

The Price of Power

Overview of Lesson Plan:

In this lesson, students learn about the current political debate over regulating power plant emissions. They then research, formulate, and present arguments regarding selective catalytic reduction systems for coal-burning plants.

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Suggested Time Allowance: 45 minutes – 1 hour

Objectives:

Students will:

1. Examine air quality statistics of various American cities; speculate about how pollutant levels could be potentially decreased.
2. Learn about the current political debate over Environmental Protection Agency regulations for power plants by reading and discussing “Cleaning Coal-Fired Plants: The Debate Burns On.”
3. Research different parties’ views on requiring selective catalytic reduction systems at coal-burning power plants.
4. Synthesize their understanding of requiring selective catalytic reduction systems by writing and presenting opening arguments at a mock congressional hearing on the topic.

Resources / Materials:

- pens/pencils
- paper
- classroom blackboard
- copies of the Environmental Protection Agency’s chart “Peak Air Quality Statistics for the Six Principal Pollutants by Metropolitan Statistical Area, 2000” (to be downloaded and printed from the EPA’s Web site, at <http://www.epa.gov/oar/aqtrnd00/pdf/factbook.pdf>, one per small group)
- copies of “Cleaning Coal-Fired Plants: The Debate Burns On” (one per student)
- four slips of paper or index cards, each containing the name of a group that has an interest in the debate over requiring coal-burning power plants to add selective catalytic reduction systems (the St. Johns River operators; the Clean Air Trust advocates; the environmental regulators who enforce the Clean Air Act at power plants; and the American Gas Association)
- resources for researching air pollution and coal plants (environmental science textbooks; articles on the Clean Air Act; encyclopedias; books on power plants; computers with Internet access)

Activities / Procedures:

1. WARM-UP/DO NOW: Prior to class, arrange students’ desks into small groups, and place a print-out of the Environmental Protection Agency’s air quality statistics chart that lists various cities and the levels of the “six principal pollutants” that are found in those areas. (If students have access to computers with Internet access, they could visit the Web site instead of relying on the printout.) Ask students in each group to discuss the following questions (written on the board prior to class) by using the EPA chart: “How do the cities’ population statistics relate to their air pollution levels? Can you draw any conclusions based on this comparison? What factors may contribute to the higher levels of air pollution?” Have each group briefly share their analyses of the statistics and their answers to the discussion questions. Inform the students that two of the pollutants—sulfur dioxide and nitrogen oxides—are contained in emissions from coal-burning power plants. What areas seem to have higher levels of these pollutants? How could these levels be potentially decreased? What factors may prevent reforms of existing power plants?
2. As a class, read and discuss “Cleaning Coal-Fired Plants: The Debate Burns On,” focusing on the

following questions:

- a. What is the purpose of the “scrubber” that is located in the smokestack of the St. Johns River Power Park?
 - b. How much of the power plant’s budget is spent on maintaining the scrubber?
 - c. What percentage of the United States’ electric power is generated by coal-burning plants?
 - d. Why do a majority of coal plants hope to avoid using selective catalytic reduction systems?
 - e. How are coal plants “a little like personal computers”?
 - f. What is contained in the emissions from coal plants?
 - g. According to the 1977 version of the Clean Air Act, what is required of power plants that undergo renovations?
 - h. What is “new source review”?
 - i. Why do utilities claim that new source review has been “counterproductive”?
 - j. Why is nitrogen oxides considered the “most pressing issue for St. Johns”?
 - k. How much would it cost St. Johns to add selective catalytic reduction to their plant?
 - l. How would selective catalytic reduction affect St. Johns’ levels of nitrogen oxides emissions?
3. Explain to students that today they will be conducting research in preparation for a congressional hearing on revising the Environmental Protection Agency’s regulations for power plants. Divide students into four groups, and have each group select a slip of paper or index card containing the name of a group that has an interest in the debate over mandating selective catalytic reduction systems for coal-burning power plants. (That is, the St. Johns River operators; the Clean Air Trust advocates; the environmental regulators who enforce the Clean Air Act at power plants; and the American Gas Association). Using all available resources, each group answers the following questions through their research (written on the board for easier student access):
- What is your stance on selective catalytic reduction systems?
 - How do economic concerns influence your view?
 - How do environmental concerns influence your view?
 - What is your interpretation of the Clean Air Act in relation to this issue?
 - Do you feel that the Clean Air Act should be revised? If so, how?
4. WRAP-UP/HOMEWORK: Each student writes an “opening argument” that summarizes their group’s view on mandating selective catalytic reduction systems that could be presented at the congressional hearing. In a later class, groups should reconvene and “fuse” their arguments. Then, they should present their arguments at a mock congressional hearing on power plants and selective catalytic systems.

Further Questions for Discussion:

- How do countries around the world set emissions standards for power plants?
- How do emissions from coal-burning power plants affect people’s health?
- How was the Clean Air Act originally conceived and made into law?
- How did the topic of air quality figure into George W. Bush’s campaign for the presidency?
- Why are power plants that rely on the burning of fossil fuels the most common source of energy?

Evaluation / Assessment:

Students will be evaluated based on their initial small-group discussions, thoughtful participation in class discussion, participation in their group research, and final presentations at the mock congressional hearing on selective catalytic reduction systems.

