NATIONAL GUARD
MOBILE LEARNING CENTER

Energy Lab Pre-Learning Document
What Your Students Will Learn

SCIENCE

Students will learn many science concepts through their interactions with the experiences in the Energy Lab. On-board the Energy Lab, students will have hands-on learning with:

- Endothermic & Exothermic Heat
- Wavelengths
- Unit Conversion
- Energy Transfer
- Energy Efficiency
- Renewable and Non-Renewable Energy

MATHEMATICS

Mathematics is naturally incorporated into science. In the Energy Lab, students will learn science concepts that they can apply directly to math back in the classroom. Mathematics concepts learned will include:

- Basic Trigonometry and the Graphical Representation of Waves
- Fractions and Proportions
- Dimensional Analysis
- Coordinate Planes and Graphing a Set of Data
- Quadratic Equations
- Frequency Distribution of Data

Pre-Learning Resources

The ***Earth's Precious Resources Classroom Set*** describes Earth's precious resources and the challenges we face in protecting them. Developing clean energies is critical to our future. People, communities, and nations around the world are learning how to live green and to protect the Earth's natural resources.

The ***Earth's Precious Resources Classroom Set*** includes:

Clean Energy

From solar power to wind power to geothermal energy and biofuels, the development of new technologies and the refinement of old ones are critical to sustainable, accessible energy for the people on our planet.

Living Green

There is a growing need for creative, realistic, and eco-friendly solutions to our environmental challenges. Individuals and communities can be proactive in creating a lifestyle that minimizes our impact on the environment.

*The **Earth's Precious Resources Classroom Set** was developed by Sally Ride Science. To request your set, call 1-800-561-5161.*

Pre-Learning Activity

FOSSIL FUELS (NON-RENEWABLE ENERGY)

This activity summarizes our dependency upon fossil fuels, pointing out that there are very few aspects of our daily life that are not impacted by their use. The discussion centers around whether these fuels could be replaced and makes the point that a significant percentage of them are used to manufacture products and are not simply burned for energy.

Activity: Students use a calculator to estimate how much of each fossil fuel they are responsible for consuming each year

WIND ENERGY

Activity: Students use online resources to study the relationship between barometric pressure and wind speed and direction. They will collect data on barometric pressure, wind speed, and wind direction for several days, map it, and look for relationships between wind speed and direction and the isobaric lines on the map.

SOLAR ENERGY

Activity: Students investigate the effects of color and collection area on the amount of solar energy absorbed by a system. They will use aluminum pie pans of different sizes and colors and compare the relative effect by their ability to heat water placed in them.

HYDRO (WATER) ENERGY

Activity: Students use a model turbine and generator and vary the height from which water flows into them to examine how energy output and efficiency varies.

RENEWABLE ENERGY

This is the culminating activity on renewable energy. It serves to reinforce the idea that renewable sources of energy are necessary for a sustainable future, and to discuss some of the present impacts and potential drawbacks to renewable energy.

Activity: Students will use online resources to research their present energy consumption and investigate whether it could economically be replaced by renewable sources.

Classroom activities developed by John Pratte of Kennesaw State University

Pre-Learning Discussion Questions

Where does energy come from?

Fossil fuels and renewable energy resources are not new: Fire is the most primitive energy resource dating back to prehistoric life. The use of coal as fuel predates recorded history. Farmers have used windmills and water wheels to power their farms for centuries.

What are fossil fuels and why do we primarily use them for energy?

Fossil fuels (oil, coal and natural gas) are used to make most of the energy we need to run our cars, heat our homes, power our buildings and make electricity. Fossil fuels are relatively easy to harness and they also burn efficiently, making them a popular energy choice.

Why can't we rely completely on fossil fuels?

Fossil fuels are not renewable, which means they will eventually be depleted. They take millions of years to form and the reserves are being depleted faster than new ones can be formed. The principle of supply and demand suggests that as fossil fuels diminish, prices will rise, forcing the world to create alternative, renewable energy sources.

What is the difference between renewable and non-renewable energy?

Renewable energy is energy that is replenished at the same it is used. Non-renewable energy is energy that is finite. Once the reserves are depleted, it is gone forever.

How can we solve our energy problem in the future?

We can start to solve our energy problem by finding alternative ways to create and harness energy. By relying more on renewable energy resources, we can start to power the world without the threat of depleted resources or air emissions.

WIND

Wind energy has been used for several hundred years – to power sailboats, pump water, and now to produce electricity. Operating wind machines, called wind turbines, creates no air emissions (pollution). Since the wind blows naturally, energy from the wind is renewable. Unfortunately we cannot count on the wind to always blow however, new technologies have made wind energy competitive with other power sources.

WATER

Hydropower is another name for waterpower. The power of running water can be used to produce electricity. Making electricity from rushing water is clean and it does not create air emissions. We do not have to worry about running out of hydropower, which makes water a renewable energy source. As long as rivers and streams continue to flow, we can use them to make electricity. Unfortunately, there are only so many places with water, which limits where we can use hydropower.

Pre-Learning Discussion Questions, cont.

SOLAR

Energy from the sun is called solar energy. Solar cells are small collectors of energy that can convert light to electricity when the sun shines on them. Solar cells can be combined into solar panels, which may be put on buildings or in large groups called solar arrays. Solar energy is clean, renewable and does not create air emissions. However, in some areas the sun does not shine brightly every day and it doesn't shine at all at night, so we can't always depend on solar energy. The cost of solar cells is also high, which prevents solar energy from being used often today. However, that may change in the future as costs come down and the power of solar cells improve.

How are renewable resources like wind, water and sunlight converted into electricity?

Water backs up in a river then falls through a dam to turn the blades of huge turbines, which spin generators to create electricity. Wind turns the blades of huge turbines, which spin generators to create electricity. In both cases, a transformer increases the voltage to send electricity over distribution lines. Local transformers reduce the voltage to a smaller, usable amount for you to use. When sun shines on a solar panel, loose electrons are created, which flow to create electricity. A controller then determines where electricity from the panels goes – it can be used or stored in battery for future use.

What are some pros and cons of each type of energy resource?

FOSSIL FUELS

Pros: Energy efficient, high energy density, most readily available energy resource

Cons: Pollution, non-renewable, CO_2 emissions causing global warming, expensive to build new plants

WIND

Pros: Renewable, no air emissions

Cons: Only works when the wind is blowing, high speed winds needed, wind farms sometimes considered an "eye sore"

SOLAR

Pros: Renewable, no air emissions high energy yield

Cons: Cannot collect at night, amount of energy collected depends on brightness of the sun, high cost to build and maintain

WATER

Pros: Renewable, clean, no air emissions

Cons: Limited by the number of suitable water sources, many hydro plants already being used to make electricity, can disrupt ecosystem of river or stream where dam is built

Discussion topics developed from content on XcelEnergy.com