



**Warren Central High
School Energy
Management Club**
**Project Title: Generating Clean
Energy and Educating Future
Leaders**
**Advisor names: Nathan Dick
and Dara Carver**

DURING THE 2018 TO 2019 SCHOOL YEAR THE WARREN CENTRAL HIGH SCHOOL ENERGY MANAGEMENT CLUB HELPED WITH VARIOUS PROJECTS AROUND THE SCHOOL. THESE PROJECTS INCLUDED DESIGNING A BICYCLE TO GENERATE CLEAN RENEWABLE ENERGY AND A WAY TO CHARGE PHONES THROUGH SOLAR POWER. OUR GROUP ALSO HELPED TO EDUCATE THE SCHOOL ON HOW BEING ENVIRONMENTALLY FRIENDLY AND CONSERVING ENERGY CAN BE BENEFICIAL FOR OUR FUTURE AND ASSIST THE SCHOOL IN SAVING MONEY. WE ALSO SAW HOW THERMAL DRONE TECHNOLOGY CAN BE USED FOR ENERGY PURPOSES.

PROJECTS

- 1) Bicycle Generator - Created a bicycle to generate electricity through pedaling
- 2) Solar Powered Cell Phones- Using a solar panel to generate power to charge cell phones
- 3) Educate faculty, staff, and students on how managing energy can be beneficial for the school and the environment

ENERGY MANAGEMENT CLUB PHOTO

Top Row

(from left to right):
Martin Hernandez, Mirza
Cirak, Levi Burns, Lana
Davis, and Noah Cherry

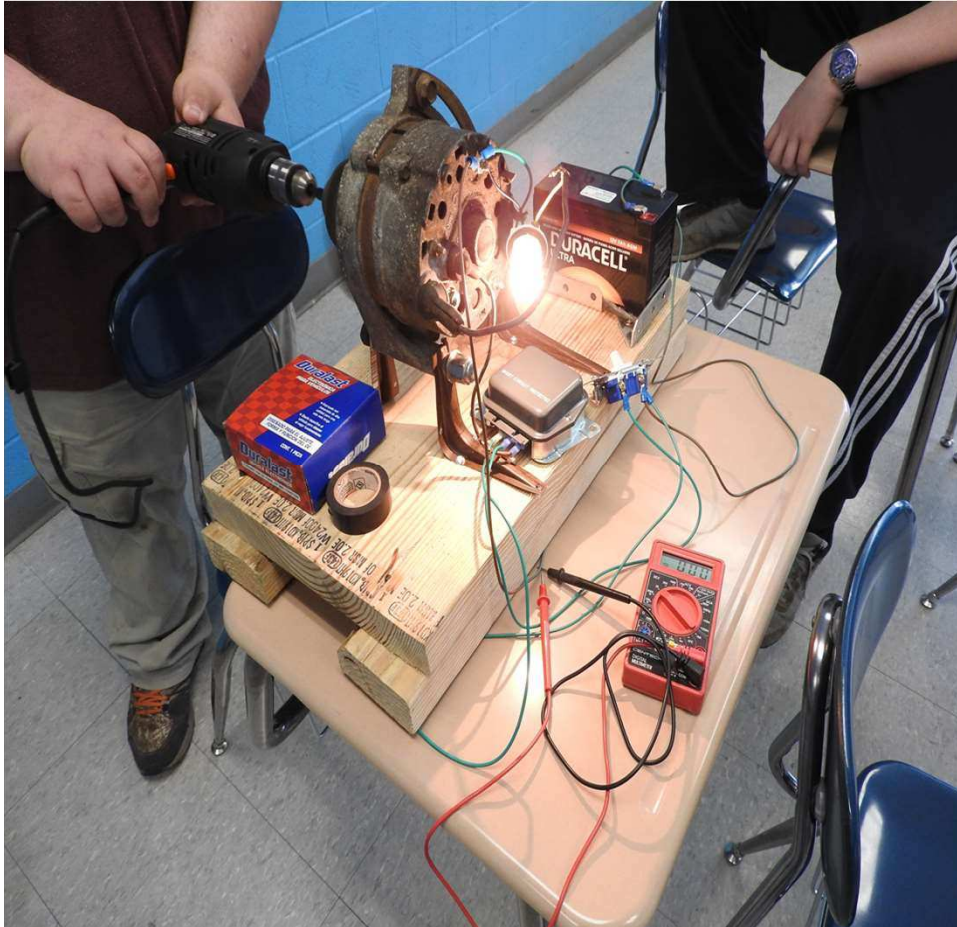
Bottom Row

(from left to right):
Lorenzo Brito,
Chloe Jones, Anna Dim,
E Myo Zin, and Mr. Dick

