TEACHER'S GUIDE

POWER TO THE PLANET

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Video Page

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Power to the Planet
Teacher's Guide

This Teacher's Guide includes the following:

- Suggested Lesson Plan
- Preview Questions
- Key Terms
- Viewing Guide
- Discussion Questions
- Activity: Who Chooses
- Quiz
- Enrichment and Integration Activities
- Answer Key
- Appendix

Suggested Lesson Plan

These materials may be used in a variety of ways. For maximum benefit, we suggest the following lesson plan:

- As a class, discuss the Preview Questions and Key Terms.
- Distribute copies of the Viewing Guide for students to use as a note-taking tool during the video.
- Play the video, pausing if needed to facilitate understanding and note-taking.
- Review and discuss answers to the Viewing Guide using Answer Key as a guide.
- Use Discussion Questions to spark class discussion, or assign these questions as homework.
- As a class or in small groups, complete the Who Chooses Activity.
- Replay the video as preparation for the Quiz.
- Administer and grade the Quiz using Answer Key as a guide.
- Optional: Assign one or more Enrichment Activities as homework.

Power to the Planet
Preview Questions

(These are meant to be read aloud by the teacher.)

1. What is energy?
2. Where does energy come from?
3. Where does electrical power come from? How is it generated?
4. Why do we need energy?
5. What would a world without electrical power be like?

Power to the Planet
Key Terms and Definitions

Ecosystem – a system, or a group of interconnected elements, formed by the interaction of a community of organisms with their environment

Energy grid – a network of synchronized power providers and consumers that are connected by transmission and distribution lines and operated by one or more control centers

Energy – power derived from the utilization of physical or chemical resources, especially to provide light and heat or to work machines

Fossil fuels – hydrocarbons, primarily coal, fuel oil or natural gas, formed from the remains of dead plants and animals

Greenhouse gas – any of various gaseous compounds (such as carbon dioxide) that absorb infrared radiation, trap heat in the atmosphere, and contribute to the greenhouse effect

Hydraulic fracturing – also known as hydrofracking, fracking, or hydrofracturing, hydraulic fracturing is an oil and gas well development process that involves injecting water under high pressure into a bedrock formation via the well. It is used to increase oil and/or gas flow to a well from petroleum-bearing rock formations.

Intermittent – occurring at irregular intervals; not continuous or steady

Living standards – the level of wealth, comfort, material goods and necessities available to a person or group in a given place or time

Proven oil reserves – those reserves claimed to have a reasonable certainty (normally at least 90% confidence) of being recoverable under existing economic and political conditions, with existing technology

Spontaneous – natural; developing or occurring without apparent external influence, force, cause, or treatment

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Power to the Planet
Viewing Guide, page 1

1. Energy raises our _____, lengthens our lives and helps give us fulfillment.

2. All the energy sources have their _____ and environmental impacts.

3. Coal … has been a workhorse _____ for the past 200 years.

4. 40% of the world's electricity is based on _____.

5. It [coal] is one of the leading causes of smog, acid rain, and other toxic substances, and it is the biggest emitter of _____.

6. Worldwide, it [oil] makes up about a _____ of the energy supply.

7. Oil generates _____ and it also causes pollution at every stage of the process.

8. _____ is also abundant, but unlike coal and oil, it's virtually clean, and it's comparatively cheap and easy to build a gas-fired power station.

9. 20% of the world's energy supply comes from gas, and it has grown rapidly to 27% of the total energy used here in the United States, and 30% of the _____.

10. With hydraulic _____ for natural gas there are also some local problems of groundwater contamination … and concerns about methane leakage.

11. _____ supplies 5% of the world's energy, and 14% of its electricity.

12. Nuclear power is one of few large-scale alternatives to _____.

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Viewing Guide, page 2

13. The largest costs [of nuclear power] are the _____costs associated and the waste containment and disposal.

14. _____ … is clean; it doesn't produce greenhouse gases or add pollutants to rivers and streams. It is fairly cheap.

15. Large dams generate almost a _____ of the world's electrical power.

16. In developed nations, almost all the suitable sites for large hydro-electrical dams are already _____.

17. Around the world almost 10% of the energy supply comes from using _____ or waste.

18. Bio-energy tends to be more _____ than the alternatives and the large-scale use of biomass demands that huge areas of land be set aside.

19. Currently _____supplies no more than 1% of energy globally, and less than 4% of the electricity.

20. The biggest drawback is that wind is _____.

21. Solar energy is _____ and abundant … but it doesn't work when the sun doesn't shine and … it's still expensive to install.

