ELECTRICITY

KEY STAGE	TEACHING AND LEARNING ACTIVITIES	CURRICULUM LINKS	
KS1	Counting electric lights in each room and corridor	**Maths**	Counting, recording and presenting results (p62, 64)
	Observing and talking about electrical appliances at home and school	**Science**	Everyday appliances that use electricity (p81)
	Making simple electrical circuits		Simple electrical circuits and switches (p81)
	Discussing the way people lived before electricity was generally available	**History**	Lifestyles at different times (p104)
	Using electricity safely	**PSHE & Citizenship**	Taking responsibility for themselves, others and the environment (p137)
	Using electricity wisely		
KS2	Estimating the amount of electricity used by lights in a school and calculating the cost	**Maths**	Applying number operations (p69)
	Checking electricity bills		Handling data (p73, 100)
			Communicating results (p73)
	Investigating which materials conduct electricity	**Science**	Electrical conductors and insulators (p88)
	Using drawing and conventional symbols to design electrical circuits with specific functions; making and testing them		Design and make electrical circuits (p88, 95)
	Investigating the role of components		Effects of changing components (p88)
	Devising a system to switch a lamp on or off in response to light levels	**D&T**	Electrical circuits that achieve results (p95)
		ICT	Creating sequences of instructions to make things happen (p100)
	Understanding how electricity has affected people in the past	**History**	Changes in lifestyle, work and transport (p105)
	Studying the impact of scientists, engineers and inventors		
	Looking at the impacts on the environment of electricity generation and distribution	**Geog**	Changes to the environment (p113)
	Using electricity wisely	**PSHE & Citizenship**	Taking responsibility for the environment (p141)
	Recognising potential dangers and minimising them		Electrical safety (p140)
KS3	Estimating usage and running costs of electrical appliances	**Maths**	Problem solving, reasoning and communicating (p58)
	Estimating costs of wasted electricity		Using data from real life (p69)
	Investigating current and voltage in series and parallel circuits	**Science**	Electrical circuits (p110)
	Making electromagnets		Electromagnetism (p110)
	Investigating electromagnetic devices		Electricity generation (p112)
	Investigate ways of generating electricity		Storage of energy (p112)
	Appreciating the convenience and limitations of electricity as a way of transferring energy from place to place		Transfer and conservation of energy (p112)
	Studying batteries, pump-storage	**D&T**	Judge the quality of products (p137)
	Investigating conduction, convection and radiation	**History**	Features of post-industrial period (p152)
	Evaluation of energy efficiency of products		
	Investigate the impact of electricity in the home, food production, industry, offices, communications and leisure	**Geog**	Factors affecting location of industry (p159)
	Investigate the location of power stations and grid lines		
	Active involvement to reduce adverse environmental impact of electricity use	**PSHE & Citizenship**	Global interdependence and responsibility (p184)
KS4	Investigating relationships between components in electrical circuits	**Science**	Energy transfer (p120, 132)
	Understanding domestic wiring and appliances		Relationships in circuits (p119, 130)
	Studying how electrical energy is generated and transferred		Mains electricity (p119, 130)
	Measuring electricity consumption and calculating costs		Electrical generation and distribution (p120, 132)
	Reducing the environmental impact of energy use		The environmental implications of electricity generation and energy use (p120, 132)
	Investigating thermal insulation and the efficient use of energy		
	Treatment of electric shock	**PSHE & Citizenship**	Basic emergency first aid (p192)
	Active involvement to reduce adverse environmental impact of electricity use		Accepting responsibility for maintaining a sustainable environment for future generations (p193)

