

Introduction

This unit provides a template for studying any environmental issue. The strategy suggested is designed to help pupils understand not just where we are now, but also where we may be going. Only by appreciating the wider impact of individual behaviour can pupils begin to consider the needs for changing lifestyles. This unit aims to help deal with the complexity of evaluating choices by considering values and scientific evidence together.

Running the activities

This unit contains a number of activities and other resources. Select those that are appropriate to your pupils and your scheme of work.

Key ideas

Notes for teachers: key ideas in citizenship and science that relate to this topic.

Focal questions

Suggestions are made for generating and discussing local issues. You are best placed to decide what the local issues are in use of energy resources.

It may be easier for pupils to start by considering local issues, but an important aim may be to allow pupils to see the wider influence of local actions. Hence many of the pupil activities are set in the context of national energy policy.

Energy resources glossary

This is a general reference including citizenship and science key words. It can help to discuss the terms with the class before embarking on this topic. You may want to issue a copy of the glossary to every pupil when introducing (or reviewing) the relevant science. Alternatively, make enlarged copies for the walls.

Discussion 'starter' cartoons (drawn by Ralph Edney)

Two drawings are provided:

- The first shows a world full of everything people want, everything carrying a high energy cost.
- The second cartoon shows a futuristic world, based on energy conservation and harnessing renewable energy resources.

These could be used in a variety of ways: Made into an OHT they would provide a stimulus for class discussion (How many things can you see in the picture? What kind of world? Is it possible? Is it desirable?); or pupils could be asked to write a caption for each, after doing a little research. The pictures are drawn to be open to many interpretations, to stimulate thinking.

The teacher's role in using these cartoons is twofold: to draw out ideas from the class, and subsequently to challenge them. For example, if pupils suggest that we should make more use of renewable energy resources, ask whether these are available; might it not be better to use less energy? If they suggest that the effects of using fossil fuels might not be so bad, ask how we might assess these effects. And so on.

What if? - An energy policy for the school

A consequence mapping exercise. This is another example of a way to tackle a moral and ethical issue without compelling pupils to take sides. Further teacher's notes follow below.

Tom's story

This is an exercise where pupils consider the goals, rights and responsibilities of individuals in a particular situation. As well as being a useful resource, it is presented here as an example of a way to tackle a moral and ethical issue without compelling pupils to take sides. Further teacher's notes are provided below.

Home energy use

A sheet on which pupils record all the ways in which they have 'used' energy resources for one day (24 hours). This could be set as homework. It is followed by a contrasting description of energy use by a family in Ethiopia, with accompanying questions.

Learning outcomes

Pupils are able to use 'rights' and 'responsibilities' in considering an environmental issue.

Pupils recognise and articulate the values they use in evaluating conflicting rights and responsibilities and recognise that different value judgements may be legitimate.

Pupils can indicate the limitations of scientific knowledge and evidence in social problems.

Pupils identify the differing values which can impinge on discussion of an environmental issue

Pupils are able to distinguish between ethical decisions (based on values) and scientific decisions (based on scientific evidence).

Prior learning

Pupils should have some familiarity with renewable and non-renewable energy resources.

Where the activities fit in

These resources may be used at appropriate places in your curriculum. The following suggestions are based upon the QCA schemes of work. Advice on teaching controversial issues can be found in appendix 9 of the QCA Key Stage 3 Citizenship Teachers' Guide, which you can download from: www.standards.dfes.gov.uk/schemes

Citizenship

1g) The importance of resolving conflict fairly

2b) Justify orally and in writing a personal opinion about issues, problems or events

2c) Contribute to group and exploratory class discussions

3a) Use their imagination to consider other people's experiences and be able to think about, express and explain views that are not their own

3b) Negotiate, decide and take part responsibly in both school and community-based activities

Give us Sunshine (by Andy Merriman)

A compelling drama for pupils to perform, wherein our heroine Jade is suddenly faced with a dilemma and has to think hard to work out what to do. There are lots of 'energy threads' for pupils to identify. The drama is intended to prompt a lively discussion about conflicting values.

You could use this as the basis for an assembly, perhaps during Science Week.

