Geothermal has 3 technologies to bring heat to the surface as heat sources:

1. Ground source heat pumps- can be used anywhere in the US
2. Direct Use Geothermal- only used in areas with high geothermal activity 2
3. Deep and enhanced geothermal systems- areas of high geothermal activity 2

The earth has a near constant temperature just below earth’s surface but as you go deeper temperatures increases 1 degree F per 70 feet.  Tectonic and volcanic areas heat and steam can come closer to the surface.

Geothermal is a renewable energy source.

**Ground source heat pumps**
Moves heat into the earth from a house to cool it and takes heat from the earth to heat a house.  It has a heat pump connected to underground pipes which are buried either horizontally or bored 100’s of feet into the earth vertically. Sometimes water goes through the pipes as a conductor of the heat. The heat pump moves the heat from the earth to the pipes in a house.  Ambient heat can be taken from a home and moved out to the earth as well to cool the home or other space.  A small amount of electricity is used to run the geothermal system but the gain is 5 times greater than the electrical use. There is use of fossil fuels if some alternative electricity like solar is not used.
How it works:

1. Heating: pipes absorb heat from the soil, rock, and surrounding earth elements which are carried in the conductant fluid in the pipes, eg. Water, into the house/building.  The heat absorbed from the earth travels through pipes that then uses a heat exchanger to  transfer heat to water or air and heats the space.   Then the conductor returns to the ground via the pipes to be reheated.
2. Cooling: water or other fluid absorbs heat via the heat exchanger which brings heated water into the pipes which gives off heat to the soil/rocks etc.  Once heat is transferred, the cooled fluid returns via pipes back to the heat exchanger to absorb more heat.  Heat is moved from the home or building to the ground in this manner to cool the space.

This ground heating/cooling system itself is relatively inexpensive but the pipe system is pricey. It can be used anywhere in the country and more pipes can be used to heat or cool larger spaces.

1. Direct Use Geothermal

Uses groundwater heated by natural biological processes used beneath the surface which can be as hot as 200 degrees F.  These regions are found around volcanic and tectonic activity.  Heat reaches the surface with geyser’s and hot springs.  This water can be pumped for heating purposes.
This use is limited due to less availability of areas with natural hot water just a few feet below the surface.  However costs are small due to less need for costly underground piping systems.

1. Deep and enhanced geothermal systems

These systems inject water into the ground into a well and allow steam to come to the surface through another well. Often these systems involve drilling over a mile below the earth’s surface to access such areas.  The high pressure keeps water in a liquid form and it then becomes steam at the surface which is used to heat.  They are currently more accessible in regions with high geothermal activity but attempts are being made to reach deep into the earth to take advantage of the natural heat that is present.  It directly disperses into the ground rather than uses a series of closed loops as in ground source heating systems.  The drilling in order to create a well is quite expensive but the steam can spin a turbine which can generate energy.1

1 [https://www.epa.gov/rhc/geothermal-heating-and-cooling-technologies](https://www.epa.gov/rhc/geothermal-heating-and-cooling-technologies%22%20%5Ct%20%22_blank)

2 **[https://www.nrel.gov/gis/geothermal.html](https://www.nrel.gov/gis/geothermal.html%22%20%5Ct%20%22_blank)**