Missing: Jacob Waltermann
and Cory Cleveland



BICYCLE GENERATOR



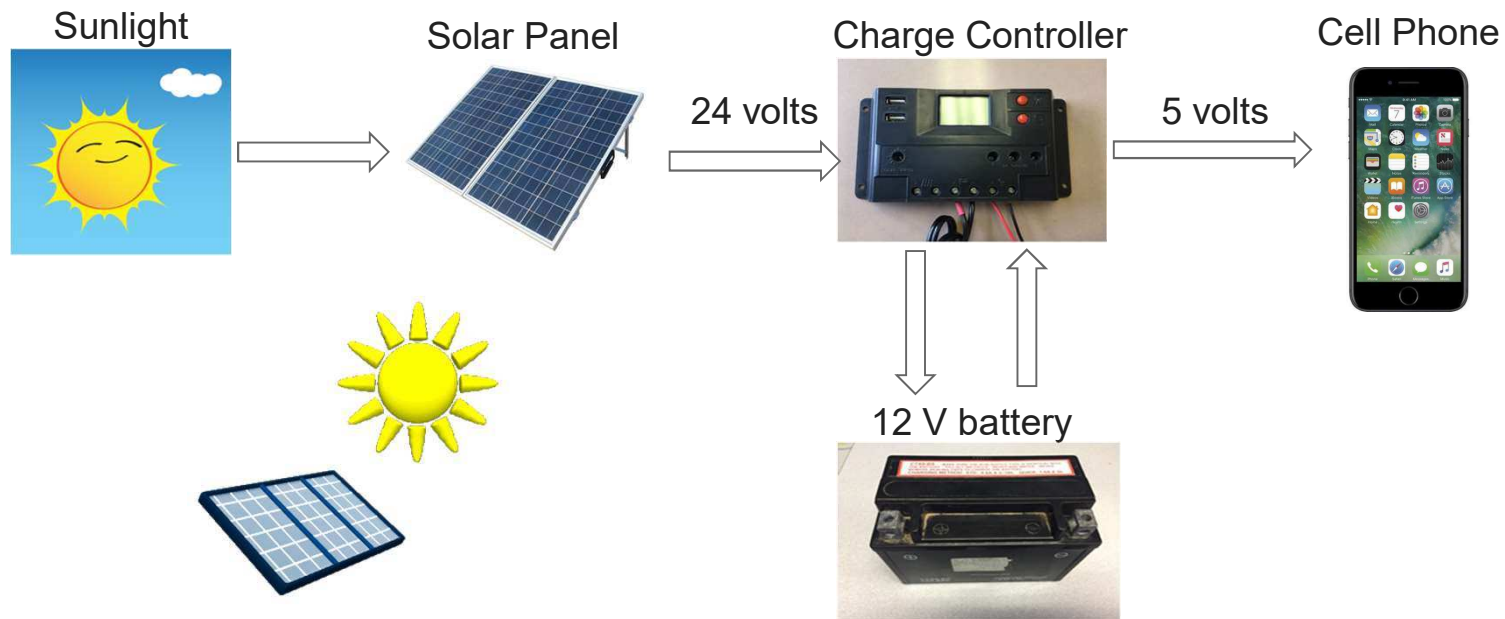
We created a stationary bicycle that generates electricity through the motion of pedaling. The bicycle turns an alternator which charges up the 12 volt battery. We have included a light bulb in the circuit. The energy created by pedaling the bicycle will be used to light the bulb.

