

## Investigating Oil Production and Consumption with Web GIS Teacher Guide

Crude oil (petroleum) was formed from the remains of tiny sea animals and plants that lived millions of years ago in marine (water) environment. In this activity, your students will use Web GIS to investigate patterns of crude oil (petroleum) production and consumption. They will

1. Examine countries with oil reserves.
2. Analyze crude oil production and consumption of countries in 1980 and 2008.
3. Investigate the relationship among countries' crude oil consumption and their populations.

Instruct students to read **all** instructions and answer **each** question on their investigation sheet.



### Step 1: Download data.


- a. Open your Web browser. Go to **www.ei.lehigh.edu/learners/energy/**
- b. Click on **Investigating Oil Production and Consumption with Web GIS**.




### Step 2: Basic Features of Web GIS

- a. The 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 their 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). Click on the Map Legend Tool. The Map Legend window will appear. In the Map Legend box, activate a data layer you wish to display by clicking 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: Examine countries with oil reserves. (Question 1)

Let's investigate which countries have large amounts of oil reserves.

- a. Activate the Oil Reserves data layer. In the Map Legend window, select **Oil Reserves**, as shown to the right. Click on the globe next to Oil. Then select the globe next to Oil Reserves to view the legend for that data layer.



- b. Open the Query Oil Database using the top toolbar menu as shown to the right (# 1 below). In the box that opens Sort By: Oil Reserves.
- c. In the Reserve Query box that appears select to Sort By: **Country and Ascending**. When finished click **Submit Query**.
- d. In the data chart that appears sort the columns based on Reserves (Trillions of Cubic Feet). To sort a column in descending order click the top of this column twice.



Have students answer **question 1** on their investigation sheet.

Oil reserves are the amount of oil that can be economically taken from crude oil reservoirs. Oil reserves are listed in amounts of billions of barrels. 1 barrel = 42 gallons.  
1 billion = 1,000,000,000.

- e. Close the **Query Oil Database** window by selecting the “x” in the top right corner.



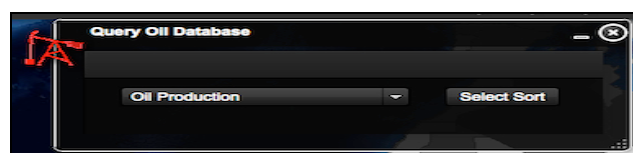
#### Step 4: Analyze oil production. (Questions 2 - 3)

Let's investigate,

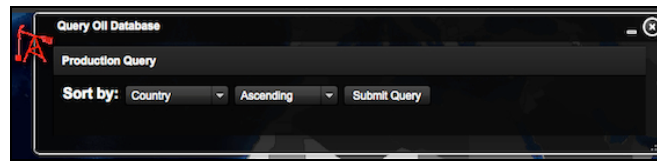
- Which countries produced **more** oil in 2008 than in 1980?
  - Which countries produced **less** oil in 2008 than in 1980?
- a. In the **Map Legend** activate the 2008 Oil Production and the 1980 Oil Production layers. Click on the globe next to these layers to view the legend. Deactivate the Oil Reserves Layer.
  - b. Students should toggle back and forth between the 1980 and 2008 layers to see which countries changed their production.



- c. Select the **Query Oil Database** using the Oil top toolbar menu.
- d. Choose to Sort By: **Oil Production**. Use the drop down box to select this feature. Click **Select Sort**.



- e. In the box that appears Sort by: **Country** and **Ascending**. When finished click **Submit Query**.



- f. In the Query Oil Database, navigate to the **Change in Production** 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 top of the column.

Country	Thousands of Barrels, 1980	Thousands of Barrels, 2008	Change in Production
Algeria	0	0	0
Algeria	44	5,88491	-34,01509
Algeria	1143	2227,33496	1084,33496
Algeria	180	2014,53101	1834,53101
Algeria	0	0	0
Algeria	0	787,84882	787,84882
Algeria	0	0	0
Algeria	480,2	595,30009	115,10009
Algeria	35,3	24,84721	-10,45279
Algeria	0	876,10222	876,10222
Algeria	0	6,42824	6,42824
Algeria	0	32,865	32,865
Algeria	0	11,22409	11,22409
Algeria	0	3,91066	3,91066
Algeria	0	0	0



Students should use the **Change in Production** column to answer **questions 2 and 3** on their investigation sheet.