Users should feel free to adapt this script in any way they see fit, for example to bring in local issues, local humour, etc.

Give us Sunshine – scene 1

A sound recording of the introductory part of the drama, recorded on location at a school. For use as an introduction to the play script.

Living with risk

This is an extension activity on the probability and psychology of risk, which can be used as an introduction to any discussion informed by an assessment of risks. For example, it can be a pre-cursor to discussing how we weigh up the risks and benefits around a controversial issue.

The intentions of the activity are to:

- Give pupils an introduction to the concept of risk;
- Allow pupils to recognise that they may *perceive* lower risk in a voluntary activity than in an involuntary activity;
- Allow pupils to recognise that risk assessment is not straightforward; that no activity is risk free; that we do not necessarily make rational choices based on risk information.

The statistics in this activity are simplified from two sources:

British Medical Association (1990) *The BMA Guide to living with risk*. London: Penguin

The Royal Society (1992) *Risk: Analysis, perception and management*. London: The Royal Society

Both of these books are useful reading about how we perceive risk information.

Science

Various aspects of the science curriculum may be covered, depending on the route chosen through the activities:

7I) Energy resources: *renewable vs. non-renewable resources*

8I) Heating and cooling

9G) Environmental Chemistry

9I) Energy and Electricity

Safety

Not applicable.

Key ideas: Energy Resources

Citizenship

Rights and responsibilities Adequate food, shelter and clothing are basic human rights, but some matters regarded as purely taste and personal choice, because of their wider impact, will affect the livelihood of others. It is important that pupils think about how interdependent people are; for example, how global climate change can result from accepting local expectations for energy use without criticism.

Global issues In moving from local to national to global issues, pupils may start to see the wider impact of use of energy resources. The political, economic and social dimensions present in local and national issues become more complex at a global level. Can nations agree on a global energy policy? Should different energy policies apply to developed and developing countries? How can fair use of energy resources be established across different nations?

Sustainable development Do we have a responsibility for protecting future generations from environmental disaster? What does 'sustainable development' mean? There are many definitions of sustainable development. Two of the most common are: *Sustainable development means improving the quality of life whilst living within the carrying capacity of the supporting ecosystems* (World Conservation Strategy, 1990)
Sustainable development is development that meets the needs of the present without compromising the needs of future generations to meet their own needs (Brundtland Report, 1987)

The sustainable development website, www.sustainable-development.gov.uk uses this definition: 'ensuring a better quality of life for **everyone** now **and** for generations to come'; i.e. four objectives have to be met at the same time:

- Social progress, which recognises the needs of everyone.
- Effective protection of the environment.
- Prudent use of natural resources.
- Maintenance of high and stable levels of economic growth and employment.

Value judgements The language of moral argument, involving for example *values* and *beliefs*, is used in a non-technical way: what is important is to examine the way we weigh up what to do in particular circumstances. What beliefs underlie our treatment of the Earth's resources? Do we weigh up personal convenience and comfort against its hidden costs?

Information Does factual information make any difference to the way people make decisions about energy use? If not, what does?

