

## Investigating Coal Production and Consumption with Web GIS

Coal comes from the energy stored by land plants from swamps that lived hundreds of millions of years ago. In this activity, you will use Web GIS to investigate patterns of coal production and consumption. You will

1. Examine locations of coal fields in the USA.
2. Examine countries with coal reserves.
3. Compare coal production and consumption of countries in 1980 and 2008.
4. Analyze relationships between country populations and coal consumption.

Read **all** instructions and answer **each** question on your investigation sheet.




### Step 1: Download Data

Open your Web browser. Go to [www.ei.lehigh.edu/learners/energy/](http://www.ei.lehigh.edu/learners/energy/)

Under **Coal**, select “Investigating Coal Production and Consumption with Web GIS”



### Step 2: Basic Features of Web GIS

<p>a. Your screen should open to a global view as shown in the picture to the right.</p> <p>b. To navigate in Web GIS you can use the navigational tools (# 1) or the hand (# 2). You can move around the map by selecting different areas or scrolling to them.</p> <p>c. You can zoom in on an area by using the zoom in tool options (# 3).</p> <p>d. You can find your exact location on the map by viewing the latitude and longitude location of your cursor in the bottom left corner of the map (# 4).</p>	
<p>e. You can also get back to the main view by using the <b>Bookmark</b> icon in the toolbar at the top of the screen (# 2). In the box that appears, select <b>World View</b>.</p> <p>f. The data for each activity can be activated using the <b>Map Legend Tool</b> (# 1). Place your mouse over this box and click on it. The Map Legend box will appear. In the Map Legend box, activate the data layer you wish to display by clicking in the checkbox. You can expand or shrink a legend item by clicking on the globe icon next to each data layer label.</p> <p>g. To observe the legend for a specific data layer, select the globe icon  next to that item in the list (# 3)</p>	

h. You can also activate portions of the data layers by selecting options from the top toolbar menus.



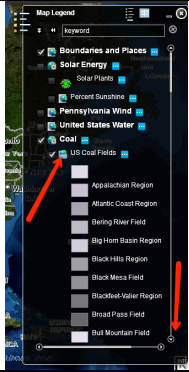
**Step 3: Explore Coal Fields in the USA. (Questions 1 and 2)**

- a. Use the Bookmarks Tool to navigate to the **Continental USA**.
- b. In the Map Legend Tool activate the **Coal** layer and the **Boundaries and Places** layer as shown to the right.



Use the Web GIS map to answer **question 1** on your investigation sheet.

- c. Open the Map Legend Tool as shown to the right. Select the Globe Icon to view the names of U.S. Coal Fields. If you cannot see the entire list, use the arrows to scroll through the list.

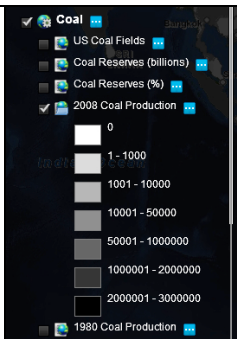


Use the GIS map to answer **question 2** on your investigation sheet.

When finished, use the **Bookmark** tool to navigate back to **World View**.

**Step 4: Explore Countries with Coal Reserves. (Coal Reserves Data Chart)**

- a. In the Map Legend, deactivate **U.S. Coal Fields**. Next, activate the **Coal Reserves (billions)** layer as shown in the picture to the right. Use the Bookmark tool to navigate to **World View**.



- b. Use the Coal top toolbar menu at the top of the page to select **Query Coal Database**.
- c. In the window that opens select to Sort By: **Coal Reserves**. Click **Select Sort** when finished.
- d. In the Reserve Query window that appears select to Sort By: **Country and Ascending**. When finished **Submit Query**.
- e. In the data chart that appears sort the data by Total (Billions of Tons). To sort a column in ascending order click the top of this column twice.



Complete the **Top 5 Countries with Coal Reserves Data Chart** on your investigation sheet. Record the amount of coal reserves in the appropriate space.

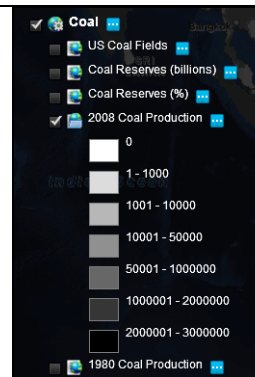
When finished, close the Query Coal Database window.



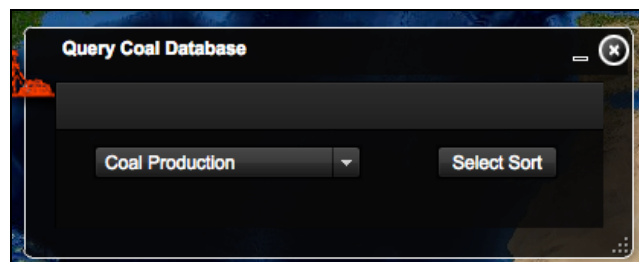
### Step 5: Explore Coal Production. (Coal Production Data Charts and Question 3)

Let's investigate which countries produced large amounts of coal in both 1980 and in 2008?

