

Exploring Wind Farms with Google Earth Teacher Guide

Wind is moving air. In this activity, students will use Google Earth to explore wind farms. They will

1. Explore seven existing wind farms around the world.
2. Investigate ideal features of wind farms.
3. Use the **Ruler** tool to measure the estimated perimeter of wind farms.

Model the following procedural instructions with your students. It is recommended that you display your computer image at the front of the classroom.



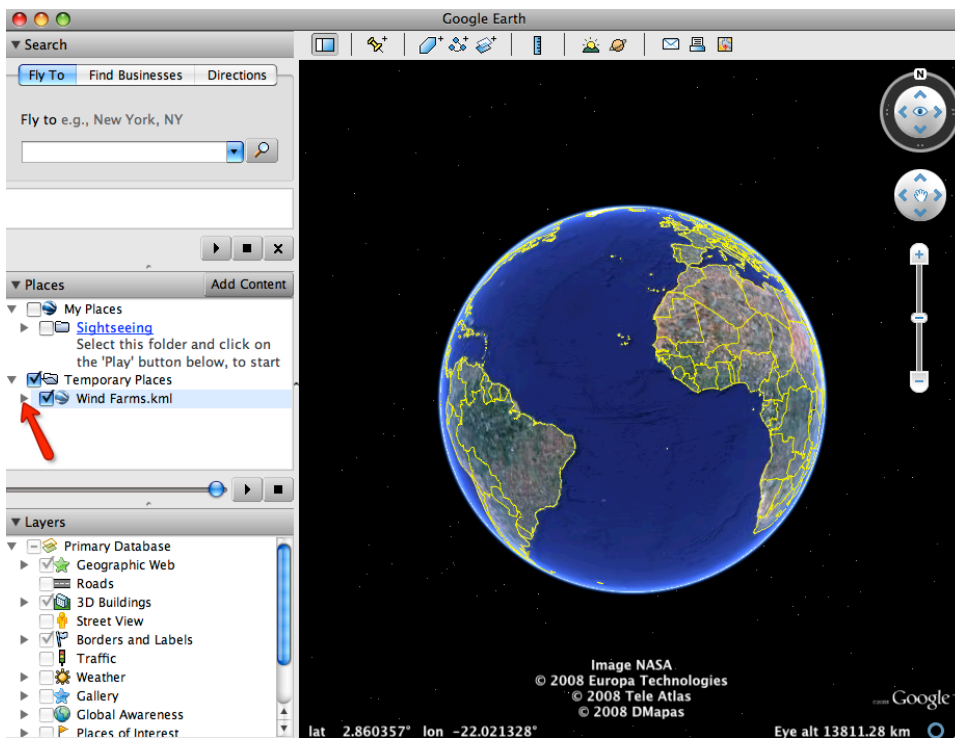
Step 1: Download data.

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

b. Click on **Exploring Wind Farms with Google Earth**.

The file is displayed in Google Earth.

c. Click the arrow to the left of “**Wind Farms.kml**” in the left panel (see arrow below).



NOTE: If the navigation controls are not visible click on View>Show Navigation>Always.

The Wind Farms drop-down list will extend (see below). If you cannot see the whole list, scroll down.




Step 2: Explore wind farms and measure the estimated perimeter.

Your students will explore wind farms and use the **ruler tool** to measure the **estimated perimeter** of each wind farm. Model how to use the **Ruler Tool** in Google Earth to measure the perimeter of the first wind farm (Taff Ely).

- a. **Double-click** on **Taff Ely** in the **Places** window.


Google Earth will zoom you in to the Taff Ely wind farm for you to view it. There is no need to zoom-out. The extent of this wind farm is contained in the 3D viewer. Look at the size of the wind farm area and the number of **wind turbines**.

