13 April 2023

GEN-AQUA

Barry Curtis
Adinah Gray
Nii Kojo Mante
Paulos Paulos

PROBLEM DEFINITION

- BACKGROUND
- PROBLEM STATEMENT

DISSATISFIED CONDITIONS

- BATTERIES AND HEAVY METALS
  - TYPICALLY USED TO STORE ENERGY IN SOLAR POWERED SYSTEMS WHICH ADD TO WASTE AT THE END OF LIFE
- ENVIRONMENT POLLUTION
  - BATTERY WASTE RESULTS IN CORROSIVE LIQUIDS WHICH ARE TOXIC FOR THE ENVIRONMENT
- FOSSIL FUELS
  - FINITE AMOUNT AVAILABLE FOR ENERGY GENERATION

NEEDS AND DEMANDS

- ENVIRONMENTALLY SAFE MECHANISM
- COMPLETELY RENEWABLE
- MORE EFFICIENT
- CHEAPER

PROJECT GOAL

OUR GOAL IS TO PRODUCE AN ENERGY-EFFICIENT SYSTEM THAT INTAKES EXCESS SOLAR ENERGY AND STORES IT AS GRAVITATIONAL POTENTIAL ENERGY TO BE USED LATER

PROBLEM STATEMENT

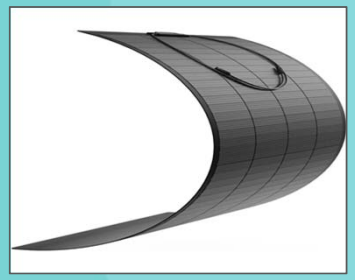
GEN-AQUA

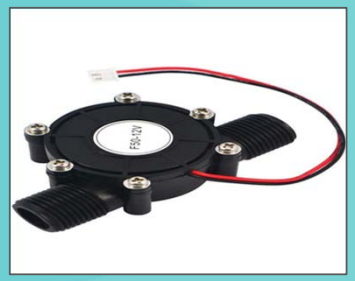
The Gen-Aqua provides user with a self-contained power generating system with an environmentally friendly method of storing solar energy for usage during hours of inadequate sunlight.

DESIGN REQUIREMENTS

DESIGN REQUIREMENTS

- 5.5V SOLAR PANEL
- 12V WATER PUMPS
- 4 WATER TANKS CAPABLE OF STORING 2-5 GALLONS OF WATER
- LED LIGHT OR LOAD FAN
- WATER WHEEL TURBINE





CONSTRAINTS

WATER PUMP

- Making sure our water pump outputs the correct amount of water into the tanks

OVERFLOW

- Water overflowing into the tank overnight

WATER WHEEL

- Efficiency of a water wheel on a bigger scale

MINIATURE FEATURES

- Size of our potential model causes size constraints for our water pump and solar panels

