



energy watch

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Energy within the **geography** curriculum

teacher notes

Energy is a theme that underlies much of geography. Without energy nothing happens, no sun shines, no plants grow, no rain falls, nothing moves.

This special edition of EnergyWatch highlights where and how energy can be taught in the geography curriculum. We hope you find it useful.



Questions	Activities	Curriculum relevance
<ul style="list-style-type: none"> • How do we use energy? • Where does our energy come from? • How long will it last? • Sustainable development • What steps are we taking? • What will the effects be? 	<ul style="list-style-type: none"> • A day in my life • A day in a developing country • It won't last forever • Fossil fuel sources and reserves • Renewable energy • Becoming sustainable • Renewable energy in the UK • Reseaching renewable energy in the UK • Life in the future: <ul style="list-style-type: none"> - environment - climate - society - technology 	<ul style="list-style-type: none"> • People and their needs • Interactions between people and places • Resource issues • Global environmental change • Sustainable development • Impact of decisions on the environment and the quality of life • Rights and responsibilities

The activities guide pupils through a process of considering their own energy use and then placing this in a broader context. Empathic thinking helps them to consider what life is like for the 4.8 billion people, the vast majority of the world's population, who share 20% of it's energy resources.

Using a newspaper article as a starting point, pupils then consider the implications for the globe due to our energy use. The effects, changes required and solutions can be considered in terms of:

Environment

how is the global (or a local) ecosystem affected by energy use?

Climate

how this will change due to energy use and the consequences of this?

Society

how will a lack of energy resources affect society in the future?

Technology

how can this be developed to reduce our impact on the globe? What stops us from moving to renewable technologies?

This leads to the opportunity to discuss the need to move to a sustainable lifestyle. What are the implications for us, and how must our lifestyles change?

Pupils can research efforts in the UK and Scotland to move to renewable sources of energy and consider life in the future, using renewable energy sources but living with the consequences of 300 years of fossil fuel use.

a day in my life

pupil activities

1 Imagine an average school day. Write down everything you do during the day in a column. In another column, write down how it requires energy.

Think carefully, sometimes it's not obvious that energy is needed. For example:

Wake up	electricity for clock radio
Shower	electricity for hot water and pump
Breakfast	gas to cook food and heat water for washing dishes
Go to school	fuel for car or bus
Use PC in ICT	electricity for power

And of course, there is always food to give you the energy to think and grow and move about!

Keep going until you've covered everything you do until going to bed!

2 How else does your school use energy that you have not written down already?

Are there any things you do that do **not** need energy? Probably very few. Even reading a book outside needs energy. For example, energy is required to make the book and transport it to the bookshop. Even reading the book requires energy!

3 Now imagine you live in a developing country where useful forms of energy are scarce. Imagine you have no electricity in school, for light, heating, cooling or for running computers. Write down what your day might be like. What sources of energy might be available?

4 Read the article below. How could **you** help to solve the problem?

- Write down some ways in which you could save energy and consume less.
- How could you encourage your family and friends to do the same?

Things to think about . . .

- The sun provides enough energy in one hour to meet the world's energy needs for a year
- 20% of the world's population use 80% of the energy
- The technology exists to cut energy use in the average home by 95%
- Oil reserves are likely to run out in approximately 40 years, gas in 60 years and coal in 230 years

IT WON'T LAST FOREVER

AT A MEETING YESTERDAY OF THE WORLD'S LEADERS, YOUNG PEOPLE WERE ASKED TO HELP PEOPLE TO SAVE ENERGY.

A spokesman said, 'Our use of energy, especially in developed countries, cannot carry on. Oil and gas could run out within our lifetimes.'

We use so much energy that most people in the world will never be able to use any. Using so much energy damages the environment. We need to change our lifestyles. 'Burning fuels has caused acid rain that is threatening lakes and forests in northern Europe. The gases produced by shops, homes, schools, cars and industries are adding to the 'greenhouse effect' making the earth warm up.

This could cause droughts and floods across the globe.

