Alternative Energy:

Should my city build a hybrid power plant?

A curriculum for after school programs based in the community
Grades 5-8

Green Energy Technologies in the City
http:getcity.org

This material is based upon work supported by the National Science Foundation under Grant No. DRL-0737642

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  - To explore how electricity is produced from renewable and nonrenewable resources
  - To develop an understanding of energy transformations
  - To understand the impact of electrical production and use on the environment
- To engage youth in a design-based investigation regarding whether their city should build a new hybrid power plant
  - To understand consumption patterns of electricity in their city and why this is important
  - To become aware of the role of technology in advancing possibilities for "clean" electricity production
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Part 1: Our power plant is closing! In this segment, youth are confronted with the immediate challenge that one of their city's power plants will be decommissioned in 2015 due to its inability to meet emission standards. The power plant is old, based solely on coal, and provides half of the city's electricity. Youth are asked to consider why this problem matters.

Part 2: What is a hybrid power plant? In this segment, youth examine the general design for a proposed hybrid power plant, which to be 30% biomass and 70% coal. Part of this investigation includes examining materials provided by the electric company to its consumers describing the plant, rationale in support of building a hybrid plant, and its impact on customers.

Part 3: Alternative energies for powering my city. In this segment, delve into the construct of hybrid technologies, youth conducted investigations into the forms of alternative energy employed by the Electric Company, although not all forms investigated are a part of the proposed hybrid plant design. These investigations involve simulating electrical production through small scale models, gathering and analyzing quantitative and qualitative data from these models, taking fieldtrips to local solar power arrays and surveying local experts and community

members on their views of the proposed power plant and the efficacy of other forms of green energy technologies.

Part 4: Educating the community. In this segment, the unit concludes with the develop of a set of cybertoolkits youth can use to educate their community, and recommendations for how to support youth in educating a broad set of local stakeholders on their findings.

Specific science and engineering learning goals

Transfer of Energy (grades 5-8, NSES, p. 155)

- Energy is a property of many substances and is associated with heat, light, electricity, mechanical motion, sound, nuclei, and the nature of a chemical. Energy is transferred in many ways.
- Heat moves in predictable ways, flowing from warmer objects to cooler ones, until both reach the same temperature.
- Light interacts with matter by transmission (including refraction), absorption, or scattering (including reflection). To see an object, light from that object—emitted by or scattered from it—must enter the eye.
- Electrical circuits provide a means of transferring electrical energy when heat, light, sound, and chemical changes are produced.
- In most chemical and nuclear reactions, energy is transferred into or out of a system. Heat, light, mechanical motion, or electricity might all be involved in such transfers.
- The sun is a major source of energy for changes on the earth's surface. The sun loses energy by emitting light. A tiny fraction of that light reaches the earth, transferring energy from the sun to the earth. The sun's energy arrives as light with a range of wavelengths, consisting of visible light, infrared, and ultraviolet radiation.

Science Inquiry (NSES, grades 5-8, pp. 148+)

All students should develop the abilities necessary to do scientific inquiry

- Use appropriate tools to gather analyze and interpret data
- Develop descriptions, explanations, predictions and models using evidence
- Think critically and logically to make the relationships between evidence and explanations
- Communicate scientific procedures and explanations
- Use mathematics in all aspects of scientific inquiry

Technological Design (NSES, grades 5-8, pp. 163-165)

All students should develop the abilities of technological designs

- Identify appropriate problems for technological design
- Design a solution or product
- Implement a proposed design
- Communicate the process of technological design

Climate Change (AAAS, p. 2009)

Climate change & Environment Sustainability

- Humans may be able to mitigate climate change by reducing greenhouse gas emissions
- Strategies for reduce greenhouse gas emissions: renewable and alternative sources & change in how humans use energy.
- Actions taken by individuals, communities, states, & countries all influence climate.

IT Skills

Data gathering and analysis tools: GIS software and databases (ArcView with Excel and ODBC to preprocess GIS attribute data, and chemical/thermal probes for local data generation) to be used in data generation and spatial analysis of energy efficiency and sustainability patterns and its impact on local practices and environmental health, and (b) *Communication Tools:* PowerPoint and web design to share findings with the local/national community.

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Lesson 1: Our power plant is closing! Why should we care?

Objectives

- To understand and analyze the transfer of energy in the electricity production system
- To explore how electricity is produced from renewable and nonrenewable resources
- To understand the impact of electrical production and use on the environment

Activities

- Our power plant is closing!
- Why should we care about coal?

Materials

- Survey monkey survey
- Computers & GET City blog

Activity 1: Our power plant is closing

Survey Monkey: Have students complete the following survey in survey monkey or Google survey so that responses can be immediately projected to the group:

Have you heard of the Eckert Power Plant?
O Yes O No O I'm not sure

Did you know that it will be shut down in 2015?
O Yes O No O I'm not sure

What problems or concerns might a shutdown cause?