CAPACITY

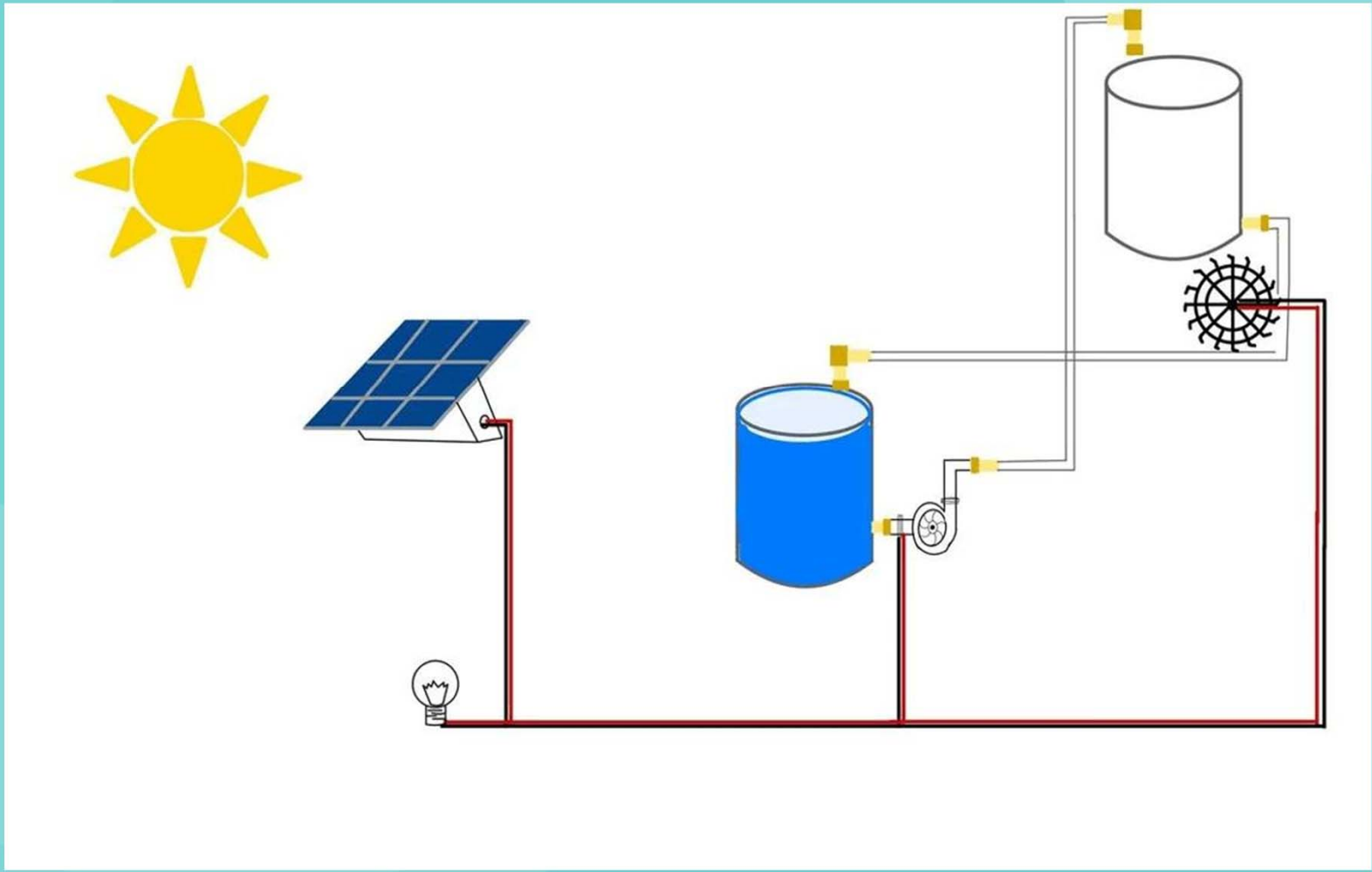
- Limited water and energy storage capacity

SYSTEM HEIGHT

- The need for differential pressure to generate enough power to power the turbine and the power of the pumps needed to move the water back up

