Lesson Plans

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Energy and Environment

1/6/2016-1/26/2016

**Learning Objectives**

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| **Content Area:** Energy and the Environment **Grade Level:** 11/12 |
| **Unit:** Renewable Energy Alternatives (Chapter 18) |
| **Learning Goals:**  18.1 I can describe how biomass energy and geothermal energy are used.   1. Explain the benefits and current status of renewable energy resources. 2. Define biomass energy and explain how it is used directly for heat and light, as well as indirectly for generation of electricity. 3. Describe how geothermal energy is harnessed and used directly for heat, as well as indirectly for generation of electricity.   18.2 I can explain how water can be used to address energy needs.   1. Explain how running water can be used to generate electricity. 2. Identify benefits and costs of hydropower as a source of electricity. 3. Describe how energy from the ocean can generate electricity.   18.3 I can explain how the sun and wind provide alternative energy sources.   1. Describe techniques for using solar energy to heat buildings and generate electricity. 2. Analyze the benefits and costs of solar energy. 3. Explain how wind energy can be used to produce electricity. 4. Analyze the benefits and costs of using the wind to generate electricity.   18.4 I can explain how we can use hydrogen as a source of energy.   1. Describe how hydrogen fuel (H2 gas)can be produced. 2. Explain the way fuel cells work and how they are used. 3. Describe the costs and benefits of using hydrogen fuel for transportation and for electricity. |
| **Score 4:** Student demonstrates in-depth inferences and applications of the learning goal(s) and can reconstruct and apply their knowledge from limited information:  The student can:  18.1-18.4  Analyze environmental, economic, and social or political costs and benefits of choosing one alternative energy source over another in a particular setting.  18.1-18.4  Given a description of an environmental problem that has resulted from generating electricity using alternative energy, describe a modification that would likely reduce severity of the problem, while also allowing continued electricity generation from the same energy resource.  18.1-18.4  Evaluate sustainability of an alternative energy source for generating electricity. |
| **Score 3:** Student demonstrates no major errors or omissions regarding explicitly taught learning goals.  The student can:   * Explain the difference between   18.1 A. Nonrenewable and alternative energy sources.  18.1 B. Energy uses of biomass in poor developing nations versus highly developed nations.  18.1 B*. Relative CO2 savings of using cultivated plant biomass* instead of fossil fuels for generating electricity AND *relative CO2 savings of using aqua-cultured algal biodiesel* instead of cultivated biomass for generating electricity.  18.1 C. CO2 reductions of using geothermal energy versus fossil fuels to generate electricity.  18.1 C. Electrical energy use and greenhouse gas production when controlling a building’s temperature using a traditional furnace and air conditioner versus a modified system having a ground source heat pump paired with the furnace and air conditioner.  18.2 A, B Costs/benefits of hydroelectric generation with & without a dam and reservoir.  18.3 A, B Environmental and economic costs and benefits of using solar power versus fossil fuel combustion to generate electricity.  18.3 C,D Environmental and economic costs and benefits of using wind power versus fossil fuel combustion to generate electricity.  18.1-18.4 Identify examples & practical uses of alternative energy in a described setting.   * Diagram or explain how:   18.1 C. Geothermal energy can be harvested to generate electricity.  18.2 A, C Moving water of rivers or ocean tides can be used to generate electricity.  18.3 A, B. Solar energy can be used for passive heating.  18.3 A, B. Solar energy can be used to generate electricity.  18.3 C, D Wind power can be used to generate electricity.    18.4 A Hydrogen gas (H2)can be generated for use as fuel.  18.4B Hydrogen fuel cells can be used to fuel transportation.   * Distinguish between   18.2 B. Relative environmental impacts of land-filling garbage with/ without methane capture.  18.4A Costs and benefits of switching to fuel cell-powered transportation. |
| **Score 2:** The student demonstrates no major errors or omissions regarding the simpler details and processes that support the learning goal(s).  The student can:  18.1—18.4   * Define vocabulary terms associated with alternative energy sources. * Identify five alternative energy sources & two nonrenewable energy resources (17) * List three environmental benefits of switching from nonrenewable to renewable energy. |
| **Academic Vocabulary:**  18.1 biomass energy, biofuel, biopower, geothermal energy, ground source heat pump  18.2 hydropower, tidal energy, ocean thermal energy conversion (OTEC)  18.3 passive solar heating, active solar heating, flat-plate solar collector, photovoltaic (PV) cell, concentrating solar power (CSP), wind turbine, wind farm  18.4 electrolysis, fuel cell |