ESD topics/activities in shaded areas

SOME RESOURCES

Title	Description	Links	KS	Teachers' Ref	Pupils' booklets	Work cards	Website www.	Contact Information
Energy – a source of wonder	Introduction to energy	■■■■	1	✓			nea.org.uk	NEA
Finding out about Domestic Energy	Activities and background notes	■■ ■	2	✓			nea.org.uk	NEA
Illuminated Numbers	Using a lighting survey as a context for Numeracy, etc	■	2	✓			create.org.uk	CREATE
Save Your Energy	Software package for assessing energy efficiency of pupils' homes	■■ ■	2	✓	✓		create.org.uk	CREATE
Systematic	Making the school more energy economical by looking at inputs, processes and outputs	■■ ■	2	✓			york.ac.uk/org.ciec	Chemical Industry Education Centre
Energy Works	Visiting hands-on exhibition	■■■■	2-3				science-project.org	Science Projects
Energy Matters	Activities and support with built-in progression between Key Stages	■■ ■	2-3	✓		✓	cse.org.uk	Centre for Sustainable Energy
Practical Energy Project Pack	Activities cover fuel consumption, costs, insulation, lighting, etc	■■ ■	3	✓	✓	✓	create.org.uk	CREATE
Fossils into Fuels	Overview of geology and industry, activities, teachers' notes, etc	■	3-4	✓			petroleum.co.uk	Institute of Petroleum
Fuel for thought	Cross-curricular view of energy in its environmental and social contexts	■■ ■	3-4	✓			nea.org.uk	NEA
Pupils' Guide to Wind, Water and Solar Power	Basic guide for young people	■ ■	3-4		✓		cat.org.uk	Centre for Alternative Technology
Electricity Through the Ages	Eleven colourful posters	■	3-4				understanding_energy.org.uk	Understanding Energy
Solar Fact Sheets	Six-part set covers water-heating, photovoltaics, biomass, etc	■ ■	3-4	✓	✓		brookes.ac.uk/uk-ises	Solar Energy Society
Environmental Effects of Electricity Generation	Information for teachers and pupils	■ ■	4	✓	✓		iee.org.uk/Schools/curricul.htm	Institution of Electrical Engineers
Classroom Modules on Oil	Worksheets and video covering the practical side of the oil industry	■	4	✓	✓	✓	energychest.net	Esso
Power Challenge	Extensive role-play package deals with a new power station	■	4	✓	✓	✓	ase.org.uk	Association for Science Education
Managing Energy	Investigations involving students in school energy management	■■ ■	4	✓		✓	ase.org.uk	Association for Science Education
Renewable Energy	A compendium of information about all aspects of renewable energy	■■■■		✓			oup.co.uk	Oxford University Press
Teaching Energy and Energy Efficiency Effectively	Guidance for non-specialist teachers	■■■■		✓			ase.org.uk	Association for Science Education
Energy Efficiency Lesson Plans for Trainee Teachers	Ideas and worksheets	■■ ■		✓			nea.org.uk	NEA
Building energy efficiency in schools	The key publication on the whole school approach to energy management	■■ ■		✓				BRECSU
Energy*Watch*	Free termly newsletter for teachers	■■■■		✓			create.org.uk	CREATE
School*Energy* Rebate scheme	Funding for investment in improving energy efficiency	■■ ■		✓			schoolenergy.org.uk	CREATE
Energy towards a sustainable lifestyle	Practical advice on combining environmental and educational requirements	■■ ■		✓			eco-schools.org.uk	Eco-Schools Award Scheme
Eco-Schools Award Scheme	Recognition for schools that are reducing their adverse environmental impact	■■■■		✓			eco-schools.org.uk	Eco-Schools Award Scheme

For further information about these and many other titles see Openings! – a guide to Quality Energy Education Materials published by CREATE on behalf of the Energy Education Forum.
This is available from Kenley House, 25 Bridgeman Terrace, Wigan WN1 1TD or on www.create.org.uk

Links Key: ■ Heat and combustion ■ Light ■ Sound ■ Electricity

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SOUND

LIGHT

HEAT AND COMBUSTION

ELECTRICITY

ENERGY ZONE

A guide for teachers to the location of energy-related topics in the National Curriculum for England and some of the resources available to assist teaching

ENERGY EFFICIENCY
SCHOOLENERGY
PROMOTING THE WHOLE SCHOOL APPROACH TO SAVING ENERGY

"Looking for a way to use the school buildings as an educational resource for primary Mathematics?"

