ACTIVITY 1
Hot and Cold Spots in the Classroom

Aims

- To increase pupils' awareness of the reasons why areas of a room can be either hot or cold.

Learning Objective

- Pupils will be able to competently use room thermometers to measure temperatures and interpret results.

Curriculum Links

Science: Experimental and Investigative Science
Geography: Graphical Representation of Environment
Mathematics: Using and Applying Mathematics

Equipment Needed

Squared or graph paper
Room thermometers

Classroom Activity

Give each pupil a piece of graph or squared paper and ask them to draw a plan of the classroom on the paper, from a birds eye view, and decide which areas of the room would be the hottest and the coldest. Ask them to mark these spots on their plan; H depicting a hot spot, C depicting a cold spot.
Give out room thermometers and ask the pupils to measure the air temperature in these hot and cold spots. Areas of the classroom could include:-

- near the windows
- near the heater
- on the floor
- inside a cupboard
- by the door

Ask the pupils to record the temperatures. Ask the pupils to take regular readings to see how the temperatures change. Where their original guesses correct?

Discuss with the class how they can make best use of the hot spots and warm up the cold spots. If time, ask the pupils to draw a new layout of the classroom that makes best use of the hot and cold spots. Allocate about 45 minutes to one hour for this activity. It is best to do this activity in the morning, before the school warms up, to get greater temperature differences.

Additional Information

The warmest spots in the room are likely to be:-

- near windows if the sun is shining
- near heat sources
- in sheltered places
- in the centre of the room rather than at the edges

The coldest spots in the room are likely to be:-

- near draughty doors
- near extract fans/air bricks
- near windows if it is a cold day or they are draughty
- near cold walls

We can make best use of the ‘hot spots’ by moving desks and classroom furniture to take full advantage of the ‘free heat’. We can warm up cool spots by draughtproofing the doors and putting a shelf above the heat source (radiator).

ACTIVITY 3
Using Electricity Wisely in the Home

Aims

- To increase pupils' awareness of the efficient use of electrical appliances in the home.

Learning Objective

- identify the most expensive electrical appliances to use in the home
- calculate the running costs of particular electrical appliances.
- suggest four ways appliances can be used more efficiently in the home.

Curriculum Links

Science: Materials and Properties

Equipment Needed

Set of cards for the energy guzzlers game

Classroom Activity

Ask each pupil to list all the electrical appliances they use at home and circle all the ones they think are most common in people's homes. Discuss their answers. Allocate 10/15 minutes for this activity.

Ask each pair or group to choose two off their list which they think you as their teacher used in your home when you were their age. Draw a chart on the chalk board to show your answers – for example:

Did you have one of these appliances at home when you were our age?	**Do you have one now at home?**	
Microwave	no	yes
Video Recorder	no	yes
Lightbulb	yes	yes
Ansaphone	no	yes
Cooker	no	yes

This exercise shows that our use of electrical appliances has increased over the years. You may want the pupils to do this exercise at home and interview their parents or carers as part of their homework.

In their groups, ask the pupils to decide which electrical appliances do they think are the most expensive to run. Ask them to record their answers (Number 1 being the most expensive, Number 2 being the next most expensive and so on). When they have completed this task, give each group a pack of cards showing names or pictures of common electrical appliances used in the home and ask them to test their answers by playing the game.

To prepare for this game, make up one pack of cards by photocoping the appliance sheet four times and cutting up the sheets to make 52 cards. If you have five groups of children playing the game, you will need to make up 5 sets of cards. On the cards, you will see that some have a number written on them (4,3,2,1) - these represent the most expensive electrical appliances that people use in the home. 4 is the most expensive which is the electric immersion heater, 3 is the next most expensive, the electric fire, 2 is the next, the freezer and 1 is the next, the washing machine. By playing the game, the pupils quickly begin to see which are the real Energy Guzzlers in the home.

When you have given each group a set of 52 cards, ask the pupils to deal the pack out between themselves and place their cards face down in front of them. The first player turns their top card over and places it down to make a pile in the centre of the table. If the first player places down a card with a number on it, then the next player has to place that number of cards on top e.g. if the first player puts down a card that says freezer (2) on it, the second player must put 2 cards down on top. If both of these cards are not numbered cards, then the first player wins the cards laid down and adds them to his/her hand. If one of these cards has a number on it, then the third player must put down that stated number of cards. If the third player does not put down a numbered card, then the second player wins the cards laid down and adds them to his/her hand. The winner is the player who ends up with all the cards in his/her hand.