Vocabulary:

sleek, hopper, turbines, pollutants, electrostatic, precipitator, catalytic, modifications, invoke, emission, renovations, appeals, counterproductive, stringent, advocacy, envisioned, array, adjacent, gypsum

Extension Activities:

1. Visit Southern Illinois University's Web site to learn about how selective catalytic reduction systems operate (<http://www.siu.edu/~coalctr/postcomb.htm>). Create a "How It Works" poster that illustrates the process for your classmates.
2. Read "The Toll from Coal" report by visiting the National Wildlife Federation's Web site (http://www.nwf.org/climate/tfc_index.html). Pay special attention to the section on how mercury levels can be affected when coal is burned to produce electricity. Based on your reading, draw a hypothetical food chain that illustrates the path that mercury could take through many species, beginning with mercury accumulation in a fish population.
3. Research the renewable energy sources that can serve as alternatives to burning coal and other fossil fuels. Create a chart that highlights the advantages and disadvantages associated with each form of energy.
4. Research how the Clean Air Act was originally conceived and passed into law. Create a timeline that documents the act's inception, the amendments that have been added, and the current debates regarding potential modifications to the act.

Interdisciplinary Connections:

Fine Arts- Draw a political cartoon that expresses your view about the current debate over Environmental Protection Agency regulations for power plants. Present your cartoon on poster board and let your classmates analyze its message.

Global Studies- Coal accounts for about 70% of China's total energy consumption. Write a research paper about how the burning of coal affects the health of the Chinese people and China's environment. Has the Chinese government taken steps to reduce the pollutant emissions from burning coal? If so, how?

Health- Visit the Environmental Protection Agency's Web site to see how air quality can affect your health (<http://www.epa.gov/air/urbanair/6poll.html>). Write a pamphlet for people who suspect that their health is being affected by poor air quality. List the most common ailments associated with poor air quality, resources where people can seek treatment for these conditions, and suggestions of how to decrease one's exposure to poor air quality.

Journalism- Interview a representative of a local energy provider for your area. How is the energy produced? How does the provider feel about the current debate over Environmental Protection Agency regulations for power plants? Submit your completed interview to your school newspaper.

Other Information on the Web:

The Environmental Protection Agency (<http://www.epa.gov/>) strives to protect human health and to safeguard the natural environment – air, water, and land – upon which life depends. The site includes a section on the New Source Review (<http://www.epa.gov/ttn/nsr/>) and the full text of the Clean Air Act (http://www.epa.gov/oar/oaq_caa.html) with related documents.

The Clean Air Trust (<http://www.cleanairtrust.org>) is a nonprofit watchdog group which promotes a strong, effective Clean Air Act through public education and grassroots activity.

Academic Content Standards:

Grades 6-8

- Geography Standard 8- Understands the characteristics of ecosystems on Earth's surface. Benchmarks: Knows changes that have occurred over time in ecosystems in the local region; Knows the potential impact of human activities within a given ecosystem on the carbon, nitrogen, and oxygen cycles (CTSS – 'social', '6-8', 'geo3')

- Geography Standard 14- Understands how human actions modify the physical environment. Benchmarks: Understands the environmental consequences of people changing the physical environment; Understands the ways in which human-induced changes in the physical environment in one place can cause changes in other places; Understands the ways in which technology influences the human capacity to modify the physical environment; Understands the environmental consequences of both the unintended and intended outcomes of major technological changes in human history (CTSS – 'social', '6-8', 'geo4')

- Geography Standard 18- Understands global development and environmental issues. Benchmarks: Understands how the interaction between physical and human systems affects current conditions on Earth; Understands the possible impact that present conditions and patterns of consumption, production and population growth might have on the future spatial organization of Earth; Knows how the quality of environments in large cities can be improved; Understands why different points of view exist regarding contemporary geographic issues
(CTSS – 'social', '6-8', 'geo6')

- Language Arts Standard 4- Gathers and uses information for research purposes. Benchmarks: Uses a variety of resource materials to gather information for research topics; Determines the appropriateness of an information source for a research topic; Organizes information and ideas from multiple sources in systematic ways
(CTSS – 'english', '6-8', '4')

- Language Arts Standard 7- Demonstrates competence in the general skills and strategies for reading a variety of informational texts. Benchmarks: Applies reading skills and strategies to a variety of informational texts; Summarizes and paraphrases complex, explicit hierarchic structures in informational texts; Uses new information to adjust and extend personal knowledge base; Seeks peer help to understand information; Draws conclusions and makes inferences based on explicit and implicit information in texts; Differentiates between fact and opinion in informational texts
(CTSS – 'english', '6-8', '7')

Grades 9-12

- Science Standard 7- Understands how species depend on one another and on the environment for survival. Benchmark: Knows ways in which humans can modify ecosystems and cause irreversible effects
(CTSS – 'science', '9-12', '7')

- Geography Standard 8- Understands the characteristics of ecosystems on Earth's surface. Benchmarks: Understands how relationships between soil, climate, and plant and animal life affect the distribution of ecosystems; Knows the effects of both physical and human changes in ecosystems
(CTSS – 'social', '9-12', 'geo3')

- Geography Standard 14- Understands how human actions modify the physical environment. Benchmark: Understands the global impacts of human changes in the physical environment
(CTSS – 'social', '9-12', 'geo4')

- Geography Standard 18- Understands global development and environmental issues. Benchmarks: Understands why policies should be designed to guide the use and management of Earth's resources and to reflect multiple points of view; Understands contemporary issues in terms of Earth's physical and human systems
(CTSS – 'social', '9-12', 'geo6')

- Language Arts Standard 4- Gathers and uses information for research purposes. Benchmarks: Uses a variety of news sources to gather information for research topics; Synthesizes a variety of types of visual information, including pictures and symbols, for research topics
(CTSS – 'english', '9-12', '4')

- Language Arts Standard 7- Demonstrates competence in the general skills and strategies for reading a variety of informational texts. Benchmarks: Applies reading skills and strategies to a variety of informational texts; Scans a passage to determine whether it contains relevant information; Summarizes and paraphrases complex, implicit hierarchic structures in informational texts, including the relationships among the concepts and details in those structures; Uses new information from texts to clarify or refine understanding of academic concepts; Uses discussions with peers as a way of understanding information