Understanding Earth's Energy Sources

Grades: 9-12

Topics: Biomass, Wind Energy, Hydrogen and Fuel Cells, Solar, Vehicles, Geothermal

Owner: ACTS

This educational material is brought to you by the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy.

Name: _____
Date: _____

Take Charge of Your Learning!

Status	Achievement	Effort
Advanced	I exceeded the objectives of the task or lesson.	I worked on the task until it was completed. I pushed myself to continue even when difficulties arose or a solution was not immediately evident. I viewed difficulties that arose as opportunities to strengthen my learning.
Proficient	I met the objectives of the task or lesson	I worked on the task until it was completed. I pushed myself to continue working on the task even when difficulties arose or a solution was not immediately evident.
Partially Proficient	I met a few of the objectives or lesson, but did not meet others.	I put some effort in the task, but I stopped working when difficulties arose.
Beginning	I did not meet the objectives of the task or lesson	I put very little effort into the task.

Learning Objectives

In Part 1, students will know how fossil fuels were formed; recognize common uses of Earth's fossil energy resources and develop an understanding of the risks and benefits of their continued use. In Part 2, students focus on the importance of renewable energy resources for a sustainable future. Current renewable energy technologies (solar, wind, biomass, hydrogen, hydroelectric, and geothermal) are discussed. Information on solar is located on a separate power point (2006 Solar PP) as is hydrogen and transportation alternatives. Students will be able to distinguish between renewable and nonrenewable energy resources and identify the positive and negative effects of each. The long-term understanding of this unit is for the students to make informed energy decisions in the future.

Time Allowed

Suggested 1 Semester to allow class discussions, hands-on activities and weekly current event reports.

Vocabulary

Nonrenewable energy
Renewable energy
Fossil fuels
Coal
Oil
Natural Gas
Global Warming
Reserve
Nuclear energy
Solar energy
Wind energy
Hydroelectric Power
Geothermal energy
Biomass
Energy from Hydrogen

Materials and Main Activity

PowerPoint presentation (outline and notes provided)
LCD projector and screen needed

Optional Activities:

DVD: *Global Warming: The Signs and Science*. 2006 PBS
Solar car models www.solarworld.com
Hydrogen car models: www.fuelcellstore.com
Student Wind Generator Kit: www.pitsco.com
The Science of Energy Kit: www.need.org
* Inexpensive used solar cells can often be found on eBay.

Prerequisite Knowledge

Students should build on previous science concepts, such as earth's relationship to the sun, photosynthesis and earth's structure. A student survey (provided) is also recommended to build on students' current knowledge of fossil fuel use in our daily lives. Teachers needing additional background information on energy are recommended to use the Links included here.

Assessments

- Student survey
- Pre-assessment (Content knowledge)
- Review Part 1.
- Review Part 2.
- Final assessment

Rubrics

- Lab Reports
- Graphs
- Presentations
- Effort

Science and Math Standards

NS.5-8.4 Earth and Space Science

CONTENT STANDARD D:
As a result of their activities in grades 5-8, all students should develop an understanding of

- Structure of the earth system
- Earth's history
- Earth in the solar system

NS.5-8.6 Science in Personal and Social Perspectives

CONTENT STANDARD F:
As a result of activities in grades 5-8, all students should develop understanding of

- Personal health
- Populations, resources, and environments
- Natural hazards
- Risks and benefits
- Science and technology in society

NM.5-8.10 Statistics.

In grades 5-8, the mathematics curriculum should include exploration of statistics in real-world situations so that students can

- Construct, read and interpret tables, charts and graphs;
- Develop an appreciation for statistical methods as powerful means for decision-making.

5/28/2010

Outline
"Understanding Earth's Energy Sources"

Power Point Presentation Part 1. Introduction to Earth's Energy Sources and Nonrenewable Energy

Outline Part 1.

