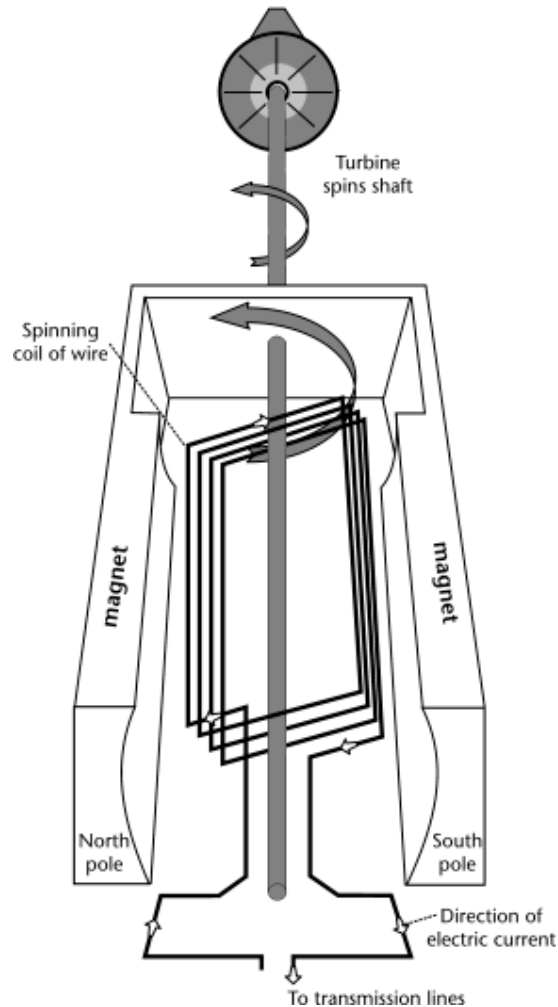


INFORMATION FOR TEACHERS

We use electricity to power things that we use every day from our lights to our refrigerators. In order for the students to get the most out of the program when they visit Macalester, I thought it would be good for them to have some basic information.

By spinning a metal coil in between two magnets, an electrical current is created. The electricity that is generated is directed through a series of wires to your home. The figure below shows how this electricity is generated.

TURBINE GENERATOR



We need to use energy to turn the generator. There are a variety of energy sources that we use to turn the generator. Most of our energy comes from steam turbines. In this method, there are blades attached to the shaft and steam is used to turn these blades.

How do we get that steam?

We burn a variety of fuels to heat water to create steam.

49% of our electricity is produced by burning coal

Natural gas and petroleum can also be burned. Natural gas accounts is used for 20% of our electricity and petroleum for 2%.

We can burn biomass (wood, garbage, plants) (1%)

We can also use a nuclear reaction to create the heat to boil the water. (19%)

We can use a wind turbine to turn a generator. (1%)

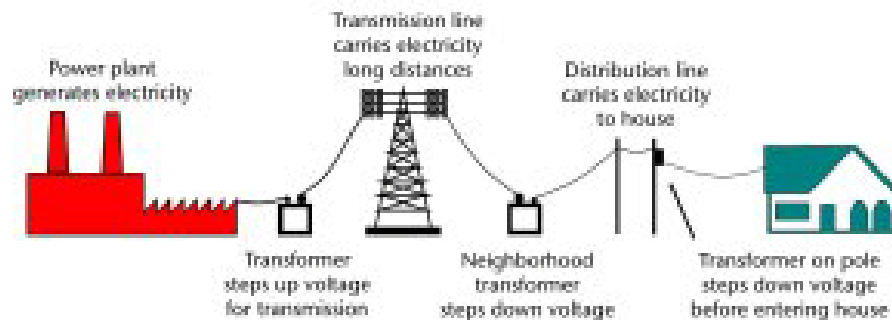
In some places, there are natural places underneath the earth's surface that have an enormous amount of heat energy, which can be used to turn water into steam. This is called geothermal. (1%)

We can use flowing water to turn the turbine, which is called hydropower. That's what the big dams do on rivers. Example: Ford Plant (7%)

We can use the sun's energy to heat water into steam in solar panels (these are called solar-thermal). Other solar panels convert this energy directly into electricity (these are called photovoltaic).

Most of this energy is generated far away from where people use it. Transmitting it across long distances is incredibly inefficient. So, instead the electricity is carried on high voltage lines. The electricity must go to a transformer to switch to the high voltage lines. However, this is too much electricity for one house to use, so it must be transformed again when it gets close to the houses back into low voltage.