SOLUTION DESIGN

PRELIMINARY DESIGN



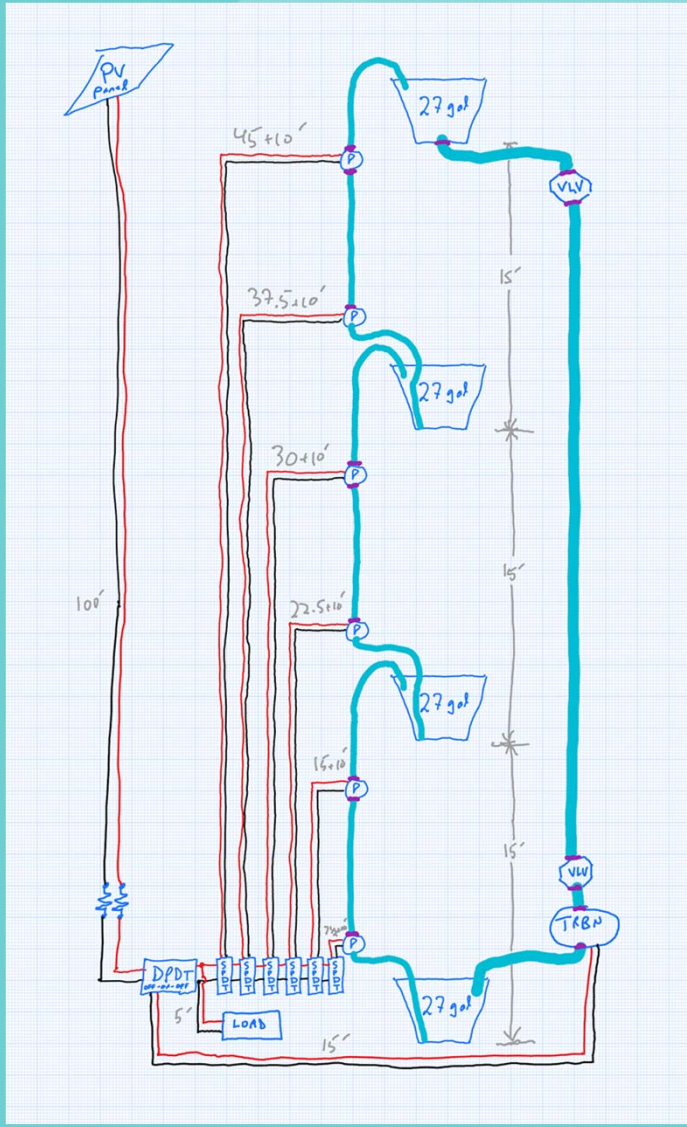
FINAL SOLUTION SCHEMATIC

DAY:

- Sun illuminates the photovoltaic cells (PV 1) to generate sufficient electrical energy needed to drive the load
- The excess energy drives the aquarium micro pumps which pumps water from the lower tank to the higher resting tanks until it reaches the highest tank.

NIGHT:

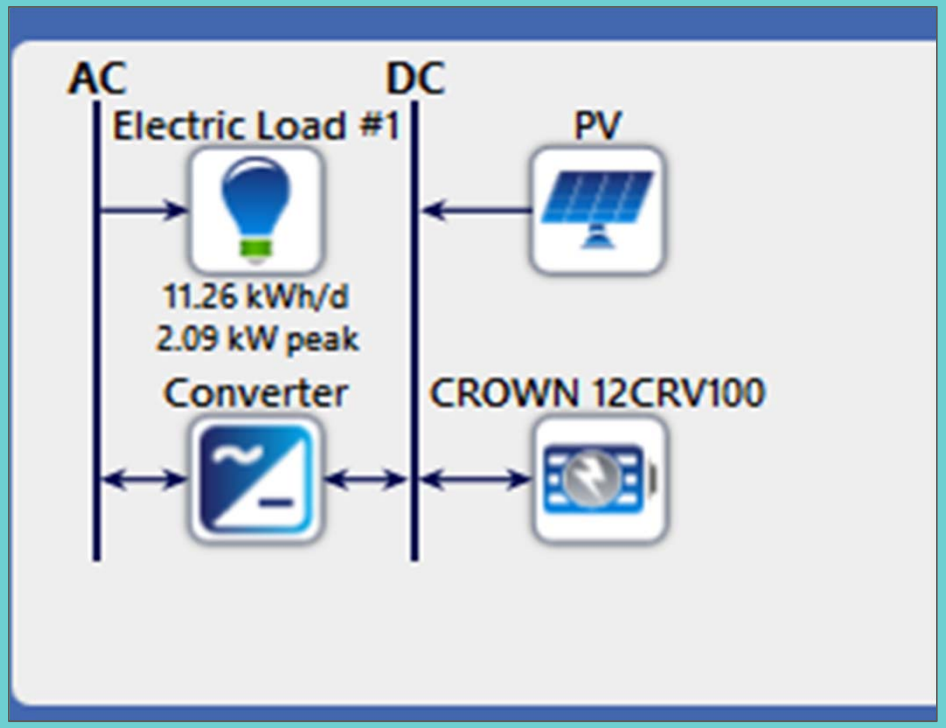
- When the system isn't receiving solar energy to power the load, a switch opens the circuit from PV 1 and completes the circuit needed for the water wheel and a valve allows water to drain from the highest tanks through to the lowest tank.
- As the water drains it turns the water turbine which will generate the needed energy to power the load in the absence of solar power.