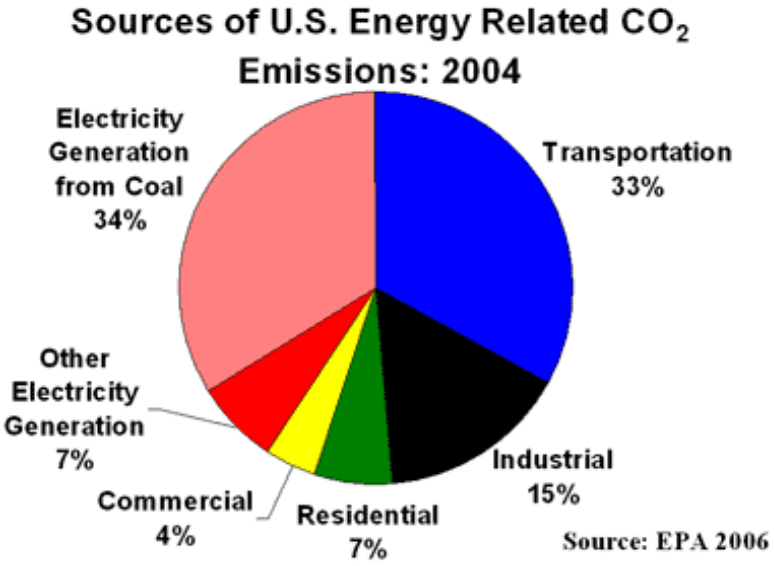
Do you think the city should build a new power plant to replace it?
O Yes O No O I'm not sure

If YES, should this new plant also be a coal plant? Why or why not?

If NO, why not?

Project responses and discuss. Points to raise in the discussion include:

- The power plant will shut down in 2015 because the plant will not meet the new emission standards for CO_2. For helpful resources and readings, see
  - Environmental Protection Agency
  - Scientific American article
  - New York Times Article
- The power plant provides over 60% of the city's electricity.
- Shutting the plant down would require citizens to drastically reduce their electrical energy consumption, or cause other problems such as: brownouts and increase in electricity costs.



Within the electricity sector, coal-fired power plants generate half of the country's electricity.

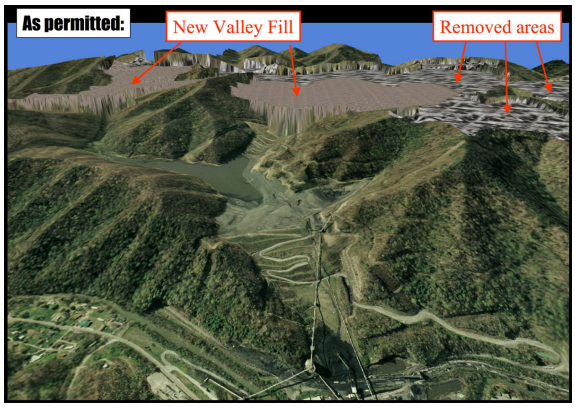
Activity 2: Why should we care about coal?
Have students read & respond to the following blog post:

Where does our COAL come from and does this matter?

Coal comes from below the ground and needs to be mined to be retrieved. There are several ways of getting the coal from below the ground. One way to get coal from the ground is called **MOUNTAIN TOP REMOVAL**.

What is MOUNTAIN TOP REMOVAL?

Mountaintop removal is a mining practice where the tops of mountains are removed, exposing the seams of coal. Mountaintop removal can involve removing 500 feet or more of the summit to get at buried seams of coal. The earth from the mountaintop is then dumped in the neighboring valleys.



What are the effects of mountaintop removal on families, communities and the environment? Dynamite blasts are needed to break open the rocky tops of mountains, but these blasts are so strong they also cause the foundations and walls of houses to crack! Coal mining also dries up an average of 100 wells a year and contaminates water in others.

Find out if the coal we use in Lansing comes from mountain top removal and listen to the impact on the lives of people who are affected by mountain top removal at: ilovemoutains.org.

Blog question

Some people argue that one reason not to build additional coal plants is because of the negative impact that mining coal has on the environment and communities. What do you think about this argument? Should this be a consideration when deciding whether Lansing builds a new power plant (70% coal, 30% biomass)? Why or why not?

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Lesson 1: Examining the plan

Have students listen to the mp3 of the message from J. Peter Lark, General Manager of the Board of Water and Light. They can follow along at the GET City blog where the following text can be found:

A message from J. Peter Lark,
General Manager,
Lansing Board of Water and Light

"The BWL's Eckert Power Plant near downtown Lansing is more than a half-century old, though it was designed to only last 40 years. The BWL staff recommends building a new, more efficient power plant whose air emissions, including greenhouse gas emissions, are much smaller than Eckert's. . . The recommendation is to build a "hybrid" plant that uses renewable fuels such as agricultural waste, wood waste and other renewable fuel sources, in combination with coal. It's important to emphasize that new technology will allow the plant to burn fuels more cleanly and efficiently than Eckert does.

While many factors led us to this plan, the conclusion is quite simple: Our Eckert Power plant is a half-century old and will eventually have to close. Our choice is to either build a more efficient, greener power plant, or buy electricity on the volatile open market. Our consultants determined that buying electricity would mean up to a 55 percent jump in your rates. My own view, after studying market pricing very carefully, is that rates would climb far higher than 55 percent."

Hold a class discussion, using the following questions:

- What about this letter surprised you or interested you?
- What sources of energy will the proposed new power plant use? How is the different from the current Eckert plan?
- In what ways will this new plant be an improvement, according to the BWL?
- What do you think Peter Lark means by burning cleanly?
- Do you think burning biomass will affect the amount of pollution or carbon dioxide the new power plant emits in comparison to other plants, both coal and other?

Lesson 2: What is a hybrid plan

Objectives

- To examine the process of generating electricity from coal
- To understand how electricity is delivered from generating plants to communities
- To develop an awareness of other sources of energy, besides coal

Activities

- How power plants work on-line environment
- Card Sort Activity
- Blogpost

Materials

- Computers with internet access
- Card sort cards & 20 pieces of yarn (about 2 feet long)

Activity 1: How power plants work on-line environment

There are many on-line games and explanations of how power plants work. The one we like the best has been developed by Southern Electric Company and can be found HERE.

