



# ENERGY SOLUTIONS: WHO CHOOSES?



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# ***Energy Solutions – Who Chooses?***

## **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

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### **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.

# ***Energy Solutions – Who Chooses?***

## **Preview Questions**

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

1. What is energy?
2. What are the benefits of energy?
3. What are the costs of energy?
4. What are some ideas for lowering the costs of energy?
5. How should energy solutions be decided?

# ***Energy Solutions – Who Chooses?***

## **Key Terms and Definitions**

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

Ethanol – (ethyl alcohol) the same type of alcohol found in alcoholic beverages. It is most often used as a motor fuel, mainly as a biofuel additive for gasoline.

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 fracking, 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.

Innovation – a new idea, device or process; the application of better solutions through more effective products, processes, services, technologies, or ideas

Renewable energy – energy that comes from resources which are naturally replenished on a human timescale such as sunlight, wind, rain, tides, waves and geothermal heat

Subsidy – a type of financial assistance to certain businesses or industries, usually from the government

Tariff – a government tax on imports, designed either to raise revenue or to protect domestic industry from foreign competition

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## ***Energy Solutions – Who Chooses?*** **Viewing Guide, page 1**

1. Governments are eager to...”solve” the [energy] problem, but their answers have unintended \_\_\_\_\_.
2. Life in [Atterwasch, Germany] was good...until a fateful \_\_\_\_\_ decision changed things forever.
3. After the nuclear disaster in Fukushima, Japan, the German government decided to abolish \_\_\_\_\_.
4. The German government wanted to reduce the use of \_\_\_\_\_ like coal.
5. The German government guaranteed the producers of \_\_\_\_\_ power a high fixed price for 20 years.
6. The Energiewende (energy transition) in Germany is staggeringly \_\_\_\_\_ ...and the price is paid mainly by German retail customers.
7. Many German companies...just produced and installed the same old solar panels to take advantage of the \_\_\_\_\_.
8. It only runs when the sun isn't shining and when the wind doesn't blow. This wrecks the \_\_\_\_\_ of a gas station (electric power plant).
9. The result is that German electricity is now up to \_\_\_\_\_ generated from coal.
10. Atterwasch...sits on a rich vein of lignite \_\_\_\_\_...necessary for Germany's energy transition.
11. To have three objectives in \_\_\_\_\_ policy: security, decarbonization, and competitiveness, and...to fail on all three, that's a pretty big achievement.

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## ***Energy Solutions – Who Chooses?*** **Viewing Guide, page 2**

12. \_\_\_\_\_ was this very promising technology which was supposed to cure a lot of our energy problems because it was renewable, it was relatively clean.
13. The U.S. government has subsidized [ethanol] by more than \$ \_\_\_\_\_ and required that ethanol be blended into gasoline.
14. A fifth of American cropland became dedicated to creating \_\_\_\_\_, which resulted in much higher grain prices and problems with global food insecurity.
15. The alternative to politicians deciding, top down, which energy source to promote...is to rely more on ...scientists, \_\_\_\_\_ and entrepreneurs.
16. In the 1970s, most people thought that the United States was running out of \_\_\_\_\_.
17. With...horizontal drilling and hydraulic fracturing...it's now \_\_\_\_\_ to extract deposits that were not economical before.
18. \_\_\_\_\_ is controversial. Some chemicals used in the process can be health risks if they're released at the surface.
19. Since 2012, Saddle Creek has begun to convert its fleet to CNG, compressed \_\_\_\_\_.
20. Coal-fired plants are being shut down as we use more gas to generate \_\_\_\_\_.
21. America has demonstrated ...it is perfectly possible to have a big \_\_\_\_\_ from coal to gas and have your energy prices fall, improve your competitiveness and in the process cut your emissions.