- h. When finished have the students close the Query Oil Database by selecting the “x” in the top right corner.



### Step 5: Examine oil consumption. (Questions 4 - 5)

Let's investigate,

- Which countries consumed more oil in 2008 than in 1980?
  - Which countries consumed less oil in 2008 than in 1980?
- a. In the **Map Legend Tool** activate the **2008 Oil Consumption** and the **1980 Oil Consumption** layers. Click on the globe next to these layers to view the legend. Deactivate the 2008 and 1980 Oil Production Layers.
- b. You should toggle back and forth between the 1980 and 2008 layers to see which countries changed their consumption.



- c. Open the **Query Oil Database** using the Oil top menu toolbar.
- d. Sort By: **Oil 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 Oil Database, navigate to the **Change in Consumption** column. If you can not see the entire data column, you can widen the columns by placing the mouse between two columns. Click and drag your mouse to make a column wider or smaller.
- g. Sort the column in Ascending and Descending order by clicking on the top column label.

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

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

Country	1980 Reserves (bil)	2008 Reserves (bil)	Change in Reserves	1980 Consumption (bil)	2008 Consumption (bil)	Change in Consumption	Reserves per Capita, 1980	Reserves per Capita, 2008	Pop. 1980	Pop. 2008	Pop. Change
Algeria	7	0	-7	0.0002	0.0002	0	0.0002	0.0002	1000000	1000000	0
Algeria	42	34	-8	0.0002	0.0002	0	0.0002	0.0002	1000000	1000000	0
Algeria	1213.3	289	-924.3	0.0002	0.0002	0	0.0002	0.0002	1000000	1000000	0
Algeria	30	14	-16	0.0002	0.0002	0	0.0002	0.0002	1000000	1000000	0
Algeria	1	2	1	0.0002	0.0002	0	0.0002	0.0002	1000000	1000000	0
Algeria	489	219	-270	0.0002	0.0002	0	0.0002	0.0002	1000000	1000000	0
Algeria	0	40	40	0.0002	0.0002	0	0.0002	0.0002	1000000	1000000	0
Australia	284	275.3	-8.7	14.0002	12.0002	-2.0002	14.0002	12.0002	1000000	1000000	0
Australia	220	203.3	-16.7	10.0002	10.0002	0	10.0002	10.0002	1000000	1000000	0
Australia	0	126	126	0	0.0002	0.0002	0	0.0002	1000000	1000000	0
Australia	21.7	10	-11.7	0.0002	0.0002	0	0.0002	0.0002	1000000	1000000	0
Belgium	0	154	154	0	0.0002	0.0002	0	0.0002	1000000	1000000	0
Belgium	320	320.3	0.3	10.0002	10.0002	0	10.0002	10.0002	1000000	1000000	0
Belgium	1.6	7	5.4	0.0002	0.0002	0	0.0002	0.0002	1000000	1000000	0
Belgium	0	21	21	0.0002	0.0002	0	0.0002	0.0002	1000000	1000000	0



Instruct students to use the **Change in Consumption** column to answer **questions 4 and 5** on their investigation sheet.

- h. When finished keep the Query Oil Database open.



### Step 6: Examine populations of countries. (Questions 6)

Let's investigate which countries have the largest population differences between 1980 and 2008.

- a. In the Query Oil Database navigate to the **Pop. Change** column. If you can not see the entire data use 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:** Use the scroll bars and expand the window from the bottom right corner if you can not view all of the data columns.



