

UES Bright Students: The Conservation Generation Pre-Visit PowerPoint Script for Teachers

Slide 1 – Intro

Welcome to the *Bright Students: The Conservation Generation* pre-visit PowerPoint presentation. The information we'll learn in this activity will help us prepare for our guest presenters from UES who will visit our classroom on (whatever day your presentations are). Let's start learning about energy!

Slide 2 – Thanks to Energy

Today, thanks to energy we can: surf the web, do homework on a computer, watch a movie, play videogames, listen to music, cook dinner, or simply turn on a light. And I'm sure you can think of other things, too.

Optional Discussion Question: What are some other things we do in our lives that require energy?

Slide 3 – Powered By Energy (*Question 1 on the Student Worksheet*)

Energy is also used to power school buses, cars, planes, and trains. It is used to harvest food, transport food to our communities, and manufacture things such as clothing, toys, books, iPods, and furniture. In fact almost everything in our lives requires energy in some form. Think about the different ways even this presentation uses energy!

Question to students (Question 1 on the Student Worksheet):

List at least three things you did or used today that required energy.

Record responses on chart paper or on the board. Give students time to record selected responses on their Student Worksheets.



Slide 4 - What is Energy? (*Questions 2 and 3 on the Student Worksheet*)

Energy is defined as the ability to do work. Energy comes in many different forms and each form offers a unique ability to do work. Forms of energy that people are familiar with include...

- light energy
- heat energy
- sound energy
- chemical energy
- and the energy of motion.

Question to students (Question 2 on the Student Worksheet):

What is the definition of energy?

Question to students (Question 3 on the Student Worksheet):

Can you think of a way we use each of these forms of energy mentioned on the slide?

To help them answer this question, have students refer to the list they created earlier about something they did that required energy.



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Slide 5 - Energy Can Change Forms (*Question 4 on the Student Worksheet*)

An important and amazing thing about energy is that IT CAN CHANGE FORMS! Here is an example: When you eat breakfast in the morning, you are eating a form of chemical potential energy (measured in calories). Our bodies transform the chemical energy of food into mechanical energy that allows us to move and do work such as riding a bike.

*Question to students (Question 4 on the Student Worksheet):
What can energy change?*



Slide 6: Energy Transformations

Energy transformation is a basic characteristic of energy. Because energy can change forms, we can put it to work for us. Another example of energy transformation is:

Radiant light energy is changed into chemical energy by plants during photosynthesis.

Slide 7: Energy Transformations (*Question 5 on the Student Worksheet*)

Another energy transformation that we've all seen thousands of times, even if we weren't aware what was going on is: Electrical energy changes to radiant and thermal energy when we turn on a light bulb.

*Question to students: (Question 5 on the Student Worksheet)
List at least two ways we transform energy to do work for us.*



Slide 8 - Types of Energy

Of all the different types of energy, one is used most often by humans. It is an energy that can easily be transformed into other types of energy and we use it daily. Do you know what type of energy this is?

Slide 9 - Electricity (*Question 6 on the Student Worksheet*)

Electricity! Electrical energy, or electricity, is simply the flow of electrons. It is a uniquely versatile form of energy. It can be easily transformed into other forms of energy, such as heat, light, or mechanical energy.

Because of its ability to easily change forms, we use electricity to do many things for us – we put it to work!

*Question to students: (Question 6 on the Student Worksheet)
What is the form of energy that humans use most often?*



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Slide 10 – Where Does Electricity Come From? (*Question 7 on the Student Worksheet*):

But where does electricity come from? How do we get it? Are there different ways to get it?

Question to students (Question 7 on the Student Worksheet):

The first thing to consider is: what is the original source? What kinds of energy sources are used to generate electricity?

Brainstorm with students energy sources that are used to produce electricity (coal, oil, sun, wind, water, etc.).



Slide 11 – How a Coal Plant Works – Transforming Energy

While electricity can be produced from several sources, let's use coal as an example to show the energy transformations that must take place to light up that bulb.

- starting with coal at the source (which is chemical energy)...
- coal is burned, transforming its chemical energy into thermal energy
- the thermal energy is used to create steam which then spins a turbine transforming the thermal into mechanical energy
- the mechanical energy spins magnets within coils of copper wire which transforms the mechanical energy into electrical energy (this is the electromagnetic effect!)
- The electricity travels through wires to our homes...
- And finally, electricity is transformed into heat and light energy as we turn on the light!

