

# Lesson Plan

## Geothermal energy at the Eden Project in Cornwall

### Overview:

Geothermal energy is a concept being explored by Eden Geothermal at the Eden Project site. The programme will be completed in two phases. Phase 1 is a research phase and has already begun. A deep well has been successfully drilled to a depth of 4,871 metres (length of the well is 5,277m), and will be used to deliver heat directly to the Biomes and other buildings at the Eden Project. If Phase 1 is successful, a second well of the same depth will be drilled to create water circulation for electricity production. This lesson aims to provide learners with an overview of what geothermal energy is and why/how it can be harnessed at Eden.

This lesson will be a resource for teachers to deliver themselves when best suited and has links to science, engineering, technology and geography.

### Who:

This lesson is aimed at primary school children in years 5 and 6.

### How long:

30 – 45 minutes. Additional time can be spent on further activities at the discretion of the teacher.

### Objectives and Curriculum links:

This lesson will enable students to:

- Understand why we need to use more renewable energy sources
- Learn what geothermal energy is
- Gain knowledge about geothermal energy at the Eden Project in Cornwall
- Find out about the rocks and geology needed for geothermal energy production

This lesson is designed to help teachers cover some aspects of the KS2 Science and Geography curriculum:

#### KS2 Science

- Rocks
- The structure of the earth
- Earth as a source of limited resources
- The production of carbon dioxide by human activity and the impact on climate
- Fuels and energy resources (renewables and non-renewables)

#### KS2 Geography

- Volcanoes and Earthquakes
- Natural resources - Energy

### Resources

- Smartboard/Whiteboard/TV
- MP4 video
- Workbook
- Additional resources for extra activities (for example the internet and creative supplies)

## Prior to the lesson:

To familiarise yourself with the geothermal project, further information and an explainer animation can be found on the website: [www.edengeothermal.co.uk](http://www.edengeothermal.co.uk) or for any specific queries about the project please contact: [cjudd@edengeothermal.com](mailto:cjudd@edengeothermal.com).

## Lesson Plan

### **Introductory video (Video 8.47 minutes long but this can be expanded by pausing the video at each objective as explained below)**

The video provided is a PowerPoint style video (with music) which allows students to learn about the four lesson objectives set out below. The video will provide answers for students to complete the workbook and inspire them to complete the extra learning activities.

You can watch the video all the way through in one go, or feel free to pause the video at each lesson objective to discuss what you have learnt.

The four lesson objectives are covered as follows:

- **Understand why we need to use more renewable energy sources**

This section of the video gives some background context into where we get our energy from and what we use it for. It also explains what energy sources we use in the UK and how this is having an impact on our environment.

Pause the video at 01.17m and ask the class to name as many renewable energy sources as they can. You could write them on the board or just have a verbal discussion.

The video will then give examples of renewable energy sources, which the students will be asked to recall when completing the workbook, along with a few other questions about this section.

- **Learn what geothermal energy is**

The video will give the students a definition of what geothermal energy is, where it comes from and how it is used. It will also go into some details about why geothermal energy can be used in Cornwall specifically, some of the job roles that are involved in a geothermal energy project and the benefits of geothermal.

- **Gain knowledge about geothermal energy at the Eden Project in Cornwall**

The video will explain each phase of the project, the concepts and the progress of each stage. The concepts can be challenging to understand so the diagrams have been simplified to show the basics of heat being brought to the surface via a deep well (hole).

You may want to pause the video at ~05.39m and ~06.03m when each phase diagram is shown as it may be worth having a short discussion to see how the students interpret each phase concept.

Also included in this section are a few short video clips from the drillfloor and the drilling site.

Clip 1 shows workers on the floor of the drilling rig. The first section of drill pipe (also known as the BHA - Bottomhole Assembly) is being lifted into position ready for drilling. This BHA will be attached to the drill bit and it also contains other tools which help to do

things like steering, taking measurements and providing force for the bit to break the rock. Each section of drill pipe is 9m long - can your class work out how many sections of drill pipe we screw together, one on top of the other, to get to the full 4,871m depth?

Clip 2 shows the first drill bit being positioned underneath the BHA ready to be attached. This drill bit is 26" in diameter and weighs 630kg. It was the largest one used in the drilling. The 'teeth' on the bit are made from tungsten carbide and as the cones rotate, they crush the granite into very small pieces.

Clip 3 shows the BHA and the drill bit attached to each other and lowered down through the hole in the drill floor to begin drilling.

Clip 4 shows the full drill rig and some views over the site at the Eden Project.

For more information on the drilling and operations visit our website: <https://www.edengeothermal.com/the-project/drilling-and-operations/>

- **Find out about the rocks and geology needed for geothermal energy production**

Cornwall has unique geology and has the hottest rocks deep underground in the whole of the UK. Geothermal energy can be found everywhere but to generate electricity a high geothermal gradient (how quickly the rocks heat up as you go deeper) is required. This section of the video will give a brief explanation of the type of rock and geological features needed for geothermal energy production and why Cornwall is so special.

## Workbook (15-20 minutes)

The workbook can be used as a printed resource (you don't have to print the whole thing, just the A3 section), or it can be shown on a whiteboard and students can write the questions and answers in an exercise book. The video can still be kept up on the board, students can refer to it as they wish and there are also key words given on page 5 of the workbook.

The two concept diagrams (pages 3 and 4) require students to fill in the blank labels, using the video or the diagrams on page 2. If the workbook is not printed, either you can go through the answers on the board, or the students can have a go at drawing it out and labelling each part of the diagram.

## Extra Learning

### Additional activities

#### Use your graphic design skills

Create a poster all about geothermal energy - imagine you are selling the idea of geothermal to an audience

#### Be a journalist

Write an article about geothermal energy and what's happened at Eden Geothermal

#### Produce a masterpiece

In a team, design and make a collage about geothermal for a school wall display

#### Speak your mind

Share your knowledge about geothermal by presenting to a group, individually or in a team

### Useful links for further research/activities

Eden Geothermal - Explainer animation (aimed at KS3+) located on the home page: <https://www.edengeothermal.com/>

International Geothermal Association: <https://www.geothermal-energy.org/>

Geothermal Rising: <https://geothermal.org/>

British Geological Survey (Geothermal): <https://www.bgs.ac.uk/geology-projects/geothermal-energy/>