TRANSPORTING ELECTRICITY



On-Campus Activities

1&2) -Have the students split into groups of 4. Each of them should go around and explain the answers they found for the pre-visit activity. Have them write down any questions that they still have. Then have them come as a group what surprised them the most. Also, have them discuss why they think we did this activity. (Have one person write down the questions, one person write down the surprising discovery and one person write why we did this activity)

-Then meet back up as a big group, answer their questions, then have one representative (the person who didn't write) from each group share what they found most surprising, and have any group who wants to talk about why they think we did this activity.

3&4) -Transition from part 1 to talk about how it's important to understand this because without understanding this system, we can't understand its impacts. Then bring in the impact of global warming.

-Ask how many have heard of global warming. Ask them to talk in these groups about what they've heard, have each group come up with an explanation/ impacts that they've heard.

-Have each group share. Write down what they come with on a big sheet of paper and fill in any gaps that they have. This is where to talk about photosynthesis and the carbon cycle.

-Ask the question: So why should we care as 8th graders in MN? (have them give responses in the big group)

-less snow?

-what can we do? We're only kids

-we're not near an ocean

-Depending on what they come up with, stress:

-Food impacts: more rain, more drought-lots of farm land in MN

-gets lots of money in the northern part of the state for snow recreation

-we're going to have to deal with the impacts, we should be part of the solutions;

it's our job to tell adults that this matters and together we need to do something

5) So what do we do about it?

-light bulbs

-aerators

-unplug appliances

-short showers

-use containers to fill up fridge

-dry clothes

-turn down the heat

-make sure stove and fridge aren't right next to each other

-Do people actually do these things? How can we encourage it?

-Prompts! (A prompt is a short message that you put somewhere visible as a reminder. Ie. The turn off the lights signs on campus)

-Show cartoon of turning down the heat.

-weather stripping (do activity, demo, something?)

-think of as a system

-keep air flowing, use vents

-don't want to make house a trap

-weather stripping fine for older homes

-talk to parents, if have a new home, do more research

-bike, bus, walk(walkability chart)

-stress independence and fun

6) Is what we do enough?

-Need community change! That's what we're doing here at Mac. You guys can do it in your communities too, and college's great for this kind of change.

--MacBike-got bikes for students to use and bike maps that are for sale

-MacCares-work on a variety of projects, think outside the bottle, Campus Wars

-CERF-told college that they wanted to figure out a way that they could pay for efficiency projects, beneficial for everyone

-light bulbs

Other cool projects:

EcoHouse

-solar water heater

-wind turbine (activity!)

Also, college helps you out:

-class projects

-credit for internships

7) Other ways to close the system:

-Gardening

-have groups come up with a meal that uses only local foods

-Composting

-Water

-rain barrels

-rain gardens

-green roofs

8) At the end of this, have each person write down three ways that they can make individual change/ way their family can make change and three ways that they can make change in their community

-have them write down the steps that they can take to do this

-then share with a friend

If short on time:

-highlight only a few solutions and a few Mac examples, provide them with a handout of all the solutions with how they can achieve them.

-cut water information

When You Come To Visit Macalester

When you come to visit Macalester, you are coming to see what college life is like. It's a lot more than just classes and schoolwork. People on campus become like a second family and you begin to form a community. Here at Macalester, our community has come together to work to make our campus and the surrounding neighborhood more sustainable. You'll learn about what's going on here and it will give you a glimpse into college life. In preparation for your visit, I have two short activities I'd like you to complete about your own community.

- 1) a. Draw a map of your neighborhood. Be sure to include transportation infrastructure, what types of buildings exist, and where green space exists as well as where paved surfaces exist.
 - b. Who lives in your community?
 - c. How well do people know each other? Give two examples to support your answer.
 - d. What brings your community together? What tears them apart?
- 2) Tally everything in your house or apartment that uses energy. Go through each room and write down everything you see. Then think about the building as a whole.

We use lots of electricity in our buildings. Your teacher talked to you about different ways of getting that electricity. We will talk more about the big system, called the grid, that makes sure that every building has electricity. In preparation, I'd like you to look a little bit at how *your building gets electricity*.