BICYCLE GENERATOR PHOTO AND VIDEO



SOLAR-POWERED CELL-PHONES

We created a solar powered mechanism that charges phones using power generated by the sun. (Explanation of mechanism here) Panel - Charge controller - battery - voltage convertor (12V to 5V) - Usb 1 amp



CALCULATIONS AND MEASUREMENTS

To find the power that the solar panel would need to output, we used the cell phone's internal battery voltage (5 V) and amp hour rating (2000 mAh, source below) to find its power of 10 Wh. We then scaled up to account for three cell phones (6 Wh). The cell phone port only allows for a maximum of 1 amp. So it will take each cell phone (2 Ah/1A) 2 hours to charge. This means that a total of (6Wh/2h) 3 W are needed. The solar panel is about 80% efficient so we would have to scale up the power by a factor of 1.2 to get a solar panel power rating of 3.6 W.

The solar panel that we purchased for the project is rated for 25 W so this was sufficient for our needs.

The battery used for the project was a small 12 V 7Ah Duracell battery purchased from Batteries and Bulbs.

Source: <https://www.fluxchargers.com/blogs/flux-blog/best-smartphones-largest-battery-capacity-life>

COST ANALYSIS OF SOLAR PANELS

It was not the end goal of the project for the setup to pay for itself quickly. It was more meant for educational purposes. However, it is very logical to ask the question how long will it take for the solar powered cell phone system to pay for itself. In order to do this we need to consider the costs of the system.

Solar panel: \$40

Battery: \$33.29

Usb port: \$1

Next we need to consider the amount of electrical energy that will be conserved. If ten cell phones are drained to 50% and charged on the setup each day. Based on the calculations done on the previous slide, there would be 1.8W used by the three cell phones to recharge. In order to find the amount of money saved in one day,

Money saved in one day = $0.0018\text{Wh} \times 2\text{h} \times \$0.12/(\text{KW}\cdot\text{h}) = \0.0004

Amount of time to pay off = $\$74.29/\$0.0004 \text{ per day} = 185725 \text{ days} = 508.83 \text{ years}$

Obviously if we were charging more cell phones the system would be much more economical.