22. Another cost that is common to both wind and solar is the lack of _____.

23. Every energy source comes with its own set of _____.

24. If we can develop better and greener, and cheaper energy sources, they will spread around the world in a _____ way.

25. The simple and surprising answer is that there is no one best [energy] _____.

Power to the Planet
Discussion Questions

1. Why do we need energy?

2. Think of three specific examples of material progress that have been powered by energy.

3. Why is coal consumption increasing?

4. What are the advantages and disadvantages of coal?

5. How can proven oil reserves be 70% higher than 20 years ago even though a lot of oil has been consumed in that time?

6. What are the advantages of natural gas over coal and oil? Why do we still use coal and oil?

7. What are the concerns about hydraulic fracturing?

8. What are the advantages of nuclear power? What are the biggest costs?

9. What do we mean by clean energy?

10. Since hydropower is both clean and cheap, why don't we expand its use in the U.S.?

11. Which energy sources do not emit pollutants or greenhouse gases?

12. What are the drawbacks of wind power?

13. What are the drawbacks of solar?

14. Why does the mix of energy sources vary from one country or geographical region to another?

15. How do Morocco's solar power facilities work?

16. Why will energy demand increase in the future?

17. Why do people in poor countries want to be able to use more energy?

18. Why isn't there one best solution to the energy problem?

Power to the Planet
Activity:
Who chooses? Who benefits? Who pays? What's fair?

[These four questions can be a useful tool for evaluating any policy or system. Posing the questions is a great way to stimulate critical thinking.]

As a class, or in small groups, discuss the following:

(For each question, think broadly about all the possible people or groups of people who may be affected, and remember there may be non-monetary costs and benefits.)

- Will anyone choose which energy sources we use in the future? What will determine this? Does any one person or group have the power to shape these things? Explain.

- Suppose many individuals believe a particular energy source is best overall for our future, and they decide to use that source for as much of their energy as they can. Do these actions influence which energy sources will be cheapest and most abundant in the future? What does determine this?

- Suppose the government chooses to favor a particular energy source. Can its choices determine which energy source will be cheapest and most abundant in the future? What limits its power to do so? To what extent can government shape people's choices?

- Which of the costs and benefits of various sources of energy directly affect those who choose to use them? Which costs and benefits are spread throughout society?

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Power to the Planet
Quiz, page 1

1. One drawback of _____ is that it's intermittent.

    A) nuclear power
    B) hydroelectric power
    C) wind power
    D) biomass

2. Which of the following is NOT a fossil fuel?

    A) nuclear
    B) coal
    C) oil
    D) natural gas

3. The U.S. now gets 30% of its electricity from _____.

    A) solar power
    B) natural gas
    C) oil
    D) biomass

4. One advantage of coal power is _____.

    A) it doesn't emit greenhouse gases
    B) it is intermittent
    C) it is clean
    D) it is abundant

5. In developed nations, almost all of the sites for _____ are already in use.

    A) hydroelectric plants
    B) coal-fired plants
    C) wind power
    D) natural gas facilities

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Power to the Planet
Quiz, page 2

6. Large dams generate almost _____ of the world's electrical power.

    A) all
    B) half
    C) 1/5
    D) 5%

7. What is the one best energy source?

    A) Hydroelectric power
    B) Nuclear power
    C) Solar power
    D) There isn't one.

8. Large-scale use of biomass requires _____.

    A) huge quantities of water
    B) huge amounts of land
    C) hydraulic fracturing
    D) expensive waste containment and disposal

9. One problem with solar power is _____.

    A) it only works when the sun shines
    B) it emits greenhouse gases
    C) it is relatively cheap
    D) groundwater contamination

10. Hydraulic fracturing is used to extract _____.

    A) coal
    B) natural gas
    C) wind power
    D) nuclear power

Power to the Planet
Enrichment and Integration Activities, page 1

I. Class Activity: Organizing data. On a large whiteboard, blackboard, or piece of paper, create a chart with three columns. Across the top of the chart, label the three columns: Energy source, Pros, and Cons. List each of the energy sources discussed in the film down the left hand column. For each energy source, have students fill in the pros and cons columns with information provided in the film. (See sample chart in Appendix.)