Slide 1. Title Page
Slide 2. Intro to nonrenewable and renewable
Slide 3. Intro nonrenewable key terms
Slide 4. Intro renewable key terms
Slide 5. Fossil fuel definition
Slide 6. Coal facts
Slide 7. Map U.S. coal reserves
Slide 8. Graph world coal reserve
Slide 9. City Lights
Slide 10. World energy use at night
Slide 11. Discussion: Electricity Uses
Slide 12. World population growth projections
Slide 13. Global warming
Slide 14. Global warming air chemistry data
Slide 15. Global warming air chemistry data
Slide 16. Carbon Sequestration
Slide 17. Carbon Sequestration
Slide 18. Time
Slide 19. China
Slide 20. Gore book
Slide 21. National Geographic
Slide 22. NOAA remarks
Slide 23. Melting of ice caps
Slide 24. Coal benefits and concerns
Slide 25. Oil facts
Slide 26. Oil rig
Slide 27. Ocean tanker
Slide 28. Oil refineries
Slide 29. Barrel of crude products
Slide 30. Crude products
Slide 31. Oil to Gasoline
Slide 32. Price of Crude
Slide 33. Gasoline usage
Slide 34. Crowed highways cartoon
Slide 35. Crowded highway
Slide 36. Cartoon
Slide 37. Brown cloud
Slide 38 Graph Countries with
Slide 39. Users of oil with world oil reserves
Slide 40. Geopolitical concerns - Middle East
Slide 41. Geopolitical concerns - Middle East
Slide 42. Geopolitical concerns - Venezuela
Slide 43. Environmental concerns - Oil Spill
Slide 44. Environmental concerns – Oil Spill Spain
Slide 45. Environmental concerns – Oil Spill Spain
Slide 46. Environmental concerns
Slide 47. Environmental concerns
Slide 48. ANWR debate
Slide 49. ANWR Discussion
Slide 50. ANWR Oil graph
Slide 51. Oil benefits and concerns
Slide 52. Natural gas facts
Slide 53. Pie chart natural gas uses
Slide 54. Gas tanker
Slide 55. Natural gas uses
Slide 56. Graph world supply of natural gas
Slide 57. Natural gas benefits and concerns
Slide 58. Outlook for fossil fuels resources
Slide 59. Fossil fuel review
Slide 60. Acknowledgements

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Power Point Presentation Part 2. Renewable Energy

Outline Part 2.

Slide 1. Title Page
Slide 2. Intro Renewable Terms
Slide 3. Justification and need
Slide 4. Reasons
Slide 5. Spaceship earth
Slide 6. Energy Drink
Slide 7. Maps showing availability
Slide 8. Wind
Slide 9. Wind definition
Slide 10. Small turbine
Slide 11. Wind farm
Slide 12. Wind farm
Slide 13. Wind farm
Slide 14. Wind farm
Slide 15. Wind farm
Slide 16. Wind farm
Slide 17. Scale factor to plane
Slide 18. Wind farm
Slide 19. Multi-use land
Slide 20. Multi-use land
Slide 21. Substation
Slide 22. Cape Wind Project
Slide 23. Graph of wind energy
Slide 24. Map Kw
Slide 25. Inside Turbine
Slide 26 Inside Turbine
Slide 27. Inside Turbine
Slide 28. Inside Turbine
Slide 29. Inside Turbine
Slide 30. Inside Turbine
Slide 31. Inside Turbine
Slide 32. Inside Turbine
Slide 33. Wind pros and cons
Slide 34. Bioenergy
Slide 35. Bioenergy definition
Slide 36. Corn Stover
Slide 37. Corn Stover
Slide 38. Biofuels
Slide 39. Suger extraction
Slide 40. Map, ethanol production
Slide 41 Map, ethanol fueling stations
Slide 42. Grasses as biomass
Slide 43. Sugar cane
Slide 44. Tree farm
Slide 45. Charcoal
Slide 46. Biomass research
Slide 47. Bioenergy pros and cons
Slide 48. Hydroelectric
Slide 49. Hydroelectric definition
Slide 50. Water cycle and hydroelectric
Slide 51. Glen Canyon Dam
Slide 52. Hydroelectric pros and cons
Slide 53. Geothermal
Slide 54 Geothermal definition
Slide 55. Earth's structure
Slide 56. Plate tectonics
Slide 57. Geothermal basics
Slide 58 Vent
Slide 59 Vent
Slide 60. Geothermals
Slide 61. Geothermal drilling
Slide 62. Geothermal drilling
Slide 63. Geothermal technology
Slide 64. No pollution
Slide 65. Geothermal history
Slide 66 Geothermal power plant
Slide 67. Geothermal benefits
Slide 68 Graph, emissions
Slide 69. World map, geothermal power plants
Slide 70. US map, geothermal potential
Slide 71. Residential geothermal use
Slide 72. Residential geothermal use
Slide 73. Residential geothermal use
Slide 74. Clean emissions
Slide 75. Benefits of geothermal
Slide 76. Energy Conservation
Slide 77. Renewable energy review
Slide 78. Renewable energy review
Slide 79. Renewable energy review
Slide 80. Cost trends review

