



# Hawk Energy Club

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Myrtle Beach Middle School

Myrtle Beach, SC

# About Our Club

- Myrtle Beach Middle School
- Hawk Energy Club
- **Advisor:** Katie Forrest, 8<sup>th</sup> grade science
- **Student Leaders:** Malik Gillard, Ja'Niyah Wood, George Surlis, Vanessa Mujica-Sargento
- **Project Title:** The Future is Now
- This is the second year for our club. Last year we worked on the transition from our old school to the new, energy efficient school.
- Since we started our club with brand new members this year, we began to learn about the energy efficiency of our new school designed by FirstFloor, Inc. We focused on the Solar Panels, Geothermal Wells, Plug Loads, and Light Energy. We finished out the year with our Genius Hour Playground presentation for the school and any community members who wished to attend. It helped us understand, as well as others, the fact that we can do so much better in conserving energy for the future!

# Goal 1

## Learn about different energy alternatives

- **Activities And Tasks**

- Lectures and hands-on activities about solar panels
- Geothermal Wells and how they work
- Brainstorms with group as well as family

- **Energy Content and Resources**

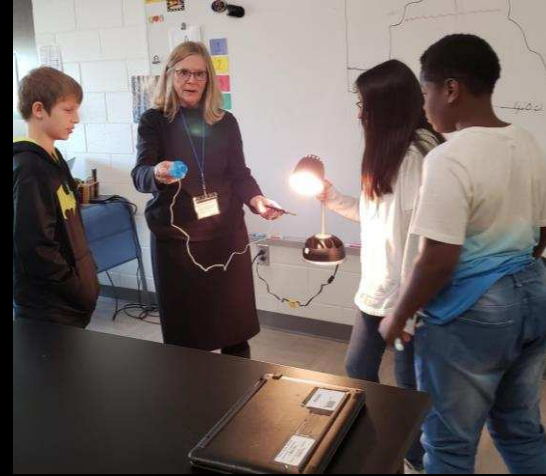
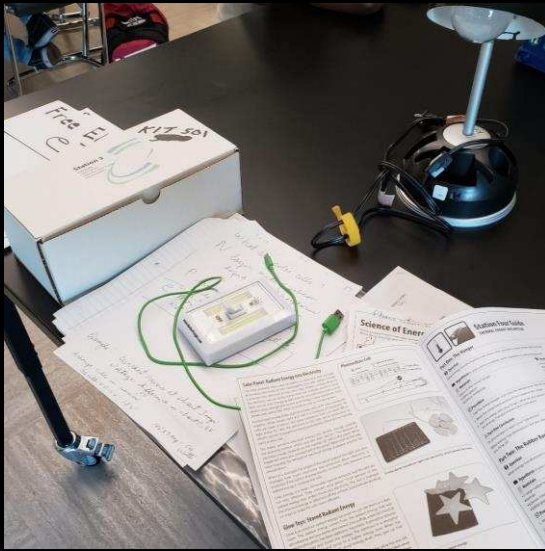
- Energy websites linked on [www.NEED.org](http://www.NEED.org) and [www.energywiseschools.com](http://www.energywiseschools.com)
- Energy Wise notebook resources
- Videos and Information linked to [www.santeecooper.com](http://www.santeecooper.com)
- NEED Learning and Conserving Kit
- NEED Science of Energy Kit
- NEED Intermediate Energy Infobook Activities

### **Student Leadership**

- 14 students total
- 2 ambassadors to greet guests
- 2 club secretaries
- 6 patrol members
- 4 editors

### **Evaluation**

- Discussed and evaluated visitor presentations
- Website discussion and evaluations
- Patrol forms evaluated
- Tour of the solar panels on the roof and tour of geothermal wells location



**Solar - 2018-2019 (Form D)**

Learn about solar: Investigate solar energy. Write a summary of what you find.  
 What do you know about solar energy? *It's a way to make power.*  
 How is it used? *To power the school. I don't have to pay as much as electrical companies.*  
 Why is it important? *For school. I don't have to pay as much.*  
 Does your school use solar energy? *Yes.*  
 Include summaries in the notebook.

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**Learn about solar panels.**

Draw a picture if possible to show panels. *Light to make power*  
 How do they work? *They catch the sunlight to make power.*  
 What is good about solar panels? *The schools don't have to pay as much.*  
 Are there any problems with solar panels? *They're very expensive.*  
 Include summaries in the notebook.

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**Learn about the solar panels in your school.**

How many panels does your school have? *2.*  
 Which way do they face, East, West??? *What is the angle? South, 5° angle.*  
 Is there storage? *Yes.*  
 How much energy do they generate? *1.5 kw hours*  
 Include the information in the notebook.

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*Madison Brown*

**Solar - 2018-2019 (Form D)**

Learn about solar: Investigate solar energy. Write a summary of what you find.  
 What do you know about solar energy? *Light or heat from the sun that produces light.*  
 How is it used? *To help power your home or school with the help of the sun.*  
 Why is it important? *It's clean and it's what replaces fossil fuels and keeps them clean.*  
 Does your school use solar energy? *Yes.*  
 Include summaries in the notebook.

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**Learn about solar panels.**

Draw a picture if possible to show panels. *Light*  
 How do they work? *They catch the sunlight and turn it into electricity.*  
 What is good about solar panels? *They're a good way to save money since it's cost free.*  
 Are there any problems with solar panels? *They can be expensive because it's a hard material.*  
 Include summaries in the notebook.

