

## Teacher Notes

Six for Six features 6 sets of complementary resources and/or activity suggestions aligned to curriculum requirements for KS2, 3 and 4 STEM subjects using real-world examples of Siemens technology, engineering or manufacturing principles as basis for learning.

Teachers are invited to select one or more suites of Six for Six materials to be used at their own discretion over the course of a half-term or term.

### Each set of six includes:

- Comprehensive teacher notes
  - Introducing and providing an overview of key learning objectives for the six resources and/or activity suggestions
  - Curriculum matrix including learning outcomes
  - Recommendations for when and how to use the resources
  - Links to additional learning opportunities and events associated with the STEM learning framework and calendar
- Six, curated lesson plans, films, interactive learning tools, workshop or challenge event activity suggestions each linked to the other to repeat and reinforce learning opportunities

### Download here

**Module 1: Understanding the body and how it works** – using and interpreting images to understand systems such as digestion and skeletal in the human body.

**Module 2: Living in a world made by STEM** – looking at the changes made to the world around us by developments in science and technology.

**Module 3: Energy for thrills** – seeing how the concept of energy transfer can help us make sense of everything from rollercoasters to double deck buses.

**Module 4: Power to the people** – the quality of our lives depends upon a reliable and cheap supply of energy. This needs to be achieved without damaging the environment however.

**Module 5: Getting around** – transport systems are crucial to modern life but need careful planning and operation to be fit for purpose. Thought needs to be given to the technology used, organisation and energy sources.

**Module 6: Building the things we need** – manufacturing skills are crucial to providing the products we need but they also provide jobs and develop skills. Manufacturing uses scientific ideas, logical thinking and an understanding of the wider world.



## Module 4: Power to the people

### Introduction

The generation of power is fundamental to ensuring a quality of life that many people regard as essential and has a key role in the developing world. Until relatively recently power generation technology tended to consist of extremely large power stations that used either fossil fuel or nuclear technology. Increasingly however smaller units are coming into play and allowing electricity to be produced on a more localised basis. This trend is set to continue and an increasing number of people will produce at least some of the electricity they need themselves.

Attitudes towards consumption have changed too. At one time the dream was to produce electricity so cheaply it wouldn't be worthwhile having meters but the focus now is upon the environmental impact of different generation methods and making devices more efficient.

### Educational context/curriculum links

This suite of materials is designed to support the teaching of science over a period of time. The resources are gathered together here for sake of convenience but there is no expectation or suggestion that they be used consecutively. Rather the idea is that as and when the topics arise in schemes of learning that the resources are accessed and deployed.

#### Subject references:

Science

- fuel use and costs
- fuels and energy resources.
- processes that involve energy transfer

Design Technology

- investigate new and emerging technologies
- test, evaluate and refine their ideas and products against a specification, taking into account the views of intended users and other interested groups
- understand developments in design and technology, its impact on individuals, society and the environment, and the responsibilities of designers, engineers and technologists

### Overview of assets

Type of resource	Title of resource
Lesson plan and activity suggestions	E-zero Island
Interactive learning tool	Energy Island
Digital Badge reward	Energy Explorer
Interactive learning tool	Siemens Farm
Lesson plan and activity suggestions	Here comes the sun
Lesson plan and activity suggestions	Underwater energy
Links to careers and employment opportunities	<a href="#">Early Careers</a>



## Rationale

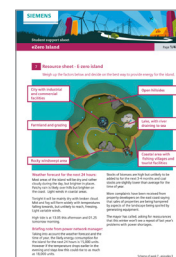
The key idea with the activities is to get pupils thinking about how we get the power we need to support the wide variety of functions we have come to rely upon. Some of these activities focus upon specific technologies and how they work and others look at how an overall power supply system can be designed and managed.

As well as the technicalities there is also opportunity to explore questions about pros and cons of various ideas and to get students to consider why some methods might be preferable to others.

### 1. Lesson plan: E-zero Island

#### E-Zero Island

The context of this activity is an island that becomes self sufficient with regards to energy. This is introduced using a video of an example of this and then develops by asking students to design a system for such a situation. They need to justify decisions they make against various criteria; a key point is that there may be conflicting factors such as security of supply, cost effectiveness and environmental impact.



This then leads into the use of the Energy Island resource (see below) in which students can try ideas out and get feedback. This could then culminate in the solutions developed by different students being compared and overall conclusions drawn about how to best meet the different aspects of the challenge.

### 2. Interactive learning tool: Energy Island

#### Interactives

Energy Island is an online interactive resource that challenges the user to set up, test and evaluate a system to supply an island with electrical power. There are various different methods of generation that can be selected; these are positioned on the island and the test period commenced. The user is then presented with a report of how well the system has worked; this is structured around the ideas of providing a continuous supply, doing so at an affordable cost and avoiding damaging the environment.



The user is then challenged to try and improve their performance by changing aspects of the system. They can then run the simulation again and see if their scores have improved. This provides an opportunity to reflect on the merits of various types of generation technology.

### 3. Digital Badge reward: Energy Challenger

#### Digital badges

This digital badge is based on the use of the Energy Island interactive resource (see above) which can be used either in school or at home. Students can engage with the ideas, develop solutions and then gather evidence from their activities to show how they have used these to develop an understanding.