Have students play around in the Power Plant environment with a partner for about 15 minutes. Encourage them to trace how electricity is generated from gas and coal, and also to learn more about how scrubbers work. If they have time as them to trace the generation of electricity from one other source (hydro or nuclear).

Activity 2: Card Sort Activity

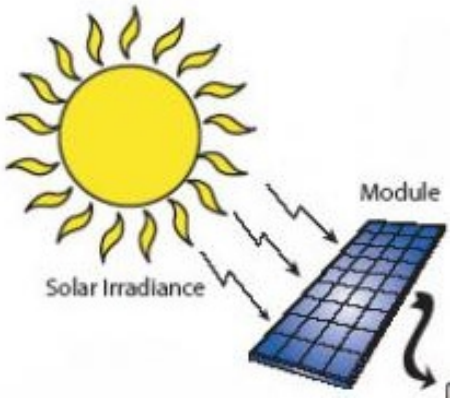
- Distribute the cards (found on the next page), one card per pair of students.
- Explain that each card is a "stop" along the way to getting electricity to their computer from coal in the earth.
- Based on what they know from previous sessions and the power plant on-line, have them write 2-3 bullet points of "what happens" at their "stop."
- Once students have written their points, ask them to get up and organize themselves in "order" of how the process might work. Note that there should be multiple pathways because multiple fuel sources are included (solar, wind, coal).
- Have students use the yarn to connect with other stops demonstrate how their stop hooks into a bigger system.

Activity 3: Blog Post

Given what you now know, do you think the Electric Company should build a new hybrid power plant?
Yes No Not sure
What issues would the plant solve?
What problems might continue?

COAL
(energy source)

SOLAR
(energy source)



WIND
(energy source)

BIOMASS
(energy source)

Power Plant

High Voltage Lines

Power Substation

Low Voltage Lines

Boys & Girls Club

Outlet 

and Computer

MUSIC
(sound energy)

Coal Mining (in a mountain)

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Alternative Energy

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Lesson 1: Biogas



Objectives

- For students to continue to explore the differences between renewable and nonrenewable energy sources
- Understand how a biogas digester works and consider the implications of biogas for the local and global environment
- For students to create and capturing biogas

Activities

- Blogpost & Think-Pair-Share: What is Methane
- Whole Group Discussion: What is methane?
- Experiment: Making methane
- Fieldtrip preparation

Materials

- Biogas power point
- Experiment guidelines & worksheet
- Biogas poster
- Plastic water bottles (1 liter, cleaned and empty) – 1 per student
- Balloons – 1 per student (with some extras)
- Duct tape or rubber bands
- Scraps of raw potatoes, about ½ cup per student

- Soil from the outdoors

Activity 1: Discussion: What is methane
Ask students to form pairs, and to complete the following blogpost together. Remind them that when they are done we will have a discussion around "biogas".

Partner Blog Post & Think-Pair-Share

- In partners, watch the movie, Biogas from food waste. After watching the movie discuss the following questions:
  How do we get energy from food waste?
- Why is this an important alternative energy?
- What is methane?

Then, once you have discussed these questions, post a comment that includes your ideas around what Lansing (or your city) might learn from this movie?

Click here: Biogas from food waste
Asden Award Winner, 2006: http://www.ashdenawards.org

Activity 2: Discussion: What is methane
Begin by having students share their blogpost entries and other ideas that they discussed, and generate a list of key ideas on the white board. Ideas that should come up include:

- Food waste produces methane (or biogas) when it decomposes (among other things)
- Methane (biogas) can be trapped (or harvested) from decomposing food scraps to provide energy to power communities
- Many parts of the world, especially developing countries and rural areas, use biogas as a primary source of fuel
- Biogas is a renewable form of energy
- Biogas can be made from things other than food waste, such as cow manure
- A family or community using just their own food waste can replace between 25% and 50% of their cooking fuel

- Biogas reduces indoor air pollution because it burns with a clean flame, but it does release carbon dioxide.

Ask students to group the list into “pros” and “cons” for biogas. A simple list should look like this:

Pros	Cons
• It is RENEWABLE! (It is given off whenever something dies, but only when no oxygen is present). • It can be produced LOCALLY! (It is helping us to remove our dependence on coal and oil for power and fuel. We only have a limited supply.) • It can be CLEANER! (It burns much cleaner than coal does, which means less pollution!)	• We tend to rely on nonrenewable or nonclean sources! • Burning methane releases CO_2! • Methane is a GAS, which makes it hard to control, making it potentially dangerous (Methane can combust to release CO_2 and H_2O. This combustion, though dangerous, is what provides the energy to produce electricity and heat your stovetops in many places!)

Activity 3: Making Methane!!

Each student should receive a plastic bottle, balloon, rubber band or 4” piece of duct tape. Use the poster (available in this plan) to illustrate the steps for the youth.

- Step 1: each student to go first to the soil station and add ¼ cup of soil to their bottle
- Step 2: Each student should then go to the potato scraps station and add ½ cup of potato scraps
- Step 3: Add about ¼ cup water to the bottle, cover with the top and shake!
- Step 4: Remove the top and stretch the neck of the balloon over the mouth of the jar and fix it tightly with the rubber band or piece of tape. Careful, you might need help with this!
- Step 5: Now, your bottle is ready to go! The optimal place to put your bottle is somewhere near a window, where it gets sunlight and warmth.
- Step 6: Observe your bottle each day and record your observations.

*Be warned! This is a smelly experiment! It involves rotting vegetables!