Power Point Solar Part 2a.

Slide 1. Solar Title Page
Slide 2. Solar definition
Slide 3. Energy from the sun
Slide 4. Passive solar
Slide 5. Passive solar
Slide 6. Passive solar
Slide 7. Passive solar blinds
Slide 8. Passive solar lighting
Slide 9. National Center for PV
Slide 10. National Center for PV
Slide 11. Renew Van
Slide 12. Direct use solar car
Slide 13. Water heating systems
Slide 14. Historic water heating
Slide 15. Water heating
Slide 16. Small water heating
Slide 17. Water heating
Slide 18. Water heating
Slide 19. Water heating
Slide 20. Water heating
Slide 21. PV panel
Slide 22. PV panel
Slide 23. Flexible panels
Slide 24. Building integrated PV
Slide 25. PV
Slide 26. PV
Slide 27. PV
Slide 28. PV McDonalds
Slide 29. PV
Slide 30. PV
Slide 31. PV
Slide 32. Agriculture PV
Slide 33. Agriculture PV
Slide 34. Troughs
Slide 35. Concentrator
Slide 36. Graph solar installations
Slide 37. Map PV needs
Slide 38. Highway PV
Slide 39. Bus stop
Slide 40. Traffic PV
Slide 41. Remote lighting
Slide 42. Remote lighting
Slide 43. Antarctica
Slide 44. Spain
Slide 45. Navigational PV
Slide 46. PV International
Slide 47. Brazil
Slide 48. Israel
Slide 49. PV International
Slide 50. PV
Slide 51. PV monks
Slide 52. PV
Slide 53. PV
Slide 54. PV
Slide 55. Parking lot cover
Slide 56. PV
Slide 57. Spa heater
Slide 58. Air plane
Slide 59. Solar in space
Slide 60. Solar in space
Slide 61. Solar in space
Slide 62. Solar pros and cons
Slide 63. PV Limitations
Slide 64. PV Camels
Slide 65. Semiconductor
Slide 66. Panel prices
Slide 67. Cell
Slide 68. Chemistry
Slide 69. Systems
Slide 70. Systems
Slide 71. Systems
Slide 72. Systems
Slide 73. Systems
Slide 74. Systems
Slide 75 Panels
Slide 76. Arrays
Slide 77. Arrays
Slide 78. Tracking
Slide 79. Systems
Slide 80. Systems
Slide 81. Systems
Slide 82-122. PV Systems

Internet Links

National Energy Education Development Project
www.NEED.org

American Solar Energy Society
www.ases.org

Formation of Fossil Fuels:
http://www.fe.doe.gov/education/energylessons/coal/coal_howformed.html

Oil Slickers: How Petroleum Benefits at the Taxpayer's Expense:
www.ilsr.org/carbo/costs/truecostes.html

Natural Gas Distribution:
http://www.energyquest.ca.gov/story/chapter09.html

Nuclear Energy:
http://www.energyquest.ca.gov/story/chapter13.html

Additional Energy Lesson Plans

http://www.energyquest.ca.gov/teachers_resources/lesson_plans.html

http://www.eere.energy.gov/education/lesson_plans.html

http://www.agiweb.org/education/ies/energy/research.html

NAME:
DATE:

