

Geothermal Energy

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Wind, solar, biomass and water are not the only sources of renewable energy. There are other renewable energy sources that are cleaner than non-renewable energy sources. These sources can provide renewable energy in the form of heat, light and electricity without polluting the air or disturbing large areas of land or water, for example, geothermal energy. This backgrounder explores what geothermal energy is and how it can be harnessed for our different energy uses.



Geothermal Heat

The Earth's core is estimated to be between 3,000 and 5,000°C (scientists are still not sure what the exact temperature is). This heat is generated by the slow breakdown of radioactive elements and by the immense gravitational pressures acting on the rocks and minerals of the Earth's interior.

The source of geothermal heat comes from pressure and nuclear reactions at the Earth's core. Energy is harnessed from high enthalpy sources such as volcanoes and geysers, as well as low enthalpy sources such as heat stored in rocks in Earth's crust (Center for Sustainable Systems, University of Michigan, 2020).

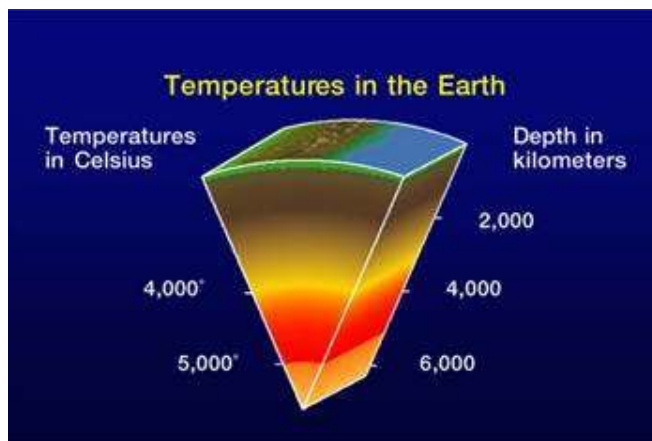


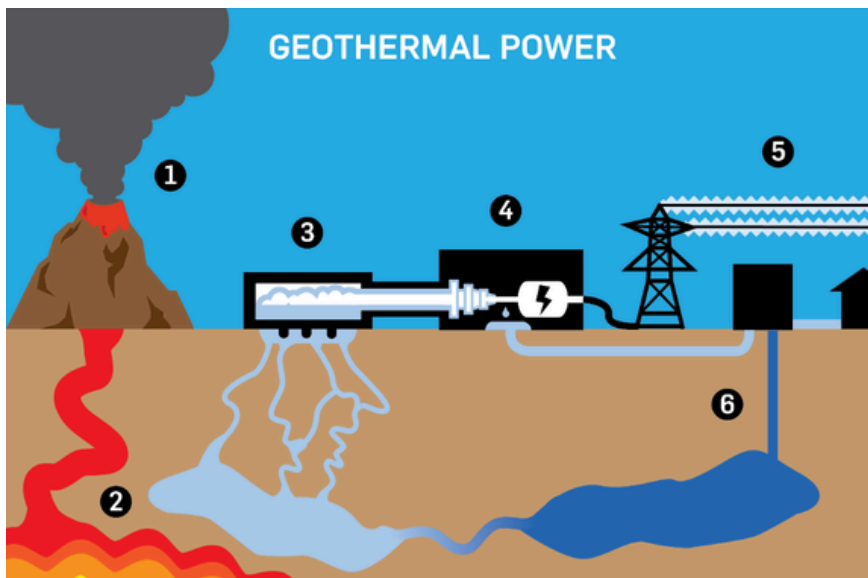
Figure 1. Temperatures found in the Earth and its distances (Geothermal Education Office, 2014)

Geothermal heat has been used to heat homes and businesses on a commercial scale since the 1920s. In most cases, communities take advantage of naturally occurring geysers, hot springs, and steam vents (called fumaroles) to gather hot water and steam for heating. Geysers and fumaroles occur when ground water seeps through cracks and comes in contact with volcanically heated rocks.

Harnessing Geothermal Heat

The main method for harnessing geothermal heat is through geothermal or ground sourced heat pumps. To learn more about heat pumps, download the heat pumps backgrounder from the activity page. Geothermal heat is being used in many countries, especially those with high geothermal potential – i.e., typically regions with high volcanic activity.

In Iceland, wells are drilled into volcanic rocks to extract hot water and steam. The hot water or steam is carried to communities in insulated pipes and used to heat homes and businesses. In some cases, the water is superheated (heated under pressure to temperatures greater than 100 °C). Superheated water quickly turns to high-pressure steam, which can turn high-speed turbines that drive electrical generators to produce electricity.



- (1) Iceland is dotted with volcanoes, several of which have erupted in recent years
- (2) Magma near these volcanoes heats water to above 100°C
- (3) The boiling water gets pumped up to the surface and used as steam
- (4) The steam goes through a turbine, which powers a generator
- (5) Electricity from the generator is sent to power homes in Reykjavik
- (6) A cooling tower sends some water to town and some back underground

Figure 2. Schematic diagram of how geothermal energy is harnessed in Iceland (CTV News, 2017).

For additional information on geothermal energy, visit the resource below.

- **National Geographic Resource Library – Geothermal Energy:**
<https://www.nationalgeographic.org/encyclopedia/geothermal-energy/>

Geothermal Projects in Canada

The Greenview Geothermal Power Plant (Alberta No. 1) is a 10MW electricity power plant proposed to be completed by 2025 (Alberta No. 1, 2024). Once constructed, this power plant will be the first conventional geothermal energy facility in the province, offsetting over 97,000 tonnes of CO₂ emissions annually. (Government of Alberta, 2021)



Figure 3. Purposed geothermal plant location (Government of Alberta, 2021).

Visit the CanGEA resource linked below to learn more about the geothermal potential and projects across Canada. The website lists geothermal potential in Alberta, British Columbia, Yukon Territory and Nunavut Territory, as these are the regions with high potential of geothermal in Canada.

Canadian National Geothermal Database and Territorial Resource Estimate Maps:

<https://ostrnrcan-dostrncan.canada.ca/entities/publication/d608e62b-d0a1-46db-aa04-e863f018a256>

Research and Discussion Questions

1. Why would geothermal heat be considered a form of renewable energy?
2. Can geothermal electricity be used as a baseload to provide continuous source of electricity for years? Why or why not?
3. Do you have geothermal energy potential where you live?
4. What would you need to do to install geothermal energy technology in your home?
5. How does Canada compare to other countries around the world for harnessing geothermal energy? (i.e., how much geothermal potential does Canada have and how much is it actually utilizing at the moment?)

References

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