The Antheaters: Solar Patio Heater

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Sponsored by Dr. Mark Walter

THE ANTHEATERS

Overview

The Antheaters are a team of undergraduate students aiming to create a clean energy alternative to current gas fueled patio heaters by harnessing the sun's heat energy through a collection process. The Project aims to use exclusively solar heat stored in a water repository to be used at a later time for patio heating purposes.

Requirements: Design must operate for 4-6 hours. The system must be able to heat 4-6 people. the design must be environmentally friendly and safe for its user

Existing Solution

Gas Powered Patio Heaters

- ≈$300 retail price with gas consumption costing $2 per hour of usage
- Provides up to 42000 BTU
- NOT Environmantelly sustainable due to use of propane
- Portable
- Does not provide shade

Figure 1. Commercial Gas Powered Patio Heater:

Features

- Environmentally friendly form of energy generation
- Provides upto 35 BTU/ft2*hr at night.
- Uses a copper coil solar collector with water as working fluid to collect thermal energy.
- Utilizes 60 Gallons of water to store necessary heat during the day.

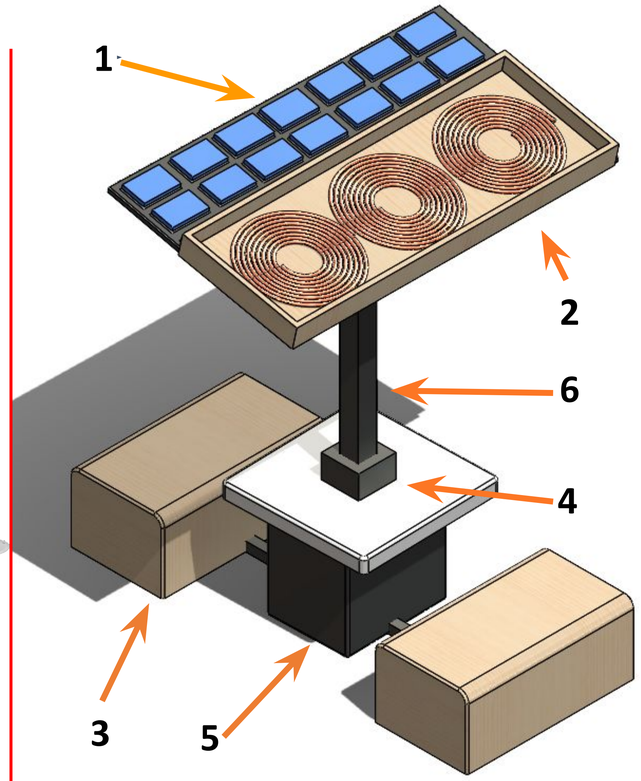

Figure 2. Antheater's Solar Patio Heater Design.

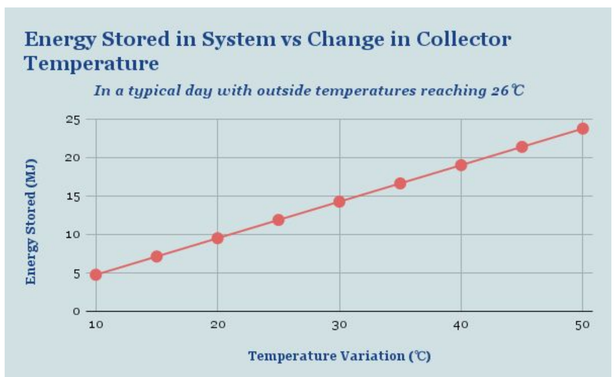

Figure 3. Energy Stored by system vs. Change in Collector Temperature.

Components

1) Solar PV Panels (power electronics)
2) Solar Collectors cycle water through copper tubing and transported to storage
3) Seats that store hot water
4) Radiator Vents
5) Housing for our radiator, ventilation system, and batteries
6) Structural pole (Aluminum, hard anodized, black) which transports water to and from the collector, as well as electricity from PV Panels (electrical routing and plumbing)

Analysis and Engineering Concepts

- On a typical day with outside temperature reaching up to 26℃ the system can store upto 24MJ of energy.
- 35 BTU/ft2*hr provides enough heat for 6 people at night.
- Collector works throughout the year in different day time temperatures varying from 18℃ to 29℃ (baseed on data from Placentia, CA)

Recommendations & Improvements

- Improve the storage fluid with the use of molten salts for better heat storage.
- Decrease weight of product with lighter materials to allow portability
- Optimize the surface area of shade component of patio heater to capture more solar energy.
- Addition of a Solar Concentrator to aid in the collection of heat

Safety

- Uses clean energy from the sun
- Water as a storage material is non flammable and non toxic.
- Implement thorough insulation on the storage system used as a patio stool for seating.
- Make roofing sturdy to support collectors on top.
- Add an emergency off button to negate electrical malfunction between pumps and radiator.

Performance

- With a reasonable efficiency the system is sufficient to heat up a space of 8x8 ft^2 for up to 6 hours at night.

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References Commercial Patio Heater:
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Cost of Patio Heaters:
https://www.northlineexpress.com/electric-patio-heater-buyers-guide