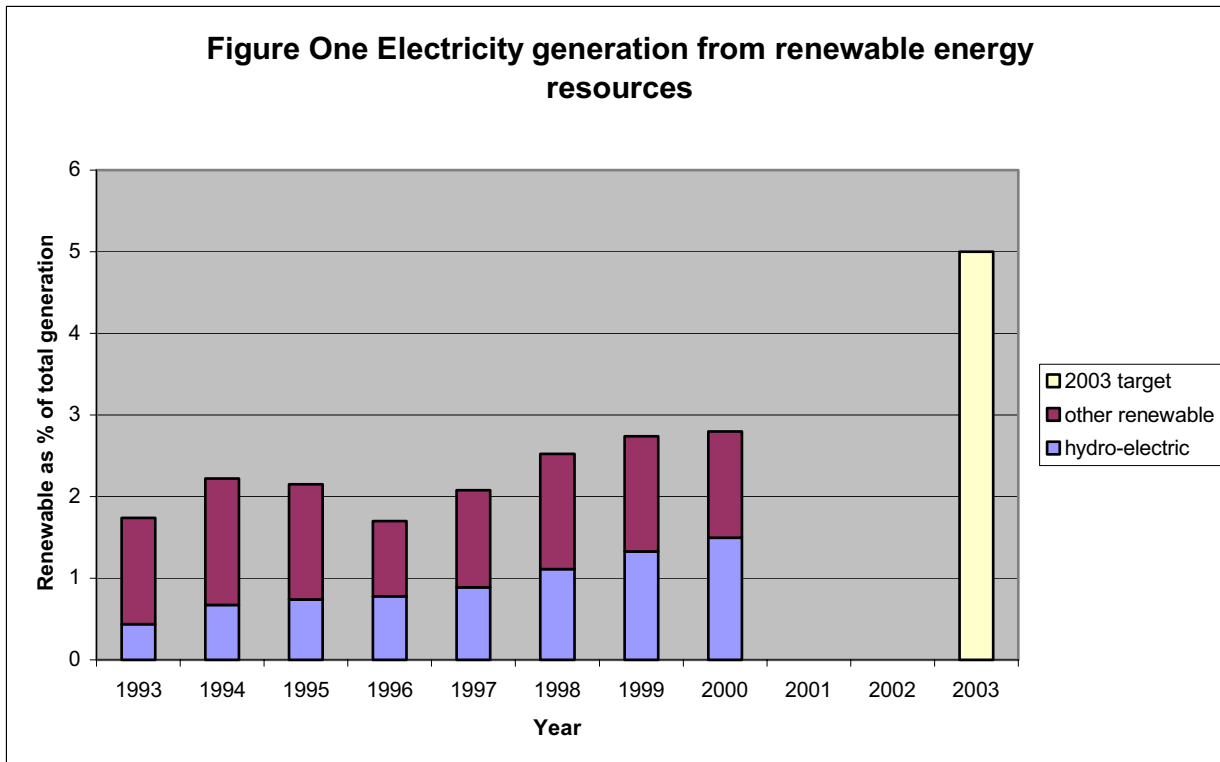
Role of the media Do media reports educate the readership/viewers with factual information? With moral argument? With assessing risks associated with energy use?

Pupil activities should focus on key citizenship ideas such as these, and avoid becoming bogged down in technical detail. Keep in mind the aim is to enable pupils to 'see the forest from the trees'.

Background information and key science ideas

Government targets

The Government has a target of 5% of electricity being generated from renewable fuels by 2003 and 10% by 2010. Figure one shows the movement towards this target in recent years.



Source: *Directory of Energy Resources 2001: DTI*

Other renewables are mainly from waste, landfill gas, biofuels and onshore wind farms. The Utilities Act 2000 defines renewable energy resources as 'sources of energy other than fossil fuel or nuclear fuel.'

Figure 1 shows the detail of electricity generated from renewable resources in 2000 (electricity generated in 2000 expressed in terawatt hours (TWh) total = 369, adapted from *postnote 164* www.parliament.uk/post/home)

Natural

Hydroelectric power: Mainly located in Scotland and Wales (5.1 TWh). Further large-scale development is limited.

Wind: On-shore wind farms provide the existing resources (0.9 TWh). Offshore wind farms are being considered.

Solar: Using photovoltaic cells for direct production of electricity (virtually nil).

Wave and tidal flows: Where the movement of water and sea is used to generate electricity (virtually nil).

Human activity

In 2000, *landfill gas* (mainly methane) (2.2 TWh), *municipal waste combustion* (1.4 TWh), *sewage sludge digestion* (0.4 TWh) provided most of the electricity from human activities. Other sources make a small contribution (0.5 TWh) e.g. energy crops (e.g. fast-growing willow) and combustion of poultry litter, farm waste and scrap tyres.

The Government has taken a number of measures in developing a 'Renewables Policy':

All electricity suppliers, from January 2002, will have to obtain a specific and increasing proportion of electricity from renewable resources.

- Electricity from renewable resources will be exempt from the Climate Change Levy.
- Capital grants will be given to develop commercially viable renewable resources.
- The development of a regional approach to strategic planning.