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**Learn about the solar panels in your school.**

How many panels does your school have? *I don't know about maybe 400 or 7*  
 Which way do they face, East, West??? *What is the angle? It's a five degree angle.*  
 How much energy do they generate?  
 Include the information in the notebook.

*3/14/2*



# Learning about Solar Panels

“It was fun to ‘be a solar panel’ in Mrs. Keele’s experiment. I really understand what is going on now!”  
 --8<sup>th</sup> grade Hawk Member



## Geothermal

NAME \_\_\_\_\_

### What is Geothermal Energy?

Geothermal energy is heat from within the Earth. The word **geothermal** comes from the Greek words *geo* (earth) and *therme* (heat). Geothermal energy is heat from within the Earth. Geothermal energy is generated in the Earth's **core**, almost 4,000 miles (6,400 km) beneath the Earth's surface. The double-layered core is made up of very hot **magma** surrounding a solid iron center. High temperatures are continuously produced inside the Earth due to the immense pressure on the core and mantle. Rocks in the mantle are warmed by the continuous, slow **radioactive decay** of minerals, which is natural in all rocks.

The outer core is the **mantle**, which is about 1,800 miles (3,000 km) thick and made of magma and rock. The outermost layer of the mantle is the **crust**. The crust is three to five miles (5-8 km) thick under the oceans and 15 to 35 miles (24-56 km) thick on the continents.

It is not a solid piece, like the shell of an egg, but is broken into pieces called **plates**. Magma comes close to the Earth's surface edges of these plates. This is where volcanoes occur. The magma erupts from volcanoes as magma that has reached the surface. Deep underground, the rocks and water in the crust are heated by the heat from this magma.

Geologists drill wells and pump the heated, underground water to the surface around the world use geothermal energy to generate electricity.

Geothermal energy is called a **renewable** energy source because it is replenished by rainfall and the heat is continuously kept within the Earth. We won't run out of geothermal energy.

### History of Geothermal Energy

Geothermal energy was used by ancient people for heating and bathing. Even today, hot springs are used worldwide for bathing, and many people believe hot mineral waters have natural healing powers.

Using geothermal energy to produce electricity is a new industry. A group of Italians first used it in 1904. The Italians used the natural steam erupting from the Earth to power a turbine generator.

The first successful American geothermal plant began operating in 1960 at The Geysers in northern California. There are now geothermal power plants in seven states, with more in development. Most of these geothermal power plants are in California with the remainder in Nevada, Utah, Hawaii, Oregon, Idaho, and New Mexico. Hawaii's facility on the Big Island needed to be capped in 2018, due to volcanic activity.

### Finding Geothermal Energy

What are the characteristics of geothermal resources? Some visible features of geothermal energy are volcanoes, hot springs, geysers, and fumaroles. But you cannot see most geothermal resources. They are deep underground. There may be no clues above ground that a geothermal reservoir is present below.

Geologists use different methods to find geothermal reservoirs. The only way to be sure there is a reservoir is to drill a well and test the temperature deep underground.

The most active geothermal resources are usually found along major plate boundaries where earthquakes and volcanoes are concentrated. Most of the geothermal activity in the world occurs in an area called the **Ring of Fire**. This area borders the Pacific Ocean.

### Hydrothermal Resources

There is more than one type of geothermal energy, but only one kind is widely used to make electricity. It is called **hydrothermal** energy. Hydrothermal resources have two common ingredients: water (*hydro*) and heat (*thermal*). Depending on the temperature of the hydrothermal resource, the heat energy can either be used for making electricity or for heating.

- **Low Temperature Resources: Heating**

Hydrothermal resources at low temperatures (50-300°F, 10-150°C) are located everywhere in the United States, just a few feet below the ground. This low temperature geothermal energy is used for heating homes and buildings, growing crops, and drying lumber, fruits, and vegetables.

In the U.S., geothermal heat pumps are used to heat and cool homes and public buildings. In fact, each year about 50,000 **geothermal exchange systems** are installed in the U.S. Almost 90 percent of the homes and businesses in Iceland use geothermal energy for space heating.

#### Earth's Interior

**ACROSS**

- Melted iron
- Greek word for heat
- Where geothermal energy is used for heating
- The Earth's crust
- Mountain with hot springs
- Area of Pacific Ocean
- Produced by volcanoes
- Center of the Earth
- Outer layer of the Earth

### Geothermal Energy

Geothermal energy is heat from inside the earth. Heat is made in the earth's core. This is very deep inside the earth. You cannot tell from the earth's surface if geothermal energy is under the ground. We see geothermal energy in volcanoes. It can also be found in hot springs. It can be found in geysers. There is an area called the Ring of Fire. It is along the coast of the Pacific Ocean. A lot of geothermal activity happens here. Geothermal energy can be used to make electricity. It can be used to control the temperature of a building. It can be used to heat buildings. Water can be heated by geothermal energy. Then heated water can be used to heat buildings and make electricity. Geothermal energy is a renewable resource. This is because we will always have water from rainfall. The core of the earth will always be very hot. There is little harm to the environment when this energy is used to heat a home. Geothermal power plants give off less carbon dioxide than other power plants. This is good for the earth.

