If energy can never be destroyed, does it matter how much we use or what we do with it?

We use more energy:

- burning more fossil fuels
- producing and using more things
- making and using more vehicles for transport
- growing more crops and eating more
- chopping down more forests for land to build on.

This means we produce more pollution. This changes the balance of greenhouse gases and our climate changes.

Climate change causes serious heat waves, storms, floods and droughts.

Everyone can help by thinking carefully about energy and how we use it:

- use renewable energy sources that do not pollute our air – such as solar, wind or water
- turn down heating, switch off lights, use less water
- waste less – reduce the amount of things we buy, use and throw away
- reuse as much as possible
- recycle paper, plastic and glass.

Think: reduce, reuse, recycle.

*Visit **'Just a dream?'** on the Science Museum website to see the new design for a 100% reusable car:*
www.sciencemuseum.org.uk/energy/teachers

energy ACTION

Save energy: protect our world, not only for ourselves but for future generations.

bp

BP Educational Service **Website:** www.bp.com/bpes **Email:** bpes@bp.com **Tel:** +44 (0)870 333 0428

energy EVERYWHERE

bp

Energy is inside us and all around us. Without energy nothing would happen. It makes everything work – including ourselves.

Energy can be stored or transferred from one form to another, but it can never be used up.

We use energy to make electricity for light and heat and to power machinery.

Electricity is generated by using the stored energy in things like biomass, fossil fuels, wind and water.

All living things need energy for warmth, growth, repair, reproduction and movement.

Plants use energy from sunlight for growth.

Animals get their energy by eating these plants, or eating other animals that eat plants.

Foods are the energy stores we use to keep our bodies going.

The Sun is the main source of energy

Energy in sunlight is called solar energy

ENERGY CANNOT BE MADE OR DESTROYED

In the end all plants and animals get the energy they need from the Sun.

If we could collect all the sunlight reaching the Earth in one minute, there would be enough energy for the whole world for a day.

*Visit **'An Indian summer'** on the Science Museum website to see how Lalita gets her energy:*
www.sciencemuseum.org.uk/energy/teachers

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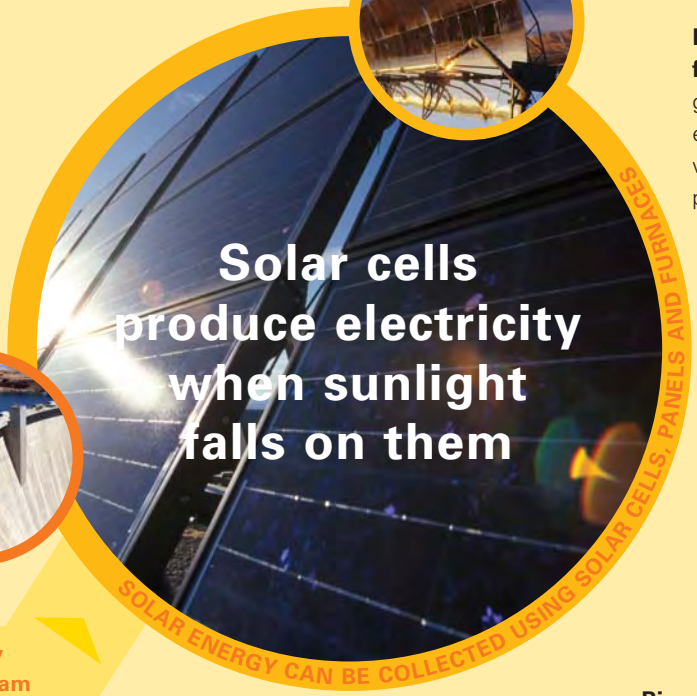
In the future we need to use alternative, renewable energy sources.

Wind: the moving air can be caught by propellers on the wind turbines which generates electricity.

Movement in water: hydroelectric dams can capture the energy of the flowing water; waves and tides can turn turbines to generate electricity.

Non-renewable nuclear energy can heat water to produce steam which drives a turbine.



Mirrors can be used to direct heat from sunlight into furnaces to heat water.

Hydrogen fuel cells: generate electricity which can power cars.

Geothermal heat: hot rocks deep in the Earth heat water to make steam. This can drive turbines and generate electricity.

Biomass: crops, trees, wood and animal waste can be burnt to provide energy.

*Visit **'Earth's biggest suntrap'** on the Science Museum website to see the largest solar power station to be built:*
www.sciencemuseum.org.uk/energy/teachers

energy FUTURES

Different parts of the world have different needs. All the advantages and disadvantages of each energy source will have to be considered.

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energy TODAY

Our world's growing population increases our need for energy: more electricity for light, heat and cooking and power for machines and vehicles.

bp

Fossil fuels are the world's most commonly used energy source. They are stores of energy formed from the remains of plants and animals that lived millions of years ago.

Coal, oil and gas are examples of fossil fuels. As these cannot be replaced easily they are called non-renewable sources of energy.

Fossil fuels are found deep beneath the ocean floor or under land.

Crude oil is of little use when it first comes out of the ground, so is transported by tankers and pipelines to refineries where it is turned into useful products:

- fuel to generate electricity and run machines
- petrol for vehicles
- materials for chemicals and plastics.

*Visit **'From Russia with love'** on the Science Museum website to see how a 3,000 kilometre pipeline is bringing gas from Russia to make electricity:*
www.sciencemuseum.org.uk/energy/teachers