- a. In the Map Legend, deactivate the **Coal Reserves (billions)** layer and activate the **2008 Coal Production** layer as shown to the right in the picture. Make sure that the main Coal layer is active as well.



- b. Open the **Query Coal Database** using the Coal top toolbar menu at the top of the page.
- c. Choose to Sort By: **Coal Production**. Use the drop down box to select this feature. Select Sort.
- d. In the window that appears select to sort by: **Country and Ascending**. When finished select **Submit Query**.



- e. Sort the **2008 (1000s Short Tons)** column in descending order.

**Helpful hint:** Click the column twice. If you can not see the entire data set, you can widen the columns by placing the mouse between two columns. Click and drag your mouse to make a column wider or smaller.

**NOTE:** 1 short ton = 907.18 kg = 2000 pounds

**NOTE:** A short ton is a weight measurement of 2,000 pounds that is commonly used in the coal industry.

Country	1980 (1000s Short Tons)	2008 (1000s Short Tons)	Change in Production
China	682587.376	3658605	2325017.62
United States	829708	1121683	247893
India	125845.28844	944103.8102	438998.48
Australia	118254.82105	458585.838	339942.89
South Africa	121588.38825	275842.894	138871.18
Indonesia	427.88888	264317.884	263900.49
Poland	252017.28888	188848.884	-63468.21
Colombia	4532.7882	88888.888	78327.21
Canada	42441.82108	24485.821	-24027.83
Greece	25271.81882	71025.823	45451.6
Vietnam	9732	58173	44441
Romania	38785.84844	38287.88	-473.87
Thailand	1833.38888	18443.81	16223.81
United Kingdom	142157.88825	18271.321	-124086.81



Write the top 5 countries that produced large amounts of coal in the **2008 Coal Production Data Chart** on your investigation sheet. Record the amount of coal produced in the appropriate space.

- f. Sort the **1980 (1000s Short Tons)** column in descending order.  
**Helpful hint:** Click the column twice.



Write the top 5 countries that produced large amounts of coal in the **1980 Coal Production Data Chart** on your investigation sheet. Record the amount of coal produced in the appropriate space.

- g. Close the **Query Coal Database** when finished. Select the “x” in the top right corner.

**Important Note for Questions 3-7:** In 1980, Russia and other countries in Eastern Europe belonged to the Soviet Union. No coal production and consumption amounts were reported for Russia in 1980. Therefore you should not include Russia in your responses to Questions 3-6 below.






Use both the **1980 and 2008 Coal Production Data Charts** to answer **question 3** on your investigation sheet.



### Step 6: Explore Coal Consumption. (Questions 4 and 5)

Let's investigate,

- Which countries consumed **more** coal in 2008 than in 1980?
- Which countries consumed **less** coal in 2008 than in 1980?