"Need ideas on ways to link energy concepts in secondary Science and Geography with action dealing with real world problems?"

ENERGY ZONE

This curriculum map will assist teachers when planning their teaching programmes. It shows where energy ...

- is required by the National Curriculum ,
- can be used as a context for delivering stipulated topics.

It also demonstrates the progression of understanding through the Key Stages.

Energy and Education for Sustainable Development

Education for Sustainable Development (ESD) is mentioned in the National Curriculum before any of the Programmes of Study because it is an underlying theme that is to permeate all teaching. Energy is a good introduction to both the theory and practice of sustainable development because ...

- it allows pupils to translate general concerns about the environment and good citizenship into practical action within their schools and homes at all times of the year,
- energy consumption is already quantified, so improvements in energy efficiency can be identified quickly and then celebrated by the pupils involved,
- wiser use of energy leads to improved levels of pupil and teacher comfort, together with cash savings that can be put to educational uses.

The School*Energy* Programme encourages effective energy management in schools with rebates of up to £3,000 for energy saving measures coupled to a whole school approach to energy.

Using the Map

Curriculum statements involving energy are allocated to one or more of four traditional themes – Sound, Light, Heat & Combustion and Electricity, together with the page reference(s) to the primary or secondary National Curriculum handbooks published by DfES.

Shaded areas are used to indicate where...

- ESD is a stipulated requirement of a National Curriculum subject,
- learning activities can be used to deliver ESD.

Language is basic to the understanding and discussion of energy and co-ordinating action to ensure its wise use. So energy can be used as a context for work in English and foreign languages. This can be reinforced through using energy as a theme in Art and Design, Music, Drama, etc.

This leaflet is based on a concept developed by the Aberdeen Environmental Education Centre and is used with their kind permission.

SOUND

KEY STAGE	TEACHING AND LEARNING ACTIVITIES	CURRICULUM LINKS	
KS1	Investigating how sounds are made	**Science**	Types and sources of sound (p81, 124)
	Recognising everyday sounds		Sounds get fainter with increasing distance (p81)
	Differentiating between loud and soft sounds		Hearing is one of the senses (p79)
	Identifying materials that absorb sound energy and those that don't		
	Inquiring into hearing	**D&T**	Properties of materials (p80, 92)
	Using sound sources safely in the home and school	**PSHE & Citizenship**	Loud sounds can cause deafness (p137)
	Role play/discussion dealing with not letting sound upset other people		What improves and harms the local environment (p137)
KS2	Investigating the sources of energy required to make sounds (e.g. manual, mechanical, electrical)	**Science**	Sounds are made when objects vibrate (p88)
	Investigating the transmission of sound		Changes in pitch and loudness (p88, 126)
	Sound is one way of transferring energy		Vibrations require a medium in which to travel (p88)
	Studying the ear		Properties of materials. e.g. sound transmission and insulation (p87)
	Identifying situations where materials that absorb/don't absorb the energy of sound will be useful	**D&T**	How the properties of materials affects how they can be used (p94)
KS3	Investigating the ear and hearing, pitch and volume discrimination	**Science**	Operation of the ear (p111)
	Investigating how sound energy is carried from place to place		Sound cannot travel through a vacuum (p111)
	Examining (model) systems, based on sound detectors, that automatically switch lighting on and off to reduce energy waste		Loudness and amplitude (p111)
	Using the energy released by sound sources safely in the home and school		Pitch and frequency (p111)
		D&T	Control systems (p137)
		PSHE & Citizenship	Energy from excessive exposure to loud noise can cause hearing loss (p189)
KS4	Comparing perceived volume of sounds with amplitude	**Science**	Sound waves (p119, 131)
	Building a model system, based on noise detectors, to automatically switch lighting on and off.		Energy transfer (p120, 132)
			Ultrasound (p119, 131)
	Discussing where and when it is socially acceptable to play music loudly	**D&T**	Control systems (p140)
		PSHE & Citizenship	Responsibility, participation, making decisions (p190)