## ***Energy Solutions – Who Chooses?***

### **Discussion Questions, page 1**

1. What is the goal of the Energiewende?
2. How will Germany's "energy transition" affect the town of Atterwasch?
3. Why did the German government decide to abolish nuclear power?
4. Why does the German government want to reduce the use of fossil fuels like coal?
5. How did the German government cause the renewable energy sector to expand dramatically?
6. Why is the Energiewende so expensive? Who pays the cost?
7. Why didn't the subsidies for renewable energy bring about innovation in solar power? What happened instead?
8. Why did Germany place high tariffs on Chinese solar panels?
9. Who benefits from high tariffs? Who pays the cost?
10. Why do solar and wind power require other fuel sources as a backup?
11. Why does Germany need more coal, not less, as a result of the "energy transition"?
12. Has the switch to renewable energy in Germany worked? Explain.
13. Why did the U.S. government start subsidizing ethanol?
14. Why is ethanol controversial? Why does the government continue to subsidize it?
15. What happened in both Germany and the U.S. as a result of government energy policy?
16. What is the alternative to top-down government energy policies?

## ***Energy Solutions – Who Chooses?***

### **Discussion Questions, page 2**

17. Why are some people concerned about fracking?
18. Why do the Kennedys allow fracking to be done on their farmland?
19. How has fracking affected the supply and price of oil and natural gas in the U.S.?
20. How does increasing the use of natural gas reduce emissions in the U.S.?
21. Why do the residents of Atterwasch, Germany, have to leave their homes and farms if they don't want to? Could this happen in the United States? Explain.
22. Who should decide whether property should be demolished to access the energy beneath it? Why?
23. When weighing the costs and benefits of corn ethanol, it is important to consider the net energy yield: how much more energy we get from a gallon of ethanol than is used to make that gallon. Fossil fuel energy is required to produce and transport fertilizers and pesticides, irrigate farmland, and plant and harvest the corn (not including the solar energy involved). Additional energy is required to transport the corn from the field to the ethanol plants and power the conversion process. Different studies have yielded different results for ethanol's net energy yield. What does it mean if the net energy yield is negative? If the net energy yield is negative or only slightly positive, does ethanol make sense as a replacement for other energy sources? Explain.



## *Energy Solutions – Who Chooses?*

### **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.)*

***“You don’t have to go to Germany to see the consequences of government picking winners in the energy game.”***

- What does it mean for the government to pick or choose a “winner”? What are its choices based on?
- Who benefits when government picks a winner? Who pays?
- What if the government’s “winner” turns out to be inefficient, wasting resources? Who pays? Who benefits?
- When government does not pick a winner, whose choices determine which businesses and industries succeed? What are their choices based on?
- Are private decision-makers likely to choose efficient or inefficient energy sources? Why?
- Who benefits from these choices? Who pays for them?
- In the absence of government involvement, if a particular company or a segment of the energy market ends up failing, who pays?
- Does anyone know which energy sources we will use in the future? If so, how do they know? If not, how can people’s choices bring this future about?
- What limits the ability of government to choose the energy sources that end up succeeding?
- If enough people think a particular energy source is the wave of the future, do we need government to subsidize that industry? Explain.

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## ***Energy Solutions – Who Chooses?***

### **Quiz, page 1**

1. The German government wanted to encourage the use of \_\_\_\_\_.
  - a. fossil fuels
  - b. nuclear power
  - c. renewable energy
  - d. Chinese solar panels
  
2. The German government heavily subsidized \_\_\_\_\_.
  - a. wind and solar power
  - b. nuclear power
  - c. electricity customers
  - d. Chinese solar panels
  
3. Who has largely paid the price for Germany's energy transition?
  - a. residential electricity customers
  - b. industrial electricity customers
  - c. taxpayers
  - d. wind and solar power producers
  
4. Wind and solar power are intermittent, so in Germany \_\_\_\_\_ is used as a backup.
  - a. nuclear
  - b. ethanol
  - c. coal
  - d. geothermal
  
5. Germany's energy transition has been \_\_\_\_\_.
  - a. relatively easy and smooth
  - b. a complete success
  - c. expensive, but good for the environment
  - d. expensive, with significant unintended consequences

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## ***Energy Solutions – Who Chooses?***

