Investigating Energy Resources for the Isle of Navitas with Web GIS

You are the chief energy officer (CEO) of one of three provinces on the Isle of Navitas, an island about the size of Pennsylvania. It has a population of about 7,000,000 people. Your task is to explore the energy resources for your province using Web GIS to recommend an efficient combination of energy sources that will minimize the impact on the environment. You will

1. Explore energy resources for the Isle of Navitas.
2. Analyze the benefits and costs of each energy source.
3. Analyze the environmental impacts of each energy source.
4. Recommend an efficient combination of energy sources for your province.

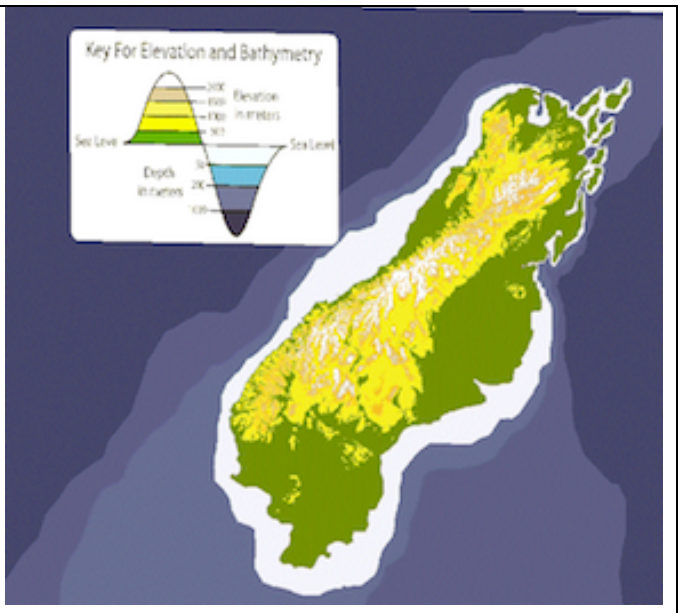
Read **all** instructions and answer **each** question on your investigation sheet.

Step 1: Download data.

1. Open your Web browser. Go to **www.ei.lehigh.edu/learners/energy/**
2. Click on **Investigating Energy Resources for the Isle of Navitas with Web GIS.**

Step 2: Basic Features of Web GIS

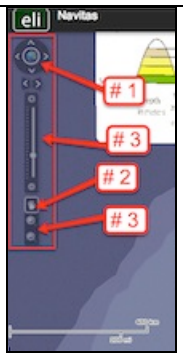
a. Your screen should open to a view of the Isle of Navitas.



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.

c. You can zoom in on an area by using the zoom in tool options (# 3).

d. A map scale is located in the bottom left corner of the map.



e. You can also get back to the main view by using the **Bookmark** icon in the toolbar at the top of the screen (# 2). In the window that appears, select Navitas, Complete View or Alternate View. These views will vary based on the computer platform you are using or the size of your computer screen.

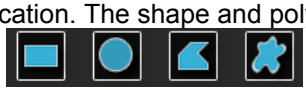
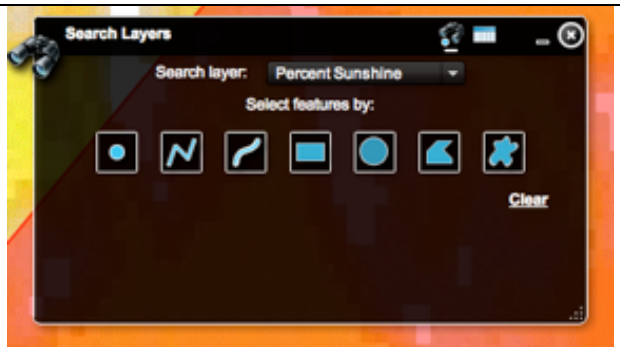
f. The data for each layer can be activated using the **Map Legend Tool** (# 1). Place your mouse over this box and click on it. The Map Legend box will appear. In the Map Legend window, activate the data layer you wish to display by clicking in the checkbox. You can expand or shrink a legend item by clicking on the globe icon  next to each data layer label.

g. If you cannot view the entire legend, use the scroll bars to navigate up and down the list.

h. To observe the legend for a specific data layer, select the globe icon  next to that item in the list (# 3).

i. A **Draw and Measure tool**  is located on the top toolbar. This is a useful feature that can be used for measuring distances between locations on the Web GIS.

