

# **Engaging High School Students in Energy Education**

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# First Things First

Most kids do not know how electricity is generated.

Like most everyone...they take it for granted, and flip the switch

# Start with the Basics

Environmental Science:

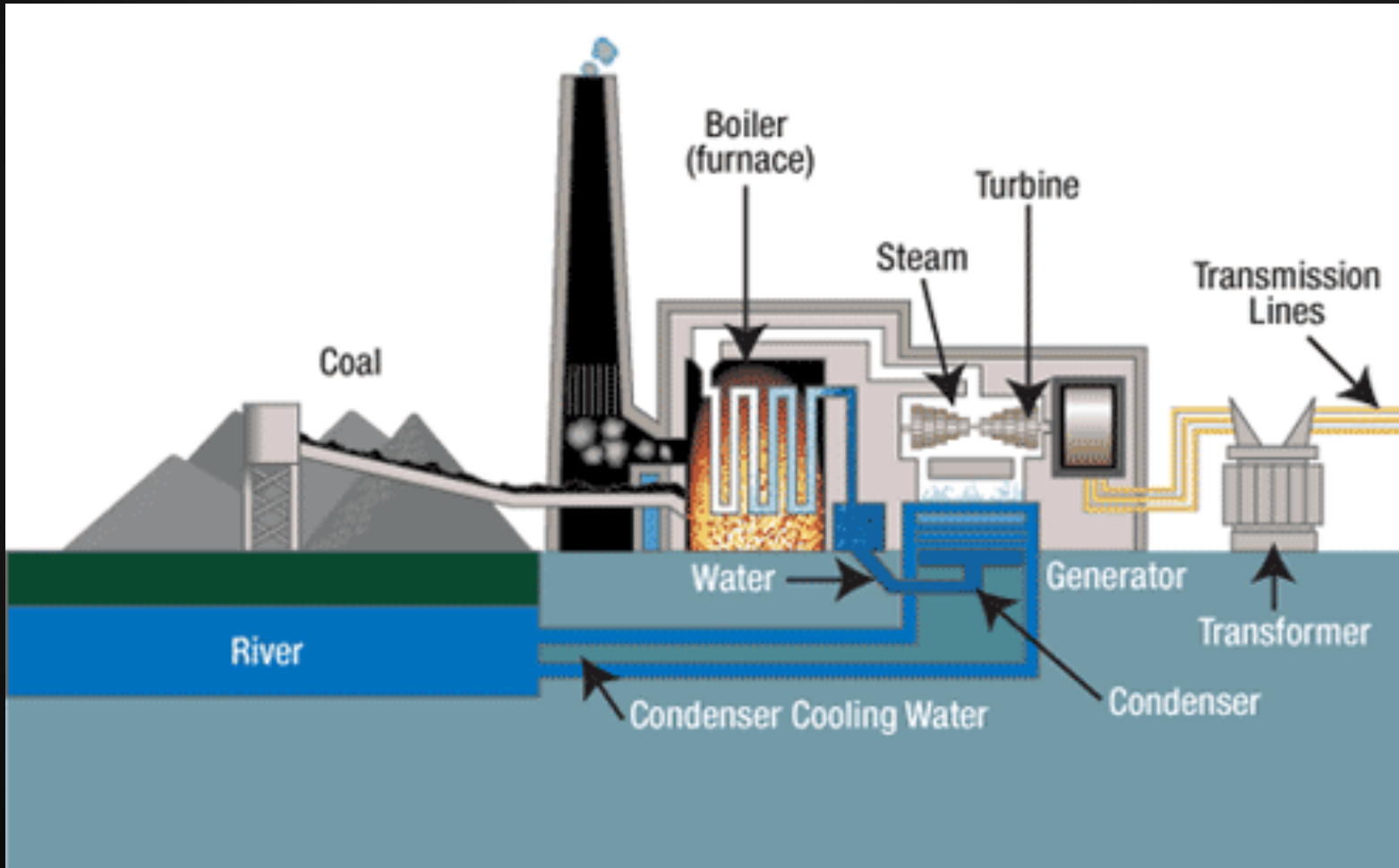
Nonrenewable vs. Renewable

Discuss Electricity generation in a coal burning power plant

Discuss pros/cons

Law of Thermodynamics

# Typical Coal Burning Power Plant



# Electricity Measurement

What is a Kilowatt? kwh?

