

Renewable Energy Toolkit

PRESENTED BY: MOHAMMED JARKHI, TALAL ALENEZI, MOHAMMAD
ALSHARIDAH, FAHAD ALSUWAILEM, HAMAD ALSHARHAN

Project Description



Figure 1: PV Solar Parts

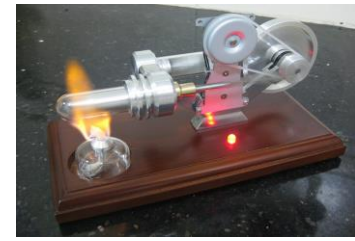


Figure 2: Air Stirling Engine

- **Goal:**

- Create a renewable energy toolkit to educate students and adults from around the world about how to implement renewable energy sources.
- Design & build a toolkit for each type of renewable energy.
- Show how each source can be optimized to maximize power output (e.g. environments, techniques).

- **Renewable Energy Sources included:**

- **Solar Photovoltaic (PV) cells (Figure 1):**
 - Produce energy gained directly from the sun.
- **Biomass - Air Stirling Engine (Figure 2):**
 - Produce energy obtained from living organisms.[1]
- **Wind Turbine (Figure 3):**
 - Produce energy gained directly from the wind.
- **Water Wheel Turbine (Figure 4):**
 - Produce energy gained directly from water.
- **Load:**
 - The usage of the load is to measure power out of each source.



Figure 3: Wind Turbine



Figure 4: Water Wheel Turbine

Customer & Engineering Requirements

Customer Requirements:

- Low Cost
- Ease to Assembly
- Portable
- Lightweight
- Safety
- Educational

Target	Tolerance
Maximum dry weight	Up to 50 kg
Price	Proposed Price < \$1500
Energy Output	At least 12W

Table 1: Engineering Requirements

PhotoVoltaic Solar Cells

Final Design specifications:

- Tablet holder
- Protractor
- Rubber twist tie
- Metal Piece
- Digital angle finder
- Compass