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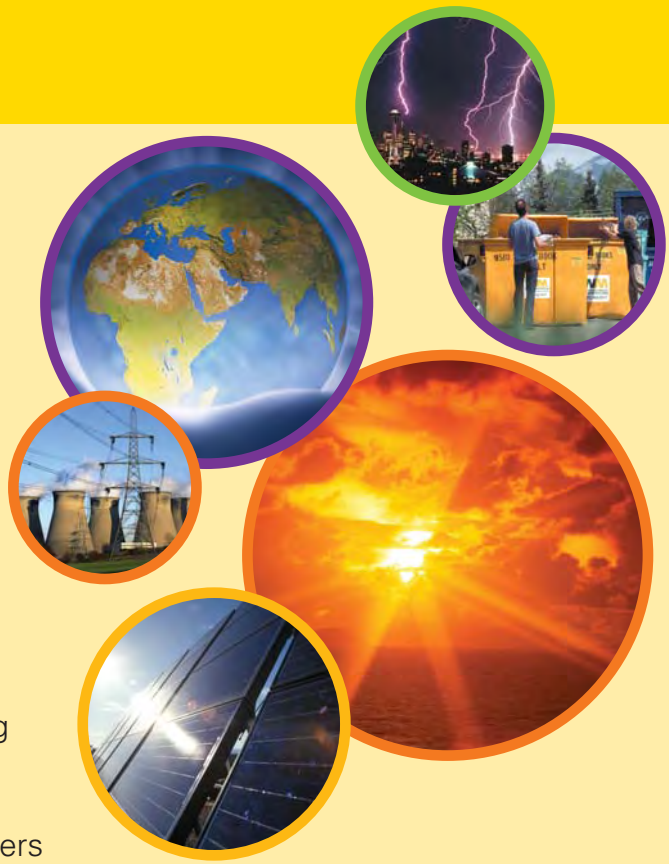
energy

teacher's notes

BP Educational Service

introduction



Energy is all around us and within us, but it can't be seen or touched or tasted. As a concept it is not easy to grasp, making it a difficult subject to teach.

BP as an energy company is keen to help pupils to gain a better understanding of this complex subject.

This resource, consisting of a set of posters and teacher's notes, aims to help young children understand how important energy is in their lives, how we get our energy, how it is used, how it is wasted and what difference can be made by using it wisely.

We have divided the topic of 'energy' into four main areas (as per the four posters) of **energy everywhere**, **energy today**, **energy futures** and **energy action**. This is designed for maximum flexibility of use and methodology. Each poster can be used individually for topics in themselves, progressively to build the story from past to future or collectively as a whole approach. (Displaying these posters will obviously depend on space available!)

BP is the principal sponsor of the Energy gallery at the Science Museum. To find out more about the Energy gallery and related teaching activities visit **www.sciencemuseum.org.uk/energy/teachers**. *The case studies which appear in the following pages are available on this website under 'Energy info zone'. In addition, four of the case studies can be found on pages 20-23.*

contents

energy EVERYWHERE

Energy is everywhere; it's inside us and all around us and without it nothing would happen, nothing would move, nothing would change. You can't really see energy itself, but you can see what it does!

There are two ways favoured in approaching the teaching of energy – the transformation model and the transference model are outlined below.

The transformation model

This takes the idea that energy is transformed into different types of energy.

Many teachers use this methodology for young children and divide energy into eight main types or forms:

- light
- chemical
- thermal or heat
- electrical
- sound
- kinetic or movement
- gravitational potential
- elastic potential.

BP Educational Service 'A day full of energy' resources for 5-7 year olds use this model.

The transference model

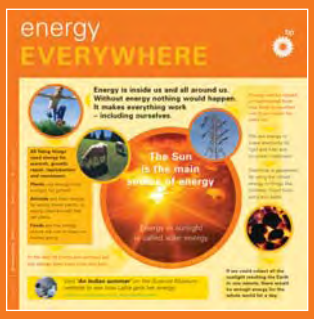
This just accepts that energy exists.

It doesn't mention types of energy, but discusses the idea that energy can be transferred in different ways, stored, conserved or dissipated.

This model takes the premise that we experience the energy in things around us, such as: movement, light, sound etc. and that every transference of energy spreads or dissipates it.

The Science Museum has utilised the transference model for their Energy gallery.

Whichever model you choose to adopt in your teaching, we hope you find this resource of posters and teacher's notes useful and that it will help you tackle the subject enthusiastically.



poster 1 of 4

Key points on the poster

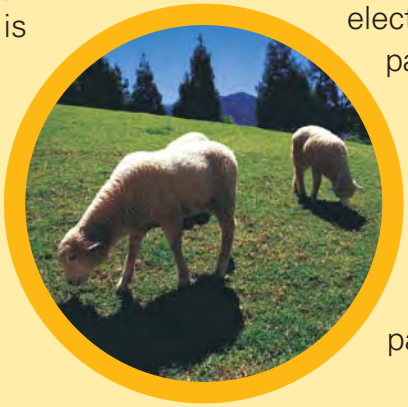
Most of the world's energy comes from the Sun – solar energy – even though some is wasted, bouncing back to space. If we could actually collect all the sunlight reaching the Earth in one minute, there would be enough energy for the whole world for a day.

Energy cannot be 'created' or 'destroyed' but it can be stored or transferred from one form to another.

All living things need energy for warmth, growth, repair, reproduction and movement. Energy comes originally from sunlight.

Plants use the energy from sunlight to carry out photosynthesis (although at this stage the children do not need to know this term). This makes oxygen to respire or 'breathe' (although not strictly), and food (glucose) for growth. This 'food' is an energy store within the plant.

Plant-eating animals get their energy by eating plants that contain the stored energy (these animals are called herbivores).

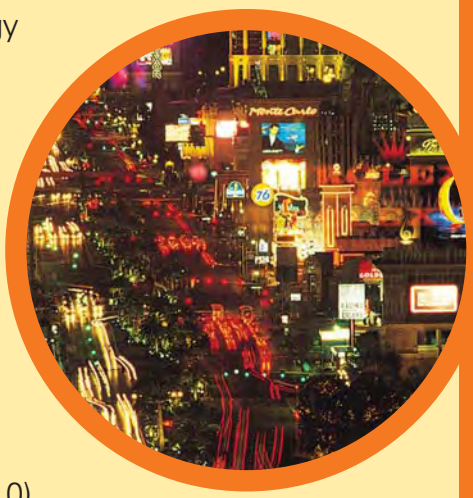


Meat-eating animals (carnivores) get their energy by eating other animals who eat plants. This is a food chain.

All food chains begin with the Sun, then a green plant called a producer. The rest in the chain are called consumers and feeding passes energy from one to another in the chain.

We as humans (animals) get our energy from food too – it gives us strength to grow, run, play, work. We also use energy in sunlight directly, for light and warmth.

Our world is so busy, where so much is constantly happening. Most of the 'work' carried out in our world uses energy in the form of electricity – our light, our heat and much of the power for our machinery and equipment (there is more information on electricity on pages 6 and 10).



We generate electricity by using the stored energy in things like biomass, fossil fuels, wind and water (there is more information on these sources of energy on pages 12-14).

energy EVERYWHERE

We often take our electricity for granted.