### **Quiz, page 2**

6. As a result of Germany's energy transition, how much coal is needed now?
  - a. none
  - b. a lot less than before
  - c. a little less than before
  - d. more than before
  
7. The U.S. government's ethanol mandates and subsidies \_\_\_\_\_.
  - a. are a good example of a successful energy policy
  - b. have been very controversial
  - c. have greatly benefited gasoline consumers
  - d. have had a beneficial effect on world hunger
  
8. What fuel is now being used by some U.S. truck fleets instead of diesel?
  - a. carbon dioxide
  - b. compressed natural gas
  - c. regular gasoline
  - d. di-hydrogen oxide
  
9. What has made it economical to extract more oil and gas in the U.S.?
  - a. hydraulic fracturing
  - b. taxes
  - c. subsidies
  - d. imported oil
  
10. Increased use of natural gas has caused emissions to \_\_\_\_\_ in the U.S.
  - a. increase
  - b. decrease
  - c. fluctuate
  - d. stabilize

## *Energy Solutions – Who Chooses?*

### **Enrichment and Integration Activities, page 1**

- I. 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? Have there been any documented cases of environmental contamination? How has fracking affected the supply and price of oil and natural gas in the U.S.? Present your findings in a written or oral report, or conduct a class debate on the issue.
  
- II. Writing: Imagine your family has lived in Atterwasch for generations and you have just learned what will happen to your town. Write an essay or journal entry describing your thoughts and feelings about this.
  
- III. Research/Persuasive Writing: Look up Atterwasch, Germany. What has happened to the town? Are plans to demolish the town still in place? Are residents still fighting to keep their village intact? Write a letter to the government of Germany arguing for or against the demolition of Atterwasch to make way for the coal mine.
  
- IV. Research Project/Report: Property Rights. What does it mean to own property? According to the U.S. Constitution, the government may take private property for public use as long as owners are paid “just compensation.” This is known as eminent domain. Research eminent domain use in the U.S. A good place to start your research would be these izzit videos: [Eminent Domain](#), [Who Owns What](#), and [The Drew Carey Project, vol. 1](#). Prepare a report documenting the use of eminent domain. Include examples of how, when, where, and why it has been used. As a class, discuss and debate under what circumstances, if any, eminent domain use is justified. Bonus: Find out what German law says about eminent domain.

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### **Enrichment and Integration Activities, page 2**

- V. Debate: Ethanol. Conduct a class debate with one team arguing for the following proposition and one team arguing against: The United States should abandon all ethanol subsidies and mandates. Those students not debating will act as judges, voting by a secret ballot at the end of the debate for the team that was most persuasive. Prior to the debate, have the entire class conduct research into the net energy yield of ethanol as well as ethanol's effect on food prices. (Helpful resources are listed on the [izzit.org](http://izzit.org) website.) Note that some sources will claim fuel ethanol is beneficial and others will claim it is not. Pay careful attention to the data used to justify such claims. Are the sources citing very different numbers, or drawing different conclusions from similar numbers?
- VI. Research/Report: Fukushima Nuclear Disaster. The German government cited the Fukushima meltdown as a reason for abandoning nuclear power in Germany. Research what happened in Fukushima. What caused the disaster? How much radiation was released? How many people were exposed, sickened, or died from the radiation? Will exposure levels have a measurable effect on future cancer rates or other illnesses? How could the disaster have been avoided? Using what you have learned about Fukushima, evaluate the German government's decision regarding nuclear power. Was the decision warranted, or was it an overreaction? Explain your reasoning. Create a report and present your research and conclusions to the class.

## ***Energy Solutions – Who Chooses?*** **Viewing Guide Answer Key**

1. consequences
2. government
3. nuclear power
4. fossil fuels
5. solar and wind
6. expensive
7. subsidy
8. economics
9. 45%
10. coal
11. energy
12. Ethanol
13. 20 billion
14. fuel
15. innovators
16. oil and gas
17. economical
18. Fracking
19. natural gas
20. electricity
21. transition

## **Quiz Answer Key**

1. c
2. a
3. a
4. c
5. d
6. d
7. b
8. b
9. a
10. b

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