GROUND SOURCE HEAT PUMPS

Using warmth stored naturally in the ground and large bodies of water to heat and cool buildings.

WHY ARE NEW HEATING TECHNOLOGIES REQUIRED?

As the climate warms and fossil fuels become difficult to access, Aotearoa New Zealand's government is seeking new energy solutions that are renewable and reliable, secure and sustainable.

GROUND SOURCE HEAT PUMPS ARE:

Renewable: unlimited earth energy,

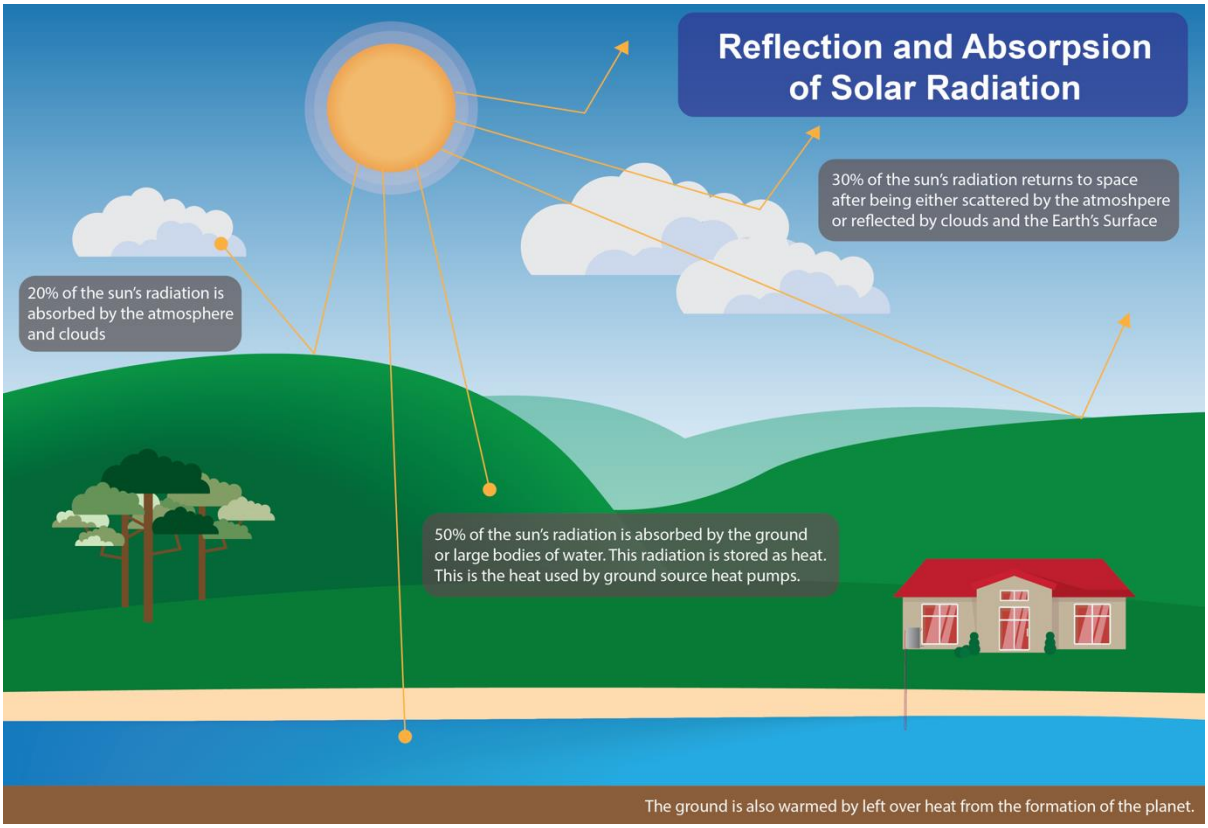
Reliable: not weather dependant,

Secure: sourced locally,

Sustainable: become part of a natural equilibrium system, minimally impacting the environment.