Leaders hope that young people can help solve the Earth's problem by:

- Helping to find new ways to save energy and reduce waste, by consuming less
- Showing adults that being happy does not need to involve using lots of energy
- Helping everyone have access to energy, not just 'rich' countries
- Helping find ways to stop and mend the environmental damage caused by energy use

renewable energy sources

pupil activities

5 'Renewable' energy sources are naturally replenished and will last for thousands of years.

- Look at the picture showing forms of energy. Which ones are renewable?

What technologies can we use to get power from them?

- Can you find examples of renewable energy being used in the UK? How about near your school or home? What impacts do they have on the environment? Look for both benefits and problems.
- Think of how renewable energy could be used in other countries. Are any countries or regions of the world particularly well suited to harnessing particular renewable energy sources.



Where does energy come from?

6 Using maps from your library or the Internet, find out where we obtain our gas, oil and coal

- How do they get to where we use them?
- How does this damage the environment?
- How factors affect their continuing availability

Sustainable energy

7 Our energy use in the future needs to be 'sustainable'. This means that:

We do not use more resources than can be replaced naturally

We do not cause permanent damage to the environment

We do not take for ourselves so much of the available energy resources that others cannot have a fair share

- What do you think this means for how you use energy?
- How might this affect your lifestyle?
- How might these changes alter your local area?
- What should the more developed countries do to show others what can be done?

Taking action

8 Use your school library and the Internet to research what is being done to develop renewable energy sources. Can you find newspaper or online articles about the subject?

- How are we encouraged to save energy?
- How much of the UK's energy already comes from renewable sources?
- How are we being encouraged to use more energy from renewable sources?
- What type of renewables are most appropriate for the UK?

9 Using what you know about the world's energy resources, now think about life in the future:

- How will our climate and environment be affected by the fossil fuels we have used?
- How might this affect our lives?
- How might we use energy in the future?
- Can you find other predictions of how energy could be used and saved in the future?

(curriculum resources)

Organisations

Centre for Research, Education and Training in Energy: CREATE promotes and supports energy education and school energy management. It considers them to be key aspects of Education for Sustainable Development. It produces EnergyWatch, a free termly newsletter for teachers, as well as Openings! - a guide to teaching resources. For further details telephone 01942 322271 or visit www.create.org.uk

Centre for Sustainable Energy: CSE provides an integrated programme of training, support and resources that uses energy efficiency in the home as a starting point for activities that link several parts of the curriculum. Progression from upper primary to lower secondary levels is built in. Details: 0117 929 9950

Eco-Schools Scheme: The handbook sets out how schools can gain a Green Flag in recognition of pupil involvement in environmentally friendly policies and practices. Available from Environmental Campaigns on 01942 824620 or online at www.eco-schools.org.uk

Environment Agency: Environment teachers' packs for all ages can be downloaded from www.environment.agency.gov.uk/education/schools/resources.htm

Government Statistics: Recent energy statistics are available from ... The Environment in Your Pocket:

DEFRA Free Literature Tel: 0870 1226 236

UK Energy in Brief: DTI Tel: 020 725 2697

SchoolEnergy: Guidance on energy management for schools. It supplies 'Building Energy Efficiency in Schools'. This is often considered as the bible for schools wanting to introduce a whole school approach to the integration of energy education and energy management. It is available free in print by contacting 0870 7000 457 or downloadable from www.schoolenergy.org.uk

National Energy Action: NEA tackles energy efficiency as part of their approach to warmth for low-income families. There is material for all ages, but mainly for upper primary pupils. Contact Louise Stott on 0191 261 5677

Energy Education Forum: Comprises representation from all the key stakeholders involved in energy education and energy management in schools and colleges. For details contact the managing agent, CREATE on 01942 322271 or visit www.eef.uk.net

Web resources

• **Energy Chest** - www.energychest.net
A compendium of information and activities to help young people explore energy in their schools and suggest improvements.

• **Funergy** - www.funergy.org.uk
Interactive site for learning about energy and its waste through games and fun.

• **Learn** - www.learn.co.uk
Educational resources that include a tour of household appliances.

