Key Concepts:

- Carbon dioxide
- Energy sector
- Fossil fuel

WHAT YOU WILL LEARN

1. You will learn which fossil fuel releases the most carbon dioxide when burned.

2. You will learn which energy sector contributes the most carbon dioxide to the atmosphere.

3. You will analyze carbon dioxide emission data for the different energy sectors and for different states.
Fossil fuels (natural gas, coal, and petroleum) are energy sources used to by the various social sectors: the electrical companies’ use them to generate electricity, industry and manufacturing use them to produce goods and products, the transportation industry uses them to transport people, goods, and materials, and the commercial and municipal/residential sectors use them to heat stores and office buildings, homes, schools, and hospitals. Although the burning of fossil fuels supports much of our society, the burning of fossil fuels also releases carbon dioxide into the atmosphere. In this activity you will learn about the amounts of carbon dioxide emissions the different social sectors (industrial, transportation, commercial and municipal/residential) contribute to the atmosphere.

1. Which fossil fuel releases the most carbon dioxide into the atmosphere?

2. Which social sector (Commercial, Electric Power, Residential, Industry, and Transportation) emits the most carbon dioxide into the atmosphere?

3. How might limiting the use of fossil fuels impact the commercial, electric power, residential, industry, and transportation sectors?
The amount of carbon in fossil fuels varies according to the type of fossil fuel. Coal contains the most carbon per unit of energy, followed by natural gas and petroleum. Natural gas has about 55% less carbon than coal per unit of energy, and petroleum has about 75% less carbon than coal. Therefore, the burning of coal releases more carbon dioxide into the atmosphere than the burning of natural gas or petroleum, but because the U.S. uses more petroleum than coal, petroleum contributes more carbon dioxide. Figure 1 shows the U.S. average carbon dioxide emissions from fossil fuels by energy use sector or social sector (e.g., residential, commercial, industrial, transportation, electric utilities).

Look carefully at the bar graph in Figure 1 and see which energy use or social sectors are emitting the most carbon dioxide, and which fossil fuels emit the most and the least amount of carbon dioxide.

4. Which sector releases the most carbon dioxide?
5. Which sector releases the most carbon dioxide from coal?

6. Which sector releases the most carbon dioxide from petroleum?

7. Based on total energy use, which fossil fuel emits the most carbon dioxide to the atmosphere?

8. Explain how population growth, economic conditions, and energy price might influence fossil fuel use and carbon dioxide emissions?

**Extend Your Thinking**

Table 1 shows the annual change in total carbon dioxide emissions, the emissions from electrical generation, and the emissions form the transportation sector over time in the U.S.

<table>
<thead>
<tr>
<th>Year</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon dioxide emissions: total for the U.S.</td>
<td>5,936</td>
<td>5,506</td>
<td>5,722</td>
<td>5,592</td>
<td>5,383</td>
</tr>
<tr>
<td>Carbon dioxide emissions: electrical generation</td>
<td>2,360</td>
<td>2,146</td>
<td>2,259</td>
<td>2,271</td>
<td>2,072</td>
</tr>
<tr>
<td>Carbon dioxide emissions: transportation sector</td>
<td>1,817</td>
<td>1,748</td>
<td>1,765</td>
<td>1,748</td>
<td>1,740</td>
</tr>
</tbody>
</table>

Unit: Tg CO₂ Eq. (Tg = million metric tons) Source: EPA
9. On a separate sheet of paper, create a line graph based on the data in Table 1.

10. What percentage of the total carbon dioxide emissions for 2012 came from electrical generation? From the transportation sector?

11. What is the trend in the total amount of carbon dioxide emissions?

12. How would you explain this trend; that is, what do you think might be causing this trend?

13. Based on your line graph, predict what the total carbon dioxide emissions might be for the year 2020.

The 2010 state energy-related carbon dioxide emissions by sector for several Midwestern states are shown in Table 2.

<table>
<thead>
<tr>
<th>State</th>
<th>Business (Commercial)</th>
<th>Electric Power</th>
<th>Homes (Residential)</th>
<th>Industry</th>
<th>Transportation</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Illinois</td>
<td>12</td>
<td>94</td>
<td>24</td>
<td>34</td>
<td>67</td>
<td>231</td>
</tr>
<tr>
<td>Indiana</td>
<td>5</td>
<td>114</td>
<td>9</td>
<td>49</td>
<td>43</td>
<td>220</td>
</tr>
<tr>
<td>Michigan</td>
<td>9</td>
<td>70</td>
<td>19</td>
<td>17</td>
<td>50</td>
<td>165</td>
</tr>
<tr>
<td>Ohio</td>
<td>11</td>
<td>121</td>
<td>18</td>
<td>35</td>
<td>65</td>
<td>250</td>
</tr>
<tr>
<td>Wisconsin</td>
<td>5</td>
<td>43</td>
<td>9</td>
<td>13</td>
<td>30</td>
<td>100</td>
</tr>
</tbody>
</table>

In million metric tons, rounded. Source: EIA
14. For the states shown in Table 2, what is the average amount of carbon dioxide emissions for each sector (Commercial, Electric Power, Residential, Industry, and Transportation)?

15. Overall for these states what are the top two sectors that contribute the most carbon dioxide?

Apply What You Have Learned

The burning of fossil fuels releases carbon dioxide into the atmosphere at a faster rate than the environment, the land, oceans and plants, can absorb it; consequently the concentration of atmospheric carbon dioxide is increasing. This increase is now thought to contribute to global warming and climate change.

The member nations of the United Nations at the conference on climate change proposed a framework for reducing carbon dioxide emissions. This framework includes emission reduction targets for each nation. It recommended that the U.S. reduce its carbon dioxide emission by 7 percent from 1990 emission levels. Explain how reducing carbon dioxide emissions might impact:

16. The different sectors that use fossil fuels.

17. The production and supply of fossil fuels.
18. Which fossil fuel releases the most carbon dioxide into the atmosphere?

19. Which social sector (Commercial, Electric Power, Residential, Industry, and Transportation) emits the most carbon dioxide into the atmosphere and why?

20. How might limiting the use of fossil fuels impact the different sectors and the production of fossil fuels?

21. Please explain how your ideas and thinking about greenhouse gases has changed.