1. What is geothermal energy?  
 A. energy from wind  
 B. energy from water  
 C. energy from the sun  
 D. energy made by heat from inside the earth

2. What is the Ring of Fire?  
 A. a geyser  
 B. a large lake that is on fire  
 C. an area along the coast of the Pacific Ocean where you can find geothermal energy  
 D. a volcano

3. Which of these is NOT a place where you can find geothermal energy?  
 A. volcano  
 B. hot springs  
 C. geyser  
 D. geysers

4. Where is the earth's core?  
 A. very deep inside the earth  
 B. between the surface and the center of the earth  
 C. on the surface of the earth

Read the information on previous pages to help you complete the information on this page. Fill out this information and complete the information on this page. This info can also be used in your Geothermal presentations.

**Geothermal** is heat from within the earth.  
 Geothermal energy is a renewable source.  
 Geothermal energy is used for heating.  
 They are deep underground. Most geothermal resources are found along the Ring of Fire.  
 We use geothermal energy and for what purposes?  
 We use geothermal energy to heat homes and buildings.  
 Effect of using geothermal energy in the environment?  
 It is good for the environment.  
 Important facts about geothermal energy:  
 Geothermal energy comes from the Greek root word (geo).

# Learning about Geothermal Wells

"I had no idea we could heat and cool the school using water!"  
 --6<sup>th</sup> grade Hawk Member

# Goal 2

## • Teach students and educators how to be more energy efficient

### Activities And Tasks

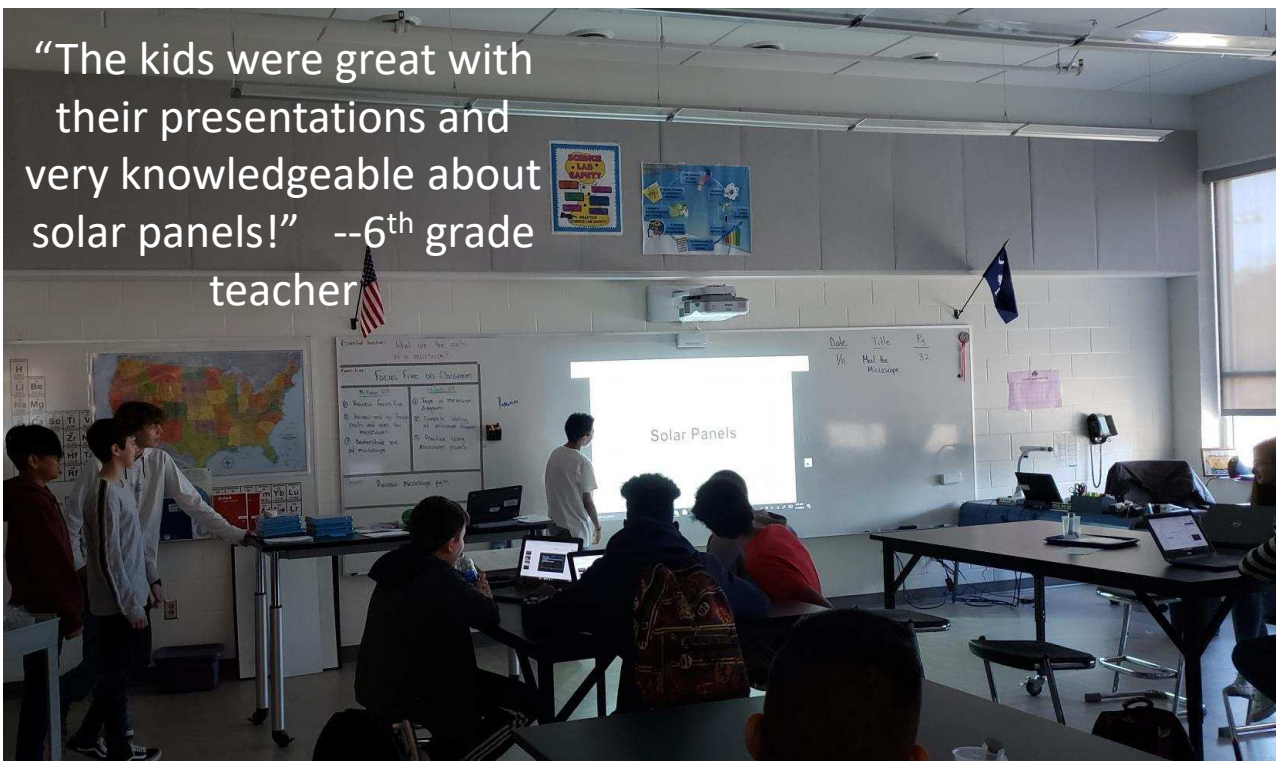
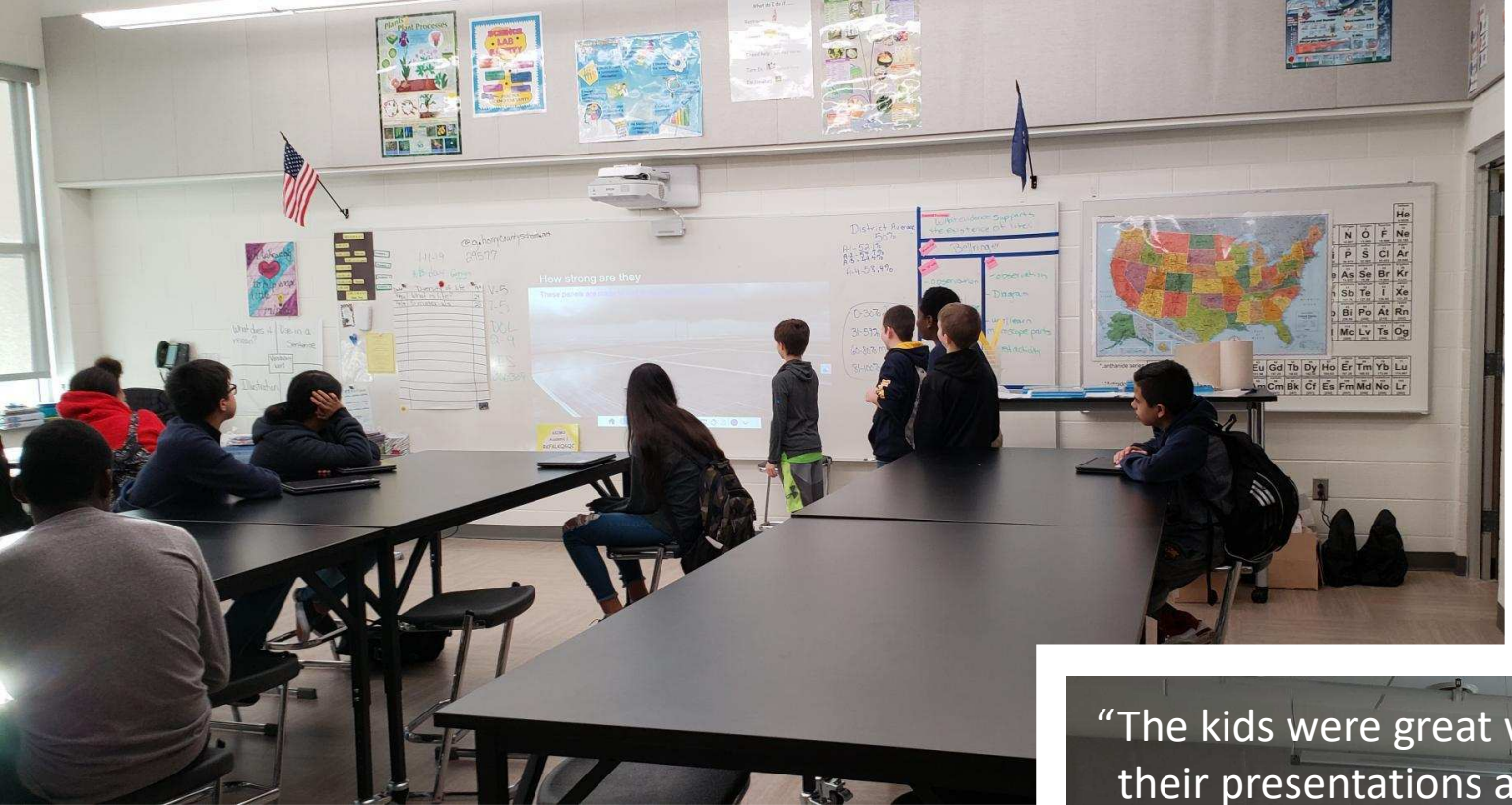
- Solar Panel and Geothermal Wells presentations
- Energy websites linked on [www.NEED.org](http://www.NEED.org) and [www.energywiseschools.com](http://www.energywiseschools.com)
- Energy Wise notebook resources
- Light energy patrols/patrol forms
- NEED Learning and Conserving Kit (KW meter, light meter, flicker checker)
- NEED Science of Energy Kit
- SC State Energy Office “Energy Zapping Challenge”
- Genius Hour Playground Presentations for MBMS

