

Geothermal Educator Guide

A resource for using QUEST video, audio, blogs and maps in the classroom

QUEST SUBJECTS

| | |
|-------------------------|--|
| Life Science | Biology Health Environment |
| Earth Science | Geology Weather Astronomy |
| Physical Science | Physics Chemistry Engineering |

CA SCIENCE STANDARDS

Grade 6

Plate Tectonics and Earth's Structure

1. (b) Earth is composed of several layers.

Heat (Thermal Energy) (Physical Science)

3. (a) Energy can be carried from one place to another.

Energy in the Earth System

4. (c) Energy in the earth's interior reaches the surface primarily through convection.

Resources

6. (b) classifying energy and material resources as renewable or non-renewable

Grades 9-12

Biogeochemical Cycles

7. (a, b) global reservoirs of carbon; Movement of matter among reservoirs is driven by Earth's internal and external sources of energy.

QUEST MEDIA FOR TEACHING ABOUT BIOFUELS

Read and comment on the blogs for these stories by clicking on the story link and clicking on the blog post link below the video/audio.

Watch **Geothermal Heats Up**

<http://www.kqed.org/quest/television/geothermal-heats-up2>

- Think solar, wind and water are our only forms of clean power? Think again! Visit The Geysers, the world's largest power-producing geothermal field, to learn about geothermal power, an exciting form of renewable energy heating up the hills just north of Sonoma.

Listen to **Geothermal Heats Up** <http://www.kqed.org/quest/radio/geothermal-heats-up>

- The hills north of Sonoma wine country are already a world leader in geothermal power production, providing electricity for some 850,000 Northern California households. In an ambitious new project, they are about to produce even more.

Read **Producer's Notes: Geothermal Heats Up Blog Post**

<http://www.kqed.org/quest/blog/2008/11/18/producers-notes-geothermal-heats-up/>

- Producer Amy Miller shares insights about geothermal power, including its potential and drawbacks.

TOPIC BACKGROUND

Geothermal energy comes from the heat stored in Earth's core, about 4,000 miles below our feet. It occurs when magma heats water found in the pores and fractures of rock in the earth's crust. Most of this hot water becomes steam, which is then trapped by another layer of rock above it. To harness this power source, wells are drilled to tap into the steam reservoirs. The steam is then pumped up to power plants on the earth's surface, where it's used to drive turbine generators that create electricity.

Often overlooked as a renewable energy source, geothermal power has been used for thousands of years all over the world. In ancient times, indigenous peoples and the Romans often used "magic water" from hot springs for cooking, cleaning, bathing and medicinal purposes. The first instance of geothermal electric power production occurred in 1904 in Italy, when Prince Piero Ginori Conti invented the first geothermal power plant at the Larderello dry steam field. In 1960, construction began on the first industrial geothermal power plant in the United States: an 11-megawatt operation at The Geysers in Northern California.

Geothermal energy currently supplies more than 10,000 megawatts to 24 countries worldwide, producing enough energy to meet the needs of approximately 60 million people internationally. The United States currently produces more geothermal electricity than any other country, accounting for roughly 30 percent of total production worldwide.

Additional background resources:

The Geysers: <http://www.geysers.com/>

Geothermal Energy on EIA Kid's Page:

<http://www.eia.doe.gov/kids/energyfacts/sources/renewable/geothermal.html>

Geothermal Education Office: <http://geothermal.marin.org/>

VOCABULARY

Cap rock

a layer of tight, generally impervious rock that overlies an oil- or gas-bearing rock or steam reservoir in the earth

Electricity

a fundamental form of energy expressed in terms of the movement and interaction of electrons

Fumarole

a hole in a volcanic area from which hot smoke and gases escape

Geothermal

of or relating to the internal heat of Earth

Magma

the molten rock material under Earth's crust

Pressure

force applied uniformly over a surface

Renewable energy

energy generated from natural resources that can't be used up

Reservoir

an underground accumulation of petroleum, natural gas and the like

Steam

pressurized water vapor

INTRO QUESTIONS

- What kinds of renewable energy are you familiar with?
- How is electricity produced?
- Where do you think geothermal energy would be most abundant?
- What do you think geothermal energy could be used for?

FOCUS QUESTIONS

- Where are geothermal sites found?
- Describe The Geysers. What is significant about this area?
- How does a geothermal energy "boiler" work?
- Do you think the drawbacks to geothermal energy are significant? Why or why not?