Slide 12 – Energy Transformations (*Question 8 on the Student Worksheet*)

So just to turn on a light, at least 4 energy transformations must take place! But because of these energy transformations, we are able to turn on a light using the energy stored in coal.

Question to students (Question 8 on the Student Worksheet):

So, now we know the energy transformations that must take place to light a bulb from the original energy source of coal. From your list of other energy sources in Question 7, describe how one or more of these energy sources might be transformed to light a bulb.

Review with students their responses to the previous question in which they brainstormed things that are used to produce electricity. Select a few of these sources and discuss how these sources might be transformed to produce electricity.



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Slide 13 – Types of Energy Sources (*Question 9 on the Student Worksheet*)

Currently, Arizona’s primary source for electricity is coal followed by natural gas. However, there are actually many energy sources from which electricity can be generated. These sources are generally classified as renewable or non-renewable.

Question to students (Question 9 on the Student Worksheet):

What are the two types of energy sources?



Slide 14 - Non-Renewable Energy Sources

Non-renewable energy sources are limited, finite resources that do not “renew” themselves and thus once used, are gone. Coal is a non-renewable energy source because as it is mined it does not replenish itself. Other non-renewable sources include natural gas, petroleum (oil), and uranium. Each of these sources must be mined from the earth and their supply is limited.

Slide 15 - Fossil Fuels (*Question 10 on the Student Worksheet*)

Coal, natural gas, and oil are also called “fossil fuels” because they developed from decomposition of plants and animals that lived hundreds of millions of years ago. The fossilized remains of the dead plants and animals were buried and compressed under many layers of sediment. The increased pressure and temperature over hundreds of millions of years transformed the remains into carbon-rich pockets of energy. Thus they are called fossil fuels and, once used, are gone forever – they are literally “non-renewable.”

Question to students (Question 10 on the Student Worksheet):

List four non-renewable energy sources. Circle any sources that are considered fossil fuels.



Slide 16 – Problems with Fossil Fuels (*Question 11 on the Student Worksheet*)

Fossil fuels (as described with coal) are burned to generate electricity. Unfortunately, this process emits carbon dioxide and many other gases into the atmosphere, which pollute the environment and contribute to global climate change. The mining of fossil fuels also has very damaging impacts on the natural environment, such as when methane, a powerful greenhouse gas, escapes from the “fracking” process. And because fossil fuels are non-renewable, our supply is limited.

Question to students (Question 11 on the Student Worksheet):

What are two negative effects of using fossil fuels?



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Slide 17 - Renewable Energy Sources

Renewable energy sources are considered renewable because they are never ending – they never run out. The three most common types of renewable energy sources are wind power (the power of moving air), hydropower (the power of water), and solar power (the power of the sun).

Slide 18 – Renewable Energy Sources (*Question 12 on the Student Worksheet*)

There are other renewable energy sources that are used around the world, too. They include biofuels (power from biomass, or living matter), geothermal power (power from the heat of the earth), and tidal power (power from the tides in the oceans). Scientists around the world continue to search for other, cutting edge forms of renewable energy.

Question to students (Question 12 on the Student Worksheet):

List four renewable energy sources.



Slide 19 - The Electromagnetic Effect (*Question 13 on the Student Worksheet*)

Like non-renewable energy sources, renewable energy sources can be transformed to generate electricity. As with fossil fuels, the energy from these sources is transformed into mechanical energy to turn turbines... which spin magnets in coils of copper wire... which generates an electrical current. This phenomenon -- is known as the electromagnetic effect.

Question to students (Question 13 on the Student Worksheet):

What is the phenomenon called when magnets spin inside of copper wires?



Slide 20 - Solar Energy

In addition to the electromagnetic effect, there is another process – another phenomenon – for generating electricity with solar energy. The phenomenon is known as the photovoltaic effect. ‘Photo’ means light and ‘voltaic’ means electricity - - so “photovoltaic” literally means electricity generated from light. Anytime you see solar panels around town on a house, for example, they are harnessing the sun’s power to generate electricity using the photovoltaic effect.

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Slide 21 – The Photovoltaic Effect (*Question 14 on the Student Worksheet*)

The photovoltaic effect occurs when sunlight is shone on special substances and causes electrons to flow -- an electric current! The main substance in which this occurs is silicon, which is one of the most abundant materials in the Earth's crust. Silicon is used to make solar cells, which are used to make solar panels, which are specifically fabricated to direct a flow of electrons – that is, to generate electricity! Review “How a Solar Cell Works” with students pointing out that sunlight is composed of tiny particles called photons. Photons strike and excite electrons in the solar cell. This starts the flow of electrons – electricity!