### Student Leadership

- 14 students total chosen
- 2 ambassadors to greet guests
- 2 club secretaries
- 6 patrol members
- 4 editors

### Evaluation

- Patrol forms evaluated
- Posters created to show light energy and plug load usage
- Presentations created to share alternative forms of energy



“The kids were great with their presentations and very knowledgeable about solar panels!” --6<sup>th</sup> grade teacher

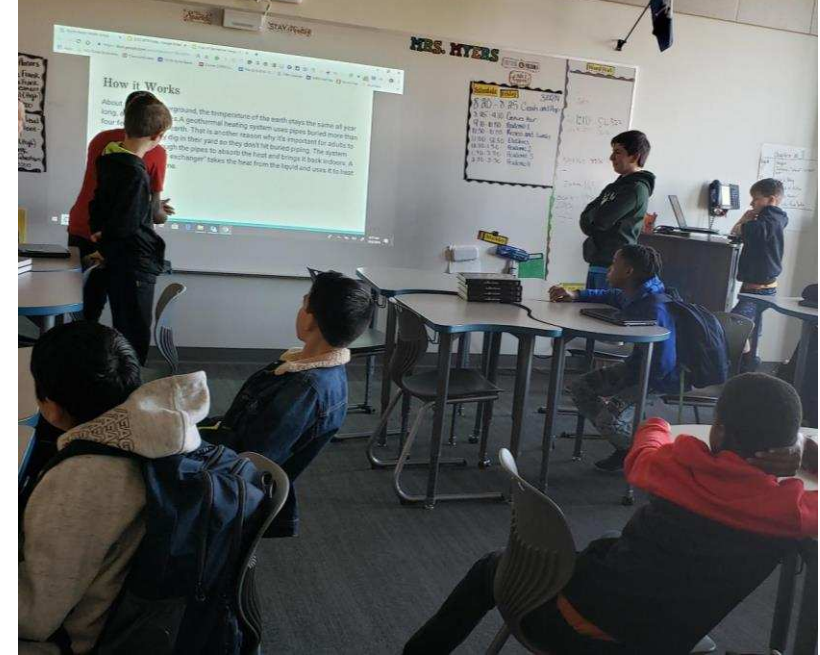
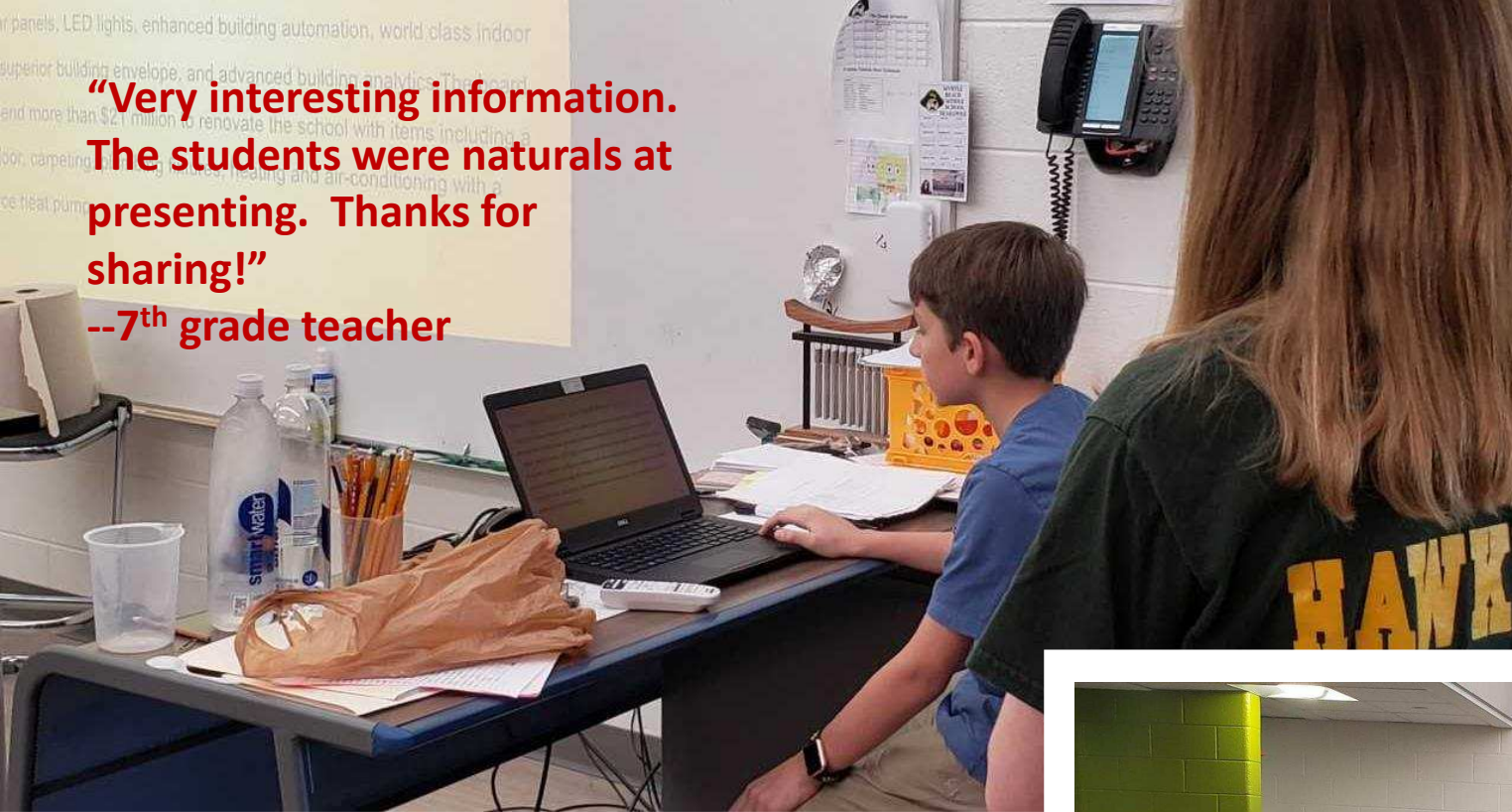
# Solar Panel Presentations

panels, LED lights, enhanced building automation, world-class indoor

superior building envelope, and advanced building analytics. The project  
and more than \$2.1 million to renovate the school with items including a  
floor, carpeting, energy efficient lighting and air-conditioning with a  
ceiling heat pump.

**"Very interesting information.  
The students were naturals at  
presenting. Thanks for  
sharing!"**

**--7<sup>th</sup> grade teacher**



**Geothermal Wells Presentation**



# Energy Zapping Challenge

Sponsored by EnergySC.Gov

ENERGY OFFICE

2018 ENERGY ACTION MONTH  
Electricity Zapping CHALLENGE!

Use these quick start instructions to get up and running in just a few minutes.

1. Connect the KII-A Watt EZ meter to the outlet and the appliance to the unit.
2. Press and hold the RESET key on the unit until "ESC" appears.
3. Press and hold the SET key until "Rate" is displayed and the currently set rate flashes.
4. Press the UP and DOWN key to set your desired rate. For example, if your utility charges you 10.6 cents per kWh, set the rate until the unit displays \$0.106.
5. Press the SET key again. "SAVE" will appear briefly in the display.

When it's time to record how much energy you've used and dollars you've spent follow these steps:

1. To display the total consumed energy in Kilowatt Hours, press the MENU key until "kWh" is indicated in the display.
2. To display the actual cost of power consumed or projected cost, press the MENU key until "Cost" is displayed at the top of the LCD. Hit up or down until "Total" is displayed at the bottom.

After recording your energy use and dollars spent, reset your KII-A Watt EZ meter using the quick start steps above and plug it back into the same appliance.