In developed countries we only realise how much we depend on electricity when there is a power cut and we have to manage without heat or light.

Many developing countries have very little access to electricity or none at all – their work has to be done mainly using their own energy. Very often these places are where they have very little food for their people and therefore less food means less physical energy.

Think of a world with no electricity, no electric lights, cookers or fridges, no powered machinery, no energy!

Visit the case study 'An Indian summer' available on the Science Museum website.

Extension notes

Light energy

- This is energy given out by any hot object (sometimes cold too!) such as the Sun, a light bulb or a flame.
- We need light to be able to see and plants need it for photosynthesis.

Heat (thermal) energy

- This is energy in a warm or hot object, e.g. burning wood or hot water.
- We need heat to keep warm, for fires, for radiators or to cook.

Sound energy

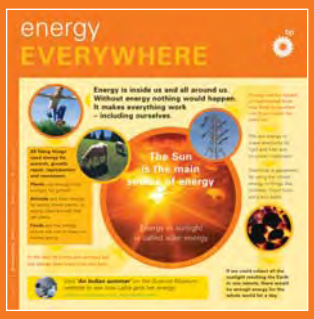
- This is energy made by anything that vibrates, e.g. our vocal chords, a guitar string or a drum.
- We use sound to communicate.

Electrical energy

- This can be natural (in lightning) or generated, such as in a power station or stored in batteries.
- We use electricity for nearly all our household appliances, our lighting and many machines.

Chemical energy

- This is energy associated with fuels such as coal or oil or any of our food.
- We need fuel to 'burn' (undergo a chemical change) in order to release the stored energy to drive – vehicles or machines or enable our bodies to grow or move.



poster 1 of 4

bp

Elastic potential energy (strain energy)

- This energy is when something is stretched or twisted or compressed, which has the ability to return to its original size or shape (elastic).
- Catapults, springs or long bows all have this energy.

Gravitational potential energy

- This is energy an object has if it is dropped or falls or slides from a height (without the 'pull down' of Earth's gravity everything would float up and away).
- Rain dropping, apples falling or skiers coming down slopes all 'use' this energy.

Movement (kinetic) energy

- This is energy in anything moving, e.g. a ball rolling, a windmill turning, the flow of water or a person running or jumping.

Energy measurement

An Englishman, James Joule, discovered a way to measure energy and a measure of energy today is a joule (J). This is the same unit to measure 'work done' – when an object moves or electricity flows or an object is heated.

Suggested extension ideas

- Food chains/feeding relationships in habitats
- Healthy eating/energy foods/ balanced diets/food packets, kJ (kilo joules), kcal (kilo calories), energy chains
- Energy stores/energy changers
- Forces and their effects
- Light spectrum
- Comparison of developing/ developed countries.

Links to BP Educational Service resources at www.bp.com/bpes

'A day full of energy' range of resources.

Further links into the Science Museum Energy gallery at

www.sciencemuseum.org.uk/energy/teachers

Teachers: **Activities for the classroom**
- Energy pairs
- Follow the energy path
- Roller-coaster ride

Quiz link: **Energy**

Energy info zone:
Stories
- An Indian summer

Watch
- Biomass power
- Bug batteries
- Energy is everything

energy TODAY

There has been a population 'explosion': it was roughly 1830 before the world's population reached 1 billion, but in the following 100 years (1831-1930) the population doubled. By the year 2030 it is expected that the population will have reached a staggering 9 billion!

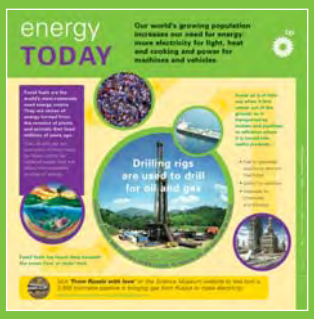
Key points on the poster

This increase in population has led to a huge increase in our need for energy. We have more mouths to feed, therefore we need more food (energy stores), which means growing more crops and rearing more animals. (See page 17 for more information on our need for more land for farming together with its effects.)

We use huge amounts of energy today to run our homes, our schools, our industry and our transport.

Much of this energy comes from coal, oil and gas (called fossil fuels). These are the world's most commonly used energy sources – either directly by burning (for light, for cooking and for warmth) or used to generate electricity to power our machines or fuel our vehicles.

Fossil fuels are stores of energy, formed from the dead plants and animals that lived many millions of years ago. These were gradually buried and compressed under layers of sediment. The pressure and heat slowly changed the sediment into rock and the dead plants and animals into fossil fuels. Once these have been used up they cannot be replaced within a human timescale. They will therefore eventually run out and are called **non-renewable sources of energy**.



poster 2 of 4

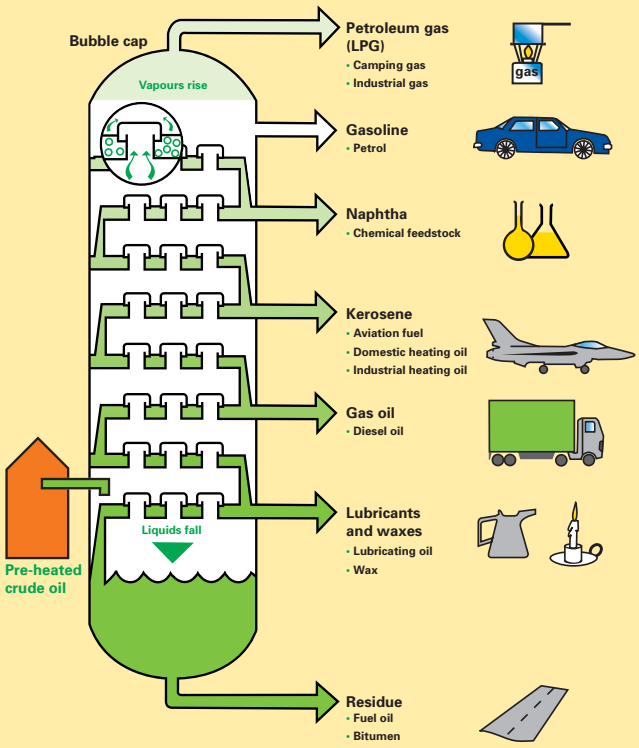
Exploring for oil and gas is not easy. In the early days geologists studied rocks, fossils and landforms for clues. Today more advanced techniques are used, like seismic surveys, which use sound waves and computers to analyse the data.

