All-rounder**  
A given system is able to provide domestic hot water, space heating and cooling without additional investments. The ground serves as seasonal storage in a new generation of local heating and cooling grids. All systems are adaptable to different types of resources and demands.



**Green and clean**  
It reduces harmful emissions, such as smog and greenhouse gases. Combined with renewable electricity, the technology produces zero emissions. This supports climate and environmental policies.



**Efficient**  
Shallow geothermal energy systems are a high performing and efficient technology with little land use. In combination with a heat pump, each kW of electricity consumed can produce at least 4 kW of space heating.

This leaflet has been created in the framework of the project GeoERA MUSE dealing with shallow geothermal energy use in European urban areas.  
[geoera.eu/projects/muse3](http://geoera.eu/projects/muse3)



# Shallow geothermal energy is the key for sustainable future heating and cooling!

## Horizontal collector – CLS

The pipes of this horizontal system are buried in 1 to 2 metres depth and solely rely on solar energy.

## Borehole thermal energy storage – CLS

Up to hundreds of borehole heat exchangers can be located close together in a field (BTES), which stores heat in summer to supply it in winter. It is often one of the central parts in a low temperature grid.

BOREHOLE THERMAL ENERGY STORAGE

HORIZONTAL COLLECTOR

LOW TEMPERATURE GRIDS

## Low temperature grids

Different types of shallow geothermal energy systems can be combined – also with other renewable sources, e.g. solar and waste heat, into efficient hybride low temperature heating and cooling grids connecting different buildings. Borehole and aquifer thermal energy storage systems are often included in the grids.

TRENCH COLLECTOR

## Trench collector – CLS

This horizontal and only a few metres deep system solely relies on solar energy.

## Thermo-active foundation system – CLS

Heat exchangers can be embedded into foundations of buildings. Foundation piles and base plates serve as well as tunnel walls and floors.

THERMO-ACTIVE FOUNDATION SYSTEM

GROUNDWATER HEAT EXCHANGER

## Groundwater heat exchanger – OLS

Groundwater provides energy for heating or cooling either directly (free cooling) or with a heat pump. If the ground fulfills specific conditions it can also be used as aquifer thermal energy storage (ATES).

## Borehole heat exchanger – CLS

One or two boreholes, 100 to 200 metres deep, provide enough energy for heating and cooling of a single family house.

BOREHOLE HEAT EXCHANGER

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