Energy use from October 1 <sup>st</sup> to October 12 <sup>th</sup>	17.5	kilowatt-hours
Dollars spent from October 1 <sup>st</sup> to October 12 <sup>th</sup>	\$ 1.70	
Energy use from October 13 <sup>th</sup> to October 26 <sup>th</sup>	2.34	kilowatt-hours
Dollars spent from October 13 <sup>th</sup> to 26 <sup>th</sup>	\$ .13	
Energy use avoided	15.16	kilowatt-hours
Dollars saved	\$ 1.57	

ENERGY.SC.GOV

**"The Energy Zapping Challenge was interesting. It really showed us what a difference it could make just to change lightbulbs to more energy efficient ones!"**  
**--8<sup>th</sup> grade science teacher**

1. Actions/behaviors:  
Changed type of lightbulb from regular to Fluorescent earth bright energy saving bulb.

2. 15.16 kwh saved

3. \$1.57 saved  $1.70 \times 180 = \$306$  <sup>approx</sup>  $\times 45 = \$13,770$   
 $.13 \times 180 = \$23.40$   $\times 45 = \$1,053$

Savings of  $\$282.60 = \$12,717$

4. Factors beyond control - out for a day because of hurricane

5. Turn lights off when not in use. Don't use on sunny days when it's not needed.

6. Change to energy efficient bulbs. Turn lights off when not in use.

After you've completed the Energy Zapping Challenge, compare your class's electricity usage before and during the measurement period. Have a discussion with the class and be sure to at least touch on the following topics:

1. What actions/behaviors did you change to become more energy efficient? *changed lightbulbs*
2. How much electricity (in kWh) did you save between the week of the 11<sup>th</sup> and the week of the 26<sup>th</sup>?
3. How much money did you save between the two periods of time? If you adopted these habits for one whole year, how much money would you save?
4. What factors beyond your control (e.g. weather) affected your electricity use? *hurricane - out a day*
5. What other actions/behaviors could you implement in the future?
6. What can you do in your home to become more energy efficient?

For more activities and lesson for integration into the Electricity Zapping Challenge feel free to visit New Mexico Solar Energy Association's lessons page!

Please a summary of your challenge results along with some topics your students discussed. The classes with the most creative and effective approaches to reducing their electricity use will be highlighted in the Energy Connection newsletter and on the ENERGY.SC.GOV website.

Mail your KII-A Watt Meter back to:

Caren Fraser  
ATTN: Energy Zapping Challenge  
SC Office & Regulatory Staff - Energy Office  
1401 Main Street, Suite 902  
Columbia, South Carolina 29201

E-mail your challenge summary to [cfraser@regaff.sc.gov](mailto:cfraser@regaff.sc.gov)

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*Antoinette*  
**Plug Load Worksheet – 2018-2019 (FORM F)**  
 Average Electricity Cost = \$0.10/kWh (kWh = kilowatt-hour) 1000 Watts = 1 kW

	A	B	C	D	E	F	G	H	I	J
			(C x # of days per month)	(C x # of days per month)	(E x 1000)	(F x #)	(G x \$-10)	(Check with your media specialist)	(H x #)	(I x #)
Equipment	Phantom Load Reading	KW Meter Reading	Typical Use, hours per day	Total Running hours per month	Monthly kWh	Months per year	Yearly kWh	Annual Cost Each \$	Quantity in school	Total Annual Cost \$
Example: Device A	6.2 W	95.8 W	8 hours	240 hr/mo	15.33 kWh	10 mo/yr	153.3 kWh/yr	\$15.33	20	\$306.60
1. Table Lamp	0.4 W	15 W	8	240	2.4	10	24	\$2.40	20	\$48
2. Chromebook	0.04	6.0				10				
3. Microwave	1.6					10				
4. Dehydrator						10				
5. Computer	0.8	0.4				10				
6. Fan	0.9					10				
7. Frypan						10				
8.										
TOTAL:										

13

### Plug-Load Study (FORM F) - THIS IS DONE ONLY ONCE

- Another way a team assesses energy is to do a plug-load study with a Kill-A-Watt meter to determine how much electricity is being used by an appliance.
- See instructions in the Student Guide in the Learning and Conserving Kit on how to use the Kill-A-Watt meter that is in the Energy WISE kit.
- List each piece of equipment tested on Form F, the quantity in your school (Media Specialist should have information), and the WATTS reading from the "Kill-A-Watt" meter. *Some suggestions for items to test:* computer monitors, TVs, VCRs, pencil sharpeners, document readers, smart boards, fans, heaters, copiers, refrigerators, microwaves, etc.
- Use a Kill-A-Watt meter to determine if the equipment has a phantom or vampire load (i.e., if the equipment continues to use electricity after it is turned off). *For example:* a VCR may be turned off but is still using energy. The VCR must be unplugged or plugged into a power strip that can be turned off to eliminate all energy usage.

