RESDP Booth – Additional Geothermal Information

The Theme: **Renewable Energy – Unlocking Saint Lucia's Energy Potential**

(a) What is Geothermal Energy?

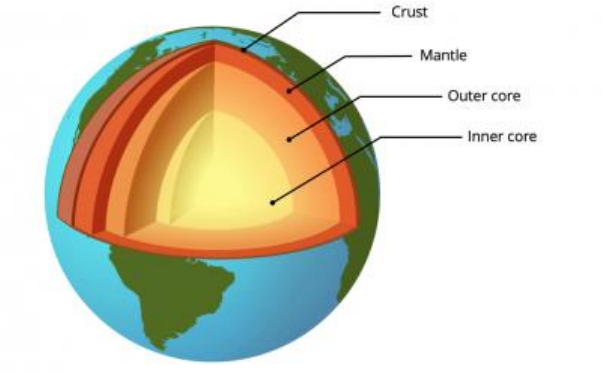
Answer: The term "geothermal" comes from the words, "geo" and "thermos". The Greek word "geo" stands for "earth", While the word, "thermos" has its origin in Latin and Greek and refers to "hot" or "warm". Geothermal energy is thermal energy which is generated and stored within the Earth.

From the earth's surface, the temperature increases the deeper you go, due to the "**geothermal gradient**".

(b) **What are the benefits of Geothermal Energy? What are the disadvantages?**

Benefits of Geothermal Energy

1. Geothermal energy is a major source of renewable energy for electricity and heat for direct use;
2. With responsible exploration and utilization, geothermal energy is an environmentally friendly and sustainable energy source;
3. The use of geothermal energy can cut back carbon emissions. It has one of the lowest carbon footprints compared to other energy sources;
4. A Geothermal Power Plant is not affected by weather conditions;
5. It uses the least amount of land per unit of energy generated, of all the renewable energy sources;
6. It is not intermittent, it can provide energy around the clock (continuous power), what we call baseload power.
7. It does not require any imported fuel, such as fossil fuels for operation, therefore making it an important element in energy;
8. Being a domestic or an indigenous resource, it is not subject to price fluctuations on the world market.



Geothermal Energy - Disadvantages

1. The upfront cost of geothermal energy is high and the drilled wells may not encounter the geothermal reservoir;
2. Drilling for geothermal resources can result in gases being released with the steam;
3. Seismic activities in the form of earthquakes in proximity of several geothermal projects have "shaken" the reputation of the geothermal industry**.**

The Saint Lucia Geothermal Exploration Experience

- **1951**: Mission to St. Lucia led by the late Gunnar Bodvarsson of Iceland. The field study that was undertaken involved the investigation of the possibilities of the Sulphur Springs area for power production and for the utilization of steam for industrial applications;
- **1975-1976**: A drilling program was undertaken at the Sulphur Springs by Merz and McLellan of England in conjunction with the British Institute of Geological Studies;
- **1982:** Aquater S.p.A. of Italy carried out scientific surveys in the Qualibou depression;
- **1983-1984**: The Los Alamos National Laboratory of New Mexico, USA, undertook more studies, as well as further geoscientific work.
- **1987-1988**: The first deep exploratory drilling campaign was carried out in Soufriere. Two wells were drilled;
- **2015-2016**: Jacobs of New Zealand carried out geoscientific studies so as to evaluate the geothermal potential on the Island;
- **2017**: A Pre-feasibility Study on the Geothermal Project was carried out. The Study concluded that it is reasonable to proceed immediately with a campaign of exploratory drilling at (i) Belle Plaine (ii) Fond St. Jacques and (iii) Mondesir-Saltibus;
- **2018**: An Environmental and Social Impact Assessment (ESIA) was carried out. The assessment concluded that most impacts would be temporary and would focus within the drilling area during well drilling and testing.

The Dominica Experience - Geothermal Drilling

Truck Mounted Rig – Dominica

Steam from geothermal well flowing from pipeline into silencer - Dominica

GEOTHERMAL DIRECT USE (To be distributed as a Flyer & displayed as a Booth Poster)

