



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 have learned about the benefits of alternative energy sources & introduce them to the “[Energy Choice](#)” Programs (<http://competitiveenergy.org/what-is-choice/>) available in their area (*advocacy*):

[Maryland Public Service Commission](http://www.psc.state.md.us/electricchoice/shop-and-compare/) (<https://www.psc.state.md.us/electricchoice/shop-and-compare/>) and Green Options and Renewable Energy. 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 Curriculum Standards 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

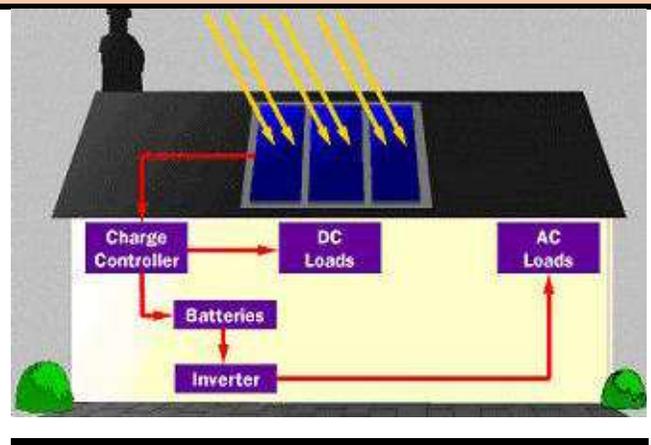
2. Cite evidence supporting that electrical energy can be produced from a variety of energy sources and can itself be transformed into almost any other form of energy.

a. Research and identify various energy sources and the energy transforming devices used to produce electrical energy:

Wind (generators, windmills), 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.



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 [Bringing Learning To Life](https://www.youtube.com/watch?v=o2-eoEi6FCo) (<https://www.youtube.com/watch?v=o2-eoEi6FCo>).
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 Commuter Programs](#)

Additional Maryland Curriculum Standards Met

Social Studies:

Social Studies Standard 4.0

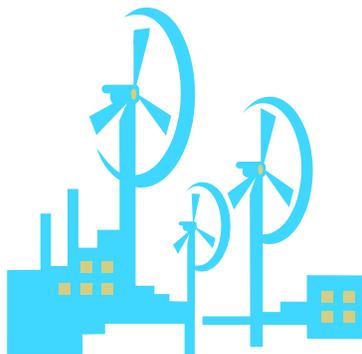
Economics: Students will develop economic reasoning to understand the historical development and current status of economic principles, institutions, and processes needed to be effective citizens, consumers, and workers participating in local communities, the nation, and the world.

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



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:

General:

- [Energy Development](https://en.wikipedia.org/wiki/Energy_development) (https://en.wikipedia.org/wiki/Energy_development)
- [Pros and Cons of 4 Common Alternative Energy Sources](https://www.thespruce.com/the-most-common-alternative-energy-sources-2941105) (https://www.thespruce.com/the-most-common-alternative-energy-sources-2941105)

Book Resource: [Reading A-Z](https://www.readinga-z.com/search/#doSearch=Search&is404=true&searchTerms=newfiles%20levels%20z%20energysourcesz) (https://www.readinga-z.com/search/#doSearch=Search&is404=true&searchTerms=newfiles%20levels%20z%20energysourcesz)

National Energy Use: [Energy KIDS](https://www.eia.gov/kids/) (https://www.eia.gov/kids/)

Nuclear:

- [United States Nuclear Regulatory Commission](https://www.nrc.gov/reading-rm/basic-ref/students.html) (https://www.nrc.gov/reading-rm/basic-ref/students.html)
- [Education World, Energy Quest](https://www.educationworld.com/awards/past/2001/r1001-12.shtml) (https://www.educationworld.com/awards/past/2001/r1001-12.shtml)
- [How Stuff Works, Nuclear Power](https://science.howstuffworks.com/nuclear-power.htm) (https://science.howstuffworks.com/nuclear-power.htm)

Coal: [Environmental Literacy Council, Coal](https://enviroliteracy.org/energy/fossil-fuels/coal/) (https://enviroliteracy.org/energy/fossil-fuels/coal/)

Natural Gas: [Environmental Literacy Council, Natural Gas](https://enviroliteracy.org/energy/fossil-fuels/natural-gas/) (https://enviroliteracy.org/energy/fossil-fuels/natural-gas/)

Oil:

