

Teacher name: Jill Kurash

Grade level: 5th/6th

Unit title: Watt's Off: A Unit on Electricity and Electrical Conservation

Length of Unit: 3-4 weeks for electromagnetism unit; on-going to implement and monitor conservation activities.

Goals of this unit:

1. To explore different ways to generate electricity,
2. To evaluate our school's electricity consumption and create ways to reduce usage,
3. To investigate more sustainable ways to generate electricity for the school.

Essential questions:

1. What is the relationship between magnetism and electricity?
2. How is electricity generated?
3. How else can electricity be generated to manage our natural resources?
4. What are ways that Woodstock Elementary School can decrease our electrical consumption?

Students will know:

- that electricity and magnetism are related.
- that electromagnetism is used to generate electric current.
- a simple motor can be made from an electromagnet and a rotating armature.
- some differences between renewable and non-renewable energy sources
- there are a variety of ways to generate electricity using both renewable (wind, hydro, solar, etc.) and non-renewable (fossil fuels) sources

Students will be able to:

- begin to understand how a simple motor works
- begin to understand how a generator works
- take steps to reduce the amount of electricity used at school and hopefully at home as well.

Activities

1. **STC unit "Magnets and Motors":** 16 lessons. I used this unit to lay the foundation for my students' understanding of the relationship between magnetism and electricity. Students are also introduced to electromagnetism and are challenged to build a simple motor and generator. About half way through the unit, students design an experiment to test the electromagnetic force when one variable is changed. AIMS "Electrical Connections", also has a similar activity in which students design a similar experiment.

2. **VEEP: Electricity and the Environment presentation:** During this in class presentation, students learn about electricity and how it powers our world, from Faraday's Coil to our modern energy economy. Students take turns generating it on their own with different hand-powered and foot-powered activities, including taking a spin on our energy bike.

This presentation was a wonderful way to bring the Magnets and Motors unit to an end. It really tied together how electromagnetism works in a generator. And it opened the door for a discussion and investigation into renewable energy sources. The staff at VEEP has been great to work with and full of resources.

3. **Explore Learning Gizmo:**
- Energy Conversions (gr. 3-5)
 - Household Energy Usage (gr. 6-8)
 - Electromagnetic Induction (gr. 6-8)

I used various parts or all of these Gizmos throughout this unit. The Electromagnetic Induction Gizmo was a good whole group activity to complete on the Smartboard.

4. **Hibernation Vacation** (from VEEP's Whole School Energy Challenge) Groups of students target specific locations within the school and identify devices and appliances that should be turned off and unplugged during vacations. Students then create a checklist to be placed in each targeted location and explain the purpose of the checklist.

5. **Lighting Survey:** Students used light meters to measure the light levels in various areas of our classroom. We measured light levels at different times during the day on both sunny and cloudy days. From this survey, we found that the amount of light differed in different areas of the classroom. As a result, we are now able to make better decisions about the amount of light we need for different activities at different times during the day. The end result: the lights in the classroom are on less.

6. **Living Walls:** Outside our classroom, we planted pole beans and created a trellis from saplings with the intent of blocking some of the sunlight and heat that radiates from the adjacent parking lot. By reducing both heat and light, we hope to use less air conditioning during hot, sunny afternoons. And have good beans to eat at lunch!



Assessments:

Vermont GE'S

S5-6:26

(DOK 3)

Students demonstrate their understanding of Electromagnetic Forces by...

· Exploring and explaining devices that demonstrate the magnetic effects of electricity and the electric effects of moving magnets.

AND

· Exploring and explaining the relationship between the device and the magnetic or electric effect it produces, citing evidence to support the explanation.

Science Concepts:

a. Moving electrical charges [electricity] produce magnetic force [magnetism] (i.e., electromagnet, motor).

b. Moving magnets produce electricity (e.g., generator).

S5-6:49

(DOK 2)

Students demonstrate their understanding of Processes and Change within Natural Resources by...

· Identifying examples of good and poor management of natural resources.

NGSS:

MS-PS-4: Ask questions about data to determine the factors that affect the strength of electrical and magnetic forces

MS-PS-5 Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact.

MS –ESS3-3: Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.

Assessments:

1. Successful completion of experiments and activities in “Magnets and Motors”.
2. Quiz and final unit assessment.
3. Exit questions - used at the end of lessons 1-2 times per week.
4. Inquiry experiment: students design an experiment to test the strength of an electromagnet by changing one variable. Students create a poster to display their question, results and conclusion. A diagram of the experimental design is also required.
5. Successful completion of “Hibernation Vacation” checklist.

Supporting resources

Books

Electrical Connections, AIMS (Activities Integrating Math and Science) 1991.

Energy and Society, Project Learning Tree, 2012.

Energy for Keeps Creating Clean Energy from Renewable Resources.

Keeley,Page, Uncovering Student Ideas in Physical Science, Electricity and Magnetism Formative Assessment Probes, NSTA Press, 2014.

Robertson,William C., Stop Faking It: Magnetism and Electricity, NSTA Press, 2005.

“Magnets and Motors”, Science & Technology for Children, Smithsonian/The National Academies National Science Resource Center, 2002.

“Energy Literacy”, 2012, Department of Energy. A downloadable publication by the Department of Energy.

Websites:

www.ase.org/initiatives/education, Alliance to Save Energy

www.eia.gov/kids Energy Information Administration
A student friendly website by the Department of Energy

www.energyville.com/ - game sponsored by Chevron. Students make decisions on how to power a city. Their efforts are measured by the environmental, economic and safety impact their choices have on the city,

www.energy4me.org/ Society of Petroleum Engineers:

www.explorelearning.com/ ExploreLearning Gizmos

[http://energyteachers.org/-](http://energyteachers.org/) network for educators interested in energy production and use.

<http://nef1.org/> National Energy Foundation:

www.ngridenergyworld.com/student.html National Grid,

www.need.org/ National Energy Education Development Project

<http://veep.org/> Vermont Energy Education Program