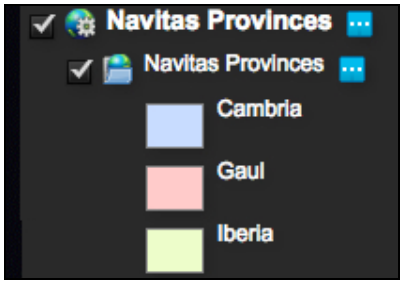
j. You can use the **Search tool** 

located on the top toolbar to obtain data in the GIS layers. Select the data layer you wish to gather information from by using the **Search layer** dropdown menu. Next, **select features by** clicking on a drawing shape. Then, click on the area on the Web GIS map that you wish to obtain data from. The **Draw Point** tool  is used to obtain a single location. The shape and polygon draw tools  can be used to obtain data from larger areas in the GIS.	

Step 3: Explore energy resources.

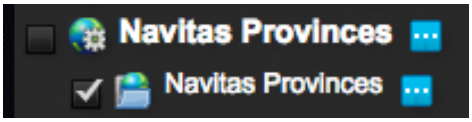
The Web GIS shows the elevation and bathymetry of the Isle of Navitas. Elevation is how high the ground is above sea level. Bathymetry is how deep the ocean is in a particular area. Topography is a map of elevations and bathymetry.

NOTE: Only this first section provides a step-by-step example on how to use the Web GIS Map Legend to visualize the data layers. Images are only included in this section. The process of displaying other data layers is very similar. **Follow the Directions carefully.**

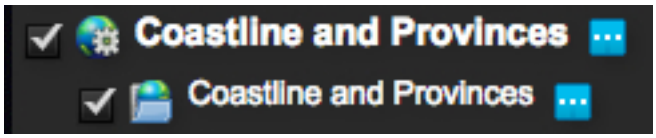
1. Click on the **Cities** layer to make it active. Expand the legend as shown to the right to display the population key and legend. The big red circles on the map represent cities with larger populations and the small red circles represent cities with smaller populations.	
2. Locate the **Navitas Provinces** layer. Click the square to display this layer. This layer displays the three provinces of the Isle of Navitas: Cambria, Gaul, and Iberia. Expand the layer to view the legend key. 3. Use the legend to view each province. You can zoom in on a specific area using the zoom tool.	

Fill in the **name** of your assigned **province** on your investigation sheet below **question 1.**

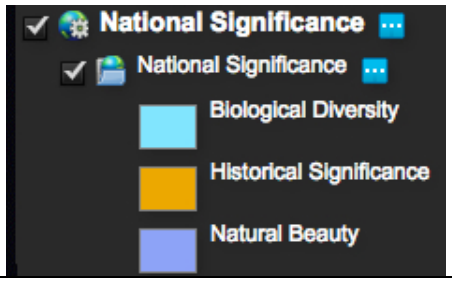
4. Click the box to turn the **Navitas Provinces** layer off. Turn the Cities layer off in the same manner by clicking the checkbox next to that layer.



5. Click the square to turn the **Coastline and Provinces** layer on. This layer outlines the coastline and the province boundaries.



6. Click the square to turn the **National Significance** layer on. This layer displays locations of biological diversity, historical significance, and natural beauty. These are protected areas.



7. **Zoom in** to your assigned province to explore the different energy resources.

Note: Follow the directions above to display and remove each data layer.

Hydroelectric Power

The factors needed to determine the ideal location of a hydroelectric dam include the topography, a canyon that can be dammed, and an area to make a reservoir upstream of the dam. Zoom in to where the streams start in the mountainous areas (light green or white). Hydroelectric power requires a power plant at the dam site and access to the grid for power distribution.

8. Click the square to turn the **Lakes** layer on. This layer displays locations of lakes.

9. Click the square to turn the **Major Rivers** layer on. This layer displays locations of major rivers.

10. Click the square to turn the **Electrical Grid** layer on. This layer displays the grid that transmits and distributes electricity to the cities.

 Use the GIS map and your Impacts of Energy Sources Investigation sheet to complete the **hydroelectric table** on your investigation sheet.