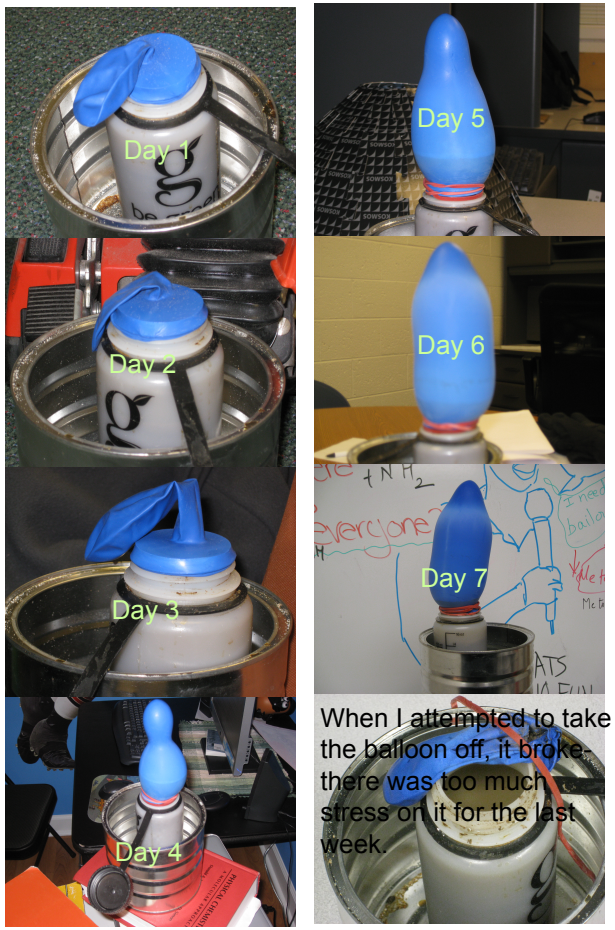
Biogas Experiment

For the next couple of weeks, we are going to be doing an experiment on biogas.

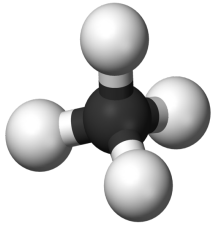
Materials:
- Water bottle
- Balloon
- Vegetable scraps
- Dirt
- Water
- Funnel

Method: We are going to take our vegetable scraps, dirt, and water, and mix them up and put them in our water bottles. After our bottles are filled, we will then put our balloons over the bottle. Then, we're going to wait a week and see what happens!

Day by day of my trial experiment:



Why does this happen?
-When vegetables rot, they give off a gas called methane. Methane is burned in order to create heat or energy-it's the gas that's used to make the flames on your kitchen stove, and is also used in many other applications!



What would an engineer do with methane or biogas?
-An engineer could do many different things with methane or biogas. They would be the ones to come up with the processes to get energy from methane on a large scale and work out any problems.

Also, methane is a completely odorless gas. So, a smelly chemical called a mercaptan is added to it, so you can smell the gas when you have a gas leak-an idea that an engineer would be responsible for coming up with!

CAN WE CREATE OUR OWN “BIOGAS”?

What happens when you put old food in a bottle and put a balloon on top?

Record your observations below:

DAY	OBSERVATION	CONJECTURE ABOUT WHAT IS HAPPENING
1		
2		
3		
4		
5		
6		
7		

Alternative Energy

Lesson Plan 2: Bio-fuels

Objectives

- Students will learn where bio-fuels originate from.
- Students will learn how to produce their own oil.

Activities

- Making Bio-fuel from biomass
- Ask the expert: bringing biomass and biogas back to the power plant!

Materials:

- Oil Seed expeller
- Lin Seeds
- Two Cups
- Bio-fuels poster

Activity

- Set up the oil expeller
- Weigh the linseed and write down the amount before pouring them in the funnel.
- Turn the lever arm until oil is getting produce.
- After the linseeds are completely out on the oil expeller, weight the product.
- Calculate the Yield of the linseed: weight of the oil/weight of the linseed x 100

Questions for Discussion

- What is Ethanol?
- What is Biodiesel?
- Why do you think ethanol could be good for the environment?
- Do you know or have heard of E85 gas?
- Do you know the percentage of petroleum imported into the country?
- Can biodiesel reduce pollution?

Student activity sheet

Getting the linseeds ready!

- Measure 1/2 cup of linseeds
- Carefully weigh the linseeds on the electronic scale
- Carefully weigh the empty collection container

How much does the linseed weigh?

How much does the container weigh?

Extracting the oil

- Carefully pour the seeds in the funnel
- Turn the lever arm until oil is getting produce – this will require some human energy!
- Collect the oil in the pre-weighed container
- After the linseeds are completely out on the oil expeller, weigh the oil.

How much does the linseed oil + container weigh?

How much does the oil weigh (subtract weight of container)?

Calculating the Yield

- To calculate the Yield of the linseed:

$$\text{Yield} = \frac{\text{weight of the oil}}{\text{weight of the linseed}} \times 100$$

Biodiesel

A stepwise process describing how to make it.

Ask an Expert

Today we are going to e-mail biomass experts about what they think about burning 30% biomass to create electricity.

Before you start,

1. Select the expert that you would like to write to on the list [provide list of local experts from the university, lobby, and business sectors].

2. Check you g-mail to locate the survey monkey link. Copy this link to the new e-mail that your are going to create for the expert. (see next page for example survey that you can use!)

Your e-mail should include the following:

1. A description of who you are and why you are writing (make sure to them about our overall investigation, "Should Lansing Build a New 70% coal/30% biomass plant?"

