

## SKILLS MENU

- Defining the Issue
- Researching
- Identifying Alternatives
- Analyzing
- Defending a Decision
- Communicating
- Evaluating



**Figure 1** This coal power plant in Spremberg, Germany, uses carbon capture and storage.

## Clean Coal Technology

Coal is an abundant and inexpensive fuel that is used all around the world. Many countries rely heavily on burning coal to generate electrical energy. However, burning coal emits large quantities of carbon dioxide (a key contributor to global warming), sulfur dioxide (which causes acid rain), nitrous oxide (which leads to the formation of smog), and other air toxins and particulates.

In recent years, new “clean coal” technologies have reduced some of the negative effects of burning coal. Coal-fired power plants typically have a tall smokestack that releases gases called “flue gases” as the coal is burned. “Scrubber” technologies can remove sulfur oxides from the flue gases before they are released into the atmosphere. Another way to lessen the negative effects of burning coal is to turn the coal into gases that are rich in hydrogen and carbon monoxide and then burn them. This process is called “coal gasification” and it helps improve the burning process so that less waste is produced. Some coal plants use chemical reactions to remove harmful minerals from the coal before burning.

Controlling or preventing the release of carbon dioxide from burning coal is the biggest challenge. Engineers have proposed many solutions to this problem, including carbon capture and storage (CCS) (**Figure 1**). CCS technologies capture the carbon dioxide and compress it. The carbon dioxide is then stored deep underground as a gas, dissolved in Earth’s oceans, or reacted chemically to produce metal carbonates.

Increasing the efficiency of coal power plants is also being investigated. Improving efficiency could lead to lower costs and more electrical energy generated per kilogram of coal. So, for the same amount of electricity produced, less coal is used and therefore less pollution is produced.

Coal plants are often portrayed as “dirty.” There has been a movement toward alternative power generation methods that are “clean,” such as wind and solar power generation. Should we continue to research improving coal power generation, or should we abandon it and move toward alternatives?

### The Issue

The province of Ontario is considering upgrading a coal-fired power plant in your community to use clean coal technology. A local concerned citizens group is urging the town to instead consider spending the money to support and use alternative methods of power generation. A town hall meeting is being held to hear the different points of view.

### ROLE

Pick one of the following stakeholders and present your decision from their perspective: community member, power plant executive, power plant employee, government minister, manufacturer of clean coal technology, coal industry representative, environmentalist, alternative power plant executive.

### AUDIENCE

Your teacher and classmates will represent local citizens attending a town hall meeting about the proposed plant upgrade.

### Goal

To convince the citizens of your community to either upgrade the coal-fired plant or spend money on alternative methods of power generation

## Research

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You should research specific details related to the role you have chosen. You might want to research the following examples:

- CCS is currently in use at a power plant in Spremberg, Germany (Figure 1). Find out what people are saying about this development. Be sure to research the efficiency of this method.
- The government of Alberta has dedicated \$2 billion to CCS technology. Find out about some of the proposed projects.
- Ontario is planning a wind farm on the shores of Lake Ontario, and a large solar power plant is proposed for Sarnia. Research these alternatives to help you make a decision. 

### WEB LINK

To learn more about CCS technologies and alternatives,



GO TO NELSON SCIENCE

## Identify Solutions

You may wish to consider the following factors to help identify options for your community:

- How efficient are coal-fired plants that use CCS compared to wind power and solar power?
- What financial costs and benefits are associated with CCS plants compared to wind and solar power generation?
- What kinds of impacts (positive and negative) does each type of power generation have on the community? Consider employment opportunities, environmental effects, effects on wildlife and habitat, noise, and pollution.

## Make a Decision

Decide whether you think CCS technology is a reasonable and workable tool for upgrading the coal-fired electricity generating plant. Are there disadvantages to CCS technology? Should the town develop other forms of electricity generation instead?

## Communicate

- Prepare a graphic organizer from the perspective of your role. Your graphic organizer should be designed to convince local citizens to support your position. You must be able to support your arguments and answer questions about the information you have collected. Your graphic organizer must highlight both advantages and disadvantages. Graphic organizers can be t-charts, SWOT (strengths, weaknesses, opportunities, and threats) tables, flow charts, or any other suitable format.
- Post your graphic organizer for others to see. Review your classmates' graphic organizers. Make note of any arguments for and against the CCS plant. You may find some points that you have not considered.
- Find a partner in your class who chose the opposite position to you and discuss. After the discussion, write a one-page reflection focusing on which of you had better arguments.

## Plan for Action

Suppose that an article is presented in the local newspaper on the proposed clean coal plant. Write a letter to the editor stating your views. The letter should focus on arguments that you thought were strong. Plan a way to get people in your community to side with you and help your voice be heard.