Energy Survey and Pre-Test

1. What type of transportation do you use? Check all that apply:
_____ Walk/Run
_____ Roller blades
_____ Bike
_____ Skateboard
_____ Automobile
_____ Motorcycle
_____ Taxi
_____ Bus
_____ Light Rail/Train
_____ Airplane
_____ Other

2. Who pays for the gasoline when you ride in a car?

3. Where does gasoline come from? Is there enough for everyone's needs?

4. List 10 ways you use electricity.

5. What makes electricity?

6. Have you ever had an adult tell you to turn off the lights to prevent wasting electricity? Why do you think conserving electricity is important?

7. If you had to choose between using a car for transportation or clean air, which would you choose? Justify your answer.

8. Have you ever seen a watch or a calculator that used solar power? How do they do that?

9. Can you run a car on water? How about the sun?

10. What makes an energy source "non-renewable"?

11. What are fossil fuels? Describe how fossil fuels are formed.

12. Name three fossil fuels and describe their states of matter (solid, liquid or gas).

13. How do scientists link global warning to the burning of fossil fuels?

14. Discuss the benefits and risks of using fossil fuels.

15. What is a renewable energy?

16. Briefly describe the 6 types of renewable energies.

17. All of the following are nonrenewable energy sources EXCEPT _____?
    Coal
    Natural gas
    Geothermal energy
    Nuclear

18. Using a Venn diagram, list the similarities and differences between renewable and nonrenewable energy sources.

19. List five things you can do to conserve energy.

20. What do you think is the best approach to deal with Earth's expected population growth and energy supplies? Justify your answer.

NAME:
DATE:

Understanding Earth's Energy Sources Unit Test

1. What makes an energy source "non-renewable"? (5 points)

2. What are fossil fuels? Describe how fossil fuels are formed. (5 points)

3. Name three fossil fuels and describe their states of matter (solid, liquid or gas). (5 points)

4. How do scientists link global warning to the burning of fossil fuels? (5 points)

5. Discuss the benefits and concerns of using fossil fuels. (15 points)

6. What is a renewable energy? (5 Points)

7. Briefly describe 6 types of renewable energies. (12 points)

8. All of the following are nonrenewable energy sources EXCEPT _____? (3 points)

   Coal
   Natural gas
   Geothermal energy
   Nuclear

9. Using a Venn diagram, list the similarities and differences between renewable and nonrenewable energy sources. (20 points)

10. List five things you can do to conserve energy. (5 points)

11. What do you think is the best approach to deal with Earth's expected population growth and energy supplies? Justify your answer. (20 points)

NAME:_____ DATE: _____

Grading Rubric Guidelines
Four Levels of Understanding

A – Advanced
All of the answers are complete and go beyond what is necessary to solve the problem. The logic and the strategies used are perfect. Your understanding is awesome!

P – Proficient
You show you understand everything, but there are minor errors with the computation. Your work is shown and you explain your strategies effectively. You understand!

PP – Partially Proficient
You tried to answer, but you're still not getting it….the strategy is messed up, the work shown did not support your answer and your explanations are poor. You have major math errors. Incomplete understanding.

B – Beginning
Your strategy makes no sense. You don't know what to do to solve the problem. You are lost. You might have skipped a lot of problems. Poor understanding. Unsatisfactory!!

How to Write in Science and Math

Science Journals:

Three focus areas: content, recording strategies, and reflections.

1) **Content:** Big ideas, learning objectives, key terms, facts…
2) **Recording strategies:** lists, tables, drawing pictures, different colored pens, t-charts… Teach the proper format for tables and graphs, but in general as long as their records are organized and complete, it's recommended that the kids use the strategy that works best for them.
3) **Reflections:** Two column learning logs (information on one side, "wondering" on the other) Wonderings include asking questions and making connections outside of the classroom. A good question tends to have more than one answer and has provocative implications. Encourage creative writing in science!