2. Ask the expert to take our survey on survey monkey about what they think about burning biomass. Include the survey monkey link.

3. Ask any other questions you may have about the power plant topic that are not included in the survey.

4. Make sure to thank the expert for his/her time!

5. If you finish and there are still names of people on the list, you can use the same e-mail that you wrote and send it to more experts!

GET CITY BIOMASS EXPERT SURVEY

1. Please take our survey!

1. Name:

2. Where you work:

3. The Lansing Board of Water and Light is proposing to build a new hybrid power plant that will burn 30% bioma

- Good idea
- Bad idea
- Not sure
- It depends

Please explain your answer

4. Please mark the statements below that you agree with:

- [ ] Biomass releases greenhouse gases when burned
- [ ] Biomass releases pollution when burned
- [ ] Biomass releases less harmful greenhouse gases than coal
- [ ] Biomass releases more harmful greenhouse gases than coal
- [ ] Burning biomass to generate electricity is carbon neutral
- [ ] Some sources of biomass are better to burn than others

Additonal comments

5. Do you support building the proposed 70% coal/ 30% biomass power plant in Lansing?

- Yes
- No
- No opinion
- It depends

Why or why not?

Thanks for taking our survey!

Lesson 3: Wind Energy

Objectives
Youth will be able to:
- Explain that wind energy is kinetic energy that is converted to electricity by the windmill.
- Predict the impact of low wind intensity on electrical generation.
- Design windmill blade angle for maximum efficiency.
- Explain trade-offs involved in implementing wind energy.

Activities
- Discussion: Advantages and disadvantages of wind energy
- Experiment How does wind create energy?
- Mapping wind energy in Michigan

Materials:
- 1 Windmill Experiment kit
- 1 Hand-crank Flashlight
- 1 Poster about wind energy
- Computers

Activity 1: Discussion
- Discuss advantages and disadvantages of wind energy.
- Use poster to help them explain in their own words how wind creates electricity
- Use wind maps to help them discuss the importance of wind intensity and potential trade-offs associated with implementing wind energy

Activity 2:
- Go outside and see that the wind turns the blades.
- Insert LED into windmill and see that it lights up.
- Compare this function with the hand-crank flashlight.
- Attach water bottle to shaft of windmill to observe how wind lifts various quantities of water. Discuss trade-off between speed of lift and amount of water lifted.
- Record information on Data Sheet

Wind Power

1. Look at the wind scale on the back of the windmill. Place the windmill in front of the fan on all three settings.

   What is the wind speed of each fan setting?

   Speed 1:_____m/s **Speed 2**:_____m/s **Speed 3**:_____m/s

2. Fill the bottle to about 300ml. Measure a length of string from the top of the bottle to the bottom of the winch.

   How long does it take for the bottle to reach the winch?

   Speed 1:_____s **Speed 2**:_____s **Speed 3**:_____s

3. The equation for measuring power (in Watts) is:

$$\text{Power} = \frac{\text{Mass x Acceleration x Distance}}{\text{Time}}$$

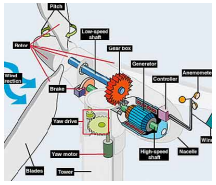
   How much power is generated by each fan speed? (Don't worry about the equation, we'll figure it out together!)

   Speed 1:_____W **Speed 2**:_____W **Speed 3**:_____W

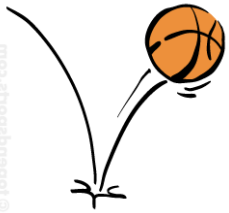
How can wind generate electricity???

Wind…

…spins these turbines…



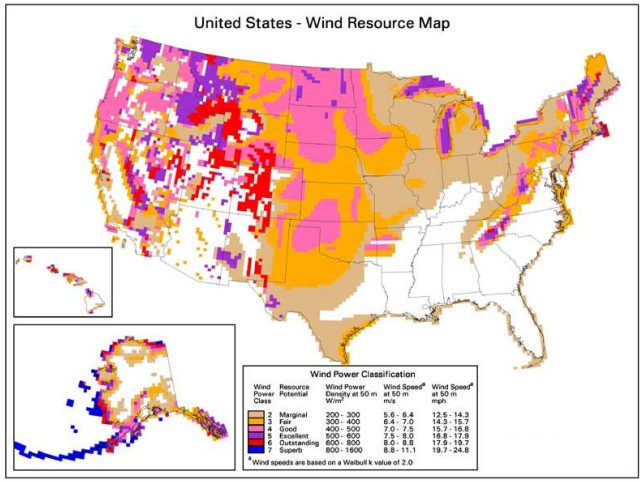
…which powers a generator inside...



…that converts the kinetic energy…

…into electricity…

…that powers our cities and homes!



Wind Map of the U.S.

Some Facts…

- Michigan is the 14th windiest state in the country - #1 east of the Mississippi River!
- There is potentially 321,000 megawatts of wind energy off Michigan's shores – that's the same as 321 large coal or nuclear plants!
- Wind power could not only generate electricity, but provide jobs for tens of thousands of Michigan residents!

Activity 3: Getting a look at wind energy!

Where is wind a good option around Michigan?

What can we learn about the possibility of wind energy in Lansing?

Visit the Michigan Wind Prospecting Tool Website:
http://www.landpolicy.msu.edu/WPT/

The **Utility Tool** allows you to find and highlight **the best areas in Michigan** for wind farm development.

The **Community Tool** allows you to produce a **community wind profile** for each community with wind resources in Michigan.