Different types of drilling rigs are used to drill for the oil and gas, depending on whether the 'field' (area containing the oil or gas) is deep beneath the ocean or under land.

When the 'oil' comes out of the ground, it is called crude oil and is of little use in that form – it needs to be separated into different 'materials' or products to make it useful. **This is done at a refinery**.

At the refinery the different parts of the crude oil are separated by fractional distillation. This is possible because they all have different boiling points. (See diagram shown opposite.)

Fractional distillation



Refineries are often close to major centres of population, where the demand for oil or gas and their products is highest. This means that the oil and gas have to be transported from the oil rigs to the refinery – often many miles away.

This is usually done by major pipelines or tankers – depending on whether the 'field' or 'find' is below land or sea bed.

Find out more about the 3,000 km pipeline bringing gas from Russia to make electricity.

Visit the case study 'From Russia with love' available on the Science Museum website.

energy TODAY

Extension notes

Electricity

A flash of lightning in the sky is electricity formed naturally.

We can get electricity from batteries, but most of our electricity is made in generating stations.

Electricity is said to be 'generated' not 'made' – as it's a form of energy, not a 'material'.

Electricity is our most convenient form of energy; it is simple to produce, is clean and silent in use.

Modern life for most of us would be hard to imagine without electricity: our lights, televisions, fridges, computers that link so many of our services, as well life saving hospital equipment, all use electricity.

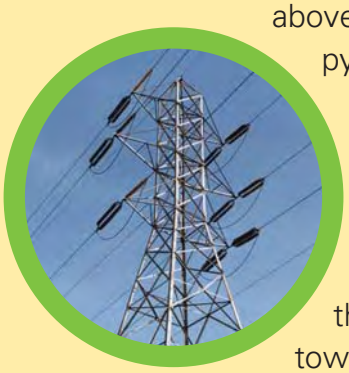
Electricity generation

When fossil fuels are burnt (although alternative energy sources are used in some areas, see notes on pages 12 and 13) they release heat energy, which boils water, turning it into steam.

This steam is forced through turbines, which are like large fans. As they turn, the turbines generate electricity. This electricity is then used as a source of energy.

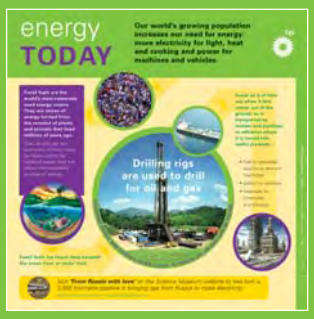
At the power station the electricity is fed into a transformer, which makes the electricity stronger, in order for it to be sent over long distances, to be used in cities, towns, villages and hamlets.

The electricity (the flow of energy) travels along large cables held high above the ground on pylons. The electricity is then fed into other transformers, which make it weaker and safer to use. Small pylons then carry the electricity to towns and villages.



In towns the electric cables go under the ground, bringing the electric current into our homes. It enters through a fuse box, which is a safety device. Wires under the floorboards or in our walls carry the electricity to sockets.

We can then plug in our 'electrical appliances', switch on, and the energy goes into the appliances to make them work.



poster 2 of 4

Each time we use an appliance, the same amount of energy flows out of them as flows into them. This is known as 'conservation of energy'. However, each time energy is transferred (from one form to another or one use to another – this is the same with our bodies as well as the things we use) some is wasted – sometimes as sound, but mostly as heat (into our surroundings – the buildings in which we live and work, the air and the outdoors). This spreads out and cannot easily be used again.

Suggested extension ideas

- Rock formation/rock cycle
- Study of fossils/timelines
- Formation of fossil fuels/other non-renewable sources
- Population increases/country differences
- Developing countries use of fuel
- Electricity generation/national grids
- Electric circuits, magnetism etc.
- Usage of electricity in home
- Energy chains.

Links to BP Educational Service resources at **www.bp.com/bpes**

- A day full of energy
- Rock, fossil and oil products boxes
- The Energy Business booklets (for older pupils, but has interesting facts)
- The Energy posters (again for older pupils).

Further links into the Science Museum Energy gallery at

www.sciencemuseum.org.uk/energy/teachers

Teachers: **Activities for the classroom**
- Oil and water just don't mix
- Sandy layers

Quiz link: **Energy today**

Energy info zone:

Stories
- Biscuits in Baghdad
- Deep, dark places
- Earth's largest floater
- From Russia with love
- Infernal combustion engine
- Trapped in the dark

Watch
- Cool coal appear
- Engines in action
- Oil and gas appear

energy FUTURES

At the moment the majority of the energy we utilise every day, through electricity, is from fossil fuels. Fossil fuels are non-renewable and will eventually run out (see page 8 for further information)**.**

If there were no more fossil fuels we would have to find an alternative for the future. We should start planning now to find and use alternative renewable sources that best suit our growing needs. This is important not only for ourselves, but also for our future generations.

Key points on the poster

The main alternative, renewable sources of energy to fossil fuels are:

Solar energy

There are several ways that sunlight can be utilised:

Solar panels

The energy in sunlight can be used directly to heat up material, that in turn can heat water – this method is still widely used in hot, developing countries.

Solar furnaces

Using many mirrors to direct the heat from sunlight onto a water tank, these furnaces boil and produce steam which can drive turbines.

Solar cells (photovoltaic cells)

The energy from sunlight can be used in solar cells to produce electricity. Solar cells are common in calculators or in satellites. In hot countries many of these cells are joined into panels to generate power for houses, refrigeration of drugs, water pumping, etc.

At the moment though, solar cells are an expensive way to produce energy, and of course are more effective in sunnier, hotter places.

To find out about the largest solar power station to be built, visit the case study 'Earth's biggest suntrap' available on the Science Museum website.

Wind energy

Wind is caused by the Sun heating up air in some places, more than others. As the hot air rises, the cool air moves into its place, causing movement.

People first made use of the power of the wind by hoisting sails on boats, later it was harnessed to turn the blades of windmills, driving millstones to grind corn or pumps to raise water.

poster 3 of 4

Modern windmills are called **wind turbines**, because the blades turn a turbine which generates electricity.