ESD topics/activities in shaded areas

LIGHT

KEY STAGE	TEACHING AND LEARNING ACTIVITIES	CURRICULUM LINKS	
KS1	Investigating how light helps us see things	**Science**	Light sources and darkness (p81)
	Observing lamps, torches, indicators and other sources of light around the school and their differences in brightness		Properties of materials and their uses (p80, 92)
	Investigating shiny and dull objects		Plants need light (p79)
	Growing seedlings in light and dark		
	Investigating sources of energy for lighting (e.g. wood fire, oil, candles, gas, electricity) and how this influenced buildings and lifestyles	**History**	Lifestyles at different times (p104)
		Geog	Similarities and differences in environments (p110)
	Recording hours of daylight at different seasons		Making simple maps (p110)
	Surveying and deciding on causes of bright, dull and dark areas in school		
KS2	Creating and investigating beams of light, shadows and mirrors	**Science**	Light travels from a source (p88)
			Creation of shadows (p88)
	Investigating the eye and seeing		Light is reflected from surfaces (p88)
	Investigating the effect of light and the use of leaves in plant growth		We only see things when light enters out eyes (p88)
	Measuring and mapping lights and light levels within a school building and deciding if they are appropriate for normal activities		Effects of light on plant growth (p85)
			Role of leaf in plant growth (p85)
		Geog	Displaying information (p112)
			Making comparisons (p113)
KS3	Calculating and comparing the lifetime costs of filament and fluorescent lamps.	**Maths**	Functions from real world (p67, 69, 71)
			Graphs (p64)
	Investigating light rays, mirrors, prisms, etc	**Science**	Light travels in straight lines (p111)
	Investigating visibility of coloured object when seen by coloured light		Absorption, scattering, reflection and refraction of light (p111)
	Investigating sight and seeing		Photosynthesis and chloroplast (p107)
	Investigating leaves and energy capture		Survival of seasonal change (p107)
	Investigating hibernation, etc		
	Using a light sensor as an input to a (model) system to control room lights and thus reduce electricity consumption	**D&T**	Control systems (p137)
KS4	Investigating waves	**Science**	Waves transfer energy without transferring matter (p131)
	The uses and dangers of different parts of the electromagnetic spectrum		Electromagnetic spectrum (p119, 131)
	Investigation of factors affecting photosynthesis		The working of the eye (p115)
	Uses to which energy stored as sugars and starch are put		Photosynthesis as an energy transforming process (p125)
	Investigating food flows in ecosystems		Food (energy) chains (p126)
	Studying dormancy and hibernation		
	Using electricity for lighting in a sensible way	**PSHE & Citizenship**	Participating in and taking responsibility for minimising the school's environmental impact (p190)

ESD topics/activities in shaded areas

HEAT AND COMBUSTION

KEY STAGE

KS1

TEACHING AND LEARNING ACTIVITIES	CURRICULUM LINKS	
Investigating materials and discussing if they will keep things hot or cold	**Science**	Properties of materials (p80)
Explore the ways materials behave when they are heated or cooled		Changes when materials are heated or cooled (p80)
Cooking simple food		Taking exercise (p79, 132)
Experiencing heat released during physical activity	**D&T**	Food technology (p93)
Recording daily temperatures inside and outside	**ICT**	Application of ICT inside and outside school (p99)
Discussing how heating systems work and are controlled	**History**	Changes in the way people live (p105)
Suggest how the school might be made more comfortable on hot or cold days		
Finding out how parents and grandparents kept warm when they were children	**Geog**	Weather (p111)
		Environmental improvement (p111)
Keeping doors and windows closed during cold weather	**PSHE & Citizenship**	Showing concern for the comfort of others (p137)
Realise that keeping the school warm costs money		Money can be used for different purposes (p137)

