

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, students will use Web GIS to investigate patterns of coal production and consumption. They 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.

Students should read **all** instructions and answer **each** question on their investigation sheet.



Step 1: Download Data

Open the Web browser. Go to www.ei.lehigh.edu/learners/energy/

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




Step 2: Basic Features of Web GIS

- a. Your screen should open to a global view as shown in the picture below.
- b. To navigate in Web GIS students can use the navigational tools (# 1) or the hand (# 2). They can move around the map by selecting different areas or scrolling to them.
- c. Students can zoom in on an area by using the zoom in tool options (# 3).
- d. They can find your exact location on the map by viewing the latitude and longitude location of the cursor in the bottom left corner of the map (# 4).



- e. Students can get back to the main view by using the **Bookmark** icon in the toolbar at the top of the screen (# 2 below). In the box that appears, select **World View**.
- f. The data for each activity can be activated using the **Map Legend Tool** (# 1 below). Place the 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.

- g. To observe the legend for a specific data layer, select the globe icon  next to that item in the list (# 3). The legend can be closed by clicking the globe icon a second time.



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



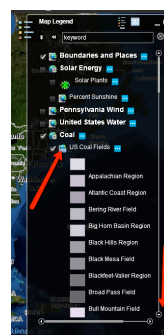
Step 3: Explore Coal Fields in the USA. (Questions 1 and 2)

- a. Students should 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 below.



Have the students use the Web GIS map to answer **question 1** on their 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.





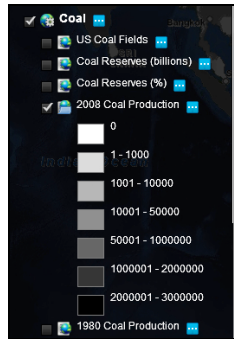
Have the Student use the GIS map to answer **question 2** on their investigation sheet.

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



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

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



- Use the Coal top toolbar menu at the top of the page to select **Query Coal Database**.
- In the window that opens select to Sort By: **Coal Reserves**. Click **Select Sort** when finished.
- In the Reserve Query window that appears select to Sort By: **Country and Ascending**. When finished **Submit Query**.

In the data chart that appears students should sort the data by Total (Billions of Tons). To sort a column in ascending order click the top of this column twice. Click it again to sort in descending order.



Have the students complete the **Top 5 Countries with Coal Reserves Data Chart** on their investigation sheet. Record the amount of coal reserves in the appropriate space.

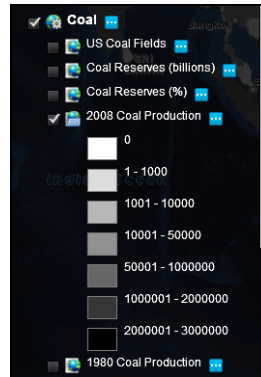
When finished, close the Query Coal Database window by selecting the "x" in the top right corner.



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?

- 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.



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



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

Helpful hint: Click the column twice. If students can not see the entire data set, they 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.



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.

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



Students should write the top 5 countries that produced large amounts of coal in the **1980 Coal Production Data Chart** on their investigation sheet. Have them record the amount of coal produced in the appropriate space.

- b. 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.



Have the students use both the **1980** and **2008 Coal Production Data Charts** to answer **question 3** on their 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?

- a. In the **Map Legend Tool** activate the **2008 Coal Consumption** and the **1980 Coal Consumption** layers. Deactivate the 2008 and 1980 Coal Production layers.
- b. Students should toggle back and forth between the 1980 and 2008 layers to see which countries changed their consumption. The legends can be activated by selecting the globe icon next to each layer.



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



- f. In the Query Coal Database, students should locate the **CC Change (Coal Consumption Change)** column. If students can not see the entire data set they can widen the columns by placing the mouse between two columns. Click and drag the mouse to make a column wider or smaller.
- g. Sort the column in Ascending and Descending order by clicking on the column heading.

Numbers that are **positive** represent countries that consumed **more** coal in 2008 than in 1980.

Numbers that are **negative** represent countries that consumed **less** coal in 2008 than in 1980.