<p>a. In the <b>Map Legend Tool</b> activate the <b>2008 Coal Consumption</b> and the <b>1980 Coal Consumption</b> layers. Deactivate the 2008 and 1980 Coal Production layers.</p> <p>b. You should toggle back and forth between the 1980 and 2008 layers to see which countries changed their consumption.</p>																																																																																																																																								
<p>c. Open the <b>Query Coal Database</b> using the Coal top toolbar menu at the top of the page.</p> <p>d. Choose to Sort By: <b>Coal Consumption</b>. Use the drop down box to select this feature. Click <b>Select Sort</b>.</p> <p>e. In the box that appears select to sort by: <b>Country</b> and <b>Ascending</b>. When finished select <b>Submit Query</b>.</p>																																																																																																																																								
<p>f. In the Query Coal Database, locate the <b>CC Change (Coal Consumption Change)</b> column. If you can not see the entire data set you can widen the columns by placing the mouse between two columns. Click and drag your mouse to make a column wider or smaller.</p> <p>g. Sort the column in Ascending and Descending order by clicking on the column heading.</p> <p>Numbers that are <b>positive</b> represent countries that consumed <b>more</b> coal in 2008 than in 1980.</p> <p>Numbers that are <b>negative</b> represent countries that consumed <b>less</b> coal in 2008 than in 1980.</p>	 <table border="1" style="width: 100%; border-collapse: collapse; font-size: small;"> <thead> <tr> <th>Country</th> <th>1980 (1000s tmc)</th> <th>2008 (1000s tmc)</th> <th>CC Change</th> <th>1980 P.</th> <th>2008 P.</th> <th>Pop. 81</th> <th>Pop. 08</th> <th>Pop. Chg.</th> </tr> </thead> <tbody> <tr> <td>China</td> <td>67911.26793</td> <td>2884236</td> <td>2816327 79688</td> <td>0.0891</td> <td>-0.3851</td> <td>98125</td> <td>13385</td> <td>3456366</td> </tr> <tr> <td>India</td> <td>122926.70792</td> <td>949452.626</td> <td>826525 82798</td> <td>0.1788</td> <td>0.9179</td> <td>89726</td> <td>71479</td> <td>4696286</td> </tr> <tr> <td>United States</td> <td>702726.8179</td> <td>7121714</td> <td>470894 2126</td> <td>2.0892</td> <td>3.9163</td> <td>23776</td> <td>30363</td> <td>7112686</td> </tr> <tr> <td>Japan</td> <td>67517.86276</td> <td>213905.2666</td> <td>146387 26216</td> <td>0.8266</td> <td>1.6716</td> <td>11676</td> <td>12706</td> <td>1008476</td> </tr> <tr> <td>South Africa</td> <td>186765.88888</td> <td>208384.7821</td> <td>21618 88888</td> <td>3.7388</td> <td>4.2268</td> <td>26276</td> <td>46762</td> <td>2651076</td> </tr> <tr> <td>Australia</td> <td>74297.86219</td> <td>167275.4662</td> <td>92977 47461</td> <td>0.2676</td> <td>7.4667</td> <td>14823</td> <td>21667</td> <td>676376</td> </tr> <tr> <td>Turkey</td> <td>22598.58964</td> <td>163321.7966</td> <td>140723 20766</td> <td>0.5042</td> <td>1.4233</td> <td>44823</td> <td>71862</td> <td>2738376</td> </tr> <tr> <td>Taiwan</td> <td>6588.2662</td> <td>71267.8916</td> <td>64679 8974</td> <td>0.2762</td> <td>3.1863</td> <td>17666</td> <td>22626</td> <td>612666</td> </tr> <tr> <td>Greece</td> <td>28628.74623</td> <td>71226.3436</td> <td>42597 82367</td> <td>0.2676</td> <td>0.6676</td> <td>96436</td> <td>10723</td> <td>1074616</td> </tr> <tr> <td>Thailand</td> <td>1626.26666</td> <td>26676.4267</td> <td>25050 12666</td> <td>0.6247</td> <td>0.2667</td> <td>46766</td> <td>66433</td> <td>1976276</td> </tr> <tr> <td>Indonesia</td> <td>645.88888</td> <td>33653.6711</td> <td>33007 47612</td> <td>0.0644</td> <td>0.1405</td> <td>14636</td> <td>23713</td> <td>929636</td> </tr> <tr> <td>Canada</td> <td>41021.23668</td> <td>79421.6676</td> <td>38400 46622</td> <td>1.7186</td> <td>3.1163</td> <td>24643</td> <td>33213</td> <td>816666</td> </tr> <tr> <td>Brazil</td> <td>18676.88888</td> <td>21261.4167</td> <td>16766 88888</td> <td>0.0812</td> <td>0.1266</td> <td>12126</td> <td>18643</td> <td>716666</td> </tr> <tr> <td>Mexico</td> <td>5021</td> <td>16436.3361</td> <td>14435 3361</td> <td>0.0713</td> <td>0.1767</td> <td>76476</td> <td>10662</td> <td>2652666</td> </tr> </tbody> </table>	Country	1980 (1000s tmc)	2008 (1000s tmc)	CC Change	1980 P.	2008 P.	Pop. 81	Pop. 08	Pop. Chg.	China	67911.26793	2884236	2816327 79688	0.0891	-0.3851	98125	13385	3456366	India	122926.70792	949452.626	826525 82798	0.1788	0.9179	89726	71479	4696286	United States	702726.8179	7121714	470894 2126	2.0892	3.9163	23776	30363	7112686	Japan	67517.86276	213905.2666	146387 26216	0.8266	1.6716	11676	12706	1008476	South Africa	186765.88888	208384.7821	21618 88888	3.7388	4.2268	26276	46762	2651076	Australia	74297.86219	167275.4662	92977 47461	0.2676	7.4667	14823	21667	676376	Turkey	22598.58964	163321.7966	140723 20766	0.5042	1.4233	44823	71862	2738376	Taiwan	6588.2662	71267.8916	64679 8974	0.2762	3.1863	17666	22626	612666	Greece	28628.74623	71226.3436	42597 82367	0.2676	0.6676	96436	10723	1074616	Thailand	1626.26666	26676.4267	25050 12666	0.6247	0.2667	46766	66433	1976276	Indonesia	645.88888	33653.6711	33007 47612	0.0644	0.1405	14636	23713	929636	Canada	41021.23668	79421.6676	38400 46622	1.7186	3.1163	24643	33213	816666	Brazil	18676.88888	21261.4167	16766 88888	0.0812	0.1266	12126	18643	716666	Mexico	5021	16436.3361	14435 3361	0.0713	0.1767	76476	10662	2652666
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Use the **Coal Consumption Change (CC Change)** column to answer **questions 4 and 5** on your investigation sheet.



### Step 7: Explore populations of countries. (Questions 6 and 7)

Let's investigate which countries have the largest population differences since 1980.

- a. Keep the Query Coal Database open.
- b. Navigate to the column **Pop. Change**. Click the top of the column twice to sort the countries in descending order.



Use the **Pop. Change** column to answer **question 6** on your investigation sheet.



Use the **Pop. 2008** column to answer **question 7** on your investigation sheet. Sort the column in descending order.

- c. Close the **Query Coal Database** window.



Use your data charts to answer **questions 8 and 9** on your investigation sheet.