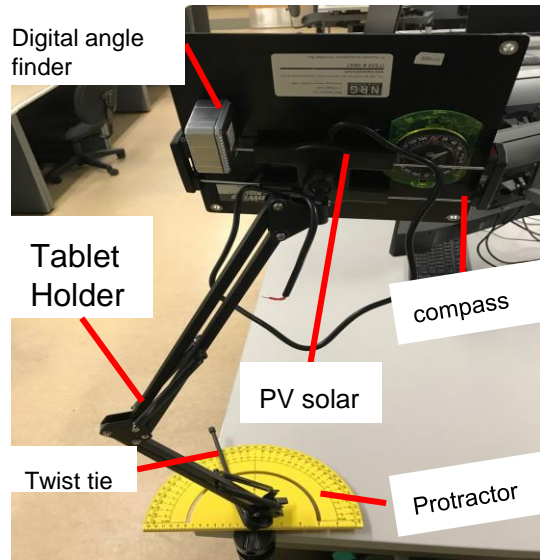


Figure 6: PV Solar Set-up

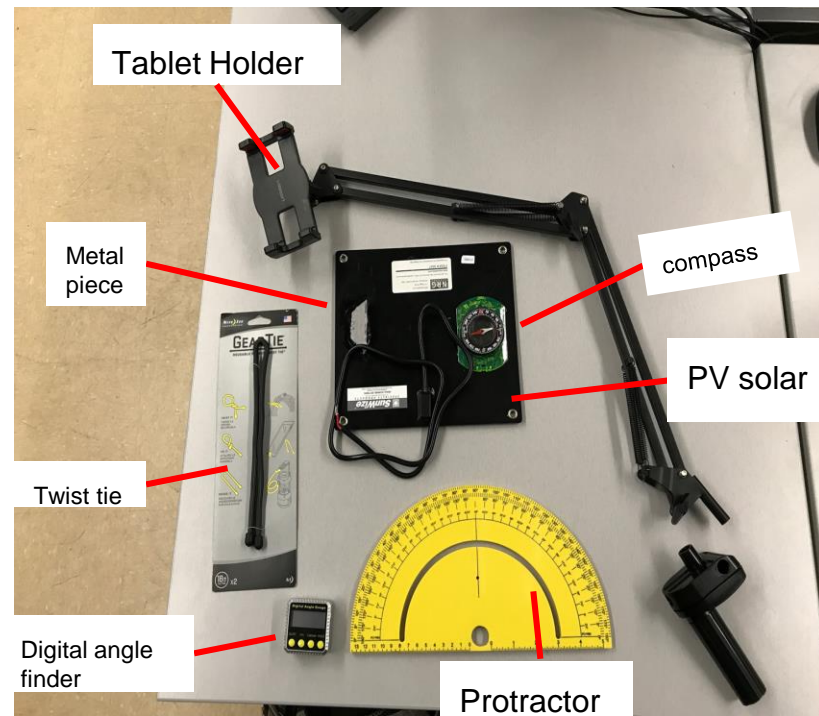


Figure 5: PV Solar Parts

Manufacturing & Results

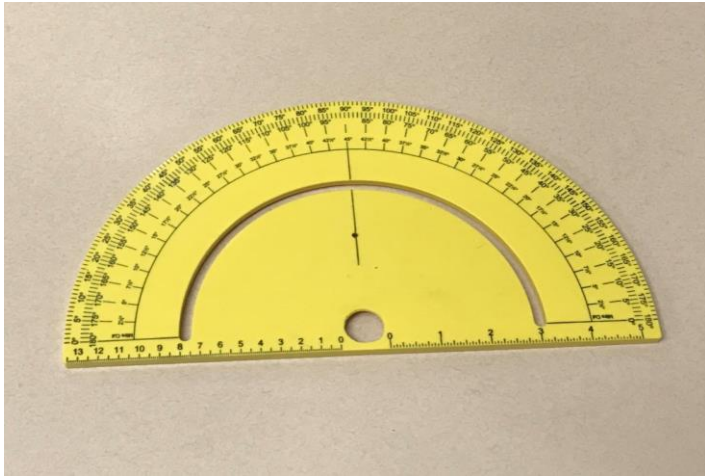


Figure 7 : protractor manufacturing

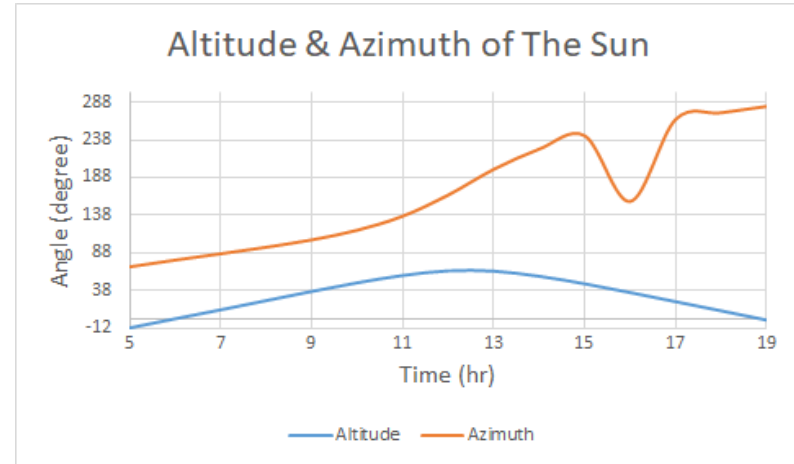


Figure 8 : Altitude and azimuth of the sun of Apr 16, 2018 Flagstaff, Arizona [2]

Air Stirling Engine

Final Design specifications:

- Air stirling engine
- Because of the heat from denatured alcohol,the engine will run madly and create the electricity
- Speed:1300 to 1500 RPM
- Weight: 350g
- Size: 180mm X 90mm X 90mm
- Material: Glass, Wood and Aluminium