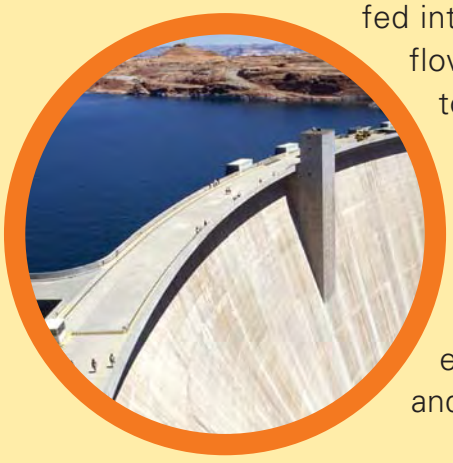
If many of these wind turbines are placed together in exposed areas they make up a **wind farm**.

Although there is no pollution, the amount of electricity produced is dependent on how much wind there is, so it's more useful in windier places. Local residents sometimes complain, saying they are noisy and spoil the scenery.

Energy in water

There are all sorts of ways that movement in water can be collected (harnessed).

Hydroelectric dams built across rivers capture the energy in the flow of the water downhill, to drive turbines. Rain water falling high in the hills can be trapped in reservoirs, which can be fed into pipes to flow down to turbines. There is no pollution, but it can have an impact on the environment and habitats.

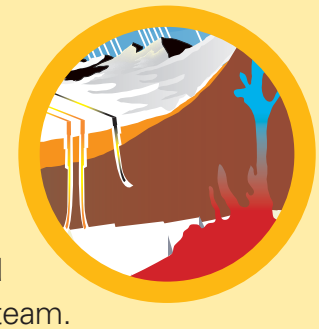


Waves (caused by wind blowing across the sea) can be used by making the rocking movement drive generators. This can sometimes be unreliable as waves tend to die out when the wind drops.

Tides (caused by the pull of the Moon on Earth), mean the movement or flow of water can be trapped behind barriers. The flow back can then be used to turn turbines and generate electricity. The tides are reliable as they happen twice a day, but the barriers can spoil the view, alter habitat and stop boats from having free access.

Hydrogen energy

New methods are being introduced using the hydrogen in water. (When hydrogen and oxygen join together they make water.) Electricity can be generated when this happens in a fuel cell. However, this is still very new technology and is expensive, but it could be a way forward in the future.



Geothermal energy

If water is pumped to hot rocks deep beneath the Earth's surface, it can be heated and piped back to the surface as steam. This can then drive turbines and generate electricity. It can be expensive to drill down deeply, so it is best when the hot rocks lie fairly near the surface.

energy FUTURES

Biomass energy

Biomass is any plant or animal, or waste material that can be burnt as a fuel. These can be burnt in power station furnaces, to produce the steam to power the turbines and generate electricity. If fast growing trees are replanted and grown as quickly as they are harvested, then they will never run out (but this isn't the same for chopping down and burning trees from the rainforests, as they take much longer to grow). However, there is some pollution given out from this process.

Extension notes

Nuclear energy

Although only briefly mentioned on the poster (as it is a non-renewable source of energy), you may want to introduce nuclear energy as an alternative source in your discussions. Radioactive materials (e.g. uranium) give out a lot of energy when they undergo a nuclear reaction. In nuclear power stations this energy is in the form of heat; it heats water, which turns into steam, turns turbines and generates electricity.

The problem with nuclear power is the nuclear waste, which remains radioactive for centuries. If not dealt with properly, this can contaminate water supplies and affects the food chain.

In the past radioactive materials have, through accidents, escaped into the atmosphere, causing health problems in animals and people. However, fewer people have died as a result of nuclear power than as a result of coal power. Many scientists believe that nuclear energy is the answer for the future.

Developing countries

Countries around the world vary greatly in their stage of development. We tend to call industrialised countries (with the infrastructure of electricity generation, industry, transport and communication) **developed**. As they continue to develop they are able to look at alternative ways to run their countries, how they might lower pollution etc. However, there are still many poorer countries, which we call **developing countries** who for many reasons – such as over population, lack of natural resources, war or natural disasters – have not got a developed infrastructure. In years to come these countries will not have the luxury to look for so called 'alternative ways' – they still need to actually develop the methods of electricity generation, industry, transport and communication. For many, the use of fossil fuels will be the main route for electricity generation.

Our energy future will very much depend on the country in which we live, where in the country we live and which source is best suited to the needs of that country.

poster 3 of 4

Suggested extension ideas

- Industrial revolution
- Renewable energy resources
- Weather/parts of world/climate
- Solar cells/light experiments
- Wind experiments
- Scientists/research
- Forces
- Temperature/experiments
- States of matter solid/liquid/gas
- Habitats/food chains
- Advantages/disadvantages of each power/energy source
- Power stations
- Nuclear energy.

Links to BP Educational Service resources at **www.bp.com/bpes**

- Solar kit
- A day full of energy
- Retail site poster
- Climate change poster and leaflet
- The Energy Business booklets – Gas, power and renewable energy (in particular for older pupils).

Further links into Science Museum Energy gallery at

www.sciencemuseum.org.uk/energy/teachers

Teachers: **Activities for the classroom**
- Hot rocks
- How strong is that wind?
- Moon and tide picture
- Solar oven
- Wave in a bottle
- Windsock

Quiz link: **Energy futures**

Energy info zone:

Stories
- Amazing Amazon (solar)
- A mighty wind (wind)
- At vast expense (water)
- Electric wonderland (hydrogen)
- Earth's biggest suntrap (solar)
- Magic bus (hydrogen)
- Moon power (tidal)
- Riding the waves (wave)
- Way over your head (solar)

Watch
- Geothermal power
- Greenhouse effect
- Hydro power
- Hydrogen power
- Solar power
- Top tidal power
- Wicked wave power
- Wind power

energy ACTION

We are causing our world to overheat and this is damaging our planet.

We all need to act now to make a difference.

Key points on the poster

Earth has many 'climates' depending on where you are in the world. Climates are hotter and drier for regions nearer the equator, than near the Poles.

Climate is affected by changing weather patterns. Weather can be affected by **natural and human activity**.

The overall temperature of our Earth is really a balance between heat coming from the Sun in light energy, and the heat bounced or radiated back into space.