#### TO COMPLETE FORM F:

- **Measure** the wattage of each piece of equipment using the Kill-A-Watt meter. The Watt and VA button is a toggle function key. Press the button once to display the Watt reading. The Watt reading is the value used to calculate kWh consumption, not the VA reading.
- If a phantom load is present, write the value in **column A**. Turn on the electrical appliance and measure the energy used. This number is recorded in **column B**. Estimate the typical usage for **column C**.
- **Calculate:**
  - **Column D** (the total running hours per month) by multiplying typical use of hours/day times number of days/month.
  - **Column E** (monthly kWh), by multiplying Kill-A-Watt meter reading times Total running hours/month and dividing by 1000. **B x D/1000**
  - **Column G** (yearly kWh) by multiplying monthly kWh times # of months used. **E x F**.
  - **Column H** (annual cost of each electrical device) by multiplying yearly kWh by \$0.10. **G x \$0.10**
  - **Column J** (total annual cost) by multiplying annual cost times the number of devices. **H x I**

*Boorle*  
**Plug Load Worksheet – 2018-2019 (FORM F)**  
 Average Electricity Cost = \$0.10/kWh (kWh = kilowatt-hour) 1000 Watts = 1 kW

	A	B	C	D	E	F	G	H	I	J
			(C x # of days per month)	(C x # of days per month)	(E x 1000)	(F x #)	(G x \$-10)	(Check with your media specialist)	(H x #)	(I x #)
Equipment	Phantom Load Reading	KW Meter Reading	Typical Use, hours per day	Total Running hours per month	Monthly kWh	Months per year	Yearly kWh	Annual Cost Each \$	Quantity in school	Total Annual Cost \$
Example: Device A	6.2 W	95.8 W	8 hours	240 hr/mo	15.33 kWh	10 mo/yr	153.3 kWh/yr	\$15.33	20	\$306.60
1. Table Lamp	0.4	15	8	240	2.4	10	24	\$2.4	20	\$48
2. Chromebook	0.04	6.0				10				
3. Microwave	1.6					10				
4. Dehydrator						10				
5. Computer	0.8	0.4				10				
6. Fan	0.9					10				
7. Frypan						10				
8.										
TOTAL:										

13

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			(C x # of days per month)	(C x # of days per month)	(E x 1000)	(F x #)	(G x \$-10)	(Check with your media specialist)	(H x #)	(I x #)
Equipment	Phantom Load Reading	KW Meter Reading	Typical Use, hours per day	Total Running hours per month	Monthly kWh	Months per year	Yearly kWh	Annual Cost Each \$	Quantity in school	Total Annual Cost \$
Example: Device A	6.2 W	95.8 W	8 hours	240 hr/mo	15.33 kWh	10 mo/yr	153.3 kWh/yr	\$15.33	20	\$306.60
1. Fan Tank	4.5	12.13	24 hrs	720 hr	9.73	12	104.76	10.48	5	\$52.38
2. Microwaves	1.23	16.4	3 hrs	60	0.984	10	9.84	0.98	8	\$7.84
3. Metal Detector	0.67	123.2	2 hrs	40	4.928	10	49.28	4.93	4	\$19.72
4. Alexa	1.3	3.3	8 hrs	160	5.28	10	52.8	5.28	1	\$5.28
5. Fan	0.0	56.7	6 hrs	120	7.044	10	70.44	7.04	2	\$14.08
6. Chromebook	0.0	6.0	2 hrs	40	0.64	10	6.4	0.64	50	\$3.2
7. Dehumidifier	0.0	9.7	24	720	6.984	1	6.984	0.70	1	\$0.70
8.										
TOTAL:										

13

"I never knew just leaving things plugged in would end up costing money!"  
 --6<sup>th</sup> grade Hawk Member

