Geothermal Energy Invention

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Problem

- Nonrenewable energy is a very big problem. The reason why nonrenewable energy is a big problem is because nonrenewable energy emits carbon dioxide (CO2) into the air. Carbon dioxide (CO2) causes global warming, which can cause catastrophic consequences, such as ice caps melting and oceans level rising.
- There are renewable energy sources, such as solar and wind, but they are more expensive than nonrenewable energy, and that is the reason that they have not overtaken nonrenewable energy yet.

We decided to create a original invention that is cheaper than other renewable sources and cheaper than nonrenewable sources to help renewable energy become the future of our planet.

Documentation of Ideas

We wanted to find a solution to the problem of renewable energy being more expensive than nonrenewable energy. We wanted to invent a energy source that was cheaper than nonrenewable energy.

We first thought about high altitude windmills, and then found out they already existed. Then we thought about inventing a cheap, portable dam, but after a web search, we found out they already existed. Then we discovered geothermal energy. We thought, “maybe we can invent a renewable geothermal energy source. Then, in a flash of inspiration, we thought of the Geothermal Energy Invention

Market Research

- Geothermal energy exists, but that consists of tapping power from underground aquifers that are heated by the earth's heat. The steam from the hot aquifers runs a steam turbine. Our invention is drastically different from existing geothermal energy because our invention directly transfers heat from the ground, and boils water at the surface. This means our invention never needs maintenance, and always outputs a constant supply of energy.
- The market for new alternative energy inventions is huge, as tons of people are working towards a 100 percent renewable energy powered Earth. Global warming is a huge problem, so any relevant invention will be met with open arms. If we get funded with enough money, we will try to build a real life working plant.

Problems With Existing Geothermal Energy

- Existing geothermal energy consists of two different ways. One taps into existing auqafirs, which are heated by the earth's heat. The hot water rises up due to extreme pressure. But the higher it gets, the more depressurized it gets. This causes steam to form. The steam is used to drive a steam turbine. The second way is the steam from the aquifer is used to boil another liquid, which is usually a organic compound with a low boiling point. The steam from the organic compound is used to drive a steam turbine. However, the first and the second method suffer from multiple drawbacks. The first drawback is that as the water is being used to generate electricity, some of the water is lost. This means that water has to be constantly pumped into the power plant to keep it running. Geothermal power plants need humongous amounts of water to keep it running. The second problem that they face is that they are expensive. They can cost more than solar or wind, so not many geothermal power plants have been built.

How Our Invention Addresses These Problems

- Our invention solves these two problems. First, no additional water is needed because the water does not interact with the earth, and the water is in a closed system encased in metal. Secondly, our invention is hundreds of thousands of dollars cheaper than solar panels. This is because my invention is simple to build and to operate. There are no or miniscule maintenance costs involved.

Purpose of Invention

- The purpose of this invention is to help fight global warming by being cheaper nonrenewable energy. Nonrenewable energy is the main cause of global warming, and if our invention can beat nonrenewable energy, then nonrenewable energy will be obsolete and the main cause of global warming will be eliminated.

- According to our calculations, 1 megawatt of our invention is many hundreds of thousands of dollars cheaper than 1 megawatt of solar panels. This means that since our invention is much cheaper than solar panels, it is also cheaper than coal, oil, or gas (although to a lesser extent than solar panels).

How It Works

- Our invention works using the principle of thermal equilibrium, which states that if you constantly heat one end of a object, given enough time, the other end will heat up, no matter how far apart they are. The time it takes the object to heat up is the thermal conductivity. Metals have very high thermal conductivity, so metals heat up very fast.

- Our invention is a long aluminum pole, 2 to 4 kilometers long, that is basically stuck into the ground. It will be located in where lava is close to the surface or the boundaries of tectonic plates. One end of the metal pole is heated up by the earth's inner heat, and the heat is transferred up the pole to the surface, where the top of the pole is located in a chamber full of water. The water boils, because the heat from the pole is hot enough to boil water. The steam from the boiling water is used to drive a steam turbine, which generates electricity.