Around our Earth is a layer of gas called the atmosphere, which keeps some of the heat in, like the glass in a greenhouse lets the Sun's light shine in, and then keeps most of the heat in.

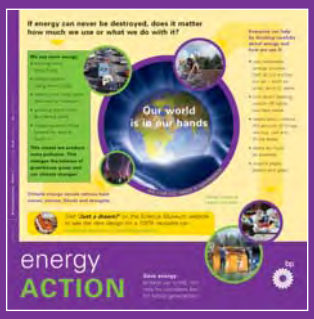
The gases that are good at keeping heat in the atmosphere (such as methane and carbon dioxide) are called **greenhouse gases**.

If anything happens to upset the balance of these gases, then the Earth warms up and weather patterns change.

We can't do much about natural causes of weather change – such as volcanoes, earthquakes, tidal waves, affecting ocean currents etc. but we can look at what human activity does to change things.

As we've already seen on (page 8) there has been a huge increase in population in our world and **we are using more and more energy**:

- **we are burning more and more fossil fuels** for heat and warmth, electricity generation and products (such as plastic)
- **we are producing and using more and more things every day**, which are often unnecessary, and are used once and thrown away



- **we are using machinery more and more** to build roads and many more cars that need petrol and oil to work
- **we are growing more crops, rearing more animals** for food, plus eating more than we really need (in developed countries this is often a problem leading to unhealthy diets and obesity)
- **we are chopping down more and more forests** for timber to use as furniture or as fuel or to clear the land to build on. When this happens in the rainforests, (which take years to grow) this means we are losing what are often called the lungs of the world.

When all of the above happens and energy is used to carry out the work, **increased greenhouse gases such as (carbon dioxide and methane) are produced**.

When all these extra greenhouse gases go into our atmosphere it changes the balance, and this changes the weather patterns and causes **climate change**.

There are many ways climate change can affect us: more extreme weather such as storms or heat waves; water shortages and droughts; rises in sea level; less agricultural

produce because of the weather; loss of some of the world's habitats, plants and animals etc.

We know much of this depends on our use of energy. As energy can never be destroyed we tend to take its use for granted. **We need to think more carefully about how we use it**.

One of the first areas that governments are looking into are ways to **stop the levels of pollution increasing**. In those areas where fossil fuels are used, ways are being found to limit the amount of carbon dioxide that gets into the air.

Visit the case study 'Trapped gas' available on the Science Museum website.

Alternative energy sources are being used to generate electricity, where possible: solar, wind, water, (see pages 12-13).

Individual businesses are being asked to reduce their waste and pollution.

Locally there are many schemes to cut down the use of cars that, because they use petrol, produce a lot of pollution (many car users also turn to using cleaner petrol). Public transport – buses, trams, trains – are all encouraged or car sharing on journeys.

Every one of us can really make a big difference by saving energy and wasting less – every day in everything we do.

energy ACTION

Remember

REDUCE – REUSE – RECYCLE

Reduce

- We can certainly reduce the huge amounts we eat (eat healthy balanced diets and not too much). Many take-away foods are less healthy and have huge amounts of packaging as waste – think of the energy that has been used to make the paper, the cartons, the plastic cutlery etc. and the energy it will take to get rid of the waste!
- If we only buy what we really need then we will throw less away.
- We should turn down thermostats, close curtains and blinds at night to reduce the loss of energy through windows.

- We can turn off the lights or electrical items when we are not using them.
- Use less water in baths or take showers.

Reuse

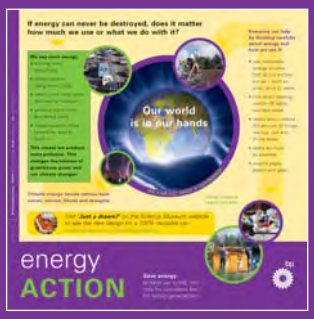
- We should think about repairing/ mending things, before we throw them away and buy new items.
- Reuse as much as possible – carrier bags, scrap paper, washable plates and cups.
- Use rechargeable or renewable things rather than disposable.
- Donate as much as possible to charities or community groups to reuse items such as furniture, furnishings, clothing.

Recycle

- First try to buy items that are already made from recycled materials.
- Separate all your rubbish and waste, so as much as possible can be easily recycled:
  - lots of kitchen waste can be used as compost for vegetable and flower gardens
  - paper, bags, tissue, newspapers, magazines
  - glass, containers, bottles etc
  - cans.

- Look for where your nearest recycling centre is, if you don't have your rubbish collected separately. Computers, phones, TVs, radios and clocks can all be recycled or donated to local charities.

Saving energy is important. We need to protect our world – not only for ourselves but for future generations.



poster 4 of 4

Suggested extension ideas

Pollution – affects on humans, animals, plants, buildings

Weather and climate

Global warming

Developing countries

Deforestation

Farming

Transport

Recycling.

Links to BP Educational Service resources at **www.bp.com/bpes**

A day full of energy

The Energy Business booklets – BP and the environment (in particular for older pupils)

Renewable energy video

Retail site poster

Climate change poster and leaflet.

Further links into Science Museum Energy gallery at

www.sciencemuseum.org.uk/energy/teachers

Teachers: **Activities for the classroom**

- Lagging the boiler (preventing waste)
- Pay-me game (use of energy)
- Sail-car (wind)
- Water purifier (muddy to clear)

Quiz link: **Energy action**

Energy info zone: **Stories**

- BedZed des res (house of future)
- Is it getting warmer? (global warming)
- Just a dream? (reusable car design)
- The energy trap (greenhouse gases)
- The enforcers (India waste checks)
- Trapped gas (Sleipner project)
- Trees R us (planting trees)
- Use it wisely (American recycling)

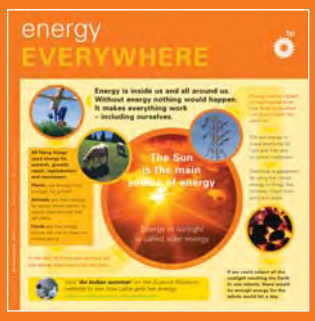
Watch

- Biofuels being made
- Greenhouse effect
- Storing carbon

energy EVERYWHERE

case study

poster 1 of 4



An Indian summer

Hello, my name is Lalita. I live in India.

