

The following problem is similar to the one you did at home. But, instead of looking at power plant types one by one, you will look at combinations of power plants. You will only need the first 3 envelopes for this part of the workshop. Please do not open Envelopes #4 – #6 yet.

The next page, “Introduction” is the same as your homework. You may want to skim this if you do not remember the information on it. The sheet after it, “New Problem Question” is similar to the Problem Question in your homework. But, the some information has changed. Please read it carefully.

Introduction

Coal, oil and natural gas are called fossil fuels. Fossil fuels are burned to make energy. Burning fossil fuels also releases CO₂ (carbon dioxide) gas into the atmosphere. Most air pollutants (such as sulfur dioxide) don't stay in the atmosphere very long. CO₂ is different. Much of it stays in the atmosphere for over 100 years, until it is finally absorbed by the ocean.

CO₂ is found naturally in the earth's atmosphere. When we breathe in oxygen, we breathe out CO₂. Plants use CO₂ to grow.

CO₂ is a "greenhouse gas." It traps heat from the sun and helps make the earth a pleasant place to live. If too much CO₂ is in the air, it will trap too much heat. The temperature of the earth will increase. This is called "global warming" or "climate change." This may lead to a hotter, dryer climate, more intense storms, more floods and droughts, and rising sea levels. The change in climate can have an effect on crops, plants and animals.

Humans have burned ever growing amounts of coal, oil and natural gas (fossil fuels) over the past few hundred years. This has caused the amount of CO₂ in the earth's atmosphere to increase. There is about 30% more CO₂ in the atmosphere today than there was a few hundred years ago. The amount continues to grow ever more rapidly

Power plants that use fossil fuels to make electricity release the most CO₂ of all man-made sources.

In Pennsylvania (PA), we get most of our electricity from burning fossil fuels (coal, oil and natural gas). 56% comes from coal power plants and 6% from natural gas plants. The other large source of our electricity is nuclear plants, at 35%.

NEW PROBLEM QUESTION

The Current Situation

Today, much of the electricity in Pennsylvania (PA) comes from traditional coal plants and nuclear plants. Traditional coal plants release CO₂ (carbon dioxide) into the air. CO₂ is a gas that contributes to climate change.

The Future Situation

PA will need more electricity in 25 years than the power plants it has now can make. So, new plants will need to be built. The original plan was to build all traditional coal plants. But, suppose that the U.S. Congress has just passed a law to reduce the CO₂ released by power plants built in the future. As a result of this law, the State of PA must change some of the power plant types that will be built here over the next 25 years. The PA Governor has suggested seven new *power plant combinations*. Each combination has a mix of two or more different power plant types that collectively release 70% less CO₂. Imagine that the Governor of Pennsylvania has asked you to serve on a Citizen's Advisory Panel to give advice on the kinds of plants to build.

Your Task

Your job is to rank the seven power plant combinations from best to worst.

Power Plant Information

The attached folder has information about seven power plant combinations. They are each made up of the following types of power plants:

- Advanced biomass power (which is made from wood chips and farm crops).
- Advanced coal plants with CO₂ capture equipment (which cuts the CO₂ released by the plant).
- Advanced coal plants (without CO₂ capture equipment).
- Advanced nuclear plants.
- Natural gas plants.
- Solar cell power.
- Traditional coal plants with CO₂ capture equipment (which cuts the CO₂ released by the plant).
- Traditional coal plants (without CO₂ capture equipment).
- Wind power.

An additional option that could reduce the number of new plants that have to be built is:

- Energy efficiency or using less electricity (such as using more efficient appliances or insulating buildings). If we use less electricity, fewer plants need to be built.

Power Plant Combinations

Some power plant types can only make a small amount of the total electricity needed for PA. These plants types include wind power, solar cell power, advanced biomass power and energy efficiency. You have read about these "limits of use" in the power plant information sheets. The PA Governor considered this when choosing the power plant combinations. Therefore, the seven combinations are realistic.

What's in the other Envelopes

- The packets in Envelope #2 will give you general information about each power plant combination.
- The sheets in Envelope #3 will give more detail about (a) how much each power plant combination pollutes and (b) the cost of electricity made by each power plant combination.
- Both envelopes contain some information sheets you have seen before in your homework. You may want to refer to these old sheets, but do not have to reread them.

Now, please follow the instructions on the next page.

Your Instructions

Time Limit: 30 minutes

(Please read through all of the instructions before beginning)

1. Find two copies of the “Power Plant Combination Ranking” sheet behind these instructions. Use the first copy to take notes at any time. *Save the second copy. You will use it during the group discussion.* You may also want to look at any notes you wrote down during your homework assignment.
2. Open Envelope #2. It contains seven packets. Each packet represents one of the seven power plant combinations. The first page of each packet has a pie chart. Behind each pie chart are power plant type information sheets. Spend about 10 minutes looking at these combinations. Take notes as you go.
3. Open Envelope #3. It contains new Cost and Pollution Comparison sheets for the power plant combinations. Before looking at the graphs on each sheet, read all of the text at the top of the page. Behind these new sheets, you will find the old Cost and Pollution Comparison sheets that you used in your homework. Spend about 10 minutes looking at the new Comparison sheets. Take notes as you go.
4. After considering all of the combinations, rank the seven power plant combinations from best to worst. We suggest that you use your notes to do this. You may also want to sort the combination packets from Envelope #2 in the order you want to rank them. We suggest that do this by following the instructions up on the overhead. Write your rankings on the “Official Ranking Summary Sheet” in the *Initial Ranking* row of Table 1.
5. Place all the materials back in the envelopes. But, leave out the “Official Ranking Summary Sheet” and any sheets you have taken notes on.
6. Now, go back to Step 1 of these instructions and begin. Make sure to refer back to these instructions between every step in the process. You will not need Envelopes #5 and #6 until later in the workshop.