This tool is an initial step in informing the wind development process, and bringing stakeholders accurate reliable, and timely information. A third tool, which is a future project, will closely examine off-shore targets for wind deployment.

The fundamental base of this analysis is the National Renewable Energy Laboratory's 50m wind density map for Michigan (see figure one). This is the best available data in wind resources in Michigan.

Your task:
Generate a map of wind power in Michigan.
Generate a second map of wind power in Lansing.

Blogpost:
Do you think wind power is a good option for the new power plant based on your investigations? Why or why not?

Alternative Energy

Lesson 4: Solar Power House/Motor Lesson

Description: Students are given an activity in which they must place solar panels on a model house and use it to power an electric motor.

Objectives:

- Students will gain an understanding of the usefulness of solar power.
- Students will gain an understanding of the importance of Energy and Power in society.
- Students will learn how to wire a simple electric circuit.

Materials:

- Thames and Cosmos Powerhouse Kit
- Solar Power Station Materials (Included in Kit)
- Electric Motor (Included in Kit)
- Color Wheel (Included in Kit)
- Propeller Fan (Included in Kit)
- 60 Watt or More Lamp
- Scissors
- Ammeter
- Solar Energy Handout

Activities

- Using solar power everyday
- Solar Power Station Building & Experimenting
- Blogpost

Activity 1: Discussion & Search: Using solar power everyday

Solar powered calculator. Show students a solar powered calculator. Ask how many students have seen one before. What is it? How does it work?

What other solar power devises have you observed in your everyday life? Generate a list from student ideas.

Google Image Search. Give students 5 minutes to do a quick Google image search. What did they find? Add these items to the list. What surprised them? What did not surprise them?

Dissecting the solar calculator: Ask for a volunteer to help disassemble the solar powered calculator:

- Removing the screws that hold the top and bottom together using a small screwdriver
- Unscrew the circuit board from the front panel of the calculator too

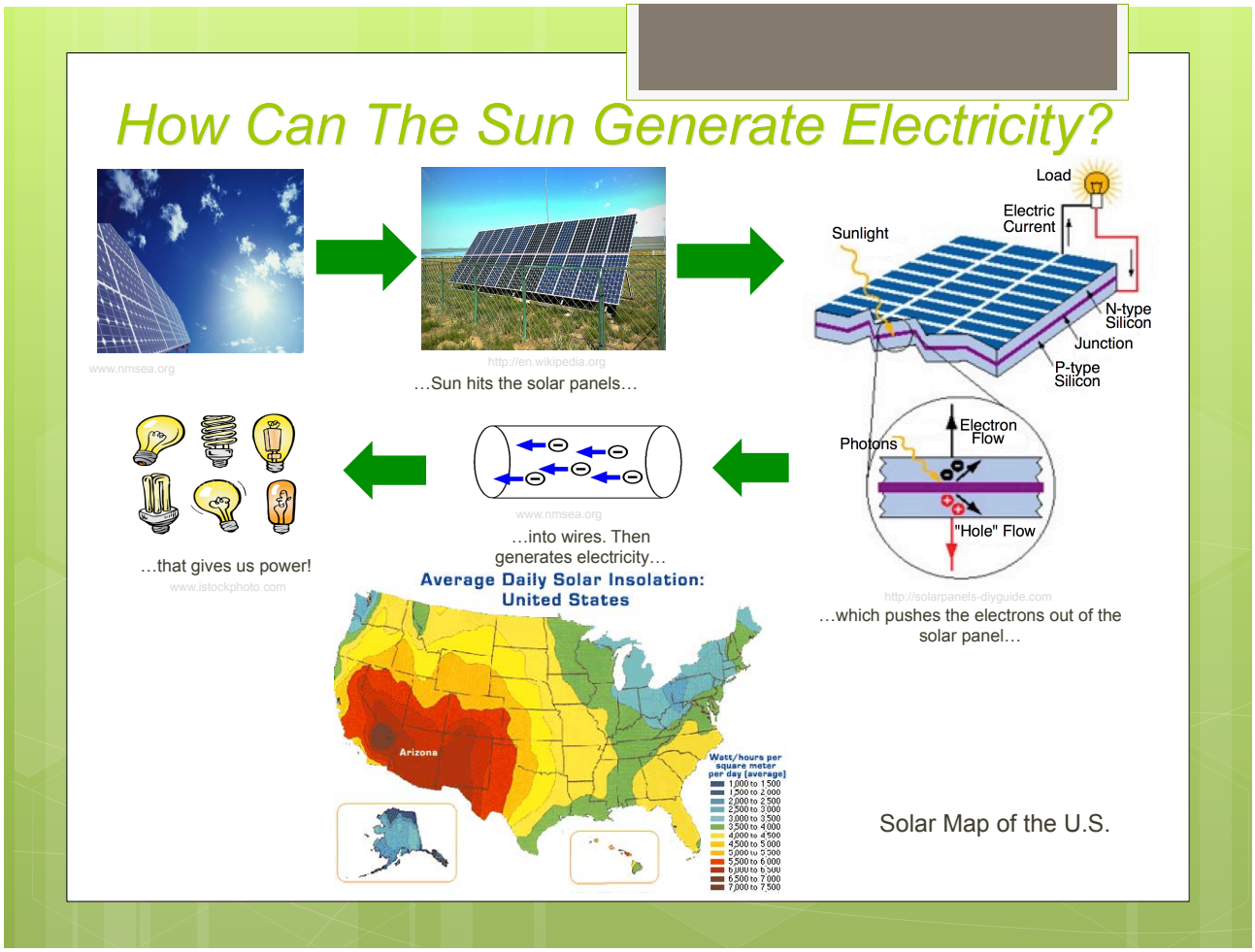
Discussion

- How does the solar calculator work?
- How was the solar panel connected to the circuit board?