At the end of the game, ask the pupils to write down the four appliances that are the Energy Guzzlers and the most expensive to use in the home. From the game, the card which they had to put 4 cards down on top of, is the most expensive, the electric immersion heater, the next in line is the electric fire then the freezer and lastly the washing machine. The correct answers at the start of identifying the Energy Guzzlers should be:

1. electric immersion heater
2. electric fire
3. freezer
4. washing machine

Calculating Electrical Consumption

You can work out exactly how much electrical appliances cost to run for one hour by using the formula below. Ask the pupils to calculate the running costs for each appliance below. Allocate about 15 minutes for this activity.

To work this out, you need to use this formula:-

Power rating in watts x 7p (approx cost of unit of electricity) x time in hours the appliance is on for

.....

1000

e.g. a 500 watt hairdryer used for 1 hour would cost

$$\frac{500 \text{ watts} \times 7p \times 1 \text{ hr}}{1000} = 3.5p$$

Answers are:		Cost
Tumble Dryer	2500 watts for 3 hours	52.5p
Video	200 watts for 10 hours	14p
Lightbulb	100 watts for 30 hours	21p

It is important that we look at how we can use electrical appliances more efficiently. Discuss with the class how they think their families could use electrical appliances wisely in the home. Develop these ideas by asking pupils in their groups to create a newspaper cover sheet; allocate at least 30/45 minutes for this task. This activity can be carried out during the session if time is permitting or carried over to another session if time is short.

Additional Information

Switch off lights in rooms not in use - even florescent lighting!
Use timers to switch water heaters on
Change an electric fire to an electric convector heater which is thermostatically controlled
Fill the kettle with as much water as you need
Don't switch lights on in rooms with natural light
Don't let hot water taps drip
TurnTV off instead of leaving on standby
Turn computer off instead of leaving on screensave
Keep freezer door shut as much as possible
Use microwave rather than cooker wherever possible
Make sure the freezer is full
Make sure the refrigerator is set at the correct temperature
Wash a full load in the washing machine and use the economy wash wherever possible
Switch off appliances at the plug socket rather than just on the appliance itself

ACTIVITY 4

Linkage

A game for KS1 and KS2

Equipment Needed

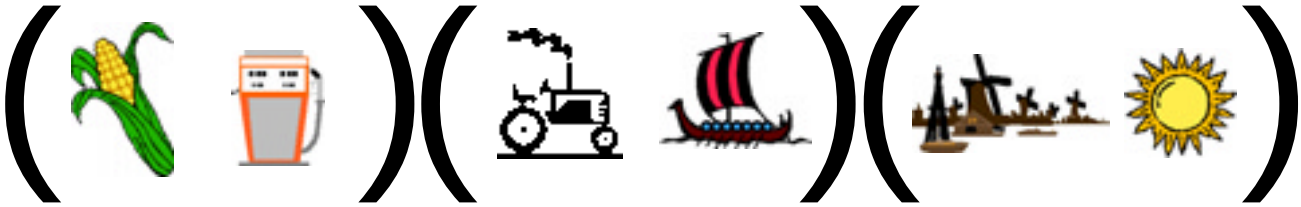
Domino-style cards, each bearing two different "energy" pictures.
These might show an overhead power line, an oil well, a waterfall, a fire.

Method

Seven cards are dealt out to each player.
Surplus cards are placed face down on the table.
One player starts by placing any one of her/his cards face up on the table.
Players take turns to place a card in accordance with the rules below.
A person who cannot play a card takes one of those that are face down.
The first player to lay down all their cards is the winner.

Rules

There must be a link between adjacent pictures.
Pictures of the same thing are not allowed, i.e. the opposite of dominoes.
As each player places a card, the link must be explained
to the satisfaction of the other players.
If the link is not accepted as true, then the card is returned to the player
andTWO face-down cards are collected.



Fuel from pump
power tractors

Both driven
by wind

Comments

The items shown should have links with several other pictures.

e.g. a coal mine links to both a power station

and trees(-ferns) of the carboniferous period.

It might also link to a railway wagon transporting it to the power station.

A grid could be used to record acceptable links.

Pupils could make their own cards, perhaps using clip-art collections.

They could add to the initial pack as they learn more about energy.

ACTIVITY 5

The Story of Six Sunbeams

A story introducing some basic concepts about energy flow and energy efficiency to pupils at Key Stage 2

Notes to teachers

The storyline must be simple, with minimal use of technical terms.

The presentation must not rely on the subtleties of language.