• **Planet Energy** - www.dti.gov.uk/renewable/ed-pack/
This site covers new and renewable energy resources. It has "Energy Trails", resources for primary and secondary pupils, and an "Information Zone" for teachers and parents.

• **GlobalWarming** - www.defra.gov.uk/environment/climatechange/schools/index.htm
Global warming is causing concern around the world. This site provides an idea of what it's all about, as well as information for projects and course work.

• **Schools: Energy-wise** - www.schoolsenergywise.com
Different websites for adults and children explain how young people have contributed to the wiser use of energy in schools across Europe.

• **Solar Classroom** - <http://das.ee.unsw.edu.au/~solar/>
Encourages pupils ages 8 to 14 to explore climate change and energy through a series of "classrooms."

• **Climate Action Network** - www.climatenetwork.org
CAN provides links to a large number of sites dealing with the political and policy aspects of energy. CAN operates through a number of world regional centres.

• **CSIRO Information Sheets** - www.dar.csiro.au/info/sheets.htm
CSIRO is a research institute in Australia. This part of its site provides fact sheets covering acid rain, the greenhouse effect, climate modelling, etc

• **Energy Facts & Figures** - www.energy-efficiency.gov.uk/document
Emission data, a carbon dioxide ready-reckoner, conversion factors and quizzes.

• **Environmental Database for use in Schools** - www.soton.ac.uk/~engenvir/
Basic information from the University of Southampton about a number of environmental challenges, mainly those associated with fuel use

• **Global Warming Cool it!** - www.greenhouse.gov.au/pubs/gwci/index.html
A home guide to reducing energy costs and greenhouse gases - Australian-style!

• **Institute of Petroleum** - www.petroleum.co.uk/edu.htm
Lists of educational resources, together with other information, diagrams, maps, etc.

• **Links and Resources for Energy and the Environment** - zebu.uoregon.edu/energy.html
A dramatic site set up by the University of Oregon. Offers resources related to energy and environmental issues. Topical information from the US Department of Energy - Office of Energy Efficiency and Renewable Energy.

• **Middelgrunden Wind Turbine Co-operative** - www.middelgrunden.dk
Description, photographs and other information about this locally owned offshore wind farm are available in Danish and English.

• **Offshore Windfarms** - www.offshorewindfarms.co.uk
This site from the British Wind Energy Association gives information on current and proposed windfarms around the UK.

• **Southampton City Geothermal and CHP Scheme** - www.southampton.gov.uk/geothermal/index.html
This site outlines how a hot water aquifer and a combined heat and power plant have been used to provide heat, hot and chilled water, and electricity.

• **Young Energy Savers** - www.govwild.org.uk/yes
This site includes an energy quiz that students can complete on a single visit.

Further information and materials

A searchable database of energy/education websites from the UK and around the world is available on www.create.org.uk Suggestions for inclusion are always welcome. Send them to info@create.org.uk

Centre for Alternative Technology: CAT has a wide range of books on energy, dealing with the social and ethical issues as well as practical aspects. Details: www.cat.org.uk

PI@net.com: This site from Channel 4 Learning includes energy case studies from across the world. Details: www.4learning.co.uk/planet/energy/ms-load-energy.html

SchoolEnergy: Cross-curricular packs for upper primary and lower secondary pupils in England, Scotland, Northern Ireland and Wales are available in print. Additional activities are available as downloads. Details: 0870 7000 457 or www.schoolenergy.org.uk

Think Energy: This site encourages pupils aged 7-14 to become more energy efficient. Materials are available as primary or secondary packs and as downloads. Details: www.think-energy.com

natural energy makes a river flow

Royston High School, Barnsley is too far from an easily accessible river or safe stream for pupils to investigate them first hand. This posed a challenge for Ken Dunn when he was Head of Geography.

"Learning is best done by doing," he said. "I much prefer a 'hands-on' approach where students can experience processes at close quarters." He adopted an unusual strategy to solve this logistical problem. If his classes could not get to the river, then the river would come to them.