Misconceptions pupils might have about the concept of energy

In the Energy resources unit (71) of the QCA KS3 Scheme of Work for science energy the word 'resource' is used in preference to 'source'. This is to try to encourage the idea that energy is not just a kind of stuff, like fuel. Energy transfer is associated with change.

You might find the following misconceptions of energy amongst pupils. Research studies (Driver et al, 1994 chapter 20) have shown that pupils may conceptualise energy as:

- Associated only with animate objects.
- A causal agent stored in certain objects.
- Linked with force and movement.
- Fuel.
- A fluid, an ingredient or a product.
- Pupils can confuse 'renewable' and 'reusable' – i.e. they may think that renewable energy resources are those that can be used again and again without being 'used up.'

(Reference: Driver, R., Squires, A., Rushworth, P., Wood-Robinson, V. (1994) Making Sense of Secondary Science. London: Routledge)

Introduction

Non-renewable energy resources are being slowly exhausted; use of renewable energy resources is being encouraged. The Government has a target of 5% of electricity being generated from renewable fuels by 2003 and 10% by 2010. In 1999, 3% of electricity was generated from renewable fuels. This activity shows how consequence mapping can be used for an identified 'What if...' question. Part of the learning success is choosing an appropriate 'What if ...' question – i.e. one which:

- In a citizenship context, has a values dimension and opportunity for considering impact on people, animals, wildlife etc.
- In a science context, has a basis in using some scientific knowledge, processes or practices – recognises the scientific evidence, and its limitations, underpinning the issue.
- Is realistic to the pupils – is a possible not hypothetical scenario.
- And where information is not too complex, further research can be undertaken in following up issues raised, if time allows.

Running the activities

a) Identify a 'What if?' question e.g. What if we had to recycle all the waste produced in school so that it can be burnt to heat the school?

b) Ask pupils in small groups to produce a consequence map and highlight:

- Positive consequences, negative consequences – show which are certain, and which are uncertain.
- Values used.
- Where scientific evidence is used (e.g. burning waste may cause air pollution).

One advantage of consequence mapping is that it encourages pupils to think beyond immediate local impact to consider wider issues of national and global responsibility.

c) Using this map, each group of pupils considers whether they support the issue, they do not support the issue, they are uncertain. In doing this they note:

- Any scientific evidence they have used and its limits.
- The judgements they have made.
- The values they have used in this reasoning.

d) Display the consequence maps along with the pupils' reasoning around the room. These may show that what are seen as positive consequences by one group are seen as negative by others. The differing values can be identified and listed on the board. Pupils can be asked to indicate what they consider the most important values might be in energy consumption and conservation. They can also identify any values missing from the maps.

e) In the plenary discussion, you can identify with the pupils the range of value judgements that have been made, and what the consequences of these are for a sustainable school energy policy. You can have a summary discussion on how the dominant values used might influence actions and behaviour i.e. what is the difference between saying we'll be energy efficient (valuing energy resources) and actually reducing energy consumption (putting values into action)? What would be needed to put an energy efficiency policy into action by everyone?

f) Pupils can be asked to indicate what they have learnt about:

- How scientific evidence helps a scientific decision e.g. efficiency of waste combustion.
- Their own values and value judgements.
- The impact of differing values on collective action.
- How a collective energy policy should be decided.

Learning outcomes

Pupils identify the differing values which can impinge on discussion of an environmental issue
Pupils are able to distinguish between ethical decisions (based on values) and scientific decisions (based on scientific evidence).

Prior learning

Pupils should have some familiarity with renewable and non-renewable energy resources.

Where the activities fit in

These resources may be used at appropriate places in your curriculum. The following suggestions are based upon the QCA schemes of work. Advice on teaching controversial issues can be found in appendix 9 of the QCA Key Stage 3 Citizenship Teachers' Guide, which you can download from: www.standards.dfes.gov.uk/schemes

Citizenship

1g) The importance of resolving conflict fairly

2b) Justify orally and in writing a personal opinion about issues, problems or events

2c) Contribute to group and exploratory class discussions

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More ideas

Choosing a focused and realistic 'What if ...' question is important. Pupils can be encouraged to set their own.