It must relate to situations with which the audience is familiar.

It must be scientifically accurate, though not necessarily giving the whole truth.

The audience must be involved during the presentation.

It should include suggestions for follow-up activities

It should encourage teachers and pupils to consider what energy-saving action they can take.

Teacher must be integrated into the delivery process so that they are neither alienated nor made to feel incompetent.

Positive messages are essential.

Format

The session is in four parts.

Plenary	• Telling a story about six sunbeams to impart information; • Defining the problem;
Group work	• Discussing and prioritising possible solutions;
Plenary	• Collating and announcing the preferred solutions; Firing up the audience to put the solutions into practice.

The basic storyboard is shown in the diagram. A minimum of explanatory terms is included to reduce reliance on language. An outline of the script for the entire session is given in "Story-line".

It is envisaged that each drawing will be on a large sheet of card (A2). As the story unfolds members of the audience are called forward to hold the cards. Each strand of the story requires a different line up of cards. Some of the cards will have flaps or holders so that they can be modified during the show. There are chairs at the back of the "stage" for pupils to sit on when they are not involved.

As each strand of the story is being explained and assembled, the presenter stands in front of the line of cards. For the summary at the end of each strand, the presenter stands behind the line. There is a round of applause for each set of cardholders at the end of their "scene".

Storyline

Select one child the audience to play the "sun" and another to play "the child". One holds the "sun" card, while the other holds the "face" card. They are key players in the story, so take advice from the teachers on whom to choose.

Sunbeam One This morning, Sunbeam 1 set out from the Sun. It carried both light and heat. It lit the Child's way to school and made her feel warm. She's happy. (Display face "happy way" up.)

SunbeamTwo Last summer, Sunbeam 2 set out from the Sun. It carried both light and warmth. It hit a Plant. The plant used the light and warmth (=energy) from the sunbeam to make its own food from carbon dioxide, water and mineral salts. The Plant grew. The Plant was eaten by Cow. The Cow made milk. It was drunk by the Child. From the Sun she's got light, warmth and drink, so she's very happy.

SunbeamThree A few years ago, Sunbeam 3 set out from the Sun, bringing light and warmth. It hit aTree. TheTree was warmed and used the Sunbeam's energy to combine carbon dioxide, water and mineral salts to grow.TheTree was chopped down and burnt in wood fire. The stored energy was released to cook food that was eaten by the Child. So from the sun she's got light, warmth, drink and cooked food, so she's very, very happy.

Sunbeam Four Four Millions of years ago, Sunbeam 4 set out from the Sun, bringing light and warmth. It hit a fern plant in a swamp. The Fern used the Sunbeam's energy in the process of photosynthesis to grow into a giant tree fern. When it was old, the Fern died, fell over and was covered with silt and mud. It became squashed and converted into Coal. The Coal was recently dug up and burnt. The stored energy was used in a factory that makes bicycles. One was given to Child as a present. So from the sun the Child has light, warmth, drink, cooked food and a bicycle, so she's very, very, very happy.

Sunbeam Five Millions of years ago, Sunbeam 5 set out from the Sun, bringing light and warmth. It hit some very small plants in the sea. They used photosynthesis to trap energy from sunlight to make their own food and to grow. In time they died, sank to bottom of sea, were covered with sand, squashed and converted into Oil and Gas. Recently the Oil was pumped up and burnt in a power station. The stored energy was used to generate electricity. Some of electricity was sent to Child's home. So the Child can have light, warmth, drink and cooked food any time she wants. And she's got a bicycle, so she's very, very, very, very happy.

But... *The smoke from the burning wood,*
and the smoke from the coal fire,
and the smoke from the oil
all made the sky dark.

Sunbeam Six To-day, Sunbeam 6 set out from the Sun, bringing light and warmth to the earth. But the sky was so black that the sunbeam couldn't get through the smoke.
It was so dark during the day that people had to switch on their lights.To generate the extra electricity, the power stations burnt more oil and coal and made more smoke.
It was so cold during the day that people put more wood and coal on their fires.
This made even more smoke.
There was so much smoke that the plant could not photosynthesise and died

Sunbeam Six To-day, Sunbeam 6 set out from the Sun, bringing light and warmth to the earth. But the sky was so black that the sunbeam couldn't get through the smoke.

It was so dark during the day that people had to switch on their lights.To generate the extra electricity, the power stations burnt more oil and coal and made more smoke.

It was so cold during the day that people put more wood and coal on their fires.

This made even more smoke.