Our farm is miles away from everywhere. I have to walk to school and to the market. I don't mind walking, except when the buses go past.

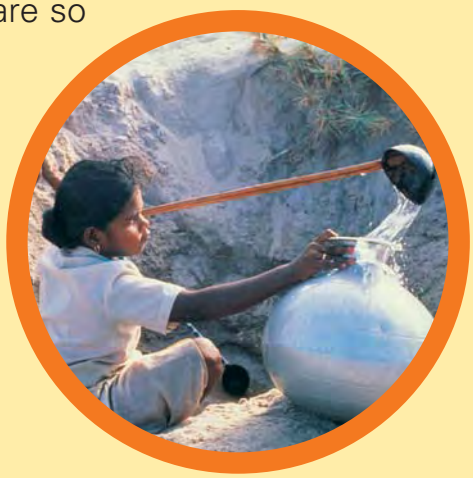
They're very old and run on petrol. Horrible smoke and fumes come out of their exhaust pipes. This pollution is really smelly.

My house is made of bricks with a tiled roof. There are two rooms.

We all sleep in the big room. Mum cooks in the small room using a wood fire. We don't have enough wood to heat water to wash in, so I wash under the pump in the yard.

The water is cold but quite refreshing. Sometimes I pretend I am an actress in a movie and I sing about washing my hair.

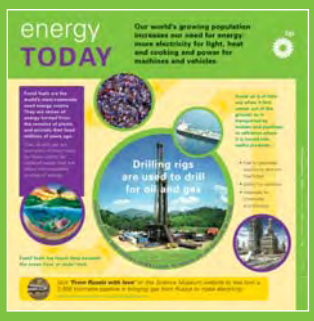
School is boring. We sit outside because there are so many pupils and it is so hot. We don't have any electricity so there are no fans.



After school I collect firewood or help Mum with dinner.

When it gets dark we light our kerosene lamp, which lights our room with a bright flame. Mum sings and Dad tells stories, but they aren't as good as mine.

Find this resource on the Science Museum website.



From Russia with love

The UK discovered gas under the North Sea in the 1960s.

We now use it to make electricity, heat our homes and cook our food. But we've almost used it all up. Soon we will have to buy gas from other countries.

Russia has more gas than any other country in the world. It can make a lot of money by selling the gas it doesn't need, and it will soon be selling some of it to us.

A special pipeline is going be built that will bring gas all the way from Russia to the UK.

When the pipeline is finished it will be 3,000 kilometres long. It will carry the gas across Russia, under the sea into Germany, across the Netherlands and finally go under the North Sea and into power stations and homes in the UK.

It will take until about 2007 to finish building this pipeline. It will cost at least £3 billion to build. It will be able to carry nearly 20 billion cubic metres of gas per year – that's enough to fill 8 million swimming pools.

It's expensive, but can you think of any other problems to do with building such a large pipeline?

Find this resource on the Science Museum website.

Earth's biggest suntrap

Almost all of the energy on Earth has travelled to us from the Sun as sunlight. Scientists have designed a device, called a solar panel, which can turn sunlight into useful electricity.

It produces the most electricity on sunny days, but can still produce some electricity on cloudy days.

By using solar panels it's possible to build power stations that only use the energy coming directly from the Sun to make some of the electricity we need. Quite a few of these have already been built.

The largest solar power station to have been built so far is on a site near a town called Regensburg, in Germany.

It is equipped with 32,740 solar panels and was built in just 12 weeks.

A new and even larger solar power station is going to open soon, and it will also be in Germany.

When it's finished it will become 'the largest solar power station in the world'.

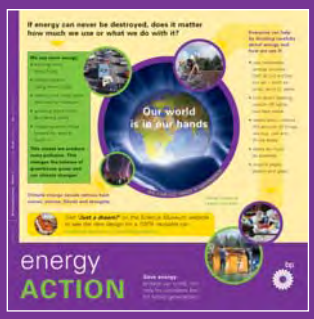
It will have 33,500 solar panels, but will only make enough electricity to power about 1,800 households or a village.

Best of all, it won't cough out any pollution because solar power stations cause almost no harm to the environment.

Find this resource on the Science Museum website.

energy ACTION case study

poster 4 of 4



Just a dream?

Ideas on energy saving and recycling have been around for a while now. But recently a new movement has developed around the idea of sustainability.

Sustainability is about designing products that have no impact on the Earth or – even better – actually repair our environment and store energy for the future.

The normal life cycle of a product goes from cradle to grave; from its creation to being thrown on a rubbish dump. Sustainable products have life cycles from cradle to cradle – they are 100–per–cent reusable.

The Model U is a new design of car that aims at sustainability.

Its engine, which is lubricated with sunflower oil, burns hydrogen instead of petrol, so it doesn't pump out any climate-changing gases.

The roof is made from corn, so it can be turned into compost, and the seating foam is based on soy.

The car is still at a very early stage in its development, but its designers hope that one day we'll all be driving vehicles made in this way.

A sustainable future is one that doesn't affect the ability for future generations to have the energy supplies they need. Is it just a dream?

Find this resource on the Science Museum website.