- Look at the solar poster (available in this unit) and use it to explain how the solar calculator works.

For more information on how solar calculators work, go here:
[How Stuff Works](#).

Poster



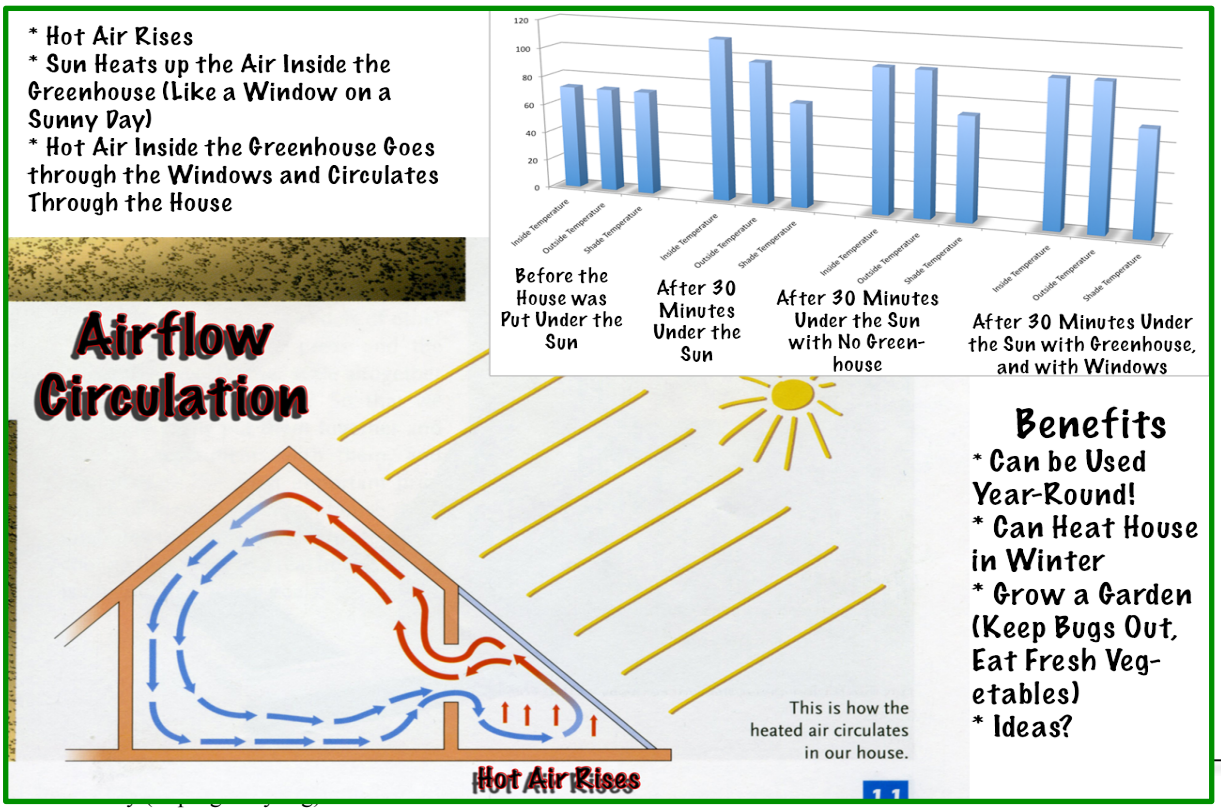
Activity 3: Building & Experimenting with a Solar Power Station
Students will assemble the Solar Power Station Kit (Thames and Kosmos 626112 Powerhouse kit).

Part 1: Assemble the building structure of the powerhouse.

- Insert the 6 metal connector clips to into the slot outside the house.
- Attach the three solar cells to the house's roof.
- Connect the wires to appropriate solar panels.
- Place lamp at a 90 degree angle to the solar panels.
- Insert the wires from the solar panels into the appropriately charged ends on the motor.
- Place the color wheel onto the motor end.

Part 2: What happens?
Students should use the attached worksheet to help them reflect on what happens.

- Turn on the lamp and observe the wheel rotating. What happens?
- Place the lamp at various angles to the solar panels and observe any changes. What happens?
- Turn off the lamp. What happens?
- Remove the color wheel and replace it with the propeller.
- Turn on the lamp and observe the propeller.
- Connect wires to ammeter to observe and measure the current change when light hits the panels from different angles.



Solar Power House/Motor Worksheet

Name:

1. What is the main source for solar energy?

2. What happens inside of the solar panel when light hits it?

3. What will happen if something blocks some of the light from reaching the panels?

4. What happens when light hits the panels directly at a 90 degree angle?

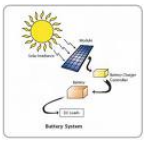
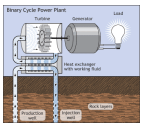
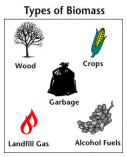
5. What happens when light hits the panels at less than a 90 degree angle?

6. What did you learn from the experiment?

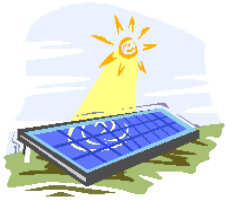
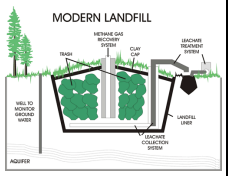
7. What was your favorite part of the experiment?

