Maryland State Department of Education

Service-Learning Unit

Reducing Energy Consumption

Primary Subject: Science/Physics **Grade Level:** 6th &/or 7th

Additional Subject Area Connections: Social Studies

Unit Title: Reducing Energy Consumption

Type(s) of Service: Advocacy

Unit Description: As students study energy transformations and energy sources that are used to produce electricity, they will research and design a plan of action to minimize the use of fossil fuels in their community.

Potential Service-Learning Action Experiences:
Educate the community about alternative energy sources (non-fossil fuels). Students teach others what they've learned about the benefits of alternative energy sources & introduce them to the "Energy Choice" Programs available in their area *(advocacy)*:
www.renewablechoice.com/about
www.renewablechoice.com/terms
www.md-electric-info.com/
www.md-electric-info.com/info-center/shopping.html
Students could:

- Organize an Energy Outreach Night hosted by the school & produce PSAs;
- Reduce school energy consumption;
- Create a model of an alternative energy source to be viewed by the public at various events;
- Write and send persuasive letters encouraging installation of alternative electricity production system(s) in the community (increased use of public transit).

Maryland State Curriculum Indicators Met

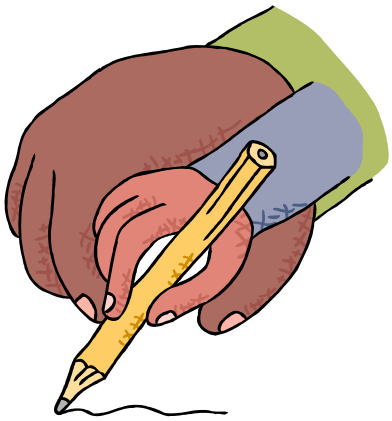
Science/Physics:
Standard 5.0 Physics: Students will use scientific skills and processes to explain the interactions of matter and energy and the energy transformations that occur.
C. Electricity and Magnetism
2. Cite evidence supporting that electrical energy can be produced from a variety of energy sources and can itself be transformed into almost any other form of energy.
a. Research and identify various energy sources and the energy transforming devices used to produce electrical energy: Wind (generators, wind mills), Sun (solar cells), Water (turbines), Fossil fuels (engines).
b. Cite examples that demonstrate the transformation of electrical energy into other forms of energy.
3. Identify and describe magnetic fields and their relationship to electric current.
b. Investigate and explain ways to change the strength of a simple electromagnet by varying the number of coils wrapped, the amount of electricity in the wire, the number of batteries used, and whether or not an iron core is used.
c. Describe how the electromagnet demonstrates the relationship of magnetism and electricity and identify common devices that demonstrate application of this relationship: Electric motors (fans, hair dryers, can openers), Electrical generators (turbine).

Alignment with Maryland's Best Practices of Service-Learning:
Reducing Energy Consumption

1. **Meet a recognized community need**
   Decrease the amount of electricity developed by fossil fuels.

2. **Achieve curricular objectives through service-learning**
   See VSC listed above (physics).

3. **Reflect throughout the service-learning experience**
   Students will keep an energy binder including research findings, brainstorming, journal entries, etc.



4. **Develop student responsibility (Students have opportunities to make decisions about the service-learning project.)**
   Students will decide from a number of ideas how they would like to complete the project/meet the community need, as well as being fully responsible to plan and implement the action chosen.

5. **Establish community partnerships**
   Depending upon the plan chosen, partnerships with local businesses could be formed to provide supplies, advertising, etc for the action plan completion. Partnerships could also be established with energy resource agencies, energy choice program, public transit/van pool organizations, and local power companies or plants.

6. **Plan ahead for service-learning**
   Students will have to devise a functional plan to meet the project objective (community need). Facilitating the completion of any plan will require organized planning.

7. **Equip students with knowledge and skills needed for service**
   Students will gain background knowledge using their own power company thus relating the curriculum to life experience. Students will use organization, communication, persuasion, technological, and teamwork skills to complete any of the suggested services. Students will better understand various sources of energy by carrying out hands on experiments with various energy sources (hook up circuits, make electromagnets, etc.).

Procedures with Resources:
Reducing Energy Consumption

These procedures represent an example of a service-learning lesson on this specific topic, but can be changed to meet individual classroom interests or varying community needs. You are encouraged to adapt this unit to fit your unique classroom and community and to solicit student input in planning and decision making.

1. Introduce the service-learning project by discussing service-learning and citizenship with students and engaging in activities to explore those themes. A resource to support this topic can be found at http://www.servicelearning.org/lsa/bring_learning/fullvideo.php.

2. Students will experiment with various energy sources (hook up circuits, make electromagnets, etc.). They will explore the Conservation of Energy concept.