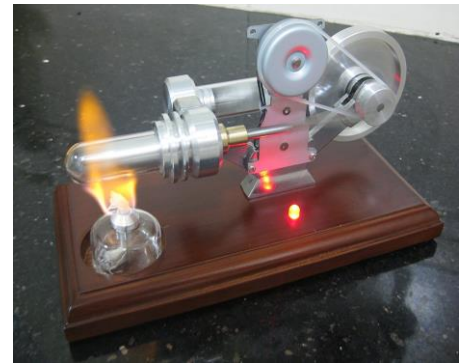


Figure 9 : Air Stirling Engine

Manufacturing & Results

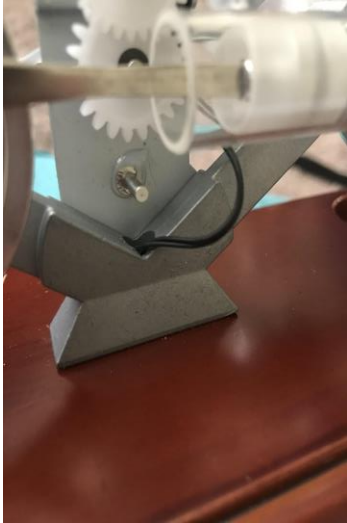


Figure 10: Red bulb wires



Figure 11: DC motor adapter

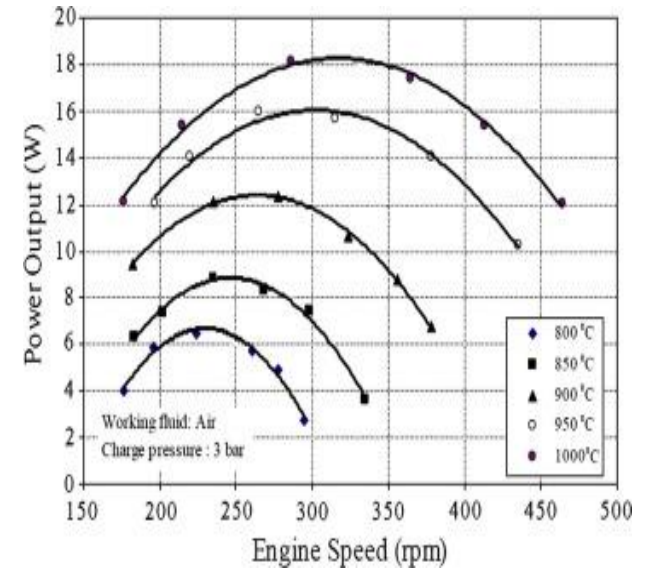


Figure 12: Power output Vs. Engine speed[5].

Wind Turbine

Final Design specifications:

My project is about three things which are wind turbine, telescoping extension pole and Anemometer.

- Wind turbine:
- Rotor type: Horizontal axis
- Generator type: 12 Volt
- Maximum Generator Output: 15 watts
- Turbine Weight: 1 lb
- Telescoping extension pole:-
- 6.5-to-18 foot
- Anemometer



