Workshop Title: Engineering in Scotland

Overview: Engineering success in Scotland will be highlighted. The challenges of building equipment and linking to the National Grid will then be highlighted.

Length: 50 minutes

Slide 1: Introduction

Slide 2: What is Engineering?

* Engineers work to find a solution to a problem.
* To do this they need scientific, technical and mathematical knowledge.
* Engineers have been at work throughout all the ages of human history creating structures, buildings and machines.
* There are different engineering disciplines and these include: mechanical, electronic, chemical, building services, structural, aerospace and civil.

Slide 3: Finding a solution

* To find a solution they work through various different stages but they will work within various constraints. For example, a limited budget, space available for the resulting design and time.
* There is always more than one solution to a problem and engineers must evaluate each possible solution and decide which is best for their constraints.
* Engineers usually begin by building some kind of model and then testing it. This can either be a physical model or a computer model.
* Testing is a very important part of the process and changes to a design will be made as a result.
* The new model will then go through the testing phase again.
* There are many, many examples of excellent engineering in Scotland. We will look at some examples now.

Slide 4: the Falkirk Wheel

* The Falkirk Wheel is the only rotating boat lift in the world and was made to allow access for boats between the Forth and Clyde canal and the Union canal.
* In the 1930s boats needed to go through a series of 11 locks taking them the 35 metre difference in height between the two.
* It would take 1 day to make this journey.
* The locks ceased to be used and by the 1960s the Forth and Clyde canal was closed.
* The proposal for the Falkirk Wheel and other work to the canals was made in the 1990s. It was part-funded by the National Lottery.
* The design itself was inspired by many different things, including a propeller of a ship, a Celtic axe and the ribcage of a whale.
* For this project there were various constraints. The site of the Wheel had previously been a mine and tar works, so this needed to be taken into account when building the foundations.
* The structure has to be strong and able to withstand changing load as it rotates.
* The final design meant that the Wheel was made from steel and fitted together with 45,000 bolts.

Slide 5: Marine

* In the 1970s there was an Oil Crisis, where access to oil was restricted and the price subsequently increased.
* At this time investment was made into finding alternative sources for our electricity that were not reliant on other countries selling us oil.
* One of the solutions proposed was by Professor Stephen Salter of the University of Edinburgh.
* His design known as “Salter’s Duck”, converted wave power into electricity.
* The “Duck” sits on the surface of the sea and rolls with the waves.
* As it rolls, gyroscopes inside the device begin to rotate, driving an electrical generator.
* Unfortunately Professor Salter’s ideas were never fully realised.
* However, marine energy is a very active area of research within Scottish universities and businesses.
* Electricity can be generated using either waves or tidal motion.
* Wave power technology is either on the surface or below the surface.
* The goal is to have a device that moves up and down with the waves.
* Tidal power technology is sometimes based on wind turbines.
* Turbines are submerged in the tidal stream and as the water flows past, the turbine blades turn.

Slide 6: EMEC

* New technologies from Scotland and around the world are tested at the European Marine Energy Centre (EMEC) in Orkney.
* EMEC has a set of bays where new types of technology can be put into the tide or waves and monitored to see how well it works.
* This offers a crucial service to engineers testing their designs.

Slide 7: Your Challenge

* Your challenge is to take on the role of a marine energy engineer to begin designing a device that will generate electricity using the power of waves.
* Step 1: investigate how objects move in the waves
* Step 2: investigate how objects move in tides
* Step 3: choose either waves or tides to design a machine for
* Step 4: sketch an outline of your design

Slide 8: Results

* Present your design and explain the movement and how electricity will be generated
* Show pupils a wave example and a tidal example.