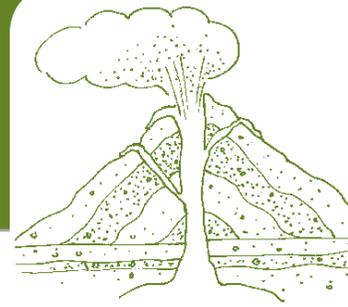


Summary: Students will act as reporters assembling a newspaper on geothermal energy.

Geothermal Gazette



Grade Level: 5–8 (9–12)

Subject Areas: English Language Arts, Science, Social Studies (Geography)

Setting: Classroom and computer lab

Time:

Preparation: 30 minutes

Activity: One week

Vocabulary: Geothermal energy, Geothermal heat pump

Major Concept Areas:

Theme II

- Development of energy resources
- Development of renewable energy resources
 - Geothermal energy

Standards Addressed:

Wisconsin Model Academic:

ELA: A.12.4, B.12.1, B.12.2, B.12.3, C.12.1, C.12.2, C.12.3, E.12.1, E.12.3, F.12.1

SC: A.12.1, A.12.2, A.12.5, B.12.4, C.12.1, C.12.2, C.12.3, C.12.4, C.12.5, C.12.6, C.12.7, E.12.1, G.12.3, G.12.4, G.12.5, H.12.5, H.12.6

SS: A.12.1, A.12.6, A.12.11, D.12.4, E.12.15

Common Core ELA: L.8.3, L.8.6, RI.8.3, RI.8.8, RL.8.4, SL.5-8.1, W.8.2, W.8.7

Common Core Math: MP1, MP2, 6.SP.5, S.ID.1, S.IC.6

NGSS: MS-ESS3-1

SEP: Constructing Explanations and Designing Solutions

DCI: ESS3.A: Natural Resources

CCC: Cause and Effect

Objectives

Students will be able to

- describe how a geothermal heat pump works; and
- provide examples of geothermal energy use in Wisconsin.

Rationale

Geothermal resources are used throughout the world. It is important for students to become aware of all renewable energy resources available to them in Wisconsin and the implications of their use.

Materials

- Resources and reference materials about geothermal resources
- Computer lab with Internet access

Background

Geothermal energy is thermal energy that originates within Earth. Geothermal resources range from shallow ground sources (low temperature) to hot water, steam, and rock miles below Earth's surface (high temperature).

High temperature geothermal sources are underground reservoirs of hot water or steam that can be tapped for electrical power production. Reykjavik, Iceland has been making the move from oil to renewable energy for some time now. The island of Iceland was formed from volcanic activity, which is a good clue that there is geothermal power ready to be tapped into. Geothermal energy provides the majority of power for most of the residential areas in Iceland.

Although Wisconsin lacks the geological properties that make high temperature geothermal energy sources available, there are many homes, businesses, and schools that are taking advantage of low temperature geothermal energy.

Low temperature geothermal systems use the relatively constant temperature of the soil or surface water as a heat source and sink for a heat pump, which heats and cools buildings. Just a few feet below Earth's surface the ground temperature stays relatively constant between 50 and 60 degrees Fahrenheit. Geothermal or ground source heat pump systems use a series of underground pipes or loops to take advantage of the constant temperature just six feet beneath the earth's surface. In winter, Earth's heat is transferred from the ground to the house or building. In summer, the process is reversed. Similar to how a refrigerator works, the warmer indoor air is pumped or drawn back into the cooler ground.

Most heat pumps use a closed loop system where fluid circulates through loops installed in the ground horizontally or vertically (see **Diagram 1**).