Mock Electricity bill (usually mine)

Sample calculations

Kill-a-Watt Meter

## Calculating Efficiency

$$\text{Efficiency (\%)} = \frac{\text{Useful Energy Out}}{\text{Total Energy In}} \times 100$$

### Questions

- 1) A light bulb takes in 30J of energy per second. It transfers 3J as useful light energy and 27J as heat energy. Calculate the efficiency.

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- 2) A kettle takes in 2000J of energy per second. It transfers 1500J as useful heat energy and 500J is wasted as sound energy. Calculate the efficiency of the kettle.

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- 3) Calculate the efficiency of a hair dryer which takes in 3000J of energy per second and transfers 600J as useful heat energy. Express your answer as a decimal and not as a percentage.

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- 4) Calculate the efficiency of a TV which takes in 5000J of energy

## Electrical Devices.

Power = energy transferred / seconds  
Power is measured in W (Watts) or kW (kilowatts)

- 1) Calculate the power of a drill which transfers 2000J of energy in 5 seconds. Show your answer in watts and kilowatts.

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To convert watts to kilowatts you divide by 1000.

- 2) Convert the following powers into kilowatts

- a) 3000W \_\_\_\_\_  
b) 20W \_\_\_\_\_  
c) 900W \_\_\_\_\_  
d) 20000W \_\_\_\_\_  
e) 1W \_\_\_\_\_

energy transferred (kilowatt-hour, kWh) = power (kilowatt, kW) x time (hour, h)

**Remember:** When calculating energy transferred; power MUST be in kW and time MUST be in hours!!!

- 3) Calculate the energy transferred by a computer with a power of 2kW which is left on for 1 hour.

# Hands on Activities

How efficient is your light bulb?

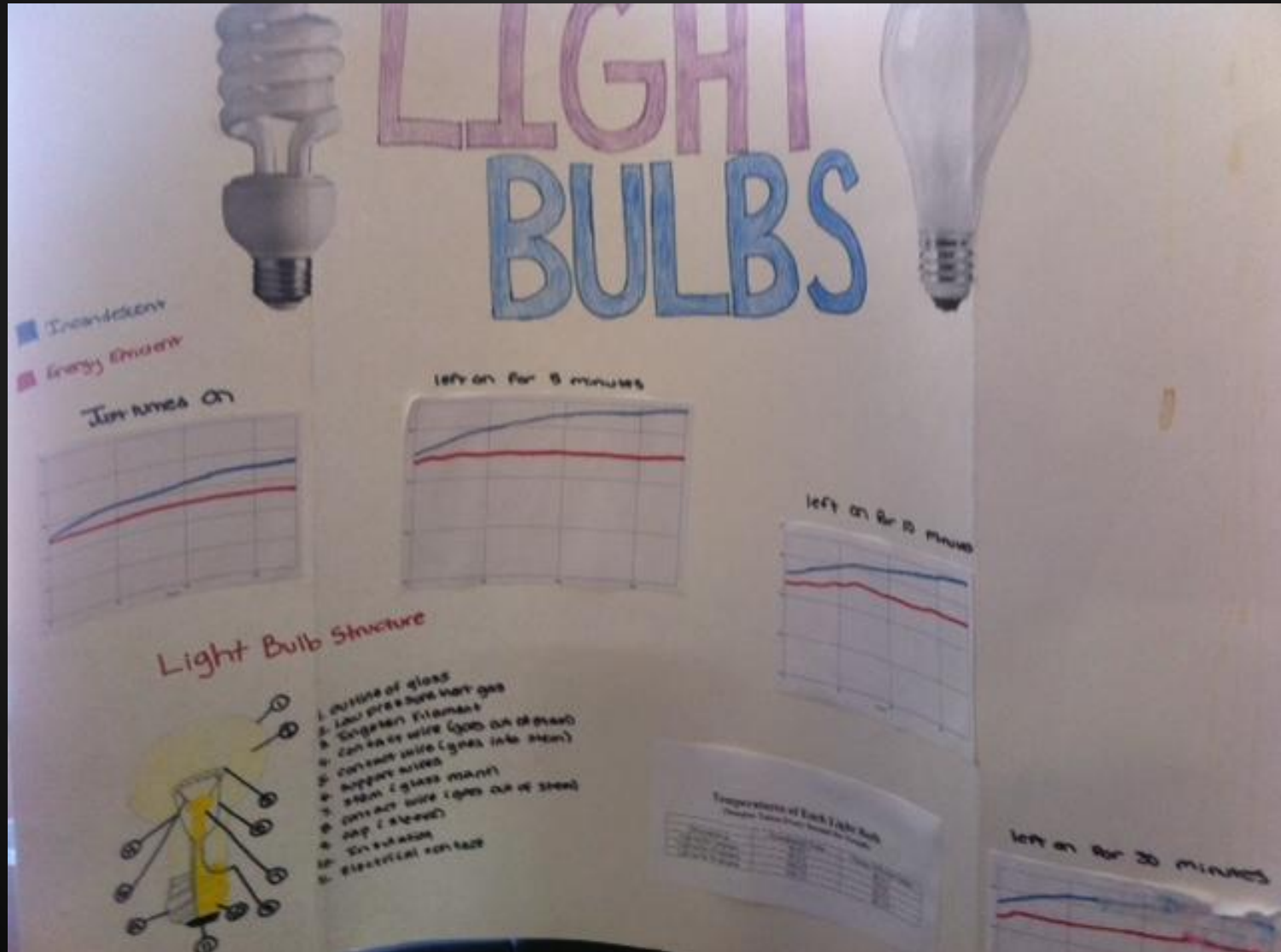
Students perform a lab experiment with 60W incandescent lightbulb vs. 60W equivalent CFL and a temperature sensor.