Within an internal courtyard Ken and his students built a model river. Its source is a "mountain lake". The river flows along a steep-sided concrete "valley", across a lowland "plain" and into an "ocean." Sediment is added, and the effects of the energy of flowing water on erosion and deposition along the course of the river are followed.

But there was a snag. Ken could not mimic the transfer of water from ocean to mountain by evaporation and rainfall. This part of the water cycle required a pump. His Headteacher, though supportive, was concerned about the running costs.

Ken reassured him that the pump would be powered by clean green renewable energy that would be sustainable, both environmentally and financially!

Ken and his students came up with two ideas and adopted both. On a south-facing roof they installed a photo-voltaic (solar) panel. A wind-turbine was placed on a pole. The electricity from both is stored in accumulators until required to power the pump. The system has worked well for several years. In the process it has won many awards. Cash prizes have recouped the initial investment and paid for the systems to be upgraded several times. On balance, it has cost the school nothing.

"Coal mining has been central to the development of the Royston community," Ken explained. "Harvesting alternative energy sources to power the pump challenges a common preconception that energy only comes from fossil fuels."

The sources we are using are renewable and non-polluting."

But then there was a new problem. The model river is only required for a few lessons in each school cycle. What should be done with the surplus electricity during the rest of the year?

There are technical difficulties connecting the low voltage supplies to the mains. So the school is investigating a separate system that will provide lighting for parts of the school during evening meetings, thus reducing the amount of mains-powered lighting it has to buy.

The science and technology teachers also use the system as real-world examples of the utilisation of free, zero-pollution, sources of energy. In addition, the panels and turbine are a constant reminder to pupils, staff, parents and the local community of what renewable resources have to offer, and that attitude and determination are as important as technology and money for their adoption. It shows that developments that facilitate and exemplify sustainability are not limited to government and companies.



From a trickle of an idea, a mighty river is developing

The Student Council Environment Group meets regularly and makes suggestions as to how energy can be used more wisely. In this respect it has the functions of the Energy Teams that operate in other schools. Energy Teams assist the school managers by ...

- identifying where energy is being used effectively,
- finding wasteful practices,
- suggesting how improvement might be made,
- monitoring, analysing and reporting on energy consumption,
- helping to spread information.

Thus energy management is allowing pupils to take an active part in reducing the adverse environmental impacts of their schools - to put concern for the global environment into practice at a local level.

But Ken and successive groups of students are not resting on their laurels.

"We hope that our current use of renewable energy is just the start," Ken continued. "We're going to explore the use of other renewable sources in innovative ways within the school's grounds."

Some of these have already started. There is a willow-powered fire station not far away at Eggborough. The school has planted its own willow coppice. "Pupils are amazed at how quickly it grows - half a meter to over four metres in just one season," commented Ken.

"It helps make the link between plants, energy, climate change and carbon neutrality." The willow will not (yet) be chipped for combustion, but it will provide the raw material for a willow artist."

"We also have a very well-established recycling initiative. This, too, has links to energy, but it is more than simply conservation of raw materials and reductions in the energy required in manufacture," Ken continued. "The money we raise is being sent to Malealea School in Lesotho where it is being used to equip the village with a wind-turbine and solar-electric panels. Both the school and the village as a whole will have access to electricity."

"Our students have been exchanging letters and photos with students in the village for some time. This has been a wonderfully enriching experience and a close relationship

has developed. When the Malealea system is fully operational we hope to establish an internet connection and have video-conferences with the students that we are assisting."

What started out as simply a way to satisfy a curriculum requirement has developed into a cluster of inter-linked projects with a strong underlying pro-environment and sustainability philosophy. From a little trickle of an idea, a mighty river is developing.

Ken is quite clear about the benefits of developing a broad energy theme.

"These projects have increased environmental awareness, knowledge, concern and action by our students well beyond what the staff had expected and which they are required to deliver in the classroom by the National Curriculum."

Ken, now promoted to School Development Manager, is willing to talk to teachers groups on his experiences. He can be contacted at Royston High School, Station Road, Royston, Barnsley, South Yorkshire, S71 4EQ.