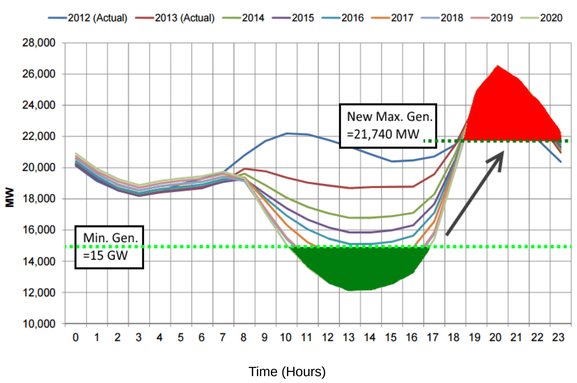
# Latent Heat Battery

## A Phase Change Battery that will brighten our nights

By Richard Dering, Richard Obregon, Xiao Yuan, Sean Headley, Vishav Singh, Justin Salazar, Gökhan Mungan, Laura Hernandez, Zach Williams, Jerry Woodall

## The Solar Storage Crisis

Within the past decade, there has been an exponential growth in solar panels around the world. With constant technological improvement, solar panels have become more efficient. However, solar panels are only efficient and useful in the daytime .




The graph above is known as the "Duck Curve". The Duck Curve is a graph of power production over the course of a day that shows the timing imbalance between peak demand and renewable energy production. The green shaded region is the point of over-generation, where PG&E can no longer buy back the energy and the energy is lost. The red shaded region is the area of over-consumption, where the demand for energy is higher than what they can supply.

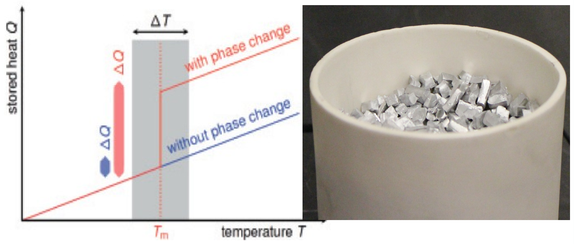
## The Solution to the Crisis

In order to stop wasting energy and exhausting our resources, we must find a way to efficiently store it. With Jerry Woodall's proposed phase change battery, we can do just that.

## The Phase Change Alloy

The material we use is an alloy made up of Aluminum and Silicon, the second and third most abundant elements on Earth. The reason we use this alloy is due to it's high latent heat, high thermal conductivity, and low thermal expansion.

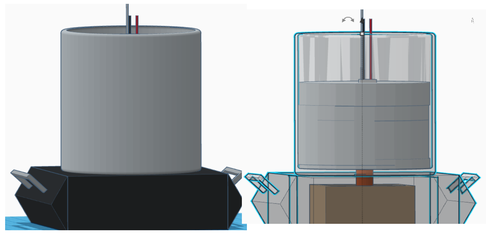
Latent Heat of Fusion



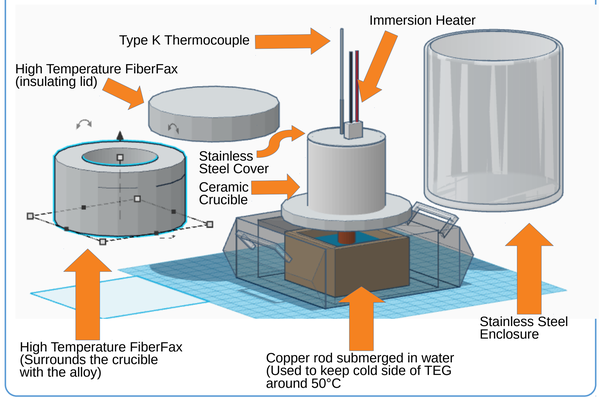

| Metal / Alloy | Latent Heat of Fusion (kJ/kg) | Melting Point (°C) |
|---|---|---|
| Aluminum | 396 | 660 |
| Silicon | 1665 | 1410 |
| Al-12.2%Si | 555 | 577 |

## The Battery

The battery operates by having a solar panel supply power to an immersion heater submerged in the alloy. The alloy will eventually reach 577°C where it will change from a solid to a liquid. Once the sun goes down, we will convert the thermal energy into electricity, to power your electronics over night.



The design above is an exterior and interior look to the prototype battery that has been created. A few key features are: insulation, a control system, and a Thermal Electric Generator(TEG).

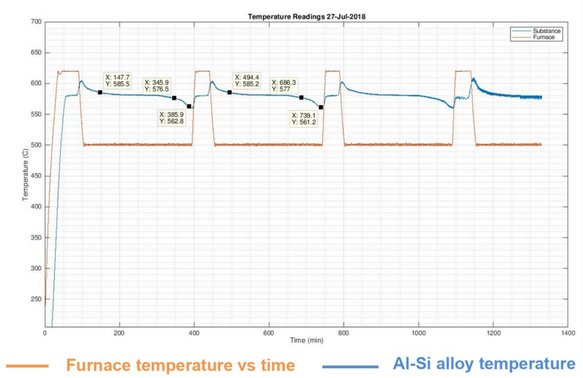



## Testing

Testing began by heating up a box furnace with 1.2Kg of the alloy placed inside. With the control system in place, The furnace acted as both a heater and then a load. With the furnace as a load, the alloy began to cool.

## The Results

We collected the data for multiple cycles and the results were promising.




The 1.2Kg substance stayed at 577°C for roughly 3 hours.

## What's Next?

With the results we have acquired we will scale up the battery from 1.2Kg to roughly 104Kg of the alloy. Using this amount should produce 16kWH.