#### 4. Interactive Learning Tool: Siemens Farm Interactives

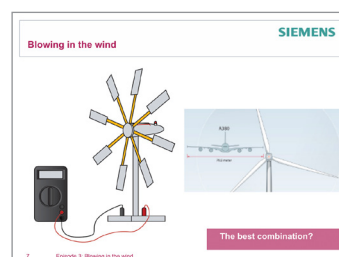
This online interactive resource is similar to Energy Island (see above) in that it challenges the user to select ways of providing energy but reflects recent developments in the approach to power generation. The context is a farm; this has energy requirements but it also has the potential to meet some (or all) of these from its own equipment. Users select how power is to be produced; options include various ways of producing it onsite, storing electricity if supply exceeds demand at certain times of the day and whether there is a connection to the National Grid.



The farm is therefore a producer as well as a consumer; it can function either independently of the National Grid or as part of it. If the latter it can sell electricity to the grid as well as buying from it. After the system is set up it then runs for a period of time and performance data is produced. This shows whether a continuous supply was maintained, what the overall cost of running the system was and what the impact on the environment was. Changes can be made to improve performance.

#### 5. Lesson plan: Blowing in the Wind KS3 Blowing in the wind scheme of work

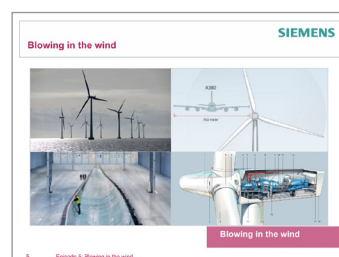
This set of activities uses the context of wind power. It involves the construction and testing of a simple wind turbine and the analysis of a number of design factors such as the number of blades and the material being used. The wind turbines should be set up to power small electric motors (therefore working as generators) and the voltage output measured to indicate the effectiveness of the design.



#### 6. Lesson plan: Underwater Energy KS4 Scheme of work underwater energy

This set of activities use the context of tidal power – the idea that the power of water moving in and out of a coastal area can be harnessed to produce electricity. It starts off by using a video clip to set the context and thus provides an opportunity for students to consider the pros and cons of such an approach.

This is then developed by looking at evidence such as tide tables. Students are challenged to see that one of the limitations is that although significant amounts of energy are produced, this may not be near to centres of population or necessarily when demand is greatest. The focus is upon analysing data and other evidence to justify a view of the value of such a project.





### Best teaching practice

There are various ways in which the resources can be used effectively but there are some key components that should be maintained.

Firstly there is a strong emphasis throughout on making a justifying decisions. In many cases there isn't a single right answer but students need to way up and trade off a variety of considerations to come up with what they judge to be an overall best fit. This is intended to encourage them to focus less upon 'is this the right answer?' and more on 'what evidence can I use to justify the claim I'm making?'



Secondly the contexts are authentic. The debate is real and ongoing about how we produce the energy we need. Although the activities are designed and set up to make them accessible to students, they are all based on genuine and ongoing contexts. It is a good opportunity to get students to understand that STEM subjects have a crucial role in the realisation of the kind of world we want to live in.

Thirdly the questions can only really be answered by using a range of skills and ideas. There are aspects that involve maths skills and those which use scientific concepts. It demonstrates how STEM professionals need to draw upon a variety of ways of thinking.

### Links to careers and employment opportunities

Although it will be some years before pupils make crucial decisions about subjects they study at school, research shows that they often form attitudes towards STEM subjects at an early stage. It is useful if early interest can be nurtured and if pupils can be supported to see themselves as potentially being active in this area.

### Make the world a smarter place

Siemens helps create what matters to society. From making sustainable energy more economical, to creating groundbreaking technologies that transform the world we live in.

There are opportunities to join Siemens in almost every country in the world. We're looking to recruit people in Engineering, Business and Finance.

Find out more at [Siemens Early Careers](#)

### Further reference

It is useful if students have a least a passing understanding of the technologies that are featured in these activities.

Some they are likely to have seen, such as arrays of solar cells in fields and wind farms but others they may know less about.

There is a useful summary from Thought Co. at: [Top renewable energy sources](#), from Conserve Energy Future at: [What are renewable energy sources](#) and from eSchool at: [What is renewable energy](#)

The Centre for Alternative Technology has information, guidance and runs a range of courses: [www.cat.org.uk](http://www.cat.org.uk)

There are many suitable video clips on YouTube, including from providers such as National Geographic.



For additional modules, visit [www.siemens.co.uk/education](http://www.siemens.co.uk/education)

Suite No.		1	2	3	4	5	6
Phase		Primary	Primary	Secondary	Secondary	Secondary	Secondary
Focus		STEM	STEM	Science	Design Technology	STEM	STEM
Module:		1	2	3	4	5	6
Title		Understanding the body and how it works	Living in a world made by STEM	Energy for thrills	Power to the people	Getting around	Building the things we need
Asset #1	Lesson plan and activity suggestions	The human body - skeletal muscular system	Clean silent trains	Formula for thrills	E-zero Island	Inspired bus company	Keeping it lean and mean
Asset #2	Lesson plan and activity suggestions	The human body – digestive system	Bus activity sheet	Monte Rosa Mountain Hut	Interactive learning tool. Energy Island	Green power challenge	Totally in control
Asset #3	Interactive learning tool	Inside the Human Body	Life without STEM	Formula for thrills	Siemens Farm	Self driving challenge	Lean machines
Asset #4	Digital Badge reward	Curiosity	Technology	Rollercoaster challenge	Energy Challenger	On the move Challenger	Mechatronics Challenger
Asset #5	Lesson plan and activity suggestions	The human body – circulatory system	Words along wires	Here comes the Sun	Blowing in the Wind	Ringing true	A case to resolve
Asset #6	Lesson plan and activity suggestions	More than skin deep	Let there be light	Blowing in the Wind	Underwater Energy	A case to resolve	Sustainability