AMBIENT GEOTHERMAL ENERGY

'Geothermal' can be misleading here. The energy used by GSHPs is not produced by magmatic activity. Instead the ground or large body of water is warmed by the sun and residual heat from the earth's core. GSHPs use this low-temperature heat stored in the ground or large bodies of water as an energy source. Heat is transferred from the ground or water source and delivered to a building in winter months. This can be reversed in summer months, and heat from a building can be stored in the earth to be used at another time. Across Aotearoa New Zealand, ground temperatures range from 10°C to 18°C, in inhabited regions. This is an ideal operating temperature range for GSHPs.

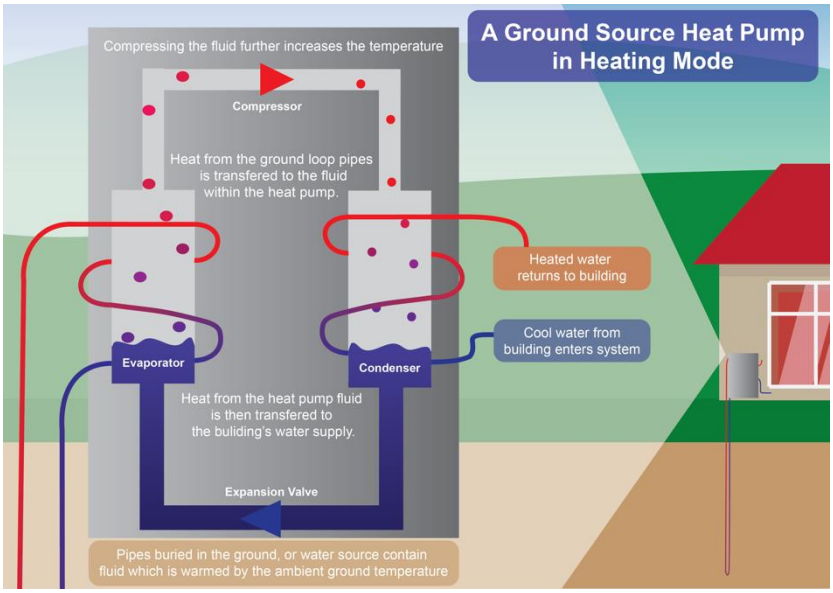


HOW DO GROUND SOURCE HEAT PUMPS WORK?

To understand how grounds heat pumps work, we must first understand a simple law of physics:

In all natural systems, heat is transferred from objects at a higher temperature to objects at a lower temperature until all objects have the same temperature.

This is the second law of thermodynamics. Heat pumps follow this law to heat/cool buildings.



1. Fluid is pumped through pipes buried in the ground or submerged in a body of water,

2. If the fluid in the pipes is cooler than the ground/water surrounding the pipes, heat is transferred from the warmer ground/water to the fluid. This heats the fluid in the pipes;

3. If the fluid in the pipes is warmer than the ground or water surrounding the pipes, heat is transferred from the warmer pipes to the ground/water. This cools the fluid in the pipes;

4. The fluid in the pipes is then condensed (heating mode) or expanded (cooling mode) in the heat pump (much like an air-sourced heat pump).

5. In heating mode, the heat pump transfers the heat collected in the ground loop to the application (e.g. space heating in a building or heating a swimming pool). In cooling mode, the process is reversed; heat is removed and transferred to the ground loop for later use

ADVANTAGES	DISADVANTAGES
Low annual operating costs	Upfront cost – but paid back in energy saving over time
Low environmental impact	
Low maintenance of the loop and pump	**OTHER CONSIDERATIONS**
Provide year-round comfort	Local and regional regulations
Long lifespan: ground loops have an expected lifespan of > 25 years	Local geology and groundwater availability
Very efficient: A GSHP uses 1 unit of electricity to move ~4 units of heat.	Other users