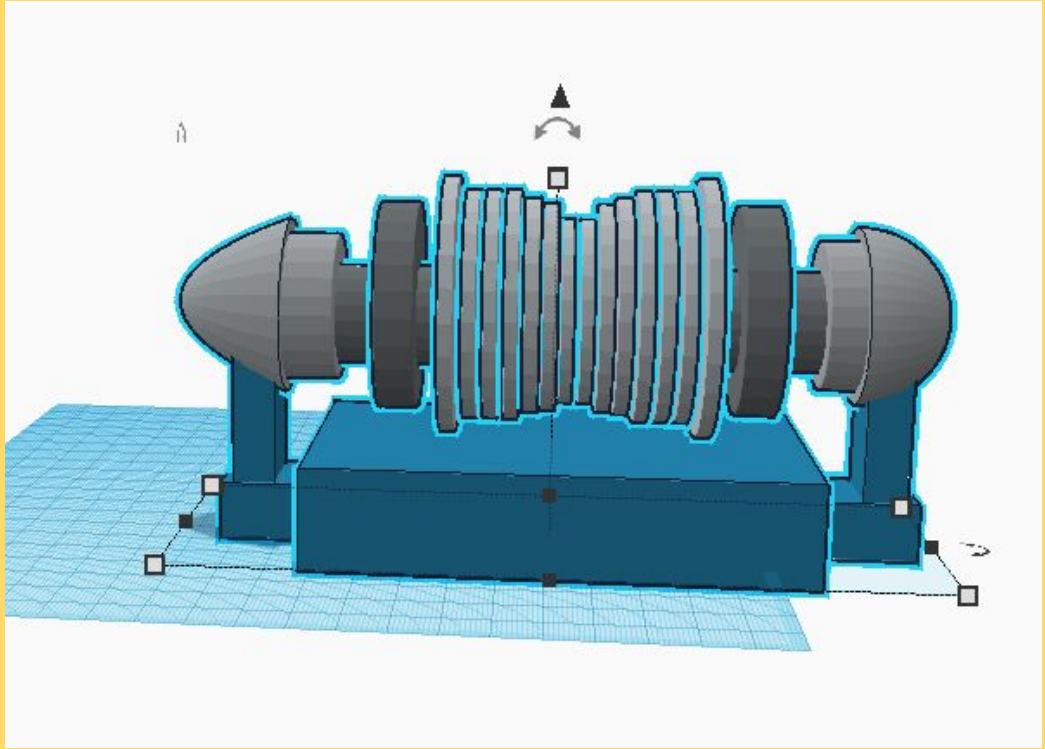
- Now, you're probably asking: How are you going to get a 2 kilometer pole into the earth? Well there is a way. A drill bit is used to dig a straight hole into the earth. While it does this, it places adhesive explosives every 20 meters or so. The explosives are going to be something that generates a lot of heat, such as octol. Then aluminum rods, 20 meters long are dropped into the hole. The the air will slow down the rods so they will not get damaged on impact. Now there are rods, 20 meters long in the hole. The ends of the rods are lined up next to the explosives, which are placed every 20 meters.

- Then the explosives are detonated. The heat from the explosion welds the ends of the rods together, to create a several kilometer long pole. Welding metals can be done with explosives, and it is used in reality. It is called cladding.

Power Plant Cost Calculation

- We found out that a 1 megawatt steam turbine costs around 600,000 dollars to 1,000,000 dollars. 1 pound of aluminum (60 cents) is 2.2 inches by 2.2 inches by 2.2 inches.
- The rod will be 10 inches wide, 10 inches long, so 100 inches squared. That is around 25 cubes. This is 15 dollars. Now this is 2.2 inches tall, but we want it 2 km tall. That is 80000 inches. 80000 times 15 = 1.2 million. This is about 2 million for the turbine and the rod.
- Add the price of the water chamber, the pipes, and the condenser, and you get 2.2 million. Now add the price of the drill rig, and the operating costs of the drill rig, and the explosives, and you get around 2.5 million.
- This is based on the price per foot of drilling, and that is $15-$30. I used $30 for this price analysis. Considering that a megawatt of solar panels can cost upwards of 3 million, plus maintenance costs, my invention is around 500,000 dollars or more than 15 percent cheaper than solar panel per 1 megawatt.

Illustrations



This is a 3d printed design for our steam turbine. Unfortunately, the 3d printed turbine came out too small to use, so we had to make one out of modeling clay. We couldn't put lots of detail into the modeling clay, so we made a simpler design.

Illustrations

This is our prototype/model, viewed from the top.

This is our prototype/model, viewed from the side.

Materials

The materials we used in this project is just a prototype. A actual working plant will need more and more expensive materials than our prototype. The function of the prototype is solely to demonstrate how our actual plant will look like.

1 bag of potting soil

1 transparent bucket

1 wooden dowel/pole

Aluminum foil

Plastic wrap

Copper wire

Plastic bowl

3D printed steam turbine

Hot glue

How It Is Made

- Firstly, we got a transparent plastic basket and we made a small sheath using plastic wrap. The purpose of the sheath was to prevent dirt from going in front of the aluminum pole and obscuring it. Then we got a wooden rod and covered it with aluminum foil. This is to represent the aluminum pole. Then we filled the bucket with dirt. The dirt was used to represent the ground. Since the rod is in the sheath, it is visible through the basket.

- Then we encountered a problem. Since the rod is at the edge of the basket, we could not put a boiling chamber over it. So we got modeling clay and wrapped it around the pole. Then we put the end of it into the boiling chamber. The boiling chamber is a paper bowl. Then we twisted copper wires into a rope and connected one end of the copper rope onto the boiling chamber, and one end onto the clay steam turbine.

STEAM Concept

We used the following STEAM concepts:

- Science: The concept of thermal equilibrium was used to determine if the pole would heat up at the top end
- Technology: We had to find out if there was explosives hot enough to melt aluminum
- Engineering: We thought of the way to insert a 2 km pole into the ground, as well as finding a way to generate energy using the heat from the earth

Practical Application

- Our invention has a very important function. It is cheaper than other renewable energy types, because aluminum is very cheap to manufacture and mold, and steam turbines are not that expensive. To put into perspective, a pound of aluminum costs 60 cents! Our invention has the potential to change the world, by providing the world with a cheap and renewable energy source. My invention can potentially overtake nonrenewable energy. By helping to fight global warming, my invention helps the environment.

Reflection/Future Expansion

Some of the things we could do next time are:

- Making the prototype more realistic
- Adding more pictures to the pitch video

Some of the things we did very well are:

- We had a really good and innovative idea that is realistic, applicable, and has the potential to completely change the world.
- We made a creative prototype using real soil to represent the ground.