Figure 14: Anemometer



Figure 13: Wind Turbine



Figure 15: Telescoping pole

Wind Turbine Testing & Results



Video 1: Shows turbine at low inclination



Video 2: Shows turbine at high inclination

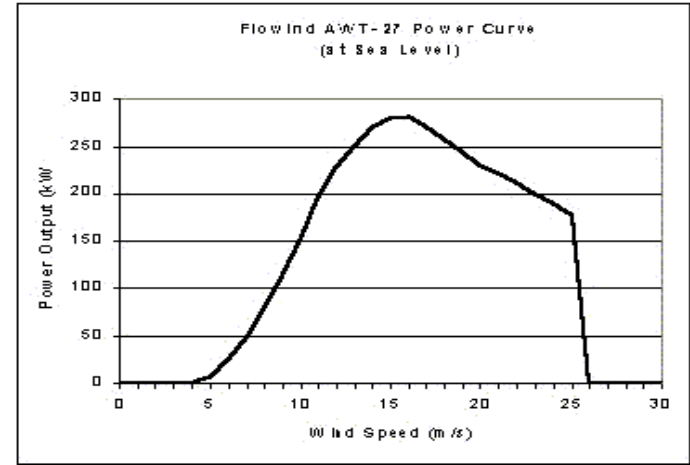


Figure 16: wind turbine output Vs. wind speed[4]

Water Wheel Turbine

The objective of a water wheel turbine to determine the amount of power can produce and will help also to understand the process of converting potential energy into mechanical energy and electrical energy and see how much of power can we get in watts.

Final Design specifications:

- Bike rim with sprocket 9 teeth
- 15 W DC motor with 50:1 gear reduction
- Wood
- 9 Cups 3D print
- Sprocket 34 teeth and diameter 5"
- Chain 52"