II. Class Activity: Understanding data. When analyzing data it is important to make sure you are comparing "apples to apples." Some of the numbers in the film referenced the percent of *energy* supplied by a particular source, either in the U.S. or worldwide; other numbers referenced the percent of *electricity* generated by a particular source, either in the U.S. or worldwide. Create a large chart to help sort out all of the percentages that were mentioned in the film. In the first column, list each of the energy sources. Review the film and identify all of the different types of percentages that are used, and create a column for each. Now fill in your chart with the percentages given. (In some cases you will need to convert a fraction to a percent.) Note that not all of the boxes in the chart will have data. Bonus: Do some research to fill in the gaps in your chart.

III. Map Activity: Dam locations. Give students a blank map, either of the U.S. or your local region, and have them look up the locations of hydroelectric dams and plot them on their maps. Bonus: Have students research to find out how much electricity is generated by each dam and include this information on their maps.

IV. Research Project/Debate: Hydraulic fracturing. "Fracking" is controversial. Find out what the arguments and evidence are on both sides of the issue. How has the industry addressed concerns? Report your findings in a written or oral report, or conduct a class debate on the issue.

Power to the Planet
Enrichment and Integration Activities, page 2

V. Individual or Small Group Research Project: Assign, or have students or groups choose, a particular energy source for further research.

VI. Research Project: Contact your local electrical utility and find out which sources of power are used, and the percentage of each. Create a graph to show your data.

VII. Writing: A wise person once said, “There are no solutions, only tradeoffs.” Write a one page essay explaining what you think this means. How does the quote apply to energy? Include specific examples. How does it apply to other current issues or problems? Include specific examples. How well do you think the quote applies to problems overall? Explain your reasoning.

VIII. Math: Percent

a. Nuclear power supplies 14% of the world’s electricity, 40% of Sweden’s electricity, and 70% of France’s electricity.
   Compare France’s use of nuclear to Sweden’s. How many times greater is France’s reliance on nuclear power than Sweden’s? Express your answer first as a ratio, then as a percent. Now compare Sweden’s use to France’s, expressing your answer as a ratio and then a percent.
   Compare France’s use of nuclear power to the rest of the world’s. How many times greater is France’s reliance on nuclear for electricity?

b. If wind supplies 4% of the world’s electricity and 1/3 of Denmark’s electricity, how many times greater is Denmark’s reliance on wind power?

c. If the cost to install a solar voltaic system was $10,000 three years ago, and the cost has dropped 40% since then, what is the cost now?
   If the cost to install a solar voltaic system is $10,000 today, and the cost has dropped 40% in three years, what was the cost three years ago?

Power to the Planet
Enrichment and Integration Activities, page 3

IX. Writing: Write a one-page essay in which you have discovered a new form of energy that is both abundant and clean. Describe your discovery and how it works.

OR

Imagine a way to solve one of the disadvantages of one of our current energy sources. Write a one-page essay explaining how your solution works.

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Answer Key, page 1

Viewing Guide

1. living standards
2. limitations
3. fuel supply
4. coal
5. greenhouse gases
6. third
7. carbon dioxide
8. natural gas
9. electricity
10. fracturing
11. nuclear
12. fossil fuels
13. construction
14. hydropower
15. fifth
16. in use
17. biomass
18. expensive
19. wind
20. intermittent
21. clean
22. storage
23. problems
24. spontaneous
25. source

Power to the Planet
Answer Key, page 2
Quiz

1. C) wind power
2. A) nuclear power
3. B) natural gas
4. D) it is abundant
5. A) hydroelectric plants
6. C) 1/5
7. D) There isn't one.
8. B) huge amounts of land
9. A) it only works when the sun shines
10. B) natural gas

Enrichment Activity VIII

a. Comparing France to Sweden: 70/40 = 7/4 = 1 ¾ = 1.75 times, or 175%
   Comparing Sweden to France: 40/70 = 4/7 = .57 = 57%
   Comparing France to world: 70/14 = 5 = 500%

b. 33 1/3 divided by 4 = 8.33

c. $10,000-.4(10,000) = $6000
   $10,000 = (1-.4)x = .6x, so x = $10,000/.6 = $16,666.67

Power to the Planet
Appendix

Energy Source	Pros	Cons
 Coal		
 Oil		
 Natural Gas		
 Nuclear		
 Hydro		
 Biomass		
 Wind		
 Solar		

Thanks for choosing izzit.org materials! We'd love to hear from you! If you have any comments, questions, or feedback, please email Ask@izzit.org or call us at the number below. We can't serve you well if we don't know what you need!

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