There was so much smoke that the plant could not photosynthesise and died (invert plant to "dead mode"). This meant that the cow went hungry and died (invert cow).

How do you think the girl feels? (Invert face to "unhappy mode".)

The girl said, "If we carry on like this our future will be black. I must do something about it."

Do you like to see the sun?		YES
	To stop the skies getting dirty we must cut down on energy use.	
But ...	Do you like being cold?	NO
	Do you like eating uncooked food?	NO
	Do you like having no toys from factories?	NO

So we must use less energy, but what energy we do use we must use more efficiently.

Go back to your classrooms. Under the direction of your teachers, divide into groups (of about 5).Think of as many ways as you can of reducing the amount of wood, coal, oil and gas that is burnt without reducing comfort, or making life dangerous. Think of products that are used. (The factories that make them use energy too.) Different groups should think about what can be done in different places, e.g. at home, in blocks of flats, at school, in shops, transport, etc.

From your list, discuss which is the best idea. Remember it must be something that is easy to do.Think about costs: most things are possible if you have lots of money. Decide who should put your best idea into practice.

(Briefing for teachers required, with list of both generic and site-specific examples, some of which are simple and cheap, others are complex and expensive, a few are amusing but impracticable. Teachers and presenter to circulate between groups, encouraging the flow of ideas and discussion.)

After a short time, the teachers note down the best ideas under each heading from their groups.The classes come back into the hall and the teachers collate the best ideas from all the classes. The headteacher then congratulates the pupils on their imagination and announces the "top three" ideas in each category.

The presenter then delivers the key message....

Knowledge of energy is necessary..
Ideas for using more effectively are great.
But it is action that is required.
And the audience are the people to carry it out in their school.

Make specific suggestions with target times and indicators of success...

e.g.

1. Set up a school energy committee to put ideas into practice
   Involve teachers, pupils, caretaker, cleaners, cooks, etc.
   Let them know how well they are doing.

2. Talk to parents, family, concierge, etc
   Get them to save energy.
   It'll save them money too!

3. Talk to the Mayor and councillors
   Tell them that you like to see the sun.
   Ask them to do something about the smoke.
   Later, check to see if they are doing anything about it.

ACTIVITY 6

The Treehouse

A starting point for the development of a story with pupils at KS2

Billy Gittings has a den at the bottom of his garden. He dug out a trench and made a pile of soil on each side. Two old doors make the roof. It is all covered in carpet. He has lived in his secret lair for day after day. He has even spent a whole night in there. Well, until half past ten, when it got too cold.

Toni andTerry live three doors along the road. They are ten and eight years old. They have a tent at the bottom of their garden. The frame is made of garden canes and it is covered with some old sheets that their Mum uses when she is decorating.The sheet is held in place with clothes pegs. This is awkward when Mum wants to hang out the washing. Each eveningT &T have to remove and fold up the sheets.They make sure all the clothes pegs are there and return them to the peg bag.

As they pack up their tent each evening, Billy Gittings laughs at them across the gardens. His den is better than their tent. He is twelve years old and goes to the High School. He knows more than they do, so it is not surprising that his secret lair was far superior to their silly wigwam.

Billy's comments makeToni andTerry annoyed. What does he mean, "My lair is better than your tent?" They have looked at his so-called secret den. If they climb up the branches of one of the trees at the bottom of their garden they can see it easily. It is a hump in the ground, covered by an old red carpet. It is obvious to anybody who goes down Billy's garden.

The den is half underground. It is more like a rabbit hole than somewhere proper to live. It is dark. It is always damp, and it is intolerably stuffy. By contrast, the inside of their tent is bright and airy. Provided they let the sun dry off the grass before they peg the sheets in place, it is dry inside.

Billy is a nuisance. His loud raucous voice disturbs the people who live in the nearby houses. His rudeness about the tent upsetsToni andTerry. They decide to beat Billy at his own game. They are going to build a superb treehouse and stay in it all night, right through to breakfast time.

How are they going to do it? What problems will they face? Will they succeed? Are they going to be able to spend a whole night in the treehouse?

It's up to you to work out what happens. A few possibilities are outlined on the next page. Like all good writers, you will have to carry out some research. You will need to find out which types of treesT&T might have at the bottom of their garden. Not all species are suitable as sites for treehouses. What is the best way to fit planks together to keep rain and wind out of the treehouse? What is the best angle for the roof? Which materials didT&T choose for insulation? Who helped them find out the answers?

Possible Help

T&T find an old hammer and saw, some screws and nails, and other useful bits and pieces.