**Detailed Daily Plans, including materials required and descriptions of assessments**

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| Unit day  Likely date | L goals & ach st’ds | Lesson segments, including materials that will be used & assessments |
| One,  Wed, 1/6 | Overview  Literacy develop-ment  Skills | Use of the “what I know now, what I’ve learned today, what I don’t understand” table to brainstorm previous knowledge about the main ideas of chapter 18, sections 1-4. Use think/pair/share format, with students adding to their list (in what I’ve learned today column) with ideas that others have shared and that they did understand but didn’t recall alone; if others had written ideas not familiar or well understood, these should be recorded in “what I don’t understand”  Start: pairs of students assigned task of using sticky notes and a large sheet of paper to create a concept map (also called a mind map or a graphic organizer), using the quick read technique that has been taught. (guiding question on larger sticky note, then major subheadings attached to the guiding question on a smaller sized sticky note, then the next level headings on a still smaller note, then finally—1 idea on each—tiny note sheets for important concepts, examples, ideas (relative to guiding question) under the sub-topics. |
| Two,  Thurs  1/7 | 18.1 A-C  Literacy develop-ment  Skills | Finish concept maps and have checked. Review the map.  Then, while sitting at your own mind map and working alone (don’t look at your partner’s answers!), complete the open note quiz on chapter 18, lesson one. Use the organization of the map to help quickly navigate it to find answers to questions.  Check and correct (new color) your answers for the self-assessment. Rate the quality of your map from 0 (totally ineffective), 1 (minimally effective), 2 (moderately effective), 3 (very effective), 4 (allowed 100% success). |
| Three,  Fri,  1/8 | 18.1 A-C  Literacy develop-ment  Skills | With your partner, compare your answers to the self-assessement, then discuss sources of differences; re-evaluate: was failure to answer questions correctly more often due to your not having included the ideas in the map OR due to ineffectiveness in using the information in the map? Could you have been more successful if remembering to use the organizational layout by topic? To what extent were your errors due to misunderstanding of the questions or how the questions related to the content of your map?  With your partner, remove the stick notes from the map, then reorganize them into the form of an outline. Self-evaluate: Are you more efficient in navigating the map or the outline? |
| Four,  Mon  1/11 | 18.1 A-B | Short video clips about use of biomass energy in the developed and developed world, including use for heat and light and cooking, as well as for generation of electricity.  1st content videos, then 2nd view a documentary clip showing the daily life of women and children in a poor undeveloped region and the impacts of using biomass as an exclusive energy source; view the positive impacts of low-cost alternatives provided—like solar ovens or more efficient rocket stoves—on their lives and on the environment.  Analyze: relative longterm costs and benefits to the US of providing and not providing assistance to replace burning biomass in these villages. |
| Five,  Tues,  1/12 | 18.1B-1C | Short video clips—nature of geothermal energy, generating electricity with solar power, pros/cons geothermal energy, and how ground source heat pumps allow electricity and Carbon savings in both summer and winter.  Discuss pros/cons of geothermal energy.  General operation of an electrical generator: small groups diagram and explain to the class, then a final group gives a general explanation for how electrical generation. END of class free write: how is electricity generated? |
| Six,  Wed,  1/13 | Literacy skills  18.2 overview | Teacher demonstrates use of the webspirationclassroom software and shows students how to open accounts, then students practice using the software to make 1st a diagram with main headings of 18.2, then 2nd use the outline generated to complete the reading notes for the chapter: finally, improve outline. Self-evaluate: which technique is best for you? Why? |
| Seven, Thurs,  1/14 | 18.2 A-C  Literacy skills | 18.2 note completion—use www.webspirationclassroom.com  Brief video on YangSe river dam to show social, economic, environmental pros/cons, then discuss it |
| Eight,  Fri,  1/15 | 18.3 C-D | 18.3 note completion--—use [www.webspirationclassroom.com](http://www.webspirationclassroom.com)  Video—wind farms—how they work/costs & benfits—discussion |
| Nine,  Wed,  1/20 | 18.3 A-B | 18.3 notes work--—use [www.webspirationclassroom.com](http://www.webspirationclassroom.com)  Video clips on how solar farms & household solar generators work + pros/cons and discussion |
| Ten,  Thurs,  1/21 | 18.4 | 18.4 notes—use [www.webspirationclassroom.com](http://www.webspirationclassroom.com) |
| Eleven,  Fri,  1/22 | 18.4 | Complete note-taking in prep for unit test on Monday, Tuesday 1/25, 1/26 |
| Twelve-13  Mon,  1/25 &  Tuesday, 1/26 |  | Video—hydrogen fuel cells and how they work/pros/cons discussion  Unit Test Part I—Students log into their own webspirationclassroom.com account, then use outlines/concept map diagrams to answer questions on test. |