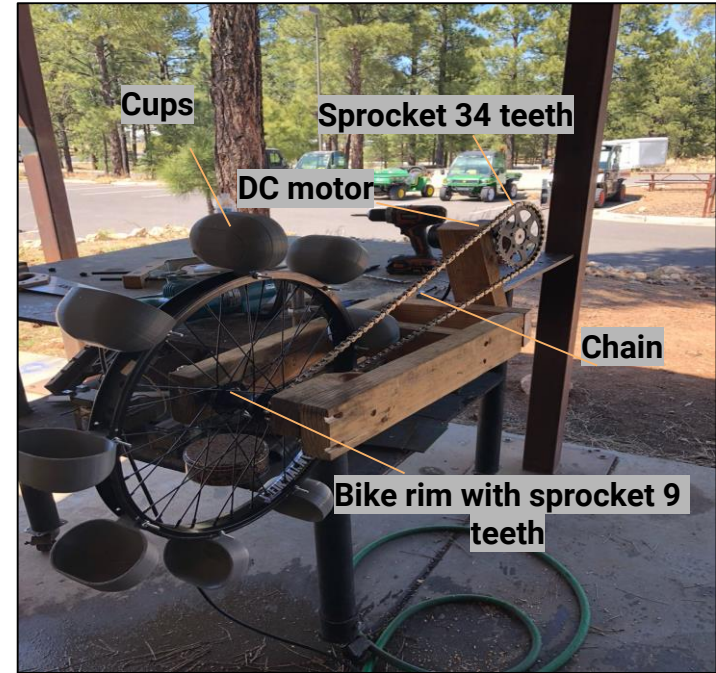


Figure 17: Water Wheel Turbine

Manufacturing

- Adapter for DC motor to connect sprocket
- Cups 3D printing
- Wood

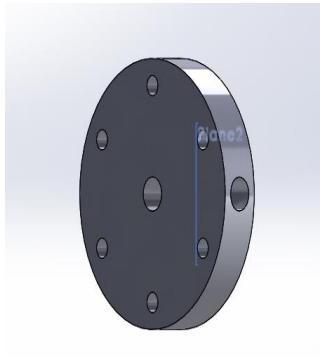


Figure 18: Adapter

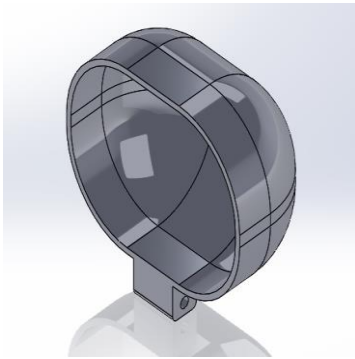


Figure 19: Cup

Water Wheel Testing & Results



Video 3: Shows test of water wheel

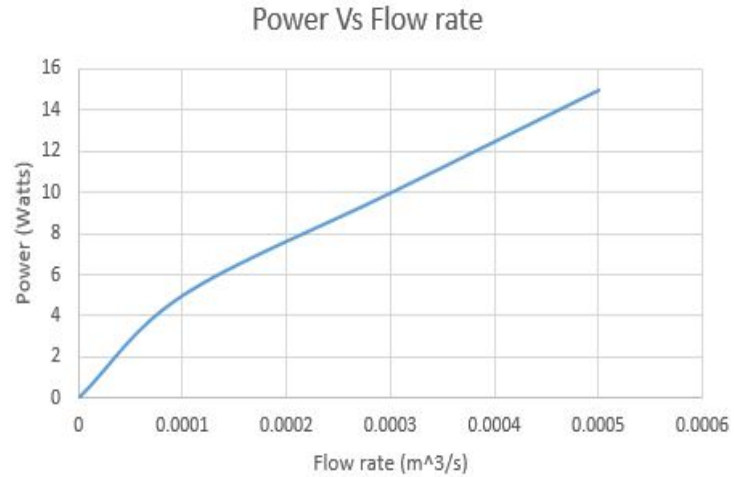


Figure 20: Power Vs. Flow rate for water wheel [3].

Load Box

Final Design specifications:

The load box is the right device to use, considering that each of its components performs well and it indicates the required results clearly with the help of the watt meter. One drawback is that its capacity is limited and an input that surpasses the capacity results in overheating, which can be extremely dangerous.

- Watt Meter
- 4 Light bulbs (each 15 W)
- 4 Light Socket Lamp Holder
- Fuse
- Fuse Holder
- 4 Switches
- Bread Board

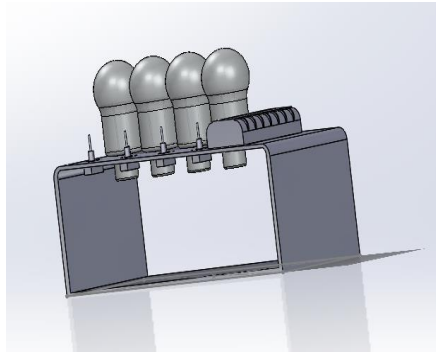


Figure 21: CAD load box



Figure 22: 3D Print load box

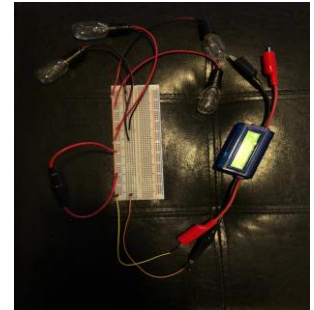


Figure 23: Final Design

Conclusion

- A toolkit can be defined as a listing of all the techniques that can be used to improve a resource's performance.
- The aim of the project is to explain the renewable energy sources and their potential implementation in different areas.
- The best individual decision is to carefully choose the right kind of energy resource and make the most out of these natural energy depending on the availability of them.

Special Thanks!



Dr. Trevas
(Instructor)



Dr. Acker (Client)



Mark Glauth (Client)



Amy Swartz (TA)

References

- [1] Klass, D. L. (1981). *Biomass as a nonfossil fuel source: Based on a symposium sponsored by the Division of Petroleum Chemistry at the ACS/CSJ Chemical Congress (177th ACS National meeting), Honolulu, Hawaii, April 2, 1979*. Washington, D.C.: American Chemical Society.
- [2] <http://aa.usno.navy.mil/cgi-bin/aa.altazw.pl>
- [3] Taylor, C.. "How to Calculate Water Wheel Power." Sciencing, <http://sciencing.com/calculate-water-wheel-power-7604567.html>. 24 April 2017.
- [4] <http://www.punchdown.org/rvb/wind/karen/thesis.html>
- [5] <https://www.sciencedirect.com/science/article/pii/S1359431117340528>

Questions?