OR

Regular Holiday Lights vs. LED Holiday Lights



# Examples



# Kill-a-Watt Meter



C.) How many hours did they run? \_\_\_\_\_

D.) Total Cost for incandescent: \_\_\_\_\_

E.) Total Cost for CFL: \_\_\_\_\_

#### Part IV- Graphs!

1.) Make a Graph that shows the temperature difference between each type of light.

#### Part V- Conclusion

1.) Research the cost of CFL and incandescent lightbulbs. Remember that you should look up the correct wattage of the bulbs to accurately compare the 2!

Calculate the **TOTAL OPERATION COST** for each type of light for **30 days**:

	CFL	INCANDESCENT
Where would you buy?		
Cost per bulb		
Cost to switch 20 bulbs in your house		
Total Cost for 30 days		

- 2.) Which type of lightbulb would you buy and why? What other factors would you consider when buying the lightbulbs? (Please type of paragraph)
- 3.) What are some sources of error in this experiment? (Please type a paragraph)
- 4.) Explain how saving electricity can benefit our environment. (Please type a paragraph).

# Energy Efficiency

How do we save energy?

Items discussed:

- ❑ daily habits
- ❑ new technologies
- ❑ new products/ insulation. etc/

# Hands on Activities in Energy Conservation



-burn the marshmallow to determine how much of it was used to heat the water.

-make an efficient chimney with aluminum foil to heat marshmallow

# Benefits to these activities

- ❑ Students learn how electricity is made and delivered to their homes
- ❑ Students learn how much electricity costs
- ❑ Students compare costs of different items they use on a daily basis (washing machines/dryers/ cell phone chargers, etc.)
- ❑ Students take the lesson home! Usually parent conversation is involved!

# Renewable Energy

- Activities with Solar/Wind
- Multimeters and actual measuring of electricity
- Design a Solar Car/Wind Turbine
- Benefit- going outside!

