

Geothermal Energy

Essential Question (EQ): How can we extract heat from the earth to heat and cool homes?

Engagement Scenario:

You are an engineer with a local company that designs and installs geothermal heat pump heating and cooling systems. Your task is to design, build, and test a scale model geothermal system that uses heat from the ground to heat and cool a home.

After researching informational texts on geothermal heating and cooling systems and participating in enabling learning activities intended to assist you in designing, building, and testing a working scale model of a geothermal system *that would be appropriate for the area of the world you select as being optimal for geothermal energy*, write a white paper OR create a video presentation in which you identify the problem of heating and cooling a home and propose a solution. Support your position with evidence from your research and with conclusions you draw from enabling learning activities.

You will select an appropriate location for geothermal energy, for which you will build your scale model, considering the Earth's heating and cooling capability. You will use mathematics and scientific principles, such as the heat transfer equation and mathematics for engineering technology, to design the system's cooling loops.

As you write your white paper or storyboard and create your video, consider how you would present it to an authentic audience, such as engineers, building professionals, geothermal professionals, college physics or engineering students, school district facilities professionals, and architects or architectural students.

Deliverables:

• White paper • Working scale model of geothermal system • Video Presentation to an authentic audience of professionals

The following resources are recommended for support of this project:

Essential Reading:

Websites:

The U.S. Department of Energy - www.energy.gov.

McQuay International Air Conditioning. (2002). Geothermal heat pump design manual.

(Application Guide AG 31-008). Retrieved from

http://search.aol.com/aol/search?enabled_terms=&s_it=c

[omsearch&q=geothermal+heat+pump+design>manual+mcquay&s_chn=prt_ct10](http://search.aol.com/aol/search?enabled_terms=&s_it=c)

Project Guide Software Technical Manual

U.S. Department of Energy, Energy Efficiency & Renewable Energy. (n.d.). Residential

geothermal savings energy. Retrieved from: http://www1.eere.energy.gov/geothermal/pdfs/ghp_workshop_johnson.pdf

Supplemental Tools:

Hyperphysics site on heat pumps at

<http://hyperphysics.phy-astr.gsu.edu/hbase/thermo/heatpump.html>

Heat Pump versus Natural Gas calculator from Cleveland utilities at

<http://www.clevelandutilities.com/heatpump.htm>

<https://www.npr.org/2018/02/04/582132168/the-forgotten-renewable-geothermal-energy-product-ion-heats-up>