- a. Which power company does your home get its energy from?
- b. Where are their power plants located?
- c. What kinds of energy does the power company use?
- d. Where do the fuels come from?
- e. Highlight everything that uses electricity in your tally.
- f. What have you learn from this investigation?

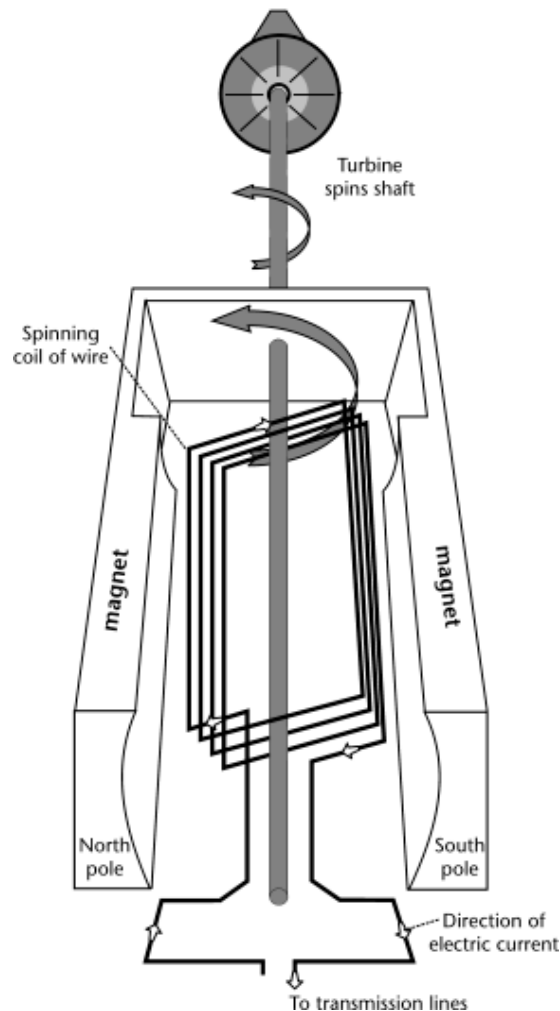
What is electricity?

Electricity is the flow of electrical charge. We use this flow to power things that we use every day from our lights to our refrigerators.

How do we get our electricity?

Nearly all of our electricity is generated by using a **turbine generator**. By spinning a metal coil in between two magnets, an electrical flow is created. The electricity that is created goes through a string of wires to your home.

TURBINE GENERATOR



Fuels we use to create electricity:

| | |
|---------------------------|--|
| Coal | Coal is burned to boil water to create steam. |
| Natural gas and petroleum | Natural gas and petroleum are burned to boil water to create steam. |
| Nuclear fission | A nuclear reaction creates heat that boils water and creates steam. |
| Biomass | Woodchips, fallen branches and plants are burned to boil water. |
| Geothermal | In some parts, there are large amounts of heat energy trapped underneath the surface of the earth. They can be tapped and the energy used to heat water. |
| Hydropower | Flowing water in rivers is used to turn the turbine. |
| Wind | On the top of a wind turbine, there are blades and a turbine. When the blades spin, they turn the shaft, which generates the electricity. |
| Solar thermal | This uses solar energy to heat up water to create steam. |
| Solar photovoltaic | This process uses the energy to create electricity directly. |

How do we get the turbine to turn?

A steam turbine can be used. For this method to work, blades are attached to the shaft and the steam turns these blades. We create the steam by boiling water. Steam turbines are by far the most common. A variety of fuels can be used to create this steam.

However, there are also energy sources that turn the turbine directly to create electricity.

How much electricity do we use? How do we measure electricity?

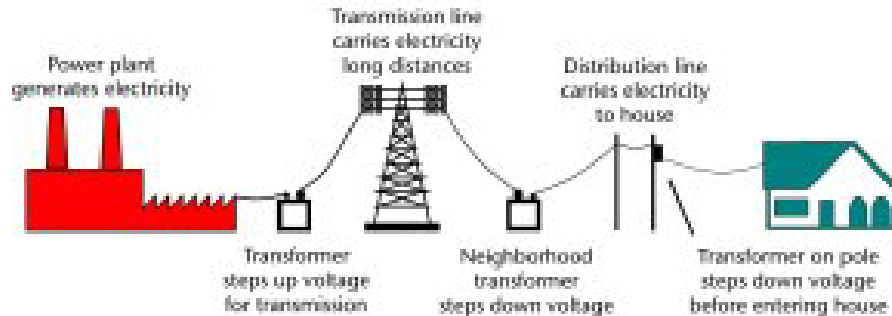
The US used **4.16 trillion kilowatthours (Kwh)** in 2007. A watt (w) is the unit that is used to measure electricity. A watthour (wh) is the number of watts it takes to power an appliance for 1 hour. A kilowatt (Kw) is 1000 watts.