A builder, whose yard backs ontoT&T's garden, lets them have pallets, bits of roofing felt, etc.
He even saves them some old double-glazing units.

The greengrocer gives them some fibre trays from apple boxes, and some egg trays.
T&T experiment with them as insulation.

A kind neighbour provides them with some spare carpet.

Another neighbour, a retired scientist, helps them carry out experiments to determine which materials are best for each part of the tree-house - framework, cladding, water-proofing, draught-proofing, insulation.

Possible Episodes

As soon asT&T get their pocket money on a Saturday morning, they go shopping for their mother. One of the shops they visit is the newsagents. They pay for the papers and then they used to buy some sweets. However, now the treehouse was under construction they have stopped getting sweets. Instead, they go along the parade to the DIY shop, and buy packets of nails. After a few visits, the shopkeeper asks them what they were doing with all the nails. When they explain about the treehouse, he tells them which sorts of nails are best for each job. He even gives them some old tools, together with screws and hinges for the door.

The man that delivers fish lets them have some used polystyrene fish boxes off his lorry. T&T use this to insulate the walls. However, after one warm day, two cats are attracted to the treehouse by the smell. They get trapped in the treehouse. During the rescue, they climb higher up the tree.

Possible Crises

There is a high wind. Will the treehouse survive the buffeting?

There is a violent thunderstorm. Rain pours down. Billy Gitting's den is flooded. Will the treehouse remain dry? AreT&T in it at the time?

ACTIVITY 7
Special Energy Investigators at KS2

Aims

- To provide a context for the practical application of scientific, technological, geographical and mathematical knowledge in a familiar real-world situation.
- To identify those parts of the school and its normal practices where it may be possible to use energy more wisely without curtailing facilities, reducing comfort or compromising safety.
- To provide information to help the school manage energy more wisely so that more of its financial resources can be spent on core educational activities.

Preparation

- Make sure that it is acceptable for pupils to have access to much of the school.
- Brief other staff, caretaker, ancillaries, etc about what will be going on and that they may be asked questions.

Equipment Needed

All groups:-

- Clip-boards, pencils and paper
- Basic map of school showing classrooms, halls, corridors, washrooms, store-rooms

Some groups may require one of the following:-

- Measuring jugs (with smaller plastic beaker if jug will not fit under hot water taps),
- Thermometers
- Draught detectors (e.g. ruler with 1 x 15cm strip of tissue paper stuck to end)

Timing

- This activity is best during spring or autumn, when supplementary lighting or heating is often being used but may not actually be required.
- This activity takes about half a day, but this need not be a whole morning or afternoon.
- Useful information can be obtained by carrying out investigations before and after normal schools hours and during breaks and dinner times.
- Some of the work can be done as part of Science, Mathematics and ICT lessons.

Procedure

- Initial introduction
- The class is divided into groups of between three and six pupils.
- Each is given copies of the briefing sheet for a different "case."
- Groups plan their investigations
- Groups move around school gathering evidence
- Groups discuss evidence

(*teacher circulating with advice and encouragement*)

- Groups present evidence and suggestions for possible improvements to the whole class.

Suggested follow-up

- Pupils present their findings to the whole school, Headteacher and/or School Board, etc.
- In due course, school management team make reasoned responses to their suggested improvements, along the lines of …

"This is already happening, but obviously it doesn't show."

"This is planned and will start …"

"This can't be done because …"

"We hadn't thought of this, so we're going to …"

"Can you help us with …"

- SMT commission further investigations of selected proposals, providing a stimulus for work in Science, Maths, English,Technology, etc.
- Pupils carry out investigations and prepare detailed report(s)
- Pupils monitor progress / lack of progress on implementation of adopted proposals.
- Pupils report to school, governors, and parents at special assembly, newsletter, etc
- Establishment of a School EnergyTeam (E-team) involving representatives of pupils and adults from the school, the local authority energy manager, and the local community.
- Home energy surveys can be made along similar lines, perhaps with pupils staging an event for their families dealing with wise energy use at home.

Reference

The use of an outsider to lead the activity, through playing the part of "J" (the Head of the Special Energy InvestigationTask Force), is described in Primary Science Education 57 – March 1999 pp 26-28
(published by the Association for Science Education)

Relevant websites:

- www.schoolenergy.co.uk (developed by CREATE for school managers)
- www.energychest.net (developed by CREATE for pupils and teachers)
- www.schoolsenergywise.com (developed by CREATE for children and their teachers)
- www.nc.uk.net/esd (developed by QCA for teachers and school managers)