

Project Title: Floating Energy

Detailed Report

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1. Problem Encountered

According to the Energy Market Authority, 95 percent of Singapore's electricity is currently generated using natural gas. The rest comes from fuel oil, waste and renewable energy. Burning of natural gases, fuel and waste can cause:-

- Fossil fuels release **carbon dioxide** when they burn, which adds to the greenhouse effect and increases **global warming** .
- It also emits air pollutants that are **harmful** to both the environment and public health.
- Burning natural gas produces **nitrogen oxides**, which can cause **smog**.

As Singapore's population grows, the need of Singapore energy supply will rise to meet higher demands as our resources depletes. We can either burn more fossil fuels such as natural gas, or we could look into a cleaner way to get energy.

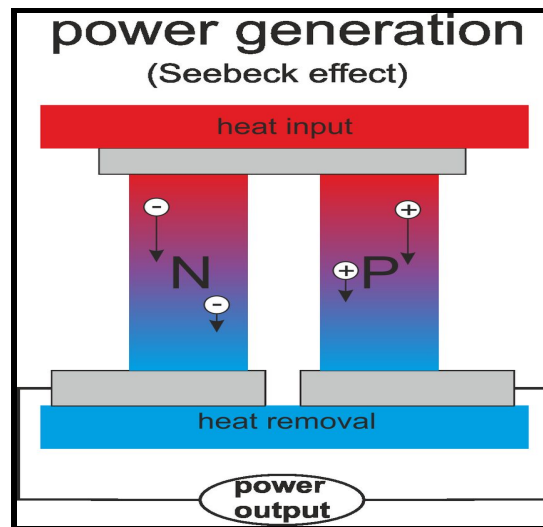
However Singapore faces two large problems when it comes to clean energy:-

1. We have **limited renewable energy options**.
2. We have **very little land space**.

Our objective is to generate electrical energy without damaging the environment. We will be harnessing energy directly from the sun.

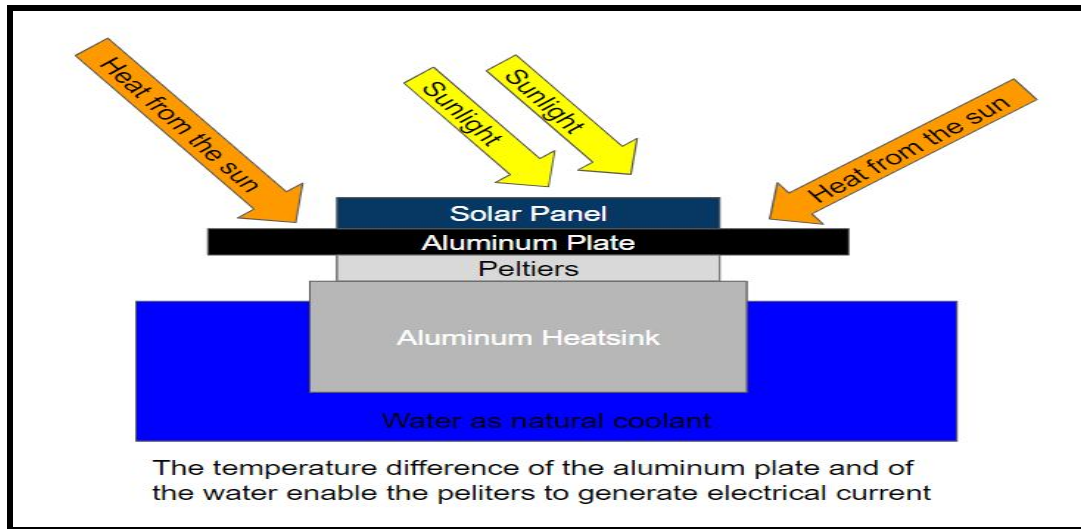
2. Proposed solution

Our solution uses both the solar panel and a static device known as the Peltier. The Peltier has ability to generate electrical energy when there is a temperature difference on it. This is called the **Seebeck Effect**. The peltier also absorbs the heat from the aluminum plate which help improve the efficiency of the solar panels



[Seebeck Effect]

Our project concentrates the energy of the sun and converts it to electrical energy. The solar panels will absorb sunlight with photovoltaic cells generating Direct Current energy. The Peltier will convert the heat energy to electrical energy. The electrical energy harvested will then be converted into usable Alternating Current energy with the help of a power inverter.