KS2

Comparing temperatures subjectively and with a thermometer	**Maths**	Use of standard units (p66)
		Presenting findings (p64)
Carrying out temperature surveys within the school building and deciding if they are appropriate for normal activities	**Science**	Temperature - a measure of hot/cold (p87)
Investigating effects of warmth and cold on plants		Grouping and classifying materials (p87)
Discovering thermal conductors and insulators		Changing materials (p87)
Describing what happens when materials are heated and cooled		Water cycle (p87)
		Burning (p87)
Investigating evaporation and condensation		Reversible and non-reversible changes (p87)
Investigating what happens when materials burn		Temperature and plant growth (p85)
Preparing more complicated dishes	**D&T**	Evaluating products (p95)
Deciding if products meet environmental considerations for energy efficiency		Food (p95)
	ICT	Simple programming (p100)
Creating a sequence of instructions to monitor and control temperature in a room	**History**	Features of periods (p105)
Finding out how people in other times worked and travelled	**Geog**	Understand places (p113)
Discussing the role of energy resources and engineers in the Industrial Revolution		Change and sustainable development (p113)
Describing weather and explaining how weather differs from place to place		
Discuss the impact of keeping the school warm on the wider environment	**PSHE & Citizenship**	Showing concern for the comfort of others and a commitment to sustainable development (p139)
Keeping doors and windows closed during cold weather		Adopting sustainable means of travel to school (p141)
Making choices that affect the environment		
Discussing impact of travel to/from school		

ESD topics/activities in shaded areas

KEY STAGE	TEACHING AND LEARNING ACTIVITIES	CURRICULUM LINKS	
KS3	Log room temperature over a period of days to see if heating regime is appropriate	**Maths**	Functions from the real world (p64, 69)
	Investigating solids, liquids and gases		Graphs (p64)
	Investigating solubility of solid and gases		Collect and interpret data to make informed decisions about real life situations (p71)
	Demonstrating breaking of rocks (and bricks) by ice and the destruction of limestone by acid	**Science**	Changes of state (p108)
	Studying fossil and other fuels, their formation, global stocks and depletion		Temperature and solubility (p108)
	Finding out about alternative fuels and renewable energy resources		Freeze-thaw and weathering of rocks (p108)
	Studying the effect of exploitation of energy resources on lifestyle and manufacturing		Transfer and conservation of energy (p112)
	Investigating gaseous and particulate pollution, climate change and acid rain and their effect on health		Energy resources (p111, 159)
			Burning and the environment (p109)
			Acid rain (p109)
			Respiration (106)
	Investigating practical applications within the school of techniques to minimise some energy transfer and maximise others	**D&T**	Application of control and feedback systems in the real world (p137, 145)
	Observing the sensors and activators of the school heating system	**ICT**	Application of control and feedback systems in the real world (p137, 145)
	Writing programs that would mimic those used by heating controllers in the school to maximise comfort and minimise fuel consumption	**History**	Industrialisation (p152)
			Technological, scientific and industrial developments (p151)
		Geog	Resource planning, use and management (p159)
			Weather and climate (p158)
	Taking action to reduce use of fossil fuels and pollution from burning	**PSHE & Citizenship**	Personal choices affect the environment (p190)
KS4			
	Plotting and interpreting monthly energy consumption of the school against a weather severity index. Identifying anomalies that could indicate malfunction	**Maths**	Derivation and application of linear equations in a real world situation (p77, 92)
	Investigation of uses by and effects of heat on living things	**Science**	Transpiration (p125)
	Carrying out fractional distillation		Temperature regulation (p115, 125)
	Studying the uses of petroleum products		Enzymes (p115, 124)
	Investigating the effect of heat on chemicals and reactions		Refining crude oil (p117, 127)
			Thermal decomposition (p117, 129)
			Rate of reaction (p118, 129)
	Studying radio-activity		Radio-activity (p120, 132)
	Investigating practical applications within the school of techniques to minimise some energy transfer and maximise others		Energy transfer (p120, 132)
		D&T	Control and feedback systems in the real world (p140, 147)
	Study school and domestic heating systems	**ICT**	Control and feedback systems in the real world (p140, 147)

ESD topics/activities in shaded areas