Selecting Sites for Renewable Energy Projects

For this exercise, you will work in teams of 2 or 3 people to use Google Earth to select sites within the United States or along its coastline for renewable energy projects. Each person in the class will electronically hand in a copy of their team's Google Earth kmz file which will identify the locations the team selected for each project and will provide additional information about the site selection criteria that were used.

1) We will begin by creating a Google Earth folder that will contain all your placemarks for this activity. We will then overlay the California map from the Energy Information Administration's Renewable Potential Maps web page, and use this along with the Renewable Energy Interactive Map Google Earth data available on the Environmental Protection Agency's Renewable Energy Interactive Map on their Maps and Incentive Sheets web page to identify an appropriate location for a solar energy project with a Google Earth placemark.

After that initial example, the team members will work together to choose a suitable location anywhere within the United States or along its coastline for projects that utilize each of the renewable sources of energy listed below and mark each of those locations with a placemark.

- Solar Energy
- Biomass
- Hydroelectricity
- Tidal Power
- Wind Energy
- Wave Energy
- Geothermal Energy
- Ocean *or* Lake Thermal Energy
- Osmotic Energy

Each location you choose for a project must be appropriate for using the designated energy source based on the conditions that exist at that site. Use maps and other information on the web to assess the factors that help you make your site selections. Make sure you give each placemark a name that indicates which energy source is to be used at that site. Within each placemark's description box:

- Explain why that site was chosen.
- Specify the power capacity of the project (in kilowatts or megawatts, for example).

- Describe the physical details of the project (number of wind turbines or solar panels, for example).
- Describe the size and location of the population to be served.
- Identify possible environmental effects of the project.
- Include hyperlinks to any web sites that provided information that you used to select that location, to determine project specifications, or to identify environmental hazards.

Be as precise as possible in choosing a site for each source. In some cases, you may wish to develop Google Earth image overlays of maps that you download from the web to help you choose appropriate sites. See the Nevada wind energy potential and the renewable energy potential example overlays in the data file linked from the web site. The Google Earth data on the *Environmental Protection Agency: Maps and Incentive Sheets* site may also be useful for selecting sites for energy facilities that are unsuitable for residential or commercial development. But offshore locations for some energy source development may be suitable as well.

In many cases, where a map has useful information but does not overlay well on Google Earth, you can first crop the map using a graphics program such as Photoshop or ImageJ, or you can instead optimize the alignment of the overlay in favor of a particular area of interest. In some cases, such as on the *California On-Line Energy Maps* page, you may find examples of maps in pdf format that are of better quality than the jpg versions that are offered. In these cases, it is best to use a graphics program to convert the pdf file to a jpg file for creating the overlay.

The sources of information listed on the following pages provide information that can help your team site these projects. Begin by studying the examples of existing renewable energy facilities that are provided. However, you should also perform searches for additional information. The activity web page (SERC: Selecting Sites for Renewable Energy Projects) also offers links to additional information about renewable energy and how to use Google Earth.

After you have created placemarks for each type of energy project, make sure that all the placemarks are contained in the folder you created for them. Then right-click the folder name in the Google Earth Places pane, and choose *Save Place As* from the contextual menu. Save it as a kmz file with your last name as the beginning part of the file name. The instructor will specify how you need to hand in the file electronically.

Getting Started: Data, Maps, and Techniques

Data File (zip archive)
Energy Information Administration Renewable Potential Maps (Source of maps that can be made into overlays on Google Earth)
Environmental Protection Agency: Maps and Incentive Sheets (Offers placemarks for contaminated sites with potential for renewable energy development.)
Google Earth User Guide: Using Image Overlays and 3D Models

Examples of Existing and Planned Renewable Energy Facilities

Solar Power: Solar Power Plant Proposed for Chicago
Biomass: From Waste to Heat in Didcot
Hydropower: Niagara Power Project
Tidal Power: Rance Tidal Power Station
Wind Energy: Altamont Pass Wind Farm
Wave Energy: Islay LIMPET Wave Power Plant
Geothermal Energy: The Geysers
Ocean Thermal Energy: Honolulu Seawater Air Conditioning
Lake Thermal Energy: Cornell Lake Source Cooling
Osmotic Energy: Statkraft Osmotic Power Prototype

Also see NPR: Visualizing The U.S. Electric Grid

Renewable Energy Technologies

Solar Energy
Energy Information Administration: Solar Thermal
Wikipedia: Solar energy
United States Department of Energy Photovoltaics
United States Department of Energy: Solar Energy Technologies Program
American Solar Energy Society
Solar Electric Light Fund

Biomass
United States Separtment of Agriculture: Bioenergy
United States Department of Energy: Bioenergy
United States Department of Energy: Biomass Program
National Renewable Energy Laboratory: Biomass Maps

Hydroelectricity
United States Department of Energy Wind and Hydropower Technologies Program
Wikipedia: Hydroelectricity

Tidal Power
Maine Tidal Power
Wikipedia: Tidal power
Blue Energy International
European Marine Energy Centre

Wind Energy
National Renewable Energy Laboratory: Wind Energy Resource Atlas of the United States
United States Department of Energy: Wind Powering America
United States Department of Energy Wind and Hydropower Technologies Program
Wind Resource Explorer
AWS Truewind
American Wind Energy Association
Navitas Energy

Wave Energy
Ocean Power Technologies
Pelamis Wave Power
EPRI Wave Energy Conversion (WEC) Project
Google Earth Community: Pelamis wave energy converter
European Marine Energy Centre

Geothermal Energy
United States Department of Energy Geothermal Technologies Program
Great Basin Center for Geothermal Energy
United States Geological Survey: Geothermal Energy—Clean Power From the Earth's Heat
Geo-Heat Center
Geothermal Resources Council
Google Earth Community: Geothermal Power Facilities

Ocean Thermal Energy
NREL: What is Ocean Thermal Energy Conversion?

Osmotic Energy
Nordic Energy Solutions: Energy from Osmosis

Additional Maps and General Information

Environmental Protection Agency: Maps and Incentive Sheets
National Renewable Energy Laboratory: Maps
National Renewable Energy Laboratory: State Renewable Electricity Profiles
United States Environmental Protection Agency: Renewable Energy Interactive Mapping Tool
California On-Line Energy Maps

Google Earth Information

Google Earth User Guide
Marking Places
Using Places
Editing Places and Folders
Using Image Overlays and 3D Models
Google Earth Community
The KML Screen Overlay Maker Utility

2) Two biomass maps on the *National Renewable Energy Laboratory: Biomass Maps* page represent total biomass resources for the United States by county in two different ways. What are the advantages of each of these methods?

a) Total Biomass Resources Available in the United States

b) Total Biomass Resources per Square Kilometer in the United States