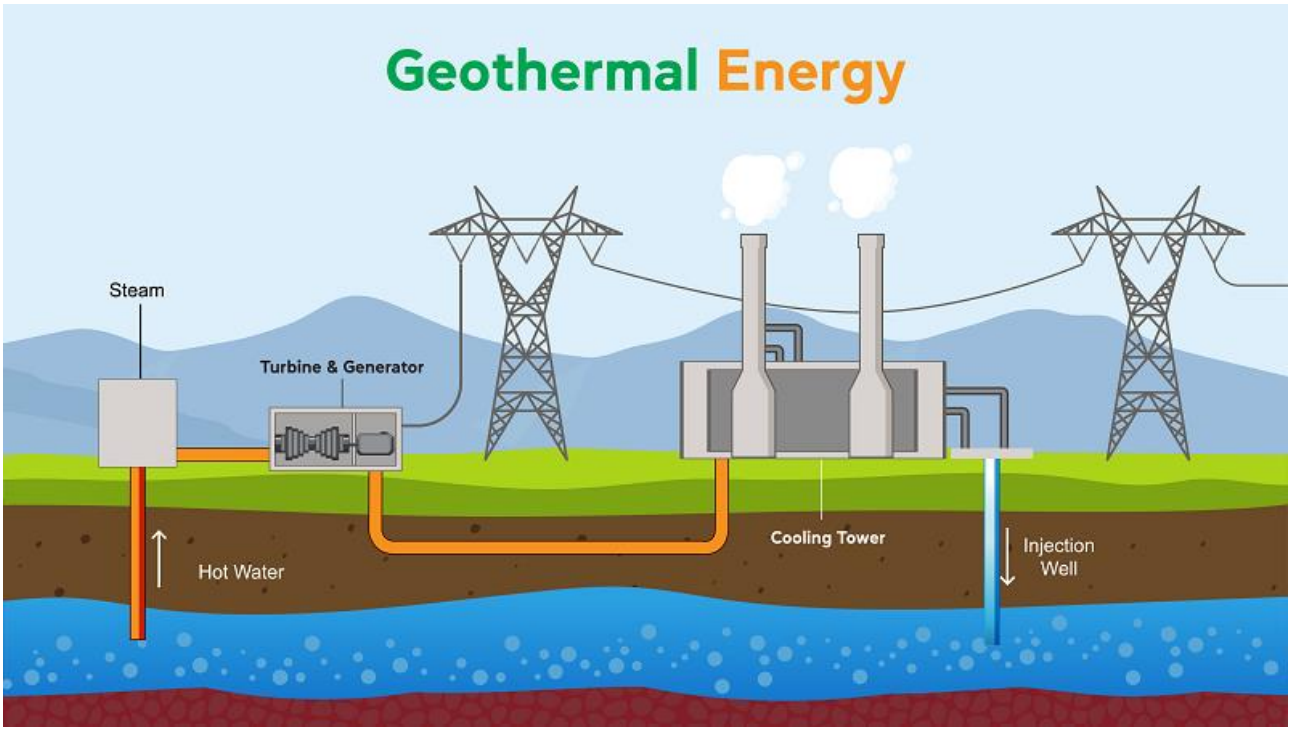
Geothermal energy is thermal energy. Utilizing geothermal energy directly for its heat value is what we call "direct use". The heat provided by geothermal energy can be an important part of the energy supply.

Examples of direct use of geothermal heat are the following as well as a wider array of industrial applications requiring heat:

- Space heating;
- Space cooling;
- Greenhouse heating;
- Aquaculture (fish farming).

The most obvious example is hot water used for bathing and swimming.

Aquaculture (Fish Farming)



Geothermal Power Plants

A Geothermal Power Plant uses heat from the depths of the Earth to produce renewable electrical energy. Our planet's internal temperature increases the closer we get to its core.

This increase in temperature, called the "**geothermal gradient**", is on average, about 3° every 100 meters of depth, but in some areas, under certain conditions, this is much higher, with temperatures of 250-350°C at a depth of 2000 meters.

Through the fracturing of rock layers, heated water and steam from heat sources such as magma, rise to the surface, where they enter geothermal wells. The steam from the wells is then conveyed to pipes, and used to operate a turbine, where the energy is changed into mechanical energy

The turbine transforms the mechanical energy into electrical energy in a generator, which is then transmitted to a transformer. This raises the voltage value to 11,000 volts and sent to the transmission grid.

The steam from the turbine is returned to a liquid state in a condenser. A cooling tower allows the water produced by the condensation of the steam to be cooled. At this point the cold water is either used in the condenser, to lower the temperature of the steam, or is injected into deep rock with injection wells, to initiate a new production cycle of renewable energy.

Types of Geothermal Plants

Geothermal energy power plants use three main technologies, (i) dry steam, (ii) flash and (iii) a binary cycle.

Dry Steam: This is the most common technology, and involves the use of steam at high temperatures (over 230°C) and pressure to spin a turbine connected to an electrical energy generator.

Flash: Water comes to the surface through wells and, because of the rapid change in pressure from the well to the atmosphere, is changed into steam (flash).

Binary Cycle: The geothermal fluid (temperature between 120 and 180°C), is used to vaporize, through a heat exchanger, a second fluid (called an organic fluid), with a lower boiling point than water. The second fluid expands in the turbine and is condensed and sent back to the exchanger in a closed circuit, without any exchanges with the outside.