Examples:

- What if everyone had to travel to school by the most energy efficient means?
- What if the temperature was set in all classrooms at a maximum of 16°C and a minimum of 0 °C to reduce use of energy resources in winter?
- What if the school / home had to reduce electricity consumption by 50%?
- What if only certain cars could be used on certain days? For example, cars with half the registration numbers on Monday, Wednesday, Friday; the others Tuesday, Thursday, Saturday.

A variation on the whole class addressing one question is to have different groups in the class produce maps for competing propositions e.g. have half the class produce maps which address:

- What if the temperature was set in all classrooms at a maximum of 16°C and a minimum of 0 °C?

And half the class address:

- What if the temperature was set in all classrooms at a maximum of 25 °C and a minimum of 20 °C?

This may allow the dominant values and scientific evidence to show up more clearly.

Insufficient evidence

One issue that is likely to arise is that of having sufficient information to discuss the issue. This can be tackled in at least two ways:

- By gathering some relevant information once the particular question for discussion has been established. This can be undertaken by pupils and, if it is a school or local community issue, can be an important step in establishing the exact context and nature of a real problem.
- By recognising that we form opinions on the basis of limited evidence – i.e. have the discussion with minimal information gathering but then, in the plenary discussion, establish what information being used is well established and what is conjecture. Discuss the ways in which we can be better informed – but note that would not necessarily lead to 'better' decisions. Information alone is not sufficient – we use our understanding of values, people and society to make judgements.

Where the activities fit in

These resources may be used at appropriate places in your curriculum. The following suggestions are based upon the QCA schemes of work. Advice on teaching controversial issues can be found in appendix 9 of the QCA Key Stage 3 Citizenship Teachers' Guide, which you can download from: www.standards.dfes.gov.uk/schemes

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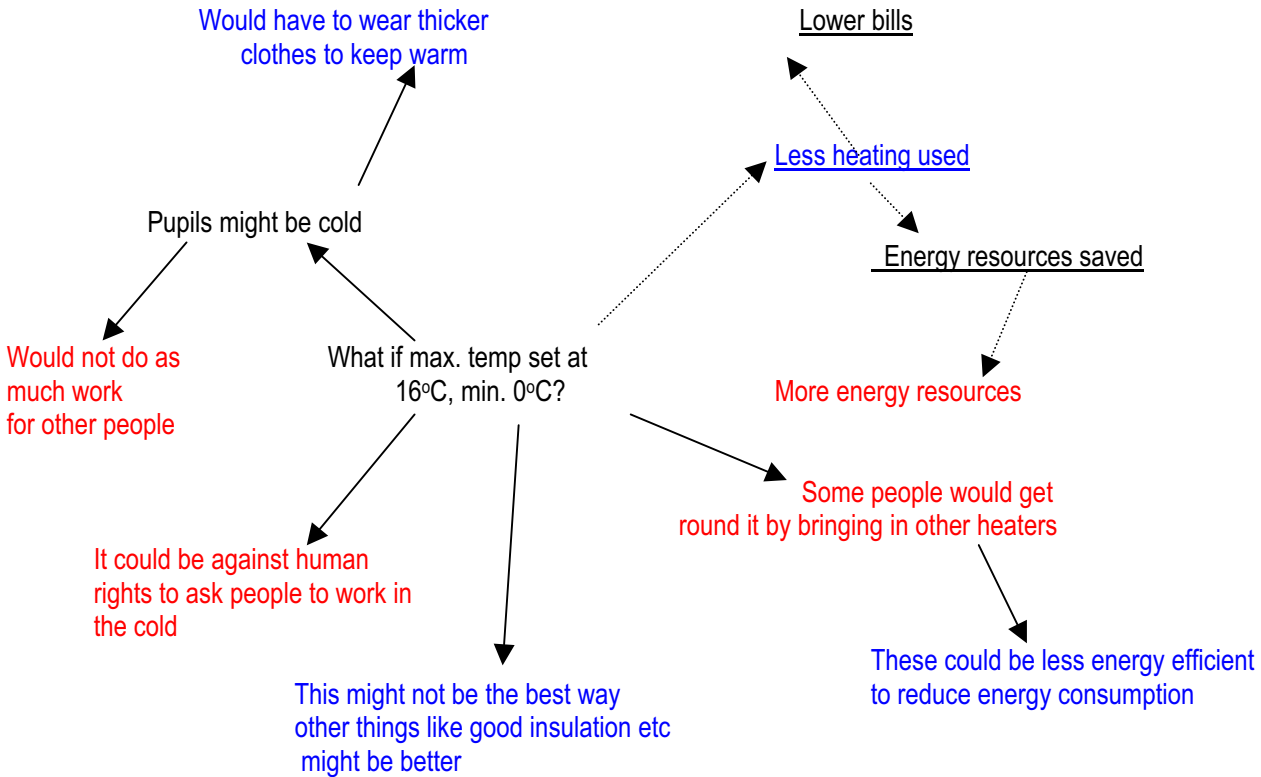
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Examples of maps



