

Overall learning objectives	Overall learning outcomes
- Investigate how maths can model a system using data and logic. - Apply ideas about energy transfer and sustainability to a novel context. - Devise technical solutions, appreciate their impact on eco systems and communities and explore how they can be modified to respond to demands.	- To identify characteristics to allow for in effective energy provision. - To evaluate different methods of supplying energy for domestic consumption. - To present and evaluate plans effectively and persuasively.

Curriculum learning objectives

Students should be able to:

Maths

- Apply suitable mathematics accurately within the classroom and beyond.
- Know that mathematics is essentially abstract and can be used to model, interpret or represent situations.
- Make and begin to justify conjectures and generalisations, considering special cases and counter-examples.
- Form convincing arguments based on findings and make general statements, communicating findings effectively.

Science

- Use appropriate methods, including ICT, to communicate scientific information and contribute to presentations and discussions about scientific issues.
- Explain how energy can be transferred usefully, stored, or dissipated, but cannot be created or destroyed.
- Explain how human activity and natural processes can lead to changes in the environment.

Technology

- Understand that products and systems have an impact on quality of life.
- Explore how products contribute to lifestyle and consumer choices.
- Evaluate the needs of users and the context in which products are used to inform designing and making.

Overview

This scheme consists of three episodes. The purpose of the first is to set the scene using a video clip which explains how ideas about renewable energy have been used in a particular context; this engages students in the challenges and opportunities. The second one takes these ideas further and gets students to think about specific needs and requirements that might exist in such a situation. The final one challenges students to come up with and test out a plan using the 'Energy Island' online resource at:

<http://siemens.zincmediadev.com/energyisland/index.html>.

Introduction

This episode is designed to set the scene for the challenge of an island becoming self-sufficient and to stimulate some ideas about not only how but also why they might want to do that.

Learning objectives

- To consider how a group of islanders made their island self-sufficient.
- To consider how easily these ideas could be transferred.

Learning activities

1. Show video clip "Island in the Wind".
This is on YouTube at:
www.youtube.com/watch?v=VMuim2KVBvc
2. Ask students for their responses as to why the islanders moved towards being self-sufficient in energy.
3. Ask students to work in groups to consider these questions and formulate responses:
 - a) How have the islanders made their island self-sufficient?
 - b) Why do you think they wanted to?
 - c) Do you think it's easier or more difficult to do that with an island than with, for example, a large town on the mainland?
 - d) Which of the techniques they used might work where you live?
4. Take feedback and draw out key points including that the island uses several different sorts of energy provision and that the islanders wanted to reduce their dependency on oil. Explore how transferable the ideas are and emphasise that although this development might be easier to implement on an island, especially one where the energy requirements may be lower and where there is plenty of sun and wind, the ideas can be used in a variety of settings.



Outcomes

- To have presented ideas about how and why an island became self-sufficient in energy.
- To have suggested how those ideas could be used elsewhere.

The challenge

To design an energy supply system for an island that doesn't rely on fossil fuel.

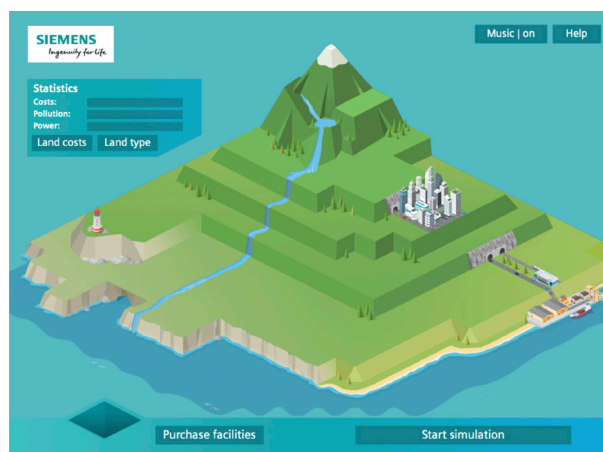
This episode enables students to work in groups to design and test their ideas against a number of criteria and 'set the scene.'

Learning objectives

- To consider the challenges represented by varied energy requirements.
- To suggest various ways of meeting these challenges.

Learning activities

1. Explain that electricity is very useful as it can easily be used to produce a range of effects, such as heat, light, sound and movement. Ask students to work in groups to identify a range of typical uses to which electricity is put in the home (they should not include battery powered devices, but they should include mains chargers for these).
2. Then ask them to go through that list and to divide it into two – those devices which *have* to run on electricity, such as TVs, and functions which *could* be powered by electricity but don't have to be, such as water heating.
3. Ask students to think about how the total energy demand in a home varies over a 24-hour cycle. They should sketch the shape of a graph to represent demand and label it to explain the main features. Ask students to identify the assumptions made in drawing the graph and draw out points such as whether the home is empty during the day, whether the temperature outside is much lower than inside, whether it is insulated and how many people live there.
4. Show the students a picture of an island and explain that their challenge is to provide the islanders with a suitable power generation system. Say that there will be various alternatives as to how electricity can be generated. Then ask for suggestions about what would make a good energy source. They should be encouraged to think about effectiveness, environmental impact and reliability.



Outcomes

- To have identified how energy is used in the home and how this demand varies.
- To explain how these demands represent a challenge for the supply of energy.

Investigate

In this episode students select an energy plan for the island from a number of alternatives. As well as making decisions about how to provide energy they have to consider the pollution caused, the reliability of the supply, whether the energy can be stored and how easily it can be regulated to allow for fluctuating demand. The resource sheets in this suite of activities can structure initial discussions; these then lead up to using the online activity at: <http://siemens.zincmediadev.com/energy/island/index.html>

Students should use the online activity, try their ideas out and see how well they work. At the end they will be shown a 'report card' which explains the effectiveness of their approach. They may decide to refine it and try again.

Learning objectives

- To weigh up a number of factors and decide on the best way of providing energy for the island.
- To consider how particular features of different ways of providing energy have certain advantages and will appeal to certain interests.
- To justify the decisions made.

Learning activities

1. Explain that the task they are to undertake is to provide for the energy needs of the islanders. They will have to make decisions about the fuels to use and how to generate electricity. The plan will have to allow for fluctuating demand, cost effectiveness and environmental impact. Say that because this is an island, options that only work on a large scale, such as fossil or nuclear power stations aren't available.
2. Student support sheets provide access to information about the various sources. Each energy card shows details of the technology, along with advantages and disadvantages. This will enable thought and discussion about which would be useful as part of an overall plan when using the interactive resource.
3. They should demonstrate awareness of how their proposals will supply electricity to the island, the likely environmental impact of their plans and how responsive it might be if the demands upon it changed.
4. At the end of running the simulation students get a report as to how well their plan worked. This refers to environmental impact, financial management and security of supply. They may well want to refine their plan to improve their performance and get a better score.
5. After they have had reasonable opportunity to engage with the activities, ask them to make notes on how they got a good score and which energy sources to use to satisfy the requirements. This could take the form of comments such as:
 - a. "This source is really good because it's good value and causes little pollution."
 - b. "This source is bad for pollution but it's reliable and stops the light from going out."
 - c. "This source is good to have as part of the plan but you wouldn't want to rely on it completely."
6. Ask students to consider what they've learned overall about the advantages and disadvantages of various energy sources.

Outcomes

- To have developed a plan for energy provision allowing for various factors.
- To have presented ideas in a clear and coherent way.