For example, a 40-watt lightbulb that is on for 3 hours uses 120 watthours or .12 kilowatthours.

Click image and a pop-up window will appear and needs to see the picture.

How do we get the electricity from the power plants to our homes?

TRANSPORTING ELECTRICITY



Most of this energy is generated far away from where people use it. Transmitting it across long distances is incredibly inefficient. As much as 20% of our energy can be lost through the transmission process. So why would we have our energy production so far away from where we live? Most power plants use dirty energy that people do not want to be near, and so they put them far away from where people live. Also, some sources of electricity like geothermal and wind have great capacities in places that aren't near our cities

One way to decrease this inefficiency is to carry the electricity on high voltage lines. The electricity must go to a transformer to switch to the high voltage lines. However, this is too much electricity for one house to use, so it must be transformed again when it gets close to the houses back into low voltage. While this is more efficient than having the electricity travel on low voltage lines, there's energy that's lost by switching from low to high voltage and then back again.

Energy Saving Tips

Heating and Cooling:

In older homes, there are many cracks where air can enter and leave the house. This means that you must use a lot more energy to keep heating your house in the winter and cooling it in the summer. To help with this, **you can:**

- Put in weather stripping. This gets rid of the cracks around the windows. You and your family can get weather stripping materials at your local hardware store. It is very cheap and can save lots of money. Your family can save up to 20% of their heating and cooling costs.
- In the winter, if you have drapes, close them at night. This will help keep air from escaping through the windows.
- Turn down the heat and put on a sweater. You can have a competition with your friends to see who can turn down the heat the most. Be sure to talk to your parents first. You don't want to get any colder than 58 degrees Fahrenheit or your pipes might freeze.
- Ask your parents if they know if the house has been insulated. Some old houses have no insulation, which means that air can escape very easily through the walls. It costs more money to put in insulation, but it also saves a lot of money and energy in the long run.

Lighting:

It requires electricity to use lights. To decrease the amount of electricity you use, **try these:**

- Remember to turn lights off when you are not using them.
- Use natural light from windows when you can. Only turn on the lights when you need them.
- Replace regular incandescent lightbulbs with compact florescent lightbulbs (CFLs). CFLs are much more energy efficient.

Appliances:

Appliances use lots of energy. To reduce energy use, **take these steps:**

- Unplug appliances when you're not using them. You can also use a power strip and turn off the power strip. When appliances are turned off but still plugged into the wall, they use electricity! This is a super easy way to decrease energy use.
- Turn off appliances when you're not using them. If you don't plan on using your computer again in the next hour, turn it off.
- When using the dishwasher or washing machine, make sure you only run them when they are full.
- Driers use lots of energy. Try hang drying your clothes instead. In the summer, you can dry them outside. In the winter, you can dry them inside.
- If your family is going to buy a new appliance, try looking for a used one. Also, look to see if the appliance is energy star rated. If it is, it means that it is energy efficient.

Refrigeration:

Your refrigerator uses a lot of energy because it is always running. To make your refrigerator more efficient, here are some **simple actions you can take**:

- It takes less energy to keep a full fridge cold than an empty one. If you have empty space in your fridge, fill containers with water and stick them in the fridge
- You spend a lot of energy heating your stove and a lot of energy cooling your fridge. Make sure that these two are not right next to each other.

Water Heating:

It takes a lot of energy to heat water, so if we decrease the amount of water we use, we also decrease the amount of energy we use. **Check out these tips**:

- Put aerators in your faucets and showerhead. These are little things that put air in your water, which means that a mixture of air and water comes out. This means that when you use a faucet, less water comes out. It can decrease your water usage up to 70%, but I bet you won't be able to tell that you're using less water!
- Try taking shorter showers. If you turn off the water when you wash your hair, you can save a lot of water.
- Insulate your water heater. It will mean that the water will stay warmer longer and thus less energy will be used to heat the water.

Be creative. Come up with your own solutions. Work with family and friends.