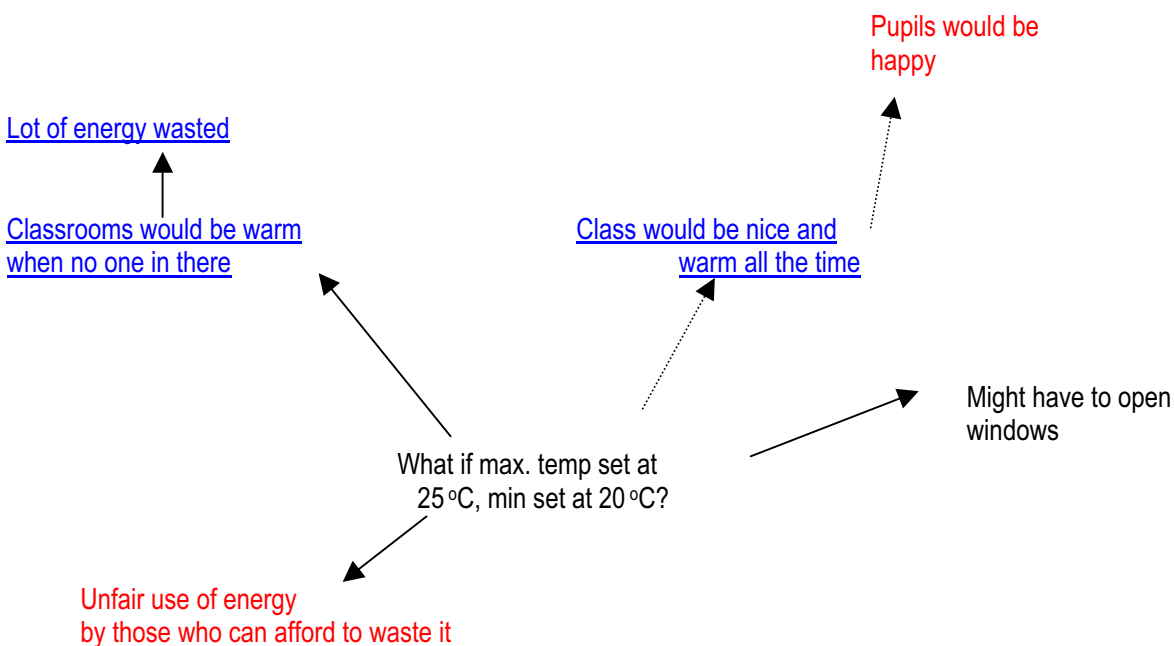
.....> positive consequences

————> Negative consequences

Scientific evidence

Value judgement

Certainties



Values used Concern for self and other pupils; concern for equitable use of energy resources for other people; human rights.