On a scale of **1 - 5** with **1** being poor and **5** being best, rate the use of hydroelectric energy as a possibility for your province. Consider the benefits and environmental impacts. Write your rating in the table on page **7** of your investigation sheet.

11. Click the check box next to the **Lakes** and **Major Rivers** layers to turn them off in the Map Legend.

Tidal Energy

The factors needed to determine the ideal shore location of a tidal power plant include a large tidal range and a funnel shaped shoreline pointing inland. Tidal power requires a power plant at the coast and access to the grid for power distribution.

12. Click the square to turn the **Tidal Range** layer on. This layer displays the tidal range.

The tidal range **bar and legend** are displayed in the Map Legend by clicking the box next to Tidal Range as shown to the right.

 Use the GIS map and your Impacts of Energy Sources Investigation sheet to complete the **tidal table** on your investigation sheet.

NOTE: if needed, turn the **National Significance** and **Coastline and Provinces** layers off to see the tidal range on the map.

On a scale of **1 - 5** with **1** being poor and **5** being best, rate the use of tidal energy as a possibility for your province. Consider the benefits and environmental impacts. Write your rating in the table on page **7** of your investigation sheet.

13. Click the check box next to the **Tidal Range** layer to turn it off.

Biofuels/Biomass

The factors needed to determine the ideal location for biomass production include lots of level farm land (may need to fertilize and water) and transportation infrastructure to get the fuel to a processing plant. Biofuels/Biomass production requires a biofuel processing plant. Although biofuels are most commonly used for transportation, they can be used to create electricity. To do this, an energy generating plant with access to the grid is also needed for power distribution.

14. Click the square at the right end of the **Climate** layer to turn it on. This layer displays the different types of climate.

    The legend displays the types climate found in each province. To activate the legend select the check box next the Climate layer as shown to the right.

    Precipitation is the annual (yearly) amount of rain.

15. Click the check box next to the **Climate** layer to turn it off.

16. Click the square to turn the **Land Use and Cover** layer on. This layer displays the different types of land use and ground cover.

    The land use legend is displayed by activating the check box next to the Land Use layer.

17. Click the square to turn the **Highways** layer on. This layer displays the major highways that are used for transportation.

18. Click the square to turn the **Railroad Tracks** layer. This layer displays the railroads used for transportation.

 Use the GIS map and your Impacts of Energy Sources Investigation sheet to complete the **biofuels/biomass table** on your investigation sheet.

Helpful hint: Go back and forth between the **Climate** and **Land Use and Cover** layers to determine a good location for producing biomass.

On a scale of **1 - 5** with **1** being poor and **5** being best, rate the use of biofuels/biomass as a possibility for your province. Consider the benefits and environmental impacts. Write your rating in the table on page **7** of your investigation sheet.

19. Click the check box next to the **Climate, Land Use and Cover, Highways,** and **Railroad Tracks** layers to turn them off.

Solar Energy

The factors needed to determine the ideal location of a solar power plant include lots of open flat areas, lots of sunshine, and no shadowing trees or buildings. Solar energy requires infrastructure to make power and distribute electricity to the grid.

20. Click the square to turn the **Percent Sunshine** layer on. This layer displays the percent annual average sunshine.

    The percent sunshine **Legend** can be displayed by activating the check box next to the Percent Sunshine layer.

Use the GIS map and your Impacts of Energy Sources Investigation sheet to complete the **solar table** on your investigation sheet.

On a scale of **1 - 5** with **1** being poor and **5** being best, rate the use of solar energy as a possibility for your province. Consider the benefits and environmental impacts. Write your rating in the table on page **7** of your investigation sheet.

21. Click the check box next to the **Percent Sunshine** layer to turn it off.

Wind Energy

The factors needed to determine the ideal location of a wind farm include enough sustained winds and grid access for power distribution.

22. Click the square to turn the **Wind Speed** layer. This layer displays the wind speeds.

    The wind speed **legend** can be displayed by activating the check box next to the Wind Speed layer.

Use the GIS map and your Impacts of Energy Sources Investigation sheet to complete the **wind table** on your investigation sheet.

On a scale of **1 - 5** with **1** being poor and **5** being best, rate the use of wind as a possibility for your province. Consider the benefits and environmental impacts. Write your rating in the table on page **7** of your investigation sheet.