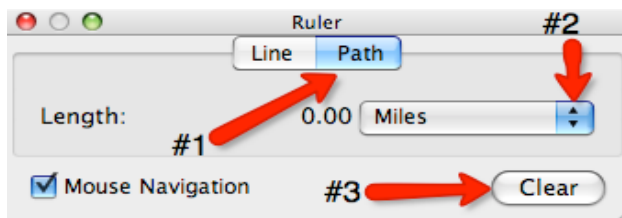
Zoom-in  a bit more to see a **wind turbine** in more detail.
Helpful hint: Look for dark shadows for turbine locations.

- b. Click on the Taff Ely push-pin  in the **3D viewer** to read information about this wind farm.



Instruct students to write the **average wind speed** at the Taff Ely wind farm in the **Wind Farms Data Chart** on their field guide.

- c. Click on the **Ruler tool**  on the **tools menu** at the top of the screen. The ruler dialog box appears (see below). If the dialog box covers up the wind farm, move it to a different area on your screen.
- d. Click on **Path** (arrow #1). Click on the drop-down arrow (arrow #2) and select **Miles** if it is not already selected.

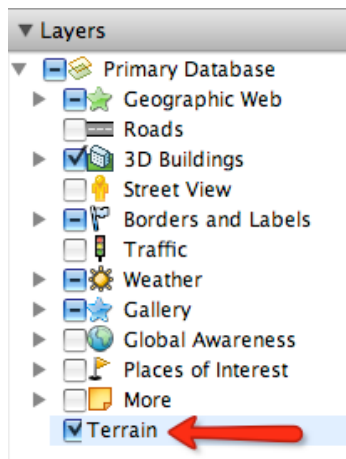


NOTE: We recommend that you explain to students how they should measure the perimeter of a wind farm. For example, have students identify four imaginary corners that form a “box” around the wind turbines and measure around that box. Alternatively, you may wish students to measure the perimeter by following closely along the turbines. The assessment information takes into account these variations. Tell students that they can identify wind turbines by the shadows they cast on the ground.

- e. Click on a corner of the wind farm where you see a wind turbine to begin measuring the **estimated perimeter** of the wind farm.

Continue to click around the wind turbines until you get back to your starting point. Click and drag the last point to join it to the starting point.

NOTE: The perimeter line will be squiggly in hilly/mountainous places if the **Terrain** layer is checked (see arrow below).



Instruct students to write the **estimated perimeter** of the Taff Ely wind farm in the **Wind Farms Data Chart** on their field guide.

- f. Click **Clear** (arrow #3 above). Close the ruler dialog box.
- g. Look at the **land cover** around the wind farm. **Land cover** refers to the **vegetation** found on an area of land. This includes the types of trees or plants or the absence of trees or plants. What does the land cover at the wind farm look like? Does it look like a forest, a desert, or a farm area?



Instruct students to write a description of the **land cover** in the **Wind Farms Data Chart** on their field guide.

- h. Look at the **topography** around the wind farm. **Topography** refers to the **terrain** of the land. This includes the presence of hills, mountains, valleys, flat land areas, and bodies of water. What does the topography look like? Does it look like a mountain, a flat land area, river banks, or something else? Is the wind farm on a flat or hilly surface?




Instruct students to write a description of the **topography** in the **Wind Farms Data Chart** on their field guide.