- [Oil](https://www.studentenergy.org/topics/oil) (https://www.studentenergy.org/topics/oil)
- [Oil: crude and petroleum products explained](http://www.eia.gov/energyexplained/oil-and-petroleum-products/use-of-oil.php) (www.eia.gov/energyexplained/oil-and-petroleum-products/use-of-oil.php)

Hydroelectric:

- [How Hydropower Plants Work](https://science.howstuffworks.com/environmental/energy/hydropower-plant.htm) (https://science.howstuffworks.com/environmental/energy/hydropower-plant.htm)
- [Hydropower explained](http://www.eia.gov/energyexplained/hydropower/) (www.eia.gov/energyexplained/hydropower/)
- [Hydroelectricity](https://en.wikipedia.org/wiki/Hydroelectricity) (https://en.wikipedia.org/wiki/Hydroelectricity)
- [Hydroelectric Power Water Use](https://www.usgs.gov/special-topic/water-science-school/science/hydroelectric-power-water-use?qt-science_center_objects=0#qt-science_center_objects) (https://www.usgs.gov/special-topic/water-science-school/science/hydroelectric-power-water-use?qt-science_center_objects=0#qt-science_center_objects)

Geothermal:

- [Geothermal Education Office](http://geothermaleducation.org/#Q6) (http://geothermaleducation.org/#Q6)
- [Geothermal Energy Basics](https://www.nrel.gov/research/re-geothermal.html) (https://www.nrel.gov/research/re-geothermal.html)

Solar:

- [How Solar Cells Work](https://science.howstuffworks.com/environmental/energy/solar-cell.htm) (https://science.howstuffworks.com/environmental/energy/solar-cell.htm)
- [Solar Energy Basics](https://www.nrel.gov/research/re-solar.html) (https://www.nrel.gov/research/re-solar.html)

Wind:

- [Basics of Wind Energy](https://www.awea.org/wind-101/basics-of-wind-energy) (https://www.awea.org/wind-101/basics-of-wind-energy)
- [How Wind Power Works](https://science.howstuffworks.com/environmental/green-science/wind-power.htm) (https://science.howstuffworks.com/environmental/green-science/wind-power.htm)
- [Wind Energy Basics](https://www.nrel.gov/research/re-wind.html) (https://www.nrel.gov/research/re-wind.html)

Biomass: [Biomass Explained](https://www.eia.gov/energyexplained/biomass/) (https://www.eia.gov/energyexplained/biomass/)

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. Alternatively, 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:
 - [Alliance To Save Energy](https://www.ase.org/initiatives/education) (https://www.ase.org/initiatives/education)
 - [Transportation Alternatives Program - Maryland](http://www.roads.maryland.gov/index.aspx?PageId=144) (www.roads.maryland.gov/index.aspx?PageId=144)
 - [Energy Education](https://energyeducation.ca/encyclopedia/Main_Page) (https://energyeducation.ca/encyclopedia/Main_Page)
 - [Kid Wind](https://www.kidwind.org/) (https://www.kidwind.org/)
 - [National Energy Education Development](http://www.need.org/educators/awesome-extras/) (www.need.org/educators/awesome-extras/)
 - [Sustainability and Climate Action - Barnard](https://barnard.edu/sustainability-climate-action) (https://barnard.edu/sustainability-climate-action)
 - [State Energy Program](https://www.energy.gov/eere/wipo/state-energy-program) (https://www.energy.gov/eere/wipo/state-energy-program)
7. Install alternative electricity production system(s) in the community. Decrease wasted electricity. Resources & Funding Links:
 - [Target - Our Community Impact](https://corporate.target.com/corporate-responsibility/community-impact) (https://corporate.target.com/corporate-responsibility/community-impact)
 - [Home Depot Foundation Grants](http://www.corporate.homedepot.com/community/home-depot-foundation-grants) (www.corporate.homedepot.com/community/home-depot-foundation-grants)
8. Implement the action plan designed by students.
9. Evaluate the success and consequences of action plan.
10. Upon completion, analyze the plan to evaluate the successful completion of the objective and overall success of the project. Also, reflect on the project using various reflection activities 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](http://marylandpublicschools.org/programs/Documents/Service-Learning/rubric_best.pdf) (http://marylandpublicschools.org/programs/Documents/Service-Learning/rubric_best.pdf).

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[Maryland Public Schools Service-Learning Website](http://www.mdservice-learning.org) (www.mdservice-learning.org)
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**This material is based upon a template for service-learning experiences created by the Maryland State Department of Education. Opinions or points of view expressed in this document are those of the authors and do not necessarily reflect the official position of the Maryland State Department of Education or constitute an endorsement.*