Lesson 5: Fieldtrip in and around the city

LANSING COMMUNITY COLLEGE
ALTERNATIVE ENERGY PROGRAM

Lansing Community College has one the best alternative energy programs in the country. While you're here today, see what you can find out about the kinds of jobs needed to support the use of alternative energy. What kinds of jobs will be created if we increase our use of renewable energy sources here in Lansing? Record what you find out below.	
Solar Energy 	
Geothermal Energy 	
Wind Energy 	
Biomass 	
Others	

LANSING BOARD OF WATER AND LIGHT FIELD TRIP

Source of Energy	Watts on a Sunny Day/ Homes Powered 	Watts on a Cloudy Day/Homes Powered 	Watts today/Homes Powered	Carbon Dioxide emissions? 	Pollution? 	Cost 
Solar Array 						
Hydroelectricity 						
Landfill Gas 						

Fieldtrip Blog Post:

You have recently visited the LCC Alternative Energy Center and the BWL Solar Array.

Post 2 ideas (along with pictures you took on the trips) that are new to you that you would like the Board of Water and Light to consider as they move forward with their plans to build a hybrid power plant.

LANSING BWL

Hometown People. Hometown Power.

BWL solar array reaches one-year milestone in clean energy generation

Michigan's largest solar array, owned and operated by the Lansing Board of Water & Light, is approaching its one-year anniversary of generating clean energy to BWL customers.

The BWL powered up the Cedar Street Solar Array on Dec. 23, 2008. General Manager J. Peter Lark "threw the switch" that officially signaled the BWL's entry into the Solar Age.

"In the past year, we have delivered clean, renewable energy to our customers while reducing our carbon footprint," Lark said. "In just one year, our solar array has prevented 85 tons of greenhouse gases from being emitted into atmosphere."

The solar array, located near downtown Lansing, consists of 432 solar panels. They provide electricity sufficient to power about 50 Lansing-area homes. The panels are manufactured by a Michigan company, and are capable of generating electricity even when skies are overcast.

As the technology for solar panels improves, and as prices come down, the BWL anticipates building more solar arrays in its service territory. "We are high on solar power because solar arrays are most productive during peak times – on hot, sunny days when the cost of electricity is highest," Lark said. "Our Cedar Street Solar Array is just the beginning."

In 2007, the BWL became the first utility in Michigan to adopt a Renewable Portfolio Standard. The BWL is the largest publicly owned utility in Michigan, serving more than 96,000 electric customers. ###

Alternative Energy:

Should my city build a hybrid power plant?

A curriculum for after school programs based in the community
Grades 5-8

PART 1

Green Energy Technologies in the City
http:getcity.org

This material is based upon work supported by the National Science Foundation under Grant No. DRL-0737642

Alternative Energy

A curriculum for after school programs based in the community
GET City

Driving Question: *Should my city build a hybrid power plant?*

Overarching objectives

- To understand and analyze the transfer of energy in the electricity production system
  - To explore how electricity is produced from renewable and nonrenewable resources
  - To develop an understanding of energy transformations
  - To understand the impact of electrical production and use on the environment
- To engage youth in a design-based investigation regarding whether their city should build a new hybrid power plant
  - To understand consumption patterns of electricity in their city and why this is important
  - To become aware of the role of technology in advancing possibilities for "clean" electricity production
  - Learn to work with the system to get the desired outcome

Unit Description
In this unit, GET City youth complete an investigation into how power plants work, examining energy transformations, from stored energy in the form of coal to electrical energy in their homes and the byproducts along the way. Throughout the investigation youth develop evidence-based arguments for and against new hybrid technologies for electricity production, while learning more about the science of renewable energy, and the feasibility of meeting demand through alternative sources.

Part 1: Our power plant is closing! In Part 1, youth are confronted with the challenge that one of their city's power plants will be decommissioned in 2015 due to its inability to meet emission standards. Youth are asked to consider why this problem matters.

Part 2: What is a hybrid power plant? In this segment, youth examine the general design for a proposed hybrid power plant, which to be 30% biomass and 70% coal. Part of this investigation includes examining materials provided by the electric company to its consumers describing the plant, rationale in support of building a hybrid plant, and its impact on customers.

Part 3: Alternative energies for powering my city. In this segment, delve into the construct of hybrid technologies, youth conducted investigations into the forms of alternative energy employed by the Electric Company, although not all forms investigated are a part of the proposed hybrid plant design.

Part 4: Educating the community. **In this segment, the unit concludes with the develop of a set of cybertoolkits youth can use to educate their community, and recommendations for how to support youth in educating a broad set of local stakeholders on their findings.**

Lesson Five: Creating an Energy Crisis Public Service Announcement

Objectives:

- As a culminating activity to the unit, youth create a PSA that communicates a message on one of the following two ideas:
    a. Should the city build a biomass hybrid power plant?
    b. Pros & Cons of different forms of alternative energy

- They use the program imovie to create their PSA.

Activities:

1. Be a PSA critic. View four energy related PSAs on youtube. Use the PSA critic rubric to critique the 4 PSAs. [2 of these PSAs were created by GET City youth, 2 are current PSAs airing on TV about reducing one's carbon footprint]
2. Create an Alternative Energy PSA to educate others about what you have learned.

Materials:

- Laptop
- Handout

Activity 1

Go to youtube and view the 4 PSAs listed on the worksheet. Use the worksheet to critique the 4 PSAs.

Clean Coal: American Coalition for Clean Coal
Get the new clean coal: This is reality
Alternative Energy (GET City youth)
What would you do? (GET City youth)