[Virtual representation on how the project will work]

Place of application

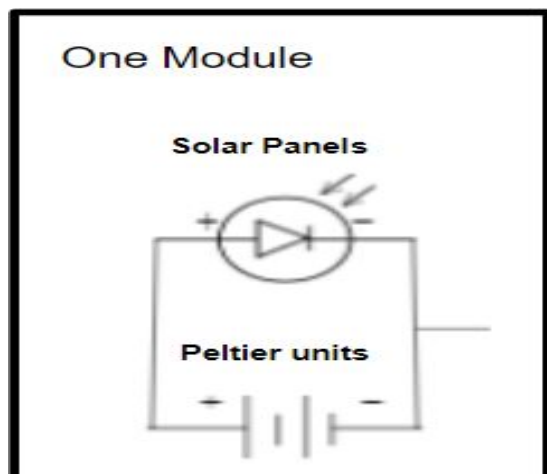
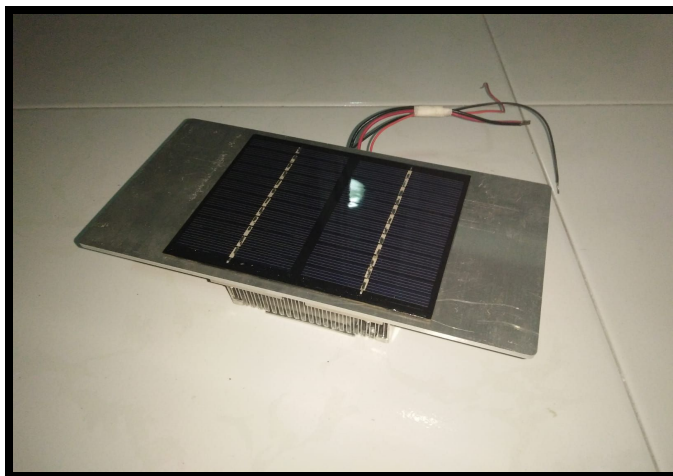
The peltier requires a temperature differences to generate electrical energy. The larger the difference the greater the amount of electrical energy is converted. Therefore we plan to place our project on the reservoirs in Singapore. The water will act as a natural coolant for the peltier. Instead of having to make space for our project, we can use this existing space.



[Jurong Lake]

Our current prototype

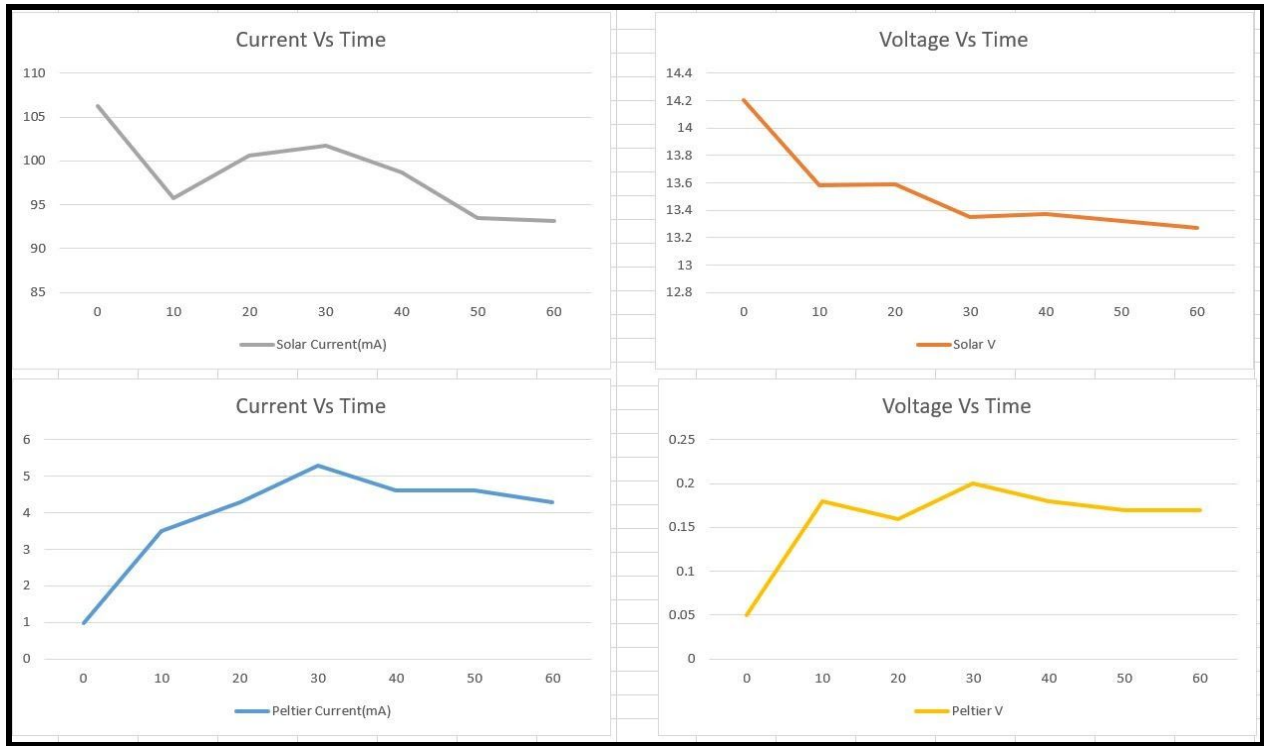
We have created a device that can harness both the light and heat energy of the sun. A few experiments were carried out to determine the feasibility of our product. Our test typically ran during the afternoon ranging arnd 2pm to 3pm. The tests were run for 1 hour with the surrounding temperature being around 35 degree celsius.