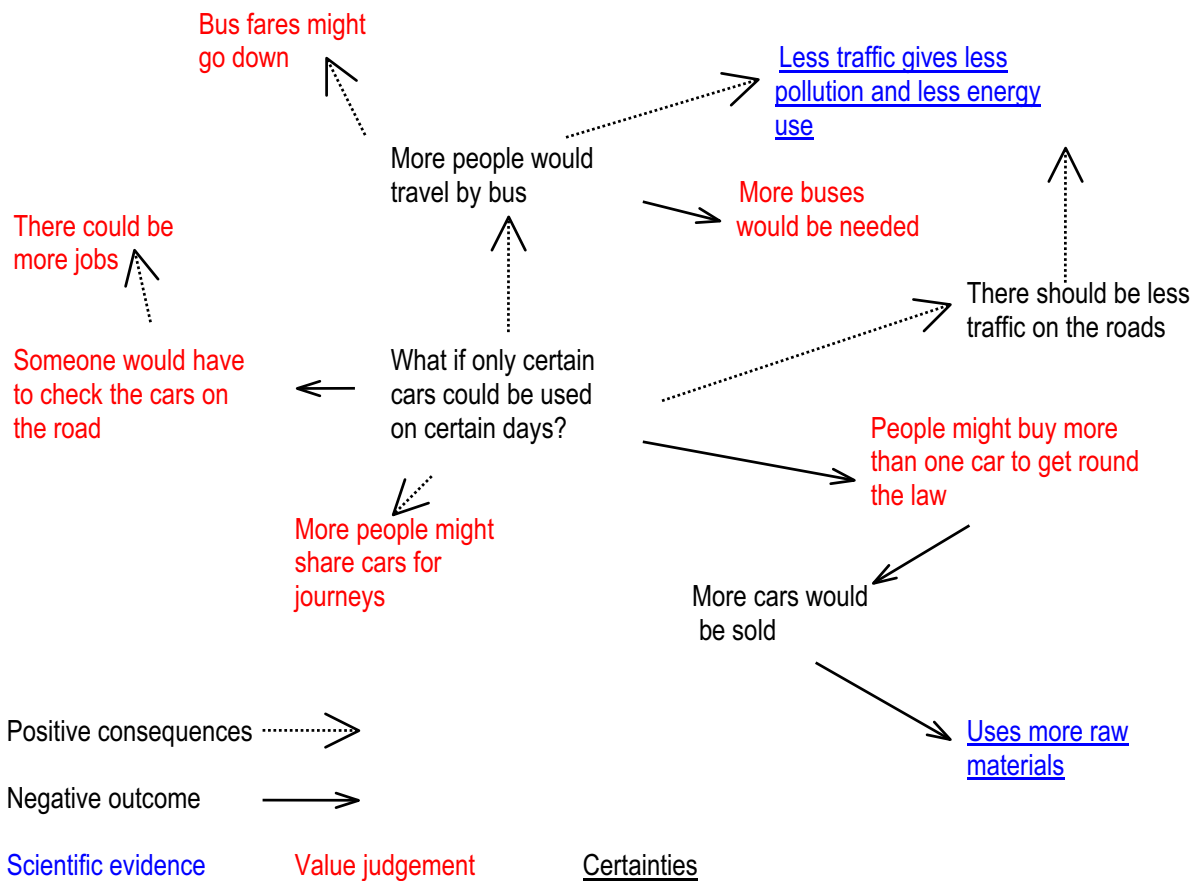
Scientific evidence Principles of insulation; energy efficiency.

Judgements *We'd try this (reducing energy) as it would save the school money and save energy resources. It would be easy to regulate. If we use less energy there'll be more for other countries to use that don't have our standard of living. People in other countries have to work in the cold. We could easily all wear another layer of clothing. The scientific evidence tells us how to keep warm, it doesn't tell us what we should do.*

We think this idea is not right. Lots of pupils would refuse to work if they were cold. People would try to get round it by adding other heaters – we could use Bunsens in the labs.

Other examples of consequences maps for energy related issues

What if only certain cars could be used on certain days?



Non-renewable energy resources are being slowly exhausted; use of renewable energy resources is being encouraged. The Government has a target of 5% of electricity being generated from renewable fuels by 2003 and 10% by 2010. In 1999, 3% of electricity was generated from renewable fuels, and it will clearly be difficult to reach even the present modest targets. What is the impact of shifting to renewable fuels on various groups of people (e.g. local energy consumers and providers)? What are their rights and responsibilities? How can these be balanced?

The resources support a suggested teaching strategy of 'Goals, Rights and Responsibilities'. Each small group of pupils is asked to consider the goals, rights and responsibilities of ONE identified person or group of people, in the context of a shift to making more use of renewable energy resources.