Country	1980 Barrels (bbl)	2008 Barrels (bbl)	Change in Consumption	Barrels per Capita, 19	Barrels per Capita, 2008	Pop. 1980	Pop. 2008	Pop. Change
Algeria	7	5	-2	0.1602	0.0297	1070000	2070000	1000000
Algeria	42	35	-7	0.1264	0.0264	1070000	2070000	1000000
Algeria	121.3	225	103.7	3.2015	3.2017	1000000	1000000	0
Algeria	25	44	19	0.5402	1.0441	770000	1000000	230000
Algeria	1	2	1	0.0001	0.0001	0	0	0
Algeria	499	819	320	0.4992	0.8192	2000000	4000000	2000000
Algeria	0	48	48	0	0.0018	1000000	1000000	0
Algeria	284	276.3	-7.7	14.7079	10.0079	1000000	1000000	0
Algeria	222	225.3	3.3	11.2102	12.0018	1000000	1000000	0
Algeria	0	120	120	0	0.0028	1000000	1000000	0
Algeria	21.7	35	13.3	0.1002	0.2002	1000000	1000000	0
Algeria	0	154	154	0	0.0028	1000000	1000000	0
Algeria	422	423.8	1.8	18.3400	22.2000	1000000	1000000	0
Algeria	1.8	7	5.2	4.0077	0.4000	1000000	1000000	0
Algeria	3	21	18	0.0001	0.0000	1000000	1000000	0



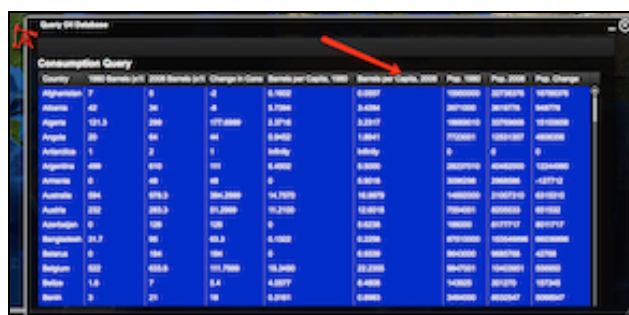
Instruct students to use the Pop. Change column to answer **question 6** on your investigation sheet.



### Step 7: Examine per capita oil consumption. (Questions 7 - 13)

Let's investigate each country's per capita oil consumption. Per capita oil consumption means the **average** amount of oil each person consumed.

- In the open Query Oil Database, navigate to the **Barrels per Capita, 2008** column.



Country	1980 Barrels (bbl)	2008 Barrels (bbl)	Change in Consumption	Barrels per Capita, 19	Barrels per Capita, 2008	Pop. 1980	Pop. 2008	Pop. Change
Algeria	7	5	-2	0.1602	0.0297	1070000	2070000	1000000
Algeria	42	35	-7	0.1264	0.0264	1070000	2070000	1000000
Algeria	121.3	225	103.7	3.2015	3.2017	1000000	1000000	0
Algeria	25	44	19	0.5402	1.0441	770000	1000000	230000
Algeria	1	2	1	0.0001	0.0001	0	0	0
Algeria	499	819	320	0.4992	0.8192	2000000	4000000	2000000
Algeria	0	48	48	0	0.0018	1000000	1000000	0
Algeria	284	276.3	-7.7	14.7079	10.0079	1000000	1000000	0
Algeria	222	225.3	3.3	11.2102	12.0018	1000000	1000000	0
Algeria	0	120	120	0	0.0028	1000000	1000000	0
Algeria	21.7	35	13.3	0.1002	0.2002	1000000	1000000	0
Algeria	0	154	154	0	0.0028	1000000	1000000	0
Algeria	422	423.8	1.8	18.3400	22.2000	1000000	1000000	0
Algeria	1.8	7	5.2	4.0077	0.4000	1000000	1000000	0
Algeria	3	21	18	0.0001	0.0000	1000000	1000000	0



Use the **Barrels per Capita, 2008** column to complete the **Oil Data Chart** on your investigation sheet.

Navigate through the list to find the countries in the data table. You can sort the countries by clicking the top of the column country.



Instruct students to answer **questions 7 - 13** on your investigation sheet.