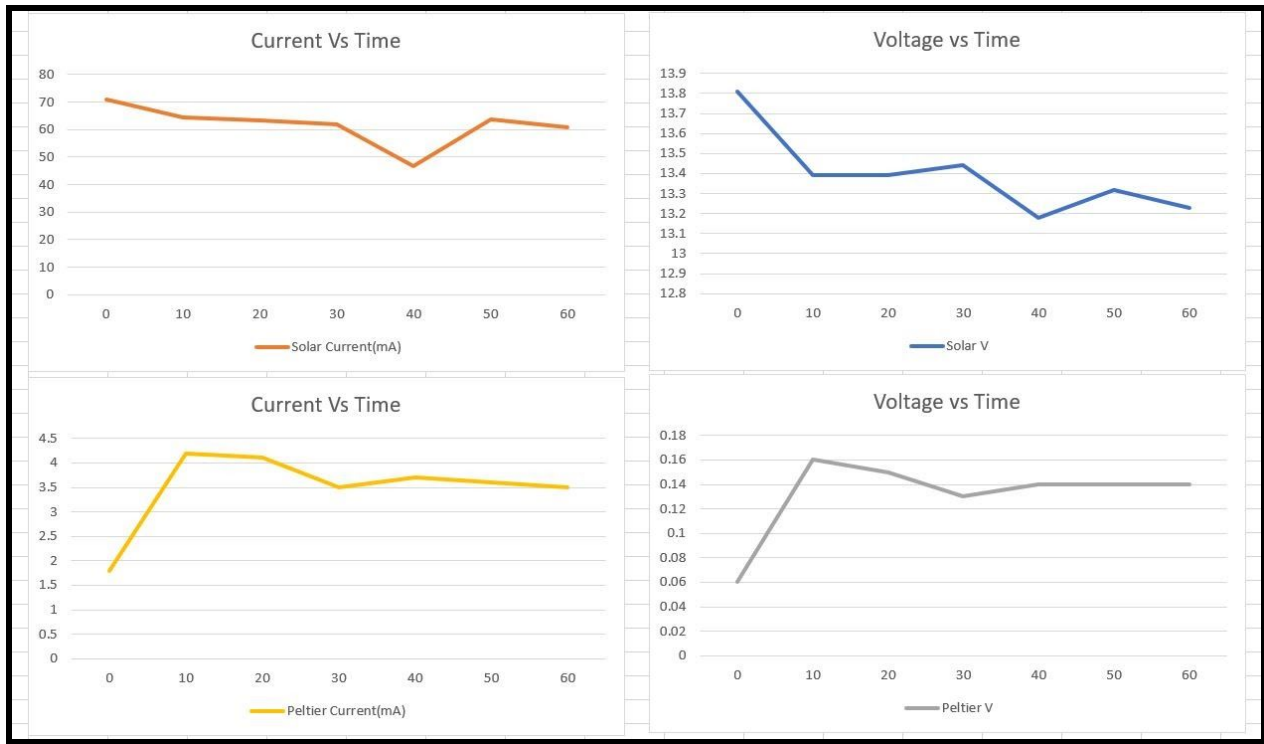
[Mechanical and System Schematic]

We have made it modular so to achieve an ease during maintenance. Our current prototype on average can generate up to 14V of DC power.

Prototype Testing



[Day 1 Testing]



[Day 2 Testing]

3. Conclusion

After performing multiple tests, we realise that as the temperature increases, the efficiency of the solar panel decreases. Instead of wasting the heat energy absorbed by the solar panels, the peltier utilized this heat energy and converts it into electrical energy.

We can conclude that indeed with the help of the peltier, we are able to achieve a slight increase of voltage produced. The Peltier can complement the uses of the solar panel to achieve voltage when the solar panel efficiency drops. We can increase the number of Peltiers in one module to increase the voltage gain per unit.

The Benefits

1. The project is made with limited moving parts, therefore leading to less maintenance due to mechanical wear and tear. This leads to savings in maintenance and service cost upon implementation, as Peltier units are mechanically strong and thermally resilient.
2. This device is powered by energy converted using the sun's energy. Therefore this leads to a greener environment as there is less reliant on electrical energy generated from burning fossil fuels.
3. The Peltier enable the device to produce voltage constantly even in the absence of sunlight.
4. The device is made modular, which helps during the maintenance. When a module is faulty, we will be able to interchange the faulty module with new ones.
5. Multiple modules can be connected at the same time to form a photovoltaic/thermoelectric power station.

The design of this module can be modified to ensure that the peltier is able to achieve a greater temperature difference. Our project is unique as its inspired by the concept of perpetual energy and since the sun is its main source of energy, this prototype would have little repercussion of using heat and light as energy.