glossary

Advantage	Something or some action that gives a benefit or a good result.
Amps (A) for current	A measure of the flow of energy.
Biomass	Crops and trees or animal waste used as fuel.
Carnivores	Animals that only eat other animals.
Climate	The weather in an area, over a long period of time.
Climate change	Long term changes in the expected climate of an area.
Disadvantage	Something or some action that gives a poor or a bad result or ends in a loss.
Drought	A long period with little or no rainfall.
Electricity	A flash of lightning in the sky is electricity formed naturally, but most of our electricity is made in generating stations – the power to give us heat, light, sound and drive machinery.
Energy	The power to make things work.
Flood	The overflow of water from rivers or sea, onto land that is normally dry.
Food chain	A series of living things, each of which eats the living thing lower in the series.
Fossil fuels	Stores of energy formed from the remains of plants and animals that were alive millions of years ago. Coal, oil and gas are fossil fuels.
Furnaces	Large enclosed fires used for producing hot water or steam.
Generate	To make or produce electricity.
Geothermal	Heat from deep inside the Earth which can be used to generate electricity.
Greenhouse gases	Gases that are good at keeping heat in the atmosphere such as carbon dioxide and methane.
Habitat	The natural home of a group of plants and animals.
Harness	To collect and use.
Herbivores	Animals that only eat plants.
Hydroelectric	Generating electricity through the power of falling/flowing water.
Hydrogen	A colourless, non-toxic, odourless, tasteless gas, which burns easily to form steam when combined with oxygen.
Joules (J) for energy	Unit of energy.
Non-renewable	Not able to be renewed or replaced, so will eventually run out.
Pollution	Substances in air, water or soil which are harmful to living things.
Recycle	To turn something that has already been used, back into another useful product.
Reduce	To use less.
Refinery	Where crude oil is separated into different materials for different users.
Renewable energy	Energy from sources that can be easily replaced and do not run out, e.g. solar, water, wind.
Reuse	To save and use things again.
Solar energy	Energy from the Sun.
Transference model	The idea that energy is just transferred, passed on, stored or conserved.
Transformation model	The idea that energy is transformed, changed into different types or forms of energy.
Transport	To carry from one place to another.
Turbine	A wheel/set of blades or propellers turned by the power of wind, water or stead.
Voltage	Electrical force measured in volts.
Watts (W) for power	A unit of power (1 watt = 1 joule per second).

curriculum links

The energy posters and teacher's notes link into Science/Geography and Environmental Studies in all the UK Curricula, and are shown listed below. However, History, English PSHE/PSD and Citizenship can also be interlinked within the topics covered.

England and Wales

Science key stage 2-3

- Scientific enquiry
  - ideas and evidence
  - investigative skills
    - planning
    - obtaining and presenting evidence
    - considering evidence and evaluating
- Knowledge and understanding
  - life processes and living things
    - life processes
    - humans and other animals
    - green plants
    - variation and classification
    - living things in their environment
  - materials and properties
    - grouping and classifying materials
    - changing materials
    - separating mixtures of materials
  - physical processes
    - electricity
    - forces and motions
    - light and sound
    - the Earth and beyond
  - energy resources and energy transfer (KS3)
  - conservation of energy (KS3)

Geography key stage 2-3

- Geographical enquiry and skills
- Knowledge and understanding of places
  - places
  - patterns and processes
  - environmental change
  - sustainable development
  - weather and climate (KS3)
  - ecosystem (KS3)
  - economic development (KS3)
  - sources and supply of resources (KS3)

Northern Ireland

Science and Technology key stage 2-3

- Investigating and making
  - planning
  - carrying out and making
  - interpreting and evaluating
- Knowledge and understanding
  - living things
    - ourselves
    - animals and plants
  - materials
    - properties
    - change
    - environment
    - energy (KS3)
- Physical processes
  - energy transfer and conservation (KS3)
  - forces and energy
  - electricity
  - sound
  - light

Geography key stage 2-3

- Geographical skills
  - observe, measure, present
- Weather
  - differences between places with contrasting weather conditions
  - effects of weather on the lives of people here and elsewhere
- Where people live and what people do
  - similarities and differences
  - provision of services
  - raw materials to consumer
  - lack of resources
- The environment
  - habitats
  - importance and use of natural resources
  - ways in which people affect the environment
  - conservation
    - physical environments (KS3)
    - rocks landscape (KS3)
    - weather and climate (KS3)
    - ecosystems (KS3)

Scotland 5-14

Environmental studies

- Skills
  - preparing for tasks
  - carrying out tasks
  - reviewing and reporting
- Developing informal attitudes
  - commitment to learning
  - respect and care for self and others
  - social and environmental responsibility

Social subject

- Knowledge and understanding
  - people in past
    - change and continuity
    - historical sequence
    - evidence
  - people and place
    - physical environment
    - human environment
    - human physical literacy
  - people in society
    - needs
    - rules, rights, responsibility
    - decision making

Science

- Knowledge and understanding
  - Earth and space
    - Earth in space
    - materials from Earth
    - changing materials
  - living things/processes of life
    - characteristics
    - processes of life
    - interactions with environment
  - energy and forces
    - properties and uses
    - conversion/transfer
    - forces

Technology

- Knowledge and understanding
  - technological capability
    - needs and how they are met
    - resources and management
    - applying processes

Science Museum
Energy - fuelling the future

Science Museum

Although energy is all around, it can't be seen or touched, making it a difficult subject to teach. BP is the principal sponsor of a new gallery at the Science Museum which aims to help young people explore how energy powers every aspect of our lives. It gives hands on opportunities to discover and question the latest ideas on how we'll help to meet the planet's growing energy demands in the years ahead.

The gallery features an exciting range of computer-based exhibits and novel interfaces, including spinning drums and dance-floor footpads and covers key themes for 7-14 year olds in Science, Geography, PSHE/PSD and Citizenship.

science museum

Maximising the learning experience

School visits are free, bookable in advance and the whole educational experience is enhanced by a briefing and de-briefing from highly trained museum 'Explainer' staff.

For more information on booking a visit for your school, contact the Education Booking Officer at the Science Museum:

+44 (0)20 7942 4777

Website and teacher's resource

The Energy gallery is supported by a website which offers related classroom activities, quizzes and an information database, making the majority of the gallery content available to all – as well as offering support to school audiences before and after a visit.

The online teacher's activities cover many curriculum areas including Science, Design and Technology, English, Geography, Citizenship, PSHE/PSD and Art. They have been specifically developed to match the requirements of the National Curriculum for England and Wales, Northern Ireland and the Scotland 5-14 Teaching Guidelines.

Visit the websites through the links below.

www.sciencemuseum.org.uk/energy
www.bp.com/energyproject

BP Educational Service
Resources

A day full of energy resource pack

The energy business booklets

A day full of energy poster set

The energy for the world video series

A day full of energy boardgame

Climate change poster and leaflet

Living with traffic resource pack

For our full range of resources and free catalogue or more information please see our website at **www.bp.com/bpes**

Acknowledgments: Grateful thanks are extended to all the teachers and pupils who helped in the development of this resource and to the Science Museum.

For further information please contact:

BP Educational Service (BPES)

PO Box 635, Harrow HA1 2GU, United Kingdom

Tel: +44 (0)870 333 0428 **Fax:** +44 (0)870 333 0131 **Email:** bpes@bp.com

Alternatively, visit our website at **www.bp.com/bpes**

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