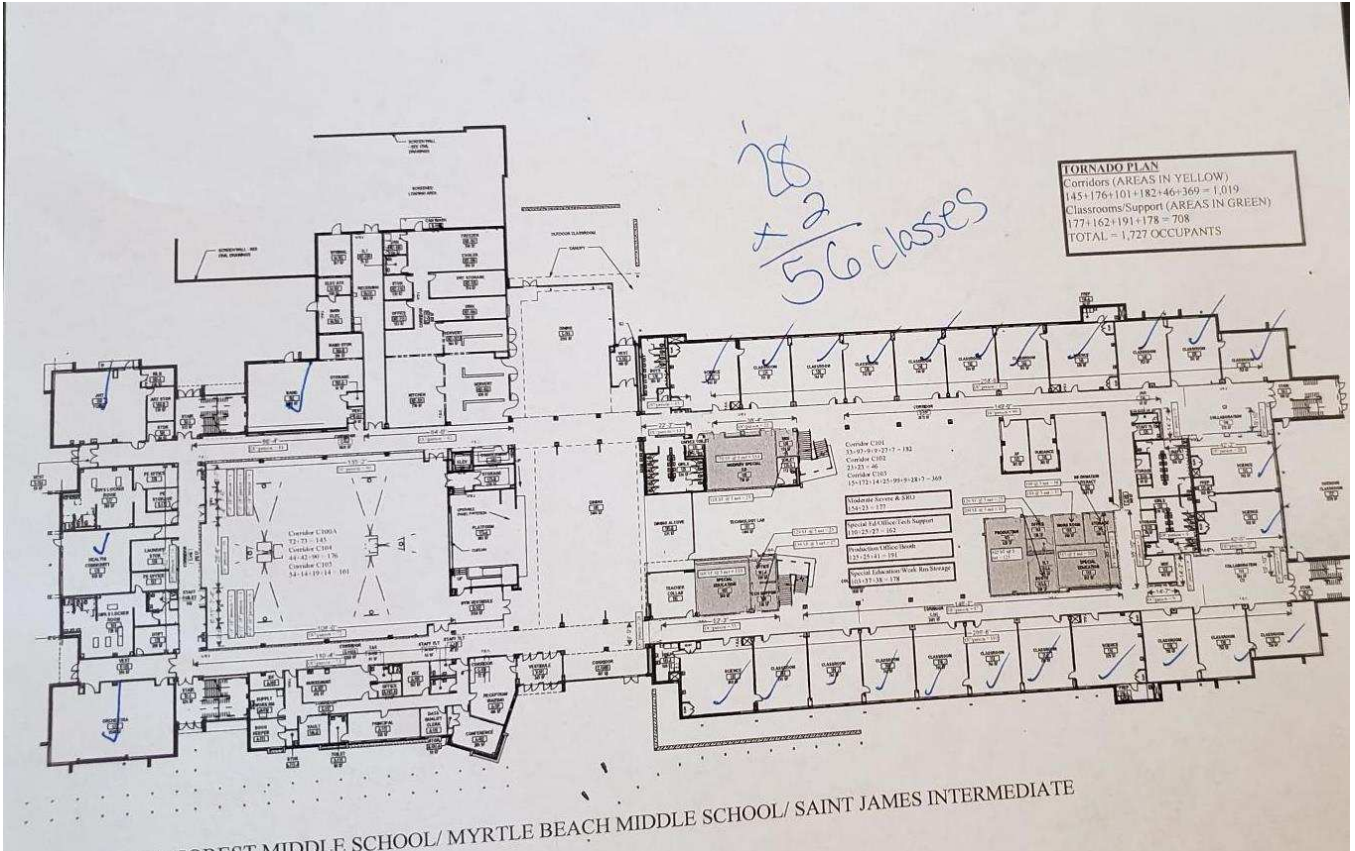
# Plug Load Analysis Activity

# Light Energy Analysis Activity

Light Activity Worksheet – 2018-2019 (FORM G)  
Average Electricity Cost = \$0.10/kWh (kWh = kilowatt-hour) 1000 Watts = 1 kW

Space/Room	Light bulb type	Wattage (info is on light bulb)	Number of Bulbs	Typical Use, Hours/Day	Total Running Hours/Month	Monthly kWh	Months/Year	Yearly kWh	Annual Cost Each	Classroom Annual Cost
Ex: Room 203	LED	32 W	27	8 hr/day	160 hr/mo	5.1 kWh/mo	10 mo/yr	51 kWh/yr	\$5.10	\$137.70
Scene 1	LM4	32	19	8	160	5.1	10	51	5.10	96.90
Scene 2	LM4	32	5	8	160	5.1	10	51	5.10	25.50
Scene 3	LM4	25	19	8	160	4	10	40	4.00	76.00
Total # of classrooms: Multiply total number of classrooms by annual cost for single classroom = total annual cost for classrooms										

Handwritten calculations:  
 $96.90 \times 56 = 5,426.40$   
 $25.50 \times 56 = 1,428$   
 $76.00 \times 56 = 4,256$   
 Total: \$11,110.40/year for classroom lights



Light Activity Worksheet – 2018-2019 (FORM G)  
Average Electricity Cost = \$0.10/kWh (kWh = kilowatt-hour) 1000 Watts = 1 kW

Space/Room	Light bulb type	Wattage (info is on light bulb)	Number of Bulbs	Typical Use, Hours/Day	Total Running Hours/Month	Monthly kWh	Months/Year	Yearly kWh	Annual Cost Each	Classroom Annual Cost
Ex: Room 203	LED	32 W	27	8 hr/day	160 hr/mo	5.1 kWh/mo	10 mo/yr	51 kWh/yr	\$5.10	\$137.70
132 1	LM4	32W	19	8	160	5.1 kWh/mo	10	51	5.10	96.90
132 2	LM4	52	5	8	160	5.1	10	51	5.10	25.50
132 3	LM4	25W	19	8	160	4	10	40	4.00	76.00
131	2R24	30W	4	8	160	4.8 kWh/mo	10	48	4.80	19.40
132	2R24	25W	4	8	160	4	10	40	4.00	16.00
Total # of classrooms: Multiply total number of classrooms by annual cost for single classroom = total annual cost for classrooms										

**“Imagine how much energy we could save if we turned the lights off when we left the room?!” -- MBM Staff member**

# What we learned this year....

"I like that we learned about solar energy and how to save money and save energy." --Antoinette

**"I LIKED THE SOLAR PANELS THE MOST!" --MALIK**

"We need energy for our life essentials." --Madison

**"I hope to accomplish more next year and learn more about energy." --Anthony**

"I loved going on the roof to learn about solar panels!" --Ja'Nyiah

**"Energy is not created, just changed." --Owen**

"Energy is something you can obtain in many ways and you must save." --Vanessa

"I enjoyed the solar panels because we learned how solar power is made and we got to see them on the roof." --George

**"WE LEARNED ABOUT EVERYTHING THAT POWERS OUR SCHOOL AND BASICALLY CONTROLS IT." --COLIN**

# Summary and Goals for next year!



**We have really enjoyed learning about energy conservation; how solar panels and geothermal wells work. Next year we are looking forward to learning about the building envelope, temperature and moisture control, and construction practices. We also want to do more to educate the community about our school and its use of alternative energy. Net positive schools are the schools of the future. Our future will lead to a better, more energy efficient world!**

# Links to presentations

## **Geothermal Energy Presentation:**

<https://docs.google.com/presentation/d/1LclRct3Bcx3WwlntJFVoyoSohncpJZhAoBGHTe9Eq1A/edit?usp=sharing>

## **Solar Panel Energy Presentation:**

<https://docs.google.com/presentation/d/1EjCMJQfwzE2jn2SJpi7fsByzMsM6-mNen9lrT0WWT6U/edit?usp=sharing>