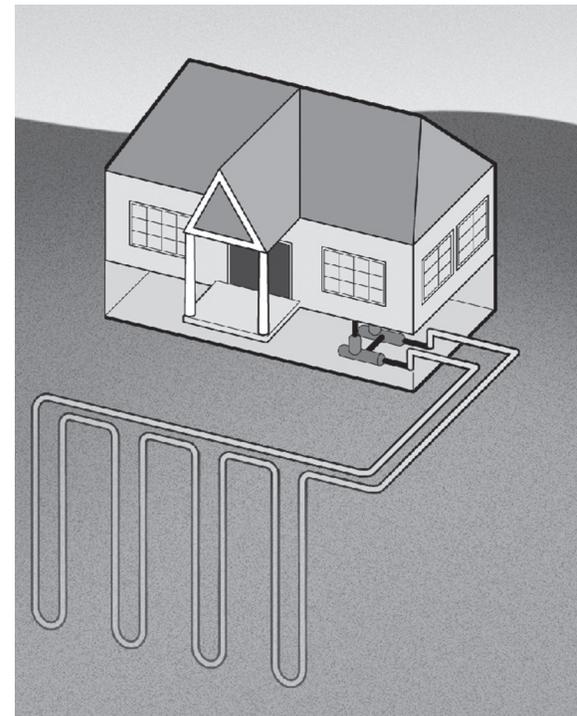


Diagram 1

Source: Geothermal Heat Pump Consortium, Inc.

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In other situations, the loops are submerged in a pond or lake (see **Diagram 2**).

Open-loop systems, while the cheapest to install, have environmental regulations that limit their use. In open-loop systems, ground water is piped from and back into a well; during the process it passes through a building where its heat is transferred to the heat pump.

Geothermal heat pumps are more efficient in the cooling cycle. A typical air conditioner takes the hot air from outside and cools it. With a geothermal system, the source of cooling is from underground and does not require as much energy, making the geothermal system more efficient and cost effective. Since the systems are more efficient for cooling, if extensive cooling is not required a geothermal system may not be the best option.

Geothermal heat pump systems can increase comfort and decrease costs for Wisconsin schools. Many schools like this technology because it allows each teacher to control his or her own system for improved comfort in the classroom. Temperature control can be applied to heat or cool whole buildings or for events in just one area. Fond du Lac and Evansville High Schools in Wisconsin utilize ground-source heat pumps to heat and cool their schools (using closed-loop pond and vertical ground closed-loop systems, respectively). For a list of schools that have a geothermal system, visit the KEEP website.

Positive aspects of a geothermal system:

- cost savings
- durability
- low maintenance
- year-round comfort
- quiet operation
- high efficiency
- low environmental impact

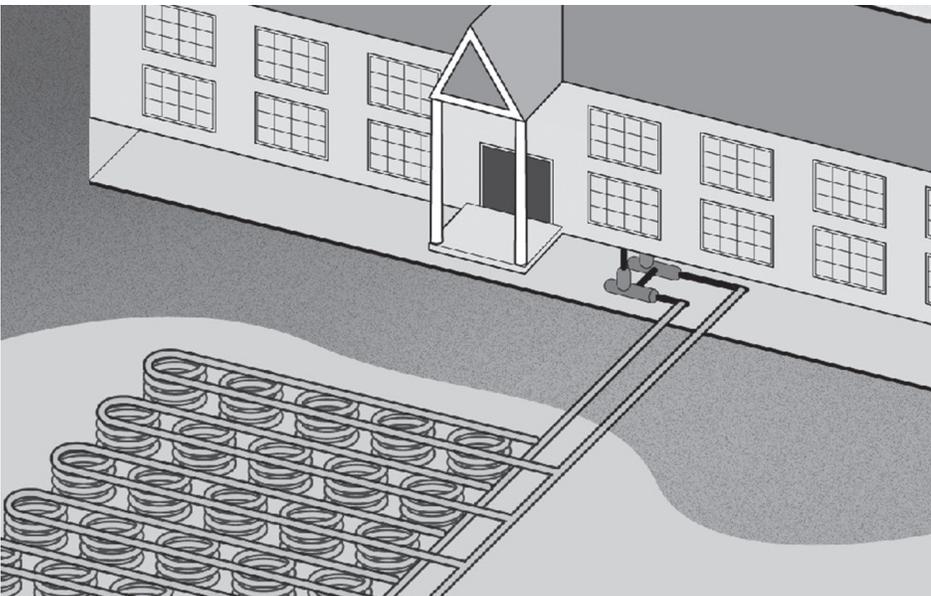


Diagram 2

Source: Geothermal Heat Pump Consortium, Inc.