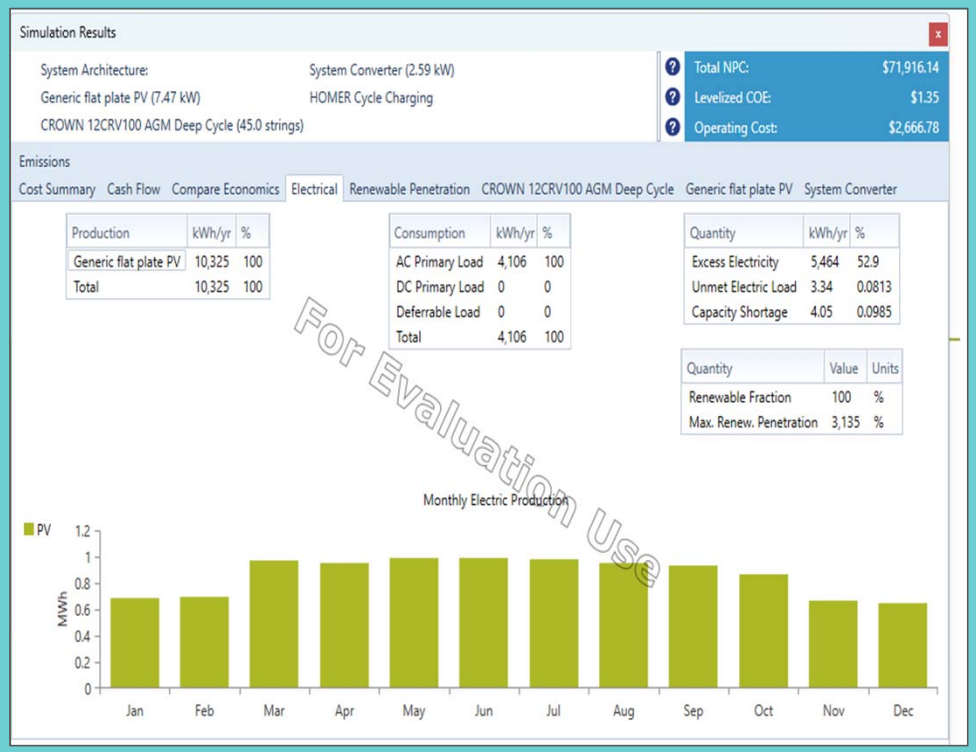


IMPLEMENTATION PROCESS

SPRINT I

HOMER SOFTWARE SIMULATION





SPRINT 2

COMPONENT TESTING

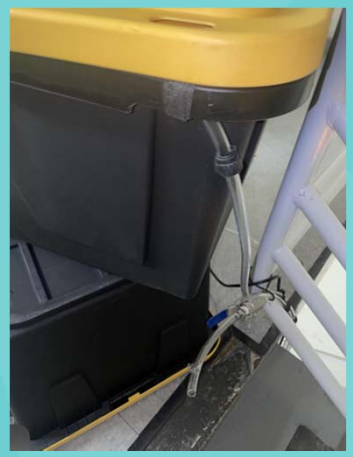
SPRINT 3

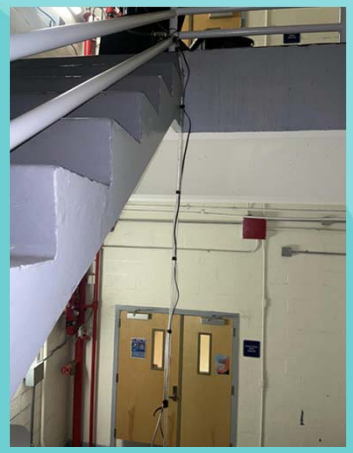
ASSEMBLY AND INTEGRATION TESTS

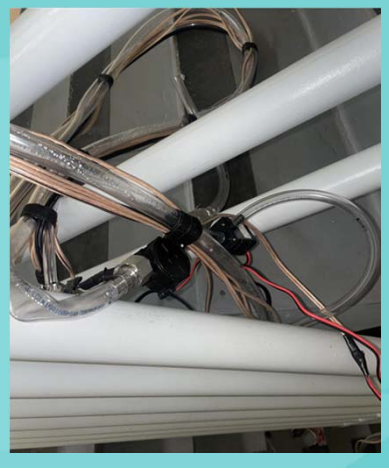
[redacted]

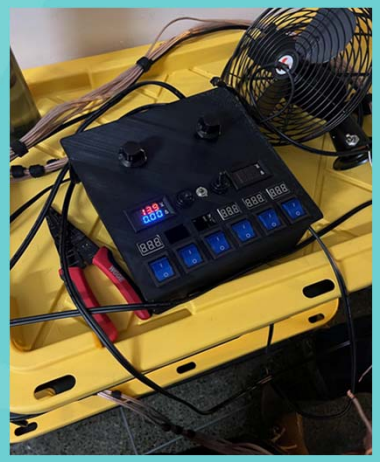
SPRINT 4

INTEGRATED SYSTEM BUILD AND TEST









SPRINT 4 CONT.

CONCLUSION

There is a need to store electrical energy harnessed from the sun in a manner which is least disruptive to our ecosystem. This design meets this goal by utilizing the gravitational potential energy of water as an energy storage medium instead of heavy metal batteries.

Q&A

Thank you for listening!