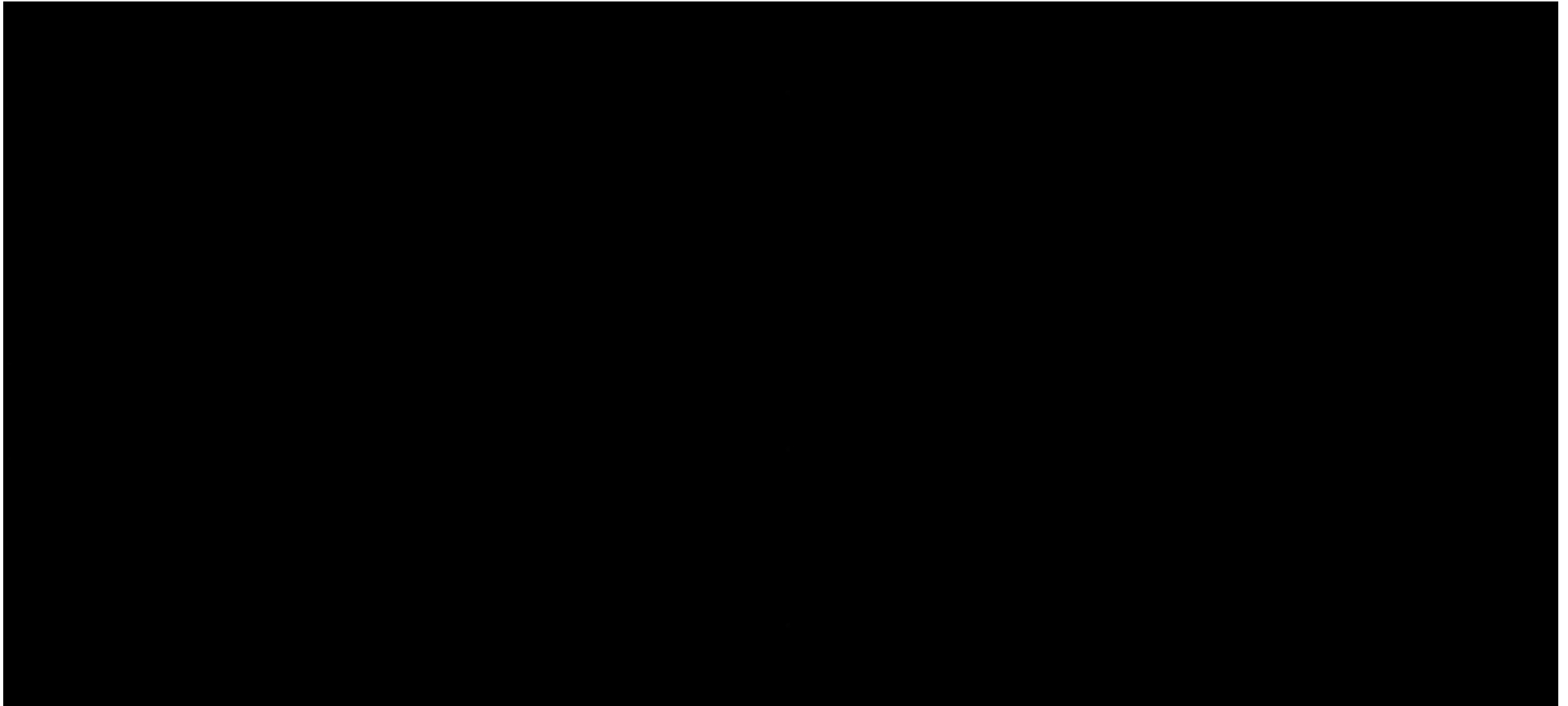
ENERGY EDUCATION



Our energy club presented an educational powerpoint to our school's global issues class about renewable and nonrenewable energy sources. We taught the class about biofuel, wind based energy, solar powered energy, and biogas being used throughout the world to work towards using all renewable energy rather than fossil fuels. The following slide shows a video about how biogas can be made from food scraps and the gas can then be used for cooking.

Source: <https://ec.europa.eu/jrc/en/news/energy-package-clean-energy-all-europeans>

ENERGY EDUCATION VIDEO ON BIOGAS



Source: <https://www.youtube.com/watch?v=xKOG7Ib48bl>

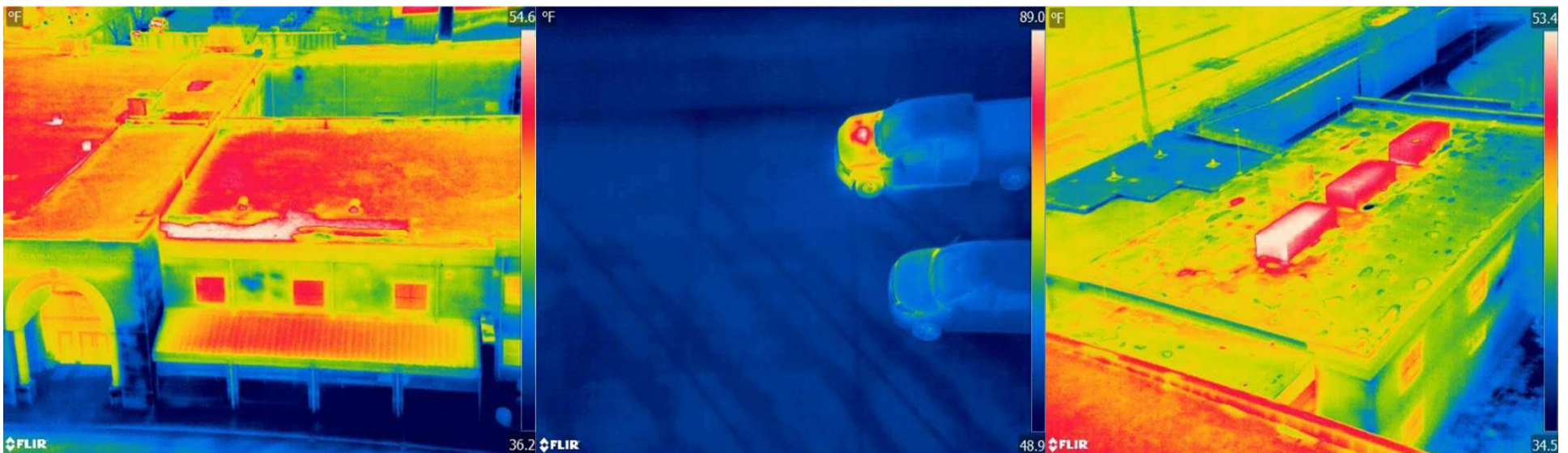
WRECC DRONE THERMAL IMAGING PHOTOS

Another part of the energy education was when WRECC came to our school to show us their drone and its thermal camera capabilities. WRECC also explained how they used the drone to monitor and repair power lines as well as how thermal drones can be used to find missing people.

