

Geothermal Sites in Arizona

Sixth Grade

Activity: 2

Time: 1 Class Period

General Description

Students will plot the locations of the geothermal hot spots in the state of Arizona and identify which location would be best to begin development.

Objectives

Students will plot geographical point on an Arizona map identifying geothermal locations. Students will identify the most ideal location for development of the geothermal resources and justify their answer.

Arizona State Standards

SC06 S5C3 PO1 Identify various way in which electrical energy is generated using renewable and non renewable resources (e.g., wind, dams, fossil fuels, nuclear reactions)

SC06 S2C2 PO2 Describe how scientific knowledge is subject to change as new information and or technology challenges prevailing theories

SC06 S1C3 PO1 Analyze data obtained in a scientific investigation to identify trends

M06 S2C1 PO2 Construct a histogram, line graph, scatter plot, or stem-and-leaf plot with appropriate labels and title from organized data

M06 S2C1 PO4 Answer questions based on simple displays of data including double bar graphs, tally charts, frequency tables, circle graphs, and line graphs

M06 S4C4 PO1 Determine the appropriate measure of accuracy within a system for a given Contextual situation

M06 S4C4 PO2 Determine the appropriate tool needed to measure to the needed accuracy

Teacher Information

Geothermal energy is energy obtained from the heat in the earth's crust. The heat is caused by the underlying mantle which is essentially molten volcanic rock of extremely high temperatures. The heat is everywhere under the earth's crust, but it is most useful in places where it is at or near the earth's surface. Geothermal energy can be classified based on how it is extracted. The three basic sources from which it is extracted are: steam only, hot rocks, or hot water/steam combination. The forms of geothermal energy that can be used to produce electricity are the steam only systems and the hot water/steam combination systems. Geothermal energy can also be used for heating, hot water, industrial applications such as distilling, sterilizing, evaporating, etc.

Materials

Activity Card 6-2a

List of Coordinates, Activity Card 6-2b

Suggested Contacts

Free Geothermal Energy Booklet
U.S. Department of Energy
P.O. Box 62
Oak Ridge, TN 37830

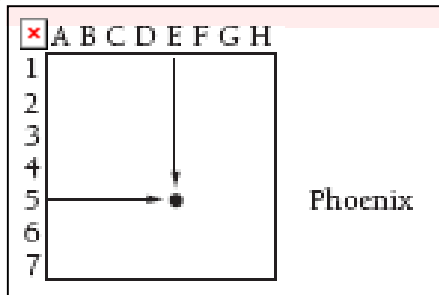
Arizona Department of Commerce Energy Office
Phone 602-771-1194 or 1-800-352-5499

For more information write to:
U.S. Department of Energy
East Mesa Geothermal Test Facility
Holtville, California 92250

Procedures/Exploration

1. Define geothermal energy. Discuss geothermal energy as a way to produce electricity using the heat from the earth's interior. Discuss the limitations of geothermal energy which are location and availability.
2. Define coordinates as a set of numbers used to specify a location on a map or grid.
3. Demonstrate how to plot points on a map by drawing a sketch of the state of Arizona on the chalkboard or overhead. Draw a few letters in a row across the top and a few numbers in a column down the side (see example below). The location of a point on a map can be found by using coordinates. Using the straight edge of a piece of paper or a ruler, show students that a plot point is found where the numbers and letters cross.

For example: Phoenix (E, 5)



4. Hand out Geothermal Sites in Arizona Activity Card 6-2a, a piece of paper or ruler, and the map of Arizona, Activity Card 6-2b.
5. Have the students plot the coordinates either individually, with a partner, or as a directed group activity as you read the list of coordinates from Activity Card 6-2b to the class.
6. Make an overhead of the map of Arizona. Have students take turns plotting the points at the end of the class on the overhead to check their work.
7. Have students' research geothermal energy and describe the pros and cons of this energy source. Have students discuss how the location of geothermal sites affects the availability.

Geothermal Sites in Arizona

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Activity Card: 6-2a**

Student's Name:

Date:

As you read the following list of Geothermal Hot Water Sites in Arizona, plot the coordinates on the map on Activity Card 6-2b. You might work up a symbol representing Geothermal Sites, or just write the numbers on the map. Select the best location to begin using geothermal energy. Base your decision on distance to nearest population, temperature, and quantity.

- Power Ranch: Subsurface temperature. 180°C. Two wells drilled to a two-mile depth well bottom hole temperatures of 163°C and 184°C. Discharge from well estimated at 4,700 gallons per minute from below one mile. **Coordinates:** (R, 27)
- Verde Hot Springs: Surface temperature 36°C. Subsurface temperature 150° C. Several springs. **Coordinates:** (S, 21)
- Castle Hot Springs: Surface temperature 50°C. Subsurface temperature 110°C. Two springs. **Coordinates:** (0, 22)
- North of Clifton: Surface temperature 59°C. Subsurface temperature 140°C. Two springs. **Coordinates:** (FF, 28)
- Clifton Hot Springs: Surface temperature 75°C. Subsurface temperature 110°C. Two springs. **Coordinates:** (GG, 28)
- Eagle Creek Springs: Surface temperature 36°C. Subsurface temperature 115°C. **Coordinates:** (EE, 29)
- Gillard Hot Springs: Surface temperature 82°C. Subsurface temperature 140°C. Five springs. **Coordinates:** (DD, 30)
- Mt. Graham: Surface temperature 42°C. Subsurface temperature 110°C. One hot mineral well. **Coordinates:** (BB, 31)
- Exxon Yuma - Yuma County: Bottom hole in a Basalt 138°C. **Coordinates:** (B, 32)
- Exxon State - Pinal Country: Bottom hole in gneiss 110°C. **Coordinates:** (T, 31)
- Exxon State - Pima County: Bottom hole in granite 146°C. **Coordinates:** (X, 37)
- Plateau Drill hole: Bottom hole temperature 46°C. **Coordinates:** (EE, 4)
- Plateau Drill hole: Bottom hole temperature 57°C. **Coordinates:** (FF, 3)
- Plateau Drill hole: Bottom hole temperature 34°C. **Coordinates:** (DD, 18)
- Plateau Drill hole: Bottom hole temperature 69°C. **Coordinates:** (DD, 16)

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