Points of Journalism:

Writing a news article is different from writing an essay. In a news article there is no conclusion. The reader should be able to stop reading the story at any time and still know what the story is about. The headline of a story should send a message about the article and is usually short. The headline can be clever as long as the cleverness does not interfere with the message. The lead is the first sentence of a story and is one of the most important parts of the article. If the reader likes the lead, then they will continue to read the story.

The lead usually contains six elements: the who, what, why, when, where and how of the story. The most important information of the article should be at the beginning and the least important at the end. Paragraphs should be short and concise; two to three sentences is usually enough.

When writing a news article, every good journalist must keep journalism ethics in mind. Ethics deal with what is good/bad and moral/immoral. Journalists have four basic rules to follow, according to the Society of Professional Journalists:

- 1. Seek truth and report it**—“Journalists should be honest, fair and courageous in gathering, reporting, and interpreting information.”
- 2. Minimize harm**—“Ethical journalists treat sources, subjects, and colleagues as human beings deserving of respect.”
- 3. Act independently**—“Journalists should be free of obligation to any interest other than the public’s right to know.”
- 4. Be accountable**—“Journalists are accountable to their readers, listeners, viewers, and each other.”

Limitations of a geothermal system:

- not available and/or feasible in all areas
- concern that some geothermal systems can pollute groundwater resources in open systems
- increases electrical use in heating

Procedure

Orientation

Ask students if they think renewable energy is a newsworthy topic. What might make renewable energy headline news? Have students look through newspapers and see if renewable energy is mentioned.

Tell students they are going to be assembling a newspaper about geothermal energy. Make sure students understand the components of a good article and the ethics of journalism. Have students explore newspapers (or on-line sources) looking for information on energy use in Wisconsin and throughout the world. Have them analyze their articles utilizing the **Points of Journalism** in the sidebar.

When discussing new, innovative, or advanced topics (including geothermal energy in Wisconsin), journalists are challenged to help the public understand technical concepts in a clear manner. Remember, a picture speaks a thousand words. Use diagrams and illustrations to help explain. Think of other strategies journalists use to educate the public in an interesting manner.

Steps

- 1.** Provide students with a brief background on geothermal energy (see **Background**). Discuss the difference between high and low temperature geothermal resources, making sure students understand that only low temperature geothermal resources are practical in Wisconsin.
- 2.** Have students break into groups and select a topic to write about. See list of **“Selected Topics”** for suggestions.

Selected Topics:

- basic geothermal facts
 - geothermal heat pumps and how they work
 - efficiency ratings of geothermal heat pumps
 - positive and negative aspects of geothermal use
 - calculating energy savings
 - comparing geothermal systems to other heating options (e.g., fossil fuels, solar, biomass)
 - geothermal use in Wisconsin
 - geothermal use nationwide and globally
 - future use of geothermal energy
- 3.** Encourage the groups to assign tasks to each group member (e.g., researcher, writer, editor), making sure that one member acts as the graphic designer. The editors and graphic designers should meet to establish guidelines for font style and size, length of each article, etc. They may need to research this topic by visiting the local newspaper or talking to the school newspaper advisor.
 - 4.** Provide the groups with time to research their topic in the library and computer lab.
 - 5.** Have students hand in their articles in one week. Edit their reports and have students make recommended changes.

Closure

Discuss the results of their research and publication. What do students know about geothermal energy use in Wisconsin as well as the rest of the world? What is their opinion of its use? Have the class discuss how to distribute their publication. How might they use it to educate others in the community about renewable energy?

Assessment

Formative

Were students able to give examples of geothermal energy use in Wisconsin and worldwide? Did students describe the positive and negative effects of geothermal energy use?

Summative

Have students search the Internet for other articles on geothermal energy. Then have them analyze the articles for parts, ethics, and intrigue within the story.

Extensions

This can be repeated in other classes with different renewable topics (solar, wind, hydro, and biomass). The newspapers can be shared and discussed in other classes.

Ask students to identify if any geothermal resource use is taking place in their community. What government agencies or utilities could they contact to find out? What makes geothermal energy a good or poor choice for their community?

Final Connection

Use this activity to help students consider geothermal systems for their plans in “Sustainable Communities” and “Green Home Design.”