Thermal image of top of school

Thermal image of truck

Thermal image of top of school

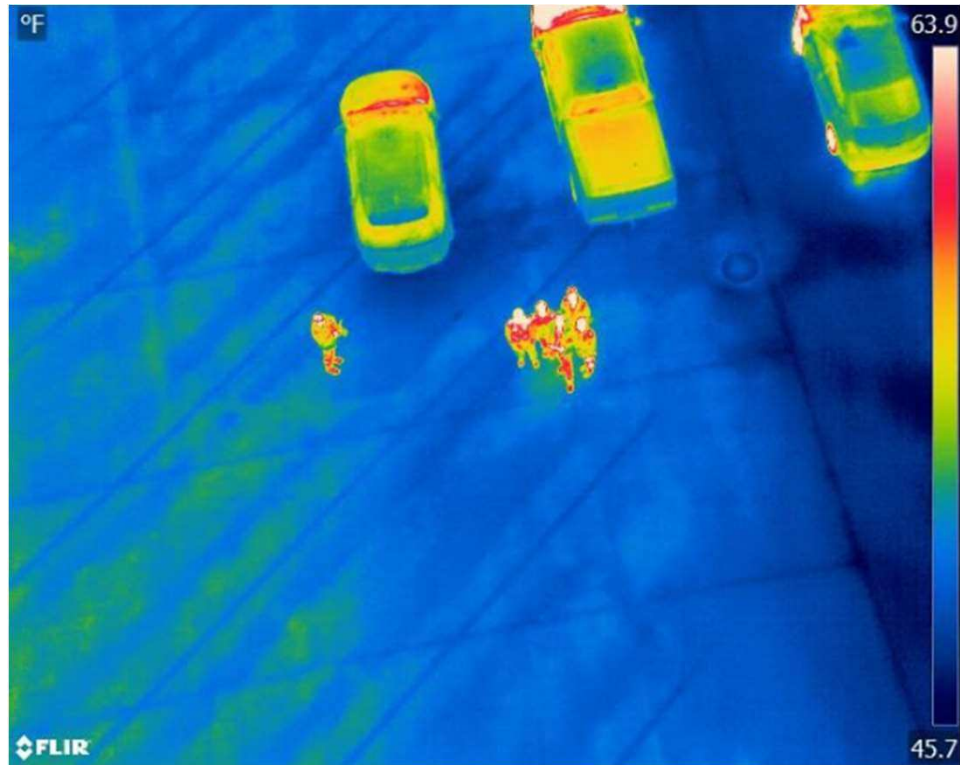


MORE WRECC DRONE THERMAL IMAGING PHOTOS

Thermal image of front entrance of school



Thermal image of energy club



IMPROVEMENTS FOR NEXT TIME

Next time we plan to continue on our theme of solar energy but want to improve things from what we have done. We would like to improve the solar cell phone charger setup by adding more panels so there will be room for more calculators. We would also like to get the setup mounted in the room. As far as the bicycle setup goes, we would like to use an inverter to convert the DC voltage to AC and then be able to use it to power more thing. It would also be neat to collect data about how much a person pedals the bicycle and how much power is output. We can continue to educate students on the importance of energy conservation. We may be able to make compost and use it in the garden at the school

THANKS TO OUR SUPPORTERS!

Warren Rural Electric County Cooperative (WRECC)
– Gave time to come speak to the club and demonstrate their thermal drone technology

Bowling Green Municipal Utilities (BGMU) – Going to come and present about the solar installations in Warren County Schools

ADDITIONAL CLUB PHOTO

