Overall learning objectives

- Assimilate and interpret key information about an emerging technology
- Understand the potential of tidal energy as part of an overall solution
- Use key features to evaluate the contribution tidal energy might make.

Overall learning outcomes

- Present a reasoned case for the potential of tidal energy and justify their conclusions

Curriculum learning objectives

Students should have the opportunity to:

Science:

- Plan to test a scientific idea, answer a scientific question, or solve a scientific problem.
- Recall, analyse, interpret, apply and question scientific information or ideas.
- Use both qualitative and quantitative approaches.
- Understand the use of contemporary scientific and technological developments and their benefits, drawbacks and risks.
- Understand that electrical power is readily transferred and controlled, and can be used in a range of different situations.

Technology

- Respond creatively to briefs, develop their own proposals and produce specifications for products and associated services.
- Generate, develop and communicate ideas in a range of ways, using appropriate strategies.
- Recognise there are moral, cultural, economic, environmental, and sustainability issues inherent in design and technology.

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Energy Challenger

Introduction

The purpose of this episode is to introduce the context to the students and get them to understand how the technology represents a viable approach to providing energy on a sustainable basis. It should also enable them to see how it could be used as part of a larger energy provision plan using a range of energy sources.

Learning objectives

- Understand the need for sustainable energy.
- Identify the key features of a technological solution.
- Recognise the advantages and disadvantages of a particular technology.

Learning activities

1. **Introduce the context by showing video (www.youtube.com/watch?v=ZPi9HeDgN58) and presenting to students the case for clean energy. Develop this by asking for ideas as to why we cannot rely solely on the wind and sun, drawing out key points about the amount of energy and the reliability.**

2. **Then ask students to research, from resources provided and wider searches, how tidal power stations work. From initial ideas, they then develop their understanding by considering the predictability of the tides, the nature of ebb and flood tides and the fact that some rural coastal locations that may be some way from other power stations might have the potential to use this type.**

3. **Ask students working in small groups to gather their ideas using a technique such as a spider chart and then to contribute to a discussion about the potential and the constraints of this technology. Produce a synoptic chart for the class (or retain the group charts) for reference later in the sequence of lessons.**

Outcomes

- Produce a summary of key features, including both advantages and disadvantages, and use this to inform contributions to a discussion.

Development

The purpose of this session is to engage students in exploring the constraints of tidal energy and in so doing enable them to understand its potential.

Learning objectives

- Identify features of a landscape which will maximise the effectiveness of the technology
- Interpret data and understand its implications
- Understand how evidence can be used to develop the case for or against a technology being deployed.

Learning activities

1. **Remind students of the key features of a tidal power station. Then challenge them to discuss and identify what is needed from a location in order for this technology to be viable.**

2. **Draw out points including:**
   a) The shape of the location needs to cause the water to flow in and out as the tides rise and fall - the sea bed needs to be on a gradient (the gentler the better). River inlets work well.
   b) The machinery can interfere with other activities, such as shipping.
   c) Proximity to centres of population and industry. Transporting electricity is very possible but results in energy losses so ideally the electricity can be used locally.

3. **Then present students with information from a set of tide tables. Ask them to consider these questions:**
   a) Going through a cycle from high tide to low tide and back to high tide, at which points is the water flowing more quickly through the blades?
   b) At what times (from the sample data) will this be?
   c) How well is this going to meet with periods of peak demand for electricity?
   d) What are the implications of this?

4. **Students should consider overall the challenges presented by this technology, such as the maximum energy generation not always being synchronous with maximum need and the impact on the environment and add to their notes or charts.**

Outcomes

- Suggest ideal characteristics of a location
- Explain the implications of the periods of maximum power output from a tidal power station

Summary

The purpose of this episode is for students to draw together key points and produce an overall reasoned and justified conclusion about the potential for tidal energy.

Learning objectives

- Summarise key points and use them to evaluate a technology
- Consider the potential contribution of tidal energy to an overall strategy

Learning activities

1. **Summarise (or gets students to summarise) key points gathered so far about tidal energy.**
2. **Then ask students to consider the assertions "...the tides provide an infinite supply of clean energy...?" and "...ocean power is a promising contributor to a clean and efficient energy mix for the future...?" and form responses. Use this as a way of getting them to summarise their understanding and their views, and considering the extent to which such technology has a contribution to make.**
3. **Ask groups to summarise their views. Then ask students to stand on a continuum line across the room, on which '0' (at one end) represents 'no role' and '10' (at the other end) represents 'total solution'. Ask students to explain why they are standing where they are. Ask them to consider if they might move if (for example) the equipment could be made invisible from the coastline, or if it could be guaranteed that no wildlife was injured by it.**

Outcomes

- Propose and justify a role for tidal energy in an overall energy strategy.