23. Click the check box next to the **Wind Speed** layer to turn it off.

Coal

The factors needed to determine the ideal location of a coal-fired power plant include transportation infrastructure for fuel delivery, water for the electrical generation plant, storage of solid waste produced by the plant, and access to the grid for power distribution.

24. Click the square to turn the **Coal Reserves** layer on. This layer displays locations of coal reserves.

25. Click the square at the right end of the **Highways, Railroad Tracks, Lakes,** and **Major Rivers** layers to turn them on.

 Use the GIS map and your Impacts of Energy Sources Investigation sheet to complete the **coal table** on your investigation sheet.

On a scale of **1 - 5** with **1** being poor and **5** being best, rate the use of coal as a possibility for your province. Consider the benefits and environmental impacts. Write your rating in the table on page **7** of your investigation sheet.

26. Click the check box next to the **Coal Reserves, Highways,** and **Railroad Tracks** layers to turn them off.

Natural Gas

The factors needed to determine the ideal location a natural gas power plant include pipelines for fuel delivery, water for the electrical generation plant, and access to the grid for power distribution.

27. Click the square to turn the **Natural Gas Reserves** layer. This layer displays locations of natural gas reserves.

    Helpful hint: Click the “Zoom” to quickly locate the natural gas reserves.

28. Click the square to turn the **Gas Pipeline** layer on. This layer displays pipelines used for transportation.

 Use the GIS map and your Impacts of Energy Sources Investigation sheet to complete the **natural gas table** on your investigation sheet.

On a scale of **1 - 5** with **1** being poor and **5** being best, rate the use of natural gas as a possibility for your province. Consider the benefits and environmental impacts. Write your rating in the table on page **7** of your investigation sheet.

29. Click the check box next to the **Natural Gas Reserve** and **Gas Pipeline** layers to turn them off.

Petroleum (Crude oil)

The factors needed to determine the ideal location a petroleum (crude oil) power plant include a refinery to process the crude oil into fuel, a plant for electrical generation, water for the electrical generation plant, and access to the grid for power distribution.

30. Click the square to turn the **Oil Reserves** layer on. This layer displays locations of oil reserves.

31. Click the square to turn the **Highways** layer on.

 Use the GIS map and your Impacts of Energy Sources Investigation sheet to complete the **petroleum (crude oil) table** on your investigation sheet.

On a scale of **1 - 5** with **1** being poor and **5** being best, rate the use of petroleum (crude oil) as a possibility for your province. Consider the benefits and environmental impacts. Write your rating in the table on page **7** of your investigation sheet.

32. Click the check box next to the **Oil Reserves, Highways, Lakes,** and **Major Rivers** layers to turn them off.

Geothermal Energy

The factors needed to determine the ideal location of a geothermal power plant include a hot Earth location and access to the grid to distribute electricity.

33. Click the square to turn the **Geothermal Areas** layer. This layer displays areas where the Earth is hot.

 Use the GIS map and your Impacts of Energy Sources Investigation sheet to complete the **geothermal table** on your investigation sheet.

On a scale of **1 - 5** with **1** being poor and **5** being best, rate the use of geothermal energy as a possibility for your province. Consider the benefits and environmental impacts. Write your rating in the table on page **7** of your investigation sheet.

34. Click the check box next to the **Geothermal Areas** layer to turn it off.

Nuclear Energy

The factors needed to determine the ideal location of a nuclear power plant include uranium mines, a plant to process the ore into fuel rods, an electrical generation plant, cooling water for power plant, grid to distribute electricity, and a place to store radioactive waste.

35. Click the square to turn the **Uranium** layer on. This layer displays locations of uranium reserves.

36. Click the check box next to the **Lakes** and **Major Rivers** layers to turn them on.

 Use the GIS map and your Impacts of Energy Sources Investigation sheet to complete the **nuclear table** on your investigation sheet.

On a scale of **1 - 5** with **1** being poor and **5** being best, rate the use of nuclear energy as a possibility for your province. Consider the benefits and environmental impacts. Write your rating in the table on page **7** of your investigation sheet.

37. Click the check box next to the **Uranium, Lakes,** and **Major Rivers** layers to turn them off.

 Analyze the completed tables on your investigation sheet to answer **questions 2 - 7.**