3. Students will identify the power company used to supply energy to their home and complete research on that company. They should determine what energy sources that company uses to produce their electricity, and then create a pie chart to indicate the percentages of each energy source used. A student worksheet attached at the end of the unit outline.
   Maryland's power companies web links:
   - Allegheny Power
   - BGE
   - Choptank
   - Delmarva Power -Residential
   - Pepco
   - SMECO
   - Maryland's Public Transportation/Van Pool Authorities

4. As a class, compile a list of energy sources used in their local area (nuclear, hydroelectric, fossil fuels – coal, oil, natural gas, & propane, geothermal, biomass, solar, & wind). Specialize in one of these energy sources on the list to answer the research questions including the pros and cons of that energy source. Student worksheet attached at end of unit outline. Resources:

Additional Interdisciplinary Connections

- Social Studies: See VSC listed above. The 6th grade (science) and 7th grade (social studies) students could team up to complete the action plan within the school and community.

General: http://en.wikipedia.org/wiki/Energy_development
http://ezinearticles.com/?Some-Pros-And-Cons-Of-The-Most-Popular-FormsOf-Alternative-Energy&id=422952
Book Resource: www.readinga-z.com/newfiles/levels/z/energysourcesz.html
National Energy Use:
www.eia.doe.gov/kids/energyfacts/science/formsofenergy.html
Nuclear: www.nrc.gov/reading-rm/basic-ref/students.html
www.energyquest.ca.gov/story/chapter13.html
www.howstuffworks.com/nuclear.htm
Coal: www.enviroliteracy.org/article.php/18.html
Natural Gas: www.enviroliteracy.org/article.php/68.html
Oil: www.energyquest.ca.gov/story/chapter08.html
Hydroelectric: www.howstuffworks.com/hydropower-plant.htm
http://ga.water.usgs.gov/edu/wuhy.html
http://en.wikipedia.org/wiki/Hydroelectric
http://ga.water.usgs.gov/edu/hyhowworks.html
Geothermal: http://geothermal.id.doe.gov/what-is.shtml
http://geothermal.marin.org/pwrheat.html#Q6
www.nrel.gov/learning/re_geothermal.html
Solar: http://science.howstuffworks.com/solar-cell.htm
www.nrel.gov/learning/re_solar.html
Wind: www.awea.org/pubs/factsheets/Wind_Energy_How_does_it_Work.pdf
www.communityenergy.biz/cei_resources_wind.html
www.nrel.gov/learning/re_wind.html
Biomass: www.nrel.gov/learning/re_biomass.html

5. Each specialized group reports back to the class. Determine through class discussion and additional research that fossil fuels are the main energy source used to create electricity yet their use has many environmental drawbacks (cons).

6. Develop an action plan for decreasing the use of fossil fuels in the community. Students might advocate for reducing energy consumption in their school, or creating an LEED certified school/building. Or they might educate the community about using alternative energy sources (energy choice) and demonstrate some of these alternative energy principles to the community in relation to Maryland's needs. Students might educate the community about reducing energy use by making other transportation choices. Resources:
www.Power_Up!
www.dnr.state.md.us/ed/checkup.html
www.ase.org/section/_audience/educators
www.energyeducation.com/aboutus.htm
www.kidwind.org/index.html

www.need.org/
www.greentagsusa.org/renewables/barnard.shtm
www.eere.energy.gov/state_energy_program/projects_by_topic_detail.cfm/sp_id=867.

7. Install alternative electricity production system(s) in the community. Decrease wasted electricity. Resources & Funding Links:
   http://servicelearning.org/resources/funding_sources/index.php
   www.skillsusa.org/educators/lowes.shtml
   Solar Project Example:
   www.paservicelearning.org/Reach/Reach1.htm

8. Implement the action plan designed by students.

9. Evaluate the success and consequences of action plan.

10. Reflect and evaluate the effectiveness of the project by completing the *Rubric for Assessing the Use of the Maryland's Seven Best Practices of Service-Learning* which can be found at www.mdservice-learning.org.

Additional Maryland State Curriculum Indicators Met

Social Studies:
Social Studies Standard 4.0 Economics:
Students will develop economic reasoning to understand the historical development and current status of economic principles, institutions, and processes needed to be effective citizens, consumers, and workers participating in local communities, the nation, and the world.
A. Scarcity and Economic Decision-making
1. Analyze the decisions that people made because resources were limited relative to economic wants for goods and services in contemporary world region.
2. Analyze how scarcity of economic resources affects economic choices in contemporary world regions
a. Describe how goals of countries affect the use of resources in the pursuit of economic growth, and sustainable development

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Achievement Matters Most

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