Country	1980 P.	2008 P.	CC Change	1980 P.	2008 P.	Pop. Ch.	Pop. Ch.
China	47911.20712	2884238	2836327.79988	0.0091	-0.0001	88125	13380
India	122928.70272	648482.625	515553.92228	0.1768	0.0079	68732	11478
United States	702728.8875	1121714	418984.9128	3.8882	0.0001	23776	20380
Japan	97917.88075	212005.2968	114088.41605	0.0289	1.0718	11878	10708
South Africa	104795.88884	208384.7071	103588.81826	1.7088	4.2088	28278	48762
Australia	74287.88218	182375.4862	108087.60402	0.0078	7.8887	14880	21882
Turkey	22588.88884	182321.7968	159732.90796	0.0042	1.4001	44828	21882
Taiwan	4588.2882	71287.8816	66700.5934	0.3782	3.1880	17888	22880
Greece	28828.78822	71288.3438	42459.55558	0.0078	0.4478	88438	10728
Thailand	1828.28888	28878.4287	27050.13982	0.0347	0.0007	48788	88438
Indonesia	448.88888	38882.8781	38433.98922	0.0044	0.1428	14828	23712
Canada	41281.28828	78121.8875	36840.59922	1.7888	2.1110	24828	33728
Brazil	18878.88888	23281.4787	14402.58982	0.0072	0.1388	12128	18828
Peru	9871	18438.2881	18438.2881	0.0712	0.1787	28418	18888



Have the students use the **Coal Consumption Change (CC Change)** column to answer **questions 4 and 5** on their 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.

County	Pop. 2008	Pop. Change
Adair	10,000	1,000
Alfalfa	15,000	2,000
Atchison	20,000	3,000
Barton	25,000	4,000
Baxter	30,000	5,000
Beckham	35,000	6,000
Benton	40,000	7,000
Berkeley	45,000	8,000
Boone	50,000	9,000
Boyd	55,000	10,000
Boyer	60,000	11,000
Butler	65,000	12,000
Cass	70,000	13,000
Cherokee	75,000	14,000
Chickasaw	80,000	15,000
Chilton	85,000	16,000
Cimarron	90,000	17,000
Cole	95,000	18,000
Comanche	100,000	19,000
Concho	105,000	20,000
Cotton	110,000	21,000
Craig	115,000	22,000
Crawford	120,000	23,000
DeWitt	125,000	24,000
Dickens	130,000	25,000
Dodd	135,000	26,000
Dolan	140,000	27,000
Dove	145,000	28,000
Dryden	150,000	29,000
Ector	155,000	30,000
Ellis	160,000	31,000
Emery	165,000	32,000
Erbe	170,000	33,000
Franklin	175,000	34,000
Fisher	180,000	35,000
Ford	185,000	36,000
Fry	190,000	37,000
Garfield	195,000	38,000
Garland	200,000	39,000
Gavin	205,000	40,000
Grady	210,000	41,000
Grant	215,000	42,000
Graves	220,000	43,000
Gray	225,000	44,000
Greene	230,000	45,000
Gregg	235,000	46,000
Gregg	240,000	47,000
Guinn	245,000	48,000
Haskell	250,000	49,000
Haskell	255,000	50,000
Haskell	260,000	51,000
Haskell	265,000	52,000
Haskell	270,000	53,000
Haskell	275,000	54,000
Haskell	280,000	55,000
Haskell	285,000	56,000
Haskell	290,000	57,000
Haskell	295,000	58,000
Haskell	300,000	59,000
Haskell	305,000	60,000
Haskell	310,000	61,000
Haskell	315,000	62,000
Haskell	320,000	63,000
Haskell	325,000	64,000
Haskell	330,000	65,000
Haskell	335,000	66,000
Haskell	340,000	67,000
Haskell	345,000	68,000
Haskell	350,000	69,000
Haskell	355,000	70,000
Haskell	360,000	71,000
Haskell	365,000	72,000
Haskell	370,000	73,000
Haskell	375,000	74,000
Haskell	380,000	75,000
Haskell	385,000	76,000
Haskell	390,000	77,000
Haskell	395,000	78,000
Haskell	400,000	79,000
Haskell	405,000	80,000
Haskell	410,000	81,000
Haskell	415,000	82,000
Haskell	420,000	83,000
Haskell	425,000	84,000
Haskell	430,000	85,000
Haskell	435,000	86,000
Haskell	440,000	87,000
Haskell	445,000	88,000
Haskell	450,000	89,000
Haskell	455,000	90,000
Haskell	460,000	91,000
Haskell	465,000	92,000
Haskell	470,000	93,000
Haskell	475,000	94,000
Haskell	480,000	95,000
Haskell	485,000	96,000
Haskell	490,000	97,000
Haskell	495,000	98,000
Haskell	500,000	99,000
Haskell	505,000	100,000



Have the students use the **Pop. Change** column to answer **question 6** on their investigation sheet.



Have the students use the **Pop. 2008** column to answer **question 7** on their investigation sheet. Sort the column in descending order.

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



Have the students use their data charts to answer **questions 8** and **9** on their investigation sheet.