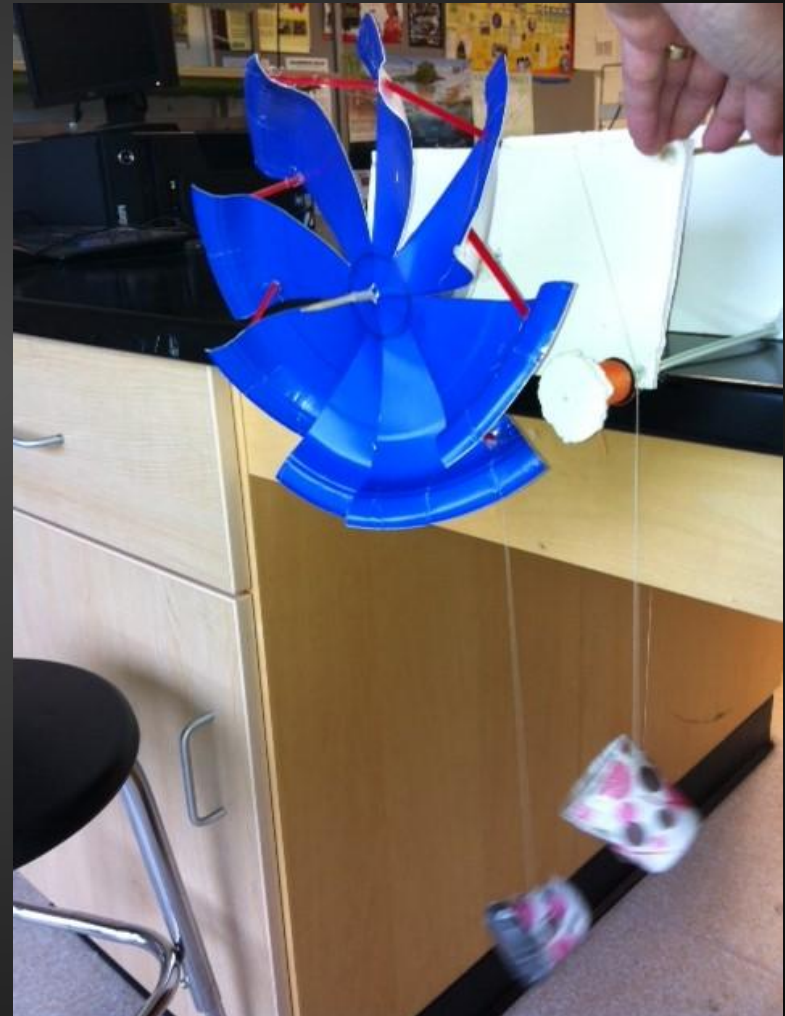


# Solar Car Race





# Wind Power



# STEM initiatives

Blend Environmental Science and Technology

Environmental Engineering Course

Students design a “Green” Home

- research R values and test insulation cooling rates
- learn about SMART home technology to reduce electricity consumption

# Step by step- Getting to Know their house



## HOUSE HUNT HOMEWORK

- 1.) What year was your house built?
- 2.) What style is your house? (colonial, cape, ranch, split-level, etc.)
- 3.) Locate your fuse box. Take a picture.  
How many amp service is your house?
- 4.) Does your house have an attic? If so, take a picture!  
What kind of insulation does it have?
- 5.) How do you heat your house? (oil, propane, etc.)
- 6.) Do you have baseboard heat? Forced hot water or forced hot air?  
Take a picture of your furnace.

- 9.) Interior: What kind of appliances do you have? Are they old or new? List and describe them.
- 10.) Take a picture of your thermostat (how you control your room temp!).
- 11.) Do you have Central Air Conditioning? If yes, list some features of your condenser...how many BTU's is it? Take a picture....
- 12.) If you have wall unit Air Conditioners, list and describe them and their BTU's...
- 13.) Describe your families' water use...(people taking showers per day, laundry use, pool gardening, lawn watering, etc.)
- 15.) Do you have trash pickup? Do you recycle? Donate to good will? How often do you s new items?

# Student Example-Digital Portfolio

<https://sites.google.com/a/auburn.k12.ma.us/enironmental-engineering-kg/>



# AHS Energy Study

50% of the time  
75% of the time  
Always

2. Do you turn your lights off when you leave the room?

Never  
25% of the time  
50% of the time  
75% of the time  
Always

3. Do you prefer to work with the lights on or off?

Lights On  
Lights Off  
Half On and Off

4. Do you leave your overhead projector on...?

Every Class  
Most Classes  
3-4 Times a Week  
Rarely

Do you turn them  
properly?

Yes  
No  
Sometimes

# AHS Club- Students of the Environment

Mission Statement:

To increase recycling and minimize waste and energy use to help AHS become a “greener” school

- Recycling Trophy
- AHS Energy Study

# AHS Energy Study

- Made graphs out of survey
  - went around the school and took pictures of lights that were on in places they were not used
  - performed calculations of potential savings
  - sent this data to the Superintendent
- 
- made a presentation on PDD first day of school
- 2011...student led!



# SeaPerch

Using Remote Controlled Underwater Robot  
to solve scientific problems

- search the seafloor for valuable resources
- obtain samples
- stop oil spill

# Spring 2013



# Our simulated oil spill



# Useful Links

[www.NEED.org](http://www.NEED.org)

- National Energy Education Project
- workshops, and free curriculum
- all grades, k-12

[www.Vernier.com](http://www.Vernier.com)

- laboratory instrument and tools for technology infusion
- curriculum books

# Ways you can help local schools

- ❖ - Ask them!
- ❖ - Fund them!
- ❖ - Assist them!



THE END

THANK YOU