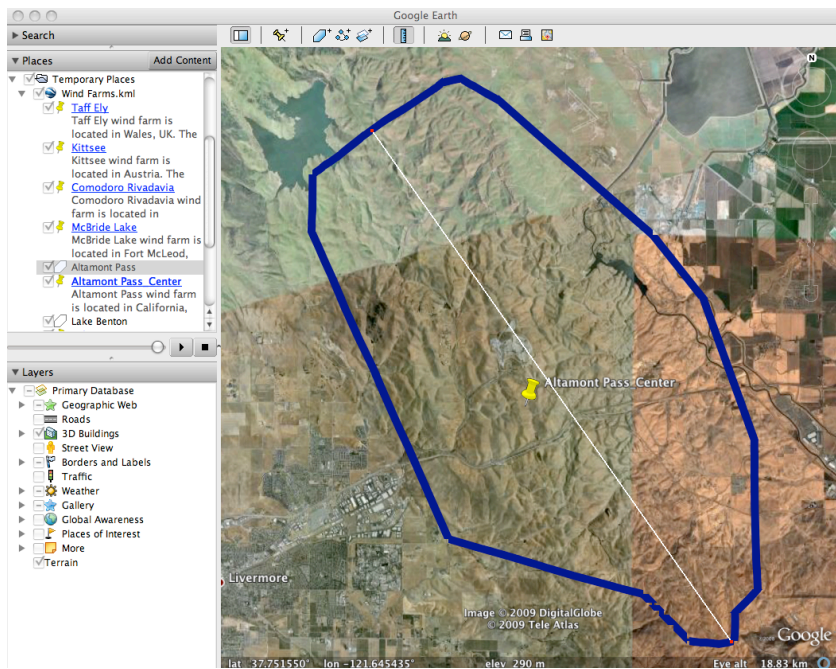
- i. **Double-click** on the next three wind farms, **Kittsee**, **Comodoro Rivadavia**, and **McBride Lake**, and repeat steps **b**, **c**, **d**, **e**, **f**, **g**, and **h** above to complete the **Wind Farms Data Chart**. There is no need to zoom-out when viewing the wind farms. The extent of these wind farms is contained in the 3D viewer.


NOTE: Ask students to examine the differences in sizes of the wind farms and the number of turbines. Tell students to use the **navigation controls** at the top right of the screen to **zoom-in** and move around the wind farm area to view the **wind turbines**. If students zoom-in and have difficulty viewing the entire wind farm, remind them that they can double-click on the wind farm name or yellow pushpin to return to the initial display.

You may note in some locations that additional wind turbines are currently being constructed. If students notice this, you may wish to tell them not to include those turbines in the perimeter measurement of that particular wind farm.


- j. **Double-click** on  **Altamont Pass** in the places window to view this wind farm. This wind farm has many **wind turbines** that cover a **very large** area. The **dark blue line** outlines the area covered by the wind farm.


NOTE: To help students understand how big this wind farm is, use the ruler tool to draw a line across the longest part of the wind farm area (see image below).



- k. **Double-click** on  **Altamont Pass_Center** in the places window or on the **Altamont Pass_Center** **yellow push-pin** in the **3D viewer** to see some of the wind turbines.



Use the **navigation controls** at the top right of the screen to **zoom-in** and move around the wind farm. Navigate to view the **wind turbines** in the far corners of the wind farm area near the **dark blue line**.

Helpful hint: **Double-click** on  **Altamont Pass** in the places window to zoom out. **Double-click** a corner of the wind farm to wind view turbines.

Click on the push-pin  in the **3D viewer** to read information about this wind farms.





Instruct students to write the average wind speed of the Altamont Pass wind farm in the **Wind Farms Data Chart** on their field guide.

- l. **Double-click** on  Altamont Pass to zoom out. Click on the **Ruler** tool  on the **tools menu** at the top of the screen. Click along the dark blue line around the wind farm to measure its estimated perimeter.



Instruct students to write the **estimated perimeter** of **Altamont Pass** in the **Wind Farms Data Chart** on their field guide. Have students complete the **land cover** and **topography** descriptions on the data chart for **Altamont Pass**.

- m. Click **Clear**. Close the ruler dialog box.
- n. **Double-click** on  **Lake Benton** in the places window to view this wind farm. This wind farm has many **wind turbines** that cover a **very large** area. The **dark blue line** outlines the area covered by the wind farm.
- o. Repeat steps **k**, **l**, and **m** for Lake Benton.
- p. **Double-click** on  **Muppandal** in the places window to view this wind farm. This wind farm has many **wind turbines** that cover a **very large** area. The **dark blue line** outlines the area covered by the wind farm.
- q. Repeat steps **k**, **l**, and **m** for Muppandal.



Instruct students to answer **questions 1 - 6** on their field guide.