Question to students (Question 14 on the Student Worksheet):

Describe the photovoltaic effect.



Slide 22 – Environment (*Question 15 on the Student Worksheet*)

An important thing to remember is that all of our energy sources (both renewable and non-renewable) are considered to be natural resources – that is they come from nature – the world around us – our environment. When considering which energy source to use, it is very important to consider the environmental effects of using that source. How much pollution does this source produce when it is used to generate electricity? What affect does mining or otherwise extracting this source have on the overall environment? How much of this source is available? These and other questions are important to ask when considering energy sources.

Question to students (Question 15 on the Student Worksheet):

Where do our energy sources come from and what are they considered to be?



Slide 23 – Resources in Arizona

Because one consideration regarding energy choices is its availability, which of all the choices you see do you think is most abundant here in Arizona?

Slide 24 – Arizona’s Solar Potential (*Question 16 on the Student Worksheet*)

Solar Energy! That’s right, Arizona is blessed with an abundance of clean, bright, never-ending sunshine. This map shows the amount of solar energy (in kilowatt hours per year) reaching the ground. The darker the red, the more solar energy. Can you see that the amount of solar radiation reaching the earth is very high in Arizona? This means that Arizona has some of the best solar energy potential in the United States.

Question to students (Question 16 on the Student Worksheet):

Of all the renewable energy sources you’ve learned about, which one is the most abundant here in Arizona?



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Slide 25 – Arizona’s Energy Use Today (*Questions 17 & 18 on the Student Worksheet*)

Even with our abundance of sunshine, we still rely mostly on coal for our energy, followed by nuclear energy and natural gas. Renewable sources currently provide for only 9% of our needs.

Question to students (Question 17 on the Student Worksheet):

What energy source do Arizonans rely on more than any other?

Question to students (Question 18 on the Student Worksheet):

Currently, what percentage of energy in Arizona is generated from renewables?



Slide 26 - Energy Efficiency (*Question 19 on the Student Worksheet*)

Energy efficiency means using energy in a smarter manner. Another way to think of it is to perform the same task or work (such as getting light from a light bulb, or using a dishwasher to wash dishes) while using less energy.

Question to students (Question 19 on the Student Worksheet):

What is energy efficiency?



Slide 27 – Energy Efficiency (*Question 20 on the Student Worksheet*)

There are two ways that we can become more energy efficient. One way is to use smarter, that is, more efficient, devices. The other way is to behave smarter or, better said, to behave more efficiently.

Question to students (Question 20 on the Student Worksheet):

How can we become more energy efficient?



Slide 28 – Energy Efficiency – Using Efficient Devices (*Question 21 on the Student Worksheet*)

There are lots of devices, big and small, in our homes that can help us become more energy efficient. Using efficient light bulbs, efficient appliances like refrigerators, smart power strips, and low-flow showerheads, and installing pipe insulation and caulking windows are just a few ways to become more efficient.

Optional Discussion Question: Can you think of any others?

Question to students (Question 21 on the Student Worksheet):

What are some devices we can use to become more energy efficient?

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Slide 29 - Energy Efficiency – Behaving Efficiently (*Question 22 on the Student Worksheet*):

There are other things we can do to become more efficient as well. These involve changing our behavior. And they're easy to do! Becoming more efficient can mean not setting your thermostat too low in the summertime, it can mean using ceiling fans when you're hot instead of using the air conditioner, it can mean hang drying clothes instead of using the dryer, it can mean washing your clothes in only cold water, running the dishwasher only when it's full, turning off lights when you leave the room, and much, much more!

Optional Discussion Question: Can you think of any others?

Question to students (Question 22 on the Student Worksheet):

What are some behavior changes we can make to become more energy efficient?



Slide 30 – Visit www.tep.com/tips

For more great tips on other ways to become more efficient at home, you can visit www.tep.com/tips

Slide 31 – Get Ready for the *Bright Students* Presentation! (*Question 23 on the Student Worksheet*)

Very soon, two presenters from UES will come to work with us more on all sorts of topics related to energy. So get ready!

Question to students (Question 23 on the Student Worksheet):

If you have any questions related to energy, write them in the space below and hopefully you'll get a chance to ask them to our presenters.