For all media see:

- Segment Summary Student Sheet
http://www.kqed.org/quest/downloads/QUEST_SegSum_StudentSheet.pdf
- Personal Response Student Sheet
http://www.kqed.org/quest/downloads/QUEST_PersResp_StudentSheet.pdf

LESSON PLANS & RESOURCES from PBS, TEACHERS' DOMAIN and NPR

NOTE: Resources from the Teachers' Domain collection require a fast and free registration.

Harvesting Geothermal Energy NPR

<http://www.npr.org/templates/story/story.php?storyId=93636624>

This August 15, 2008, **Talk of the Nation** broadcast takes a look at the methods used to harvest energy from beneath Earth's surface.

Businesses See Green in Iceland's Volcano Power NPR

<http://www.npr.org/templates/story/story.php?storyId=16780339>

Learn how Iceland has begun exchanging oil for geothermal by harnessing its volcanic roots in this December 3, 2007, **Morning Edition** radio broadcast.

"Going Green" – Geothermal Power PBS

<http://www.pbs.org/nbr/site/onair/transcripts/081104e/>

View this transcript from a November 4, 2008, **Nightly Business Report** to explore a hospital outside of Chicago that is building a geothermal power system.

Energy Sources Teachers' Domain

<http://www.teachersdomain.org/resource/phy03.sci.ess.earthsys.energysource/>

This video segment identifies some current and future alternatives to fossil fuel energy and describes some benefits and limitations involved with each.

Snapshot of US Energy Use Teachers' Domain

<http://www.teachersdomain.org/resource/tdc02.sci.life.eco.energyuse/>

How much energy do we consume by simply living our lives in a developed society? In this video segment adapted from **NOVA/Frontline**, experts discuss the estimated amount of energy we burn through daily activities and how much carbon dioxide these activities contribute to our atmosphere. Viewers get a greater understanding of why we need to reduce our fossil fuel consumption and focus on renewable energy resources, such as solar, wind and geothermal energy.

VISIT OUR PARTNERS

The Bay Institute
www.bay.org

California Academy of Sciences
www.calacademy.org

Chabot Space and Science Center
www.chabotspace.org

East Bay Regional Park District
www.ebparks.org

Exploratorium
www.exploratorium.edu

Girl Scouts of Northern California
www.girlscoutsbayarea.org

Golden Gate National Parks Conservancy
www.parksconservancy.org

The J. David Gladstone Institutes
www.gladstone.ucsf.edu

Lawrence Berkeley National Laboratory
www.lbl.gov

Lawrence Hall of Science
www.lawrencehallofscience.org

Monterey Bay Aquarium
www.mbayaq.org

Monterey Bay Aquarium Research Institute
www.mbari.org

Oakland Zoo
www.oaklandzoo.org

The Tech Museum of Innovation
www.thetech.org

UC Berkeley Natural History Museums
<http://bnhm.berkeley.edu/>

U.S. Geological Survey
www.usgs.gov

MORE EDUCATIONAL RESOURCES FOR USING QUEST MULTIMEDIA TO ENHANCE 21st CENTURY SKILLS IN TEACHING AND LEARNING

Why Use Media in Science Education?

www.kqed.org/quest/downloads/QUEST_Why_Media_08-09.pdf

- “As science educators, we know how important critical thinking and new technology skills are in the scientific community...” ([read more](#)).

Science Multimedia Analysis

www.kqed.org/quest/downloads/QUEST_Science_Multimedia_Analysis_08-09.pdf

- “By increasing students’ awareness of the intersections between media and science, we give them the tools to think like scientists...” ([read more](#)).

How to Use Science Media for Teaching and Learning

http://www.kqed.org/quest/downloads/QUEST_Media_Tips_08-09.pdf

- If we consider all forms of media “texts” from which students gather information, we can use similar literacy strategies to engage them in video, audio, blogs and Explorations. Once students have obtained information from multiple media sources, how do they share what they have learned? Through their own media-creation projects, of course!

Using Google Maps to Create Explorations

http://www.kqed.org/quest/files/download/52/QUEST_ExplorationCreation.pdf

- Do you like the science hike Explorations on the QUEST site? Use this place-based educational guide for educators and group leaders to create similar science-based maps with youth.

OTHER WAYS TO PARTICIPATE IN QUEST



LOG ON

www.kqed.org/quest



LISTEN

**KQED 88.5 FM San Francisco &
89.3 FM Sacramento**
Mondays at 6:30am and 8:30am



WATCH

KQED Channel 9
Tuesdays at 7:30pm