

## Per 12 Activity Solutions: Balance of the Planet

### 12.1 Computer Simulations

- a) Why are computer simulations used? Describe situations for which simulations are useful.

**They are useful for simulating dangerous, expensive or impossible experiments without actually doing them. (Examples: flight training, building designs, or experiments involving stars).**

**They are also useful for quickly calculating the results of changing the value of variables. (Examples: weather forecasts, stock market projections or "Balance of the Planet")**

- b) What are some limitations and disadvantages of computer simulations?

**Computer simulations can only reflect reality to the extent that it is understood. The simulation may reflect the bias or opinions of those who wrote the computer program. Simulations may oversimplify reality and they cannot predict the future.**

### 12.2 Balance of the Planet

Your instructor will explain this computer simulation. Before you begin playing the game, you will want to formulate a strategy for improving the planet. To help you develop a strategy for five important issues, answer the questions below using information from the Balance of the Planet screens.

- 1) **Energy Sources** The inhabitants of the planet need sources of energy. To help you decide which energy sources to encourage them to use, list the advantages and disadvantages of each of the energy sources listed below. (Hint: you can find info by starting at the Policy screen and clicking on the relevant tax or subsidy item.)

#### Advantages

#### Disadvantages

- a) Coal
- b) Natural Gas
- c) Oil
- d) Nuclear Power
- e) Hydro Power
- f) Solar Power
- g) Wood

**h) Taxing and funding energy sources.**

Which types of energy will you encourage people to use? \_\_\_\_\_

Which types of energy will you discourage the use of? \_\_\_\_\_

Which energy categories on the policy screen will you tax and which will you fund?

**2) Food** Providing adequate nutrition for people is of major importance. (Reducing starvation is a difficult problem to solve in this simulation.)

- a) Which tax categories would you increase and which would you decrease to reduce starvation? Describe any environmental consequences that could result from these changes.

**increase beef tax to discourage beef consumption (10 pounds of gain must be feed to a beef cow to produce 1 pound of beef)**

**decrease the fertilizer tax and pesticide tax to increase crop yields**

- b) Which items would you fund to reduce starvation?

**family planning to slow the rate of population growth**

**bioreseach to develop more disease resistance plants that produce more nutritious food**

**3) Acid Rain** Environmental damage results from acid rain.

- a) What is acid rain? (Hint: look under "coal tax," then go to "coal use," and then to "sulfur dioxide.")

**Atmospheric sulfur dioxide and nitrogen oxide gases dissolve in water droplets in the atmosphere, forming sulfuric and nitric acid. The resulting precipitation is acidic.**

- b) What causes acid rain?

**The primary source of atmospheric sulfur dioxide is incomplete combustion of coal, particularly coal-burning power plants. Nitrogen oxides are produced by automobile and jet engines.**

c) What effect does acid rain have on the environment?

**The acidic rain can damage trees and other plants and can kill aquatic life.**

d) Which energy sources would you tax to reduce acid rain? Would you decrease the tax on any energy sources? Describe any disadvantages that could result from these changes.

**increase the coal tax to discourage the use of coal and reduce the tax on the other energy sources you wish to substitute for coal**

e) Which items would you subsidize to reduce acid rain?

**coal research to reduce sulfur dioxide emission through improved technology**

**research to improve the energy sources you substitute for coal**

4) **Global warming due to carbon dioxide** One of the causes of global warming is increased concentrations of carbon dioxide in the atmosphere.

a) Describe at least four causes of increased carbon dioxide in the atmosphere. (Hint: look under "coal tax," then go to "coal use," and then to "carbon dioxide.")

**Carbon dioxide is a product of combustion. Coal, oil, and natural gas use and forest clearing produce carbon dioxide.**

b) What effect does increased carbon dioxide have on global temperature and sea level?

**Carbon dioxide in the atmosphere absorbs some of the infrared radiation emitted by the Earth and can prevent this radiation from escaping into space. If the energy radiating from the Earth and escaping into space is less than the incoming radiation from the Sun, the Earth's temperature increases. Global warming can result in melting glaciers, rising sea level, inundation of coastal areas, and increased rain and flooding.**

c) Which energy sources would you tax to reduce carbon dioxide? Would you decrease the tax on any energy sources? Describe any disadvantages that could result from these changes.

**increase the tax on fossil fuels and logging**

**decrease the tax on the energy sources you wish to substitute for fossil fuels**

d) Which items would you subsidize to reduce carbon dioxide?

**Debt for nature, which encourages developing nations not to cut down forest lands, wood stove technology, which reduces the wood fuel needed for cooking in developing countries, and**

**research for the energy sources that will be used instead of fossil fuels**

**family planning to slow the rate of population growth**

**5) Global warming due to CFCs** Another cause of global warming is chloroflourocarbons (CFSs) in the atmosphere.

a) What are CFCs? What are they used for?

**Chlorofluorocarbonates (CFC s) are gases used as a refrigerant in air conditioners and refrigerators and as a propellant in spray cans.**

b) What effect do CFCs have on the atmosphere?

**CFCs destroy the ozone layer, which protects us from ultraviolet radiation from the Sun. CFCs also act as a greenhouse gas (along with carbon dioxide and water vapor) by absorbing infrared radiation emitted by the Earth.**

c) Which tax category would you change to reduce CFCs? Describe any disadvantages that could result from these changes.

**increase the CFC tax**

**6) Other Environmental and Societal Issues** Check the Policy screen and the Results screen for other environmental or societal issues you wish to address with taxes or subsidies. When you have adjusted the tax and subsidy rates, Execute your policies. The simulation calculates the effect of your policies five years into the future. Record your scores from the Results screen on the score sheet. For details about your results, select Feedback.

Continue to play the game, making changes to the taxes and subsidies and recording your scores after each five-year period. Remember that after every five years, the changes you made to taxes are reset to the initial percentages, but the changes you made to subsidies carry forward until you change them.

The game is not easy to win, so don't be discouraged. Don't increase taxes too fast or the economy will suffer and your score will go down. Don't be afraid to hit them hard enough though. Pick a set of policies and stick with them unless you see them not having the effect you want.