Science Journal Prompts

a) Today I discovered that ….I also learned that…The most interesting part of the experiment was…. I'm still wondering….?
b) Today I observed… I predicted that… I also measured… I concluded that…
c) Today I learned about (vocabulary word)… I discovered that (vocabulary word)… I now know what happened to… I'm still unsure about…?
d) Today I conducted a science lab on…. I predicted that… I analyzed my results and concluded that… Another question that I have is….?
e) Next time I would do this differently….
f) This is significant because…. This tells me …….
g) What would happen if……What if I…..?
h) This reminds me of….. This suggests……
i) So what? Says who?

Conclusions from a lab experiment:

Use the writing prompts to write a paragraph conclusion.

1.) My question was…
2.) I thought that…. (hypothesis)
3.) My data showed…
4.) I learned….
5.) In conclusion….

Conclusions from readings:

1.) Looking at one paragraph at a time, ***delete*** trivial or redundant material.
2.) ***Substitute*** superordinate terms for lists.

3.) ***Keep*** the important ideas, including the topic sentence.

General Conclusion Guidelines:

Do:
Restate your position; remind the reader of your topic.
Use the key words from your topic sentence.
Convince the readers of your position, challenge them to think about the issue, or encourage them to take action.

Do Not:
Introduce a new topic
Use phrases such as:
-as I have said.
-as I proved.
-as you can see.

Words and phrases that may help in the conclusion:

-in fact
-obviously
-clearly
-certainly
-in conclusion
-truly
-definitely
-surely
-to sum it up
-all in all

Summary prompts for math lesson:

2.) The problem was….
3.) One strategy that worked was….
4.) Another strategy was to….
5.) In summary…..

* Let kids record their summary and play it back for the class.

Template for class notes used in math, adapted from Cornell notes by Charles Vesceri, Denver Public Schools, 2005. Model it for the students and show advanced examples as often as needed.

CLASSNOTES

Assignment: Book: <u>Topic/Main Idea/Vocabulary</u>	Name: Date: Problem: _____ Page: _____
Given: Find:	Solution (Use the back of the page if necessary)
Paragraph summary of the best strategy.	

Presenter: _____
Topic: _____
Date: _____
Grader: _____

Presentation Rubric

	Advanced	Proficient	Partially Proficient	Beginning (Unsatisfactory)
Organization	Student presents information in logical, interesting sequence which audience can follow.	Student presents information in logical sequence which audience can follow.	Audience has difficulty following presentation because student jumps around.	Audience cannot understand presentation because there is no sequence of information.
Subject Knowledge	Student demonstrates full knowledge (more than required) by clearly presenting the information and answering all class questions with elaboration.	Student is at ease with expected answers to all questions, but fails to elaborate.	Student is uncomfortable with information and is able to answer only rudimentary questions.	Student does not have grasp of information; student cannot answer questions about subject.
Eye Contact	Student maintains eye contact with audience, seldom returning to notes.	Student maintains eye contact most of the time but frequently returns to notes.	Student occasionally uses eye contact, but still reads most of report.	Student reads all of report with no eye contact.
Elocution	Student uses a clear voice and correct, precise pronunciation of terms so that all audience members can hear presentation.	Student's voice is clear. Student pronounces most words correctly. Most audience members can hear presentation.	Student's voice is low. Student incorrectly pronounces terms. Audience members have difficulty hearing presentation.	Student mumbles, incorrectly pronounces terms, and speaks too quietly for students in the back of class to hear.

Scientific Method

1. **<u>Question</u>:** ***What is the problem?***
   What are you trying to find out?
   Are you comparing?

2. **<u>Hypothesis</u>: This means an educated guess or prediction.**
   What might happen?
   Are you using background knowledge?

3. **<u>Experiment</u>: Test and test again!**
   Vocabulary: variables, control, design

4. **<u>Results</u>: Record your data and observations.**
   Is it organized?
   Do you have all items labeled on the tables and graphs?

5. **<u>Conclusions</u>: Analyze data and summarize your findings in paragraph format. Your con-clusions must come from your data. Include these writing prompts in your paragraph:**
   My question was….
   I thought that…
   My data showed…
   I learned….
   In conclusion…