Running the activity

Pupils are presented with Tom's scenario. They are told not to discuss this as it stands, but each group will focus on the goals, rights and responsibilities of one of the people concerned. Explain (or remind) pupils what we mean by goals, rights and responsibilities. (For example, Sally and Ann are best friends. Sally has told Ann that she would like to go out with Kieran but she must keep it a secret and not tell anyone. Kieran's friend Dave asks Ann whether Sally likes Kieran because Sally's been acting oddly. Should Ann tell Dave that Sally wants to go out with Kieran? Ann's goal might be to remain friends with Sally. Ann's right might be to voice her own opinion of Sally's behaviour. Ann's responsibility might be to keep Sally's secret.)

The first grid shows Tom's goals, rights and responsibilities. Pupils may be able to add to the list. Each small group of pupils writes down what they think are the goals, rights and responsibilities of one of the other people concerned - Jenny, Tom's mother or Tom's father. This may take about 5-10 minutes. By concentrating on one person the pupils are not evaluating the proposition from their own point of view, or acting in role as the people concerned, but rather looking from the outside as to what they think the issues are for these people.

Collect the views from each group in one grid on the board (as on the sheet). This can take quite a long time! Pupils may want to voice their views about people they have not considered or disagree with what other groups say. Explain that discussion is not allowed until all views are collected. Each small group is allowed their say before opening up the discussion. What this table is likely to show is that different goals, rights and responsibilities are in conflict – both for the individuals and between different people - for example, Tom's goal of having a smaller car may conflict with his responsibility to obey his parents and his mother's goal of fulfilling her job. So this activity has established that there is conflict and shown how different people may be affected by an issue, but without pupils necessarily arguing their own position and values.

Small groups of pupils can then be asked to discuss the proposition, 'Should Tom have his way and get the family to change their lifestyle?' using the views collected as a class. They can present the outcomes of their discussion as posters; alternatively, this can be set as a homework exercise. They should show:

- The arguments for the change.
- The arguments against change.

They should highlight:

- The values they have used.
- The scientific evidence used.

The intention of the activity is not necessarily to answer the question 'Should Tom have his way and get the family to change their lifestyle?' but to identify the rights and responsibilities and value judgements that have to be considered. Thus, in reflecting on the activity, pupils can be asked to indicate:

- What they have learnt about 'rights' and 'responsibilities'.
- What judgements they have made, and the basis for these.

To complete the lesson, have a summary discussion on how the dominant values used might influence actions and behaviour – i.e. what is the difference between saying we will be energy efficient (valuing energy resources) and actually reducing energy consumption (putting values into action)?

A final, vital question: What would be needed to put an energy efficiency policy into action by everyone?

Further ideas

Specific issues can be developed which reflect real local circumstances. Pupils may be able to emphasise and consider them more effectively than the circumstances of Tom's family.

Pupils can identify people who consume and organisations that provide energy locally. This might include:

- Pupils themselves or (to make consideration a little more 'objective' and empathic, rather than selfish) a local group of 'ordinary' households.
- A local employer / company consuming energy supplies on a larger scale in manufacture or employment (the school itself could come into this category).
- A local / national energy provider, based on non-renewable fuels e.g. petrol station owner, gas company, electricity company.
- An existing or possible local provider of renewable fuels, for example wind farm, incineration plant, wave farm.
- From such a list, or by considering school or home issues, questions can be developed. The more focussed the questions the better.

Possible questions could be:

- Should there be a wind farm on the local hill?
- Should the school / employers only get its energy resources from a provider that is actively using and promoting use of renewable resources?
- Should we all walk or cycle to school?
- Should our rubbish be used as a heating source – i.e. should there be a local waste incineration plant which produces heat for local heating or electricity generation?
- Should local buses run on methane generated from biomass?

One issue that is likely to arise is that of having sufficient information to discuss the issue. Here are two ways to tackle this:

We can gather some relevant information once the particular question for discussion has been established. This can be undertaken by pupils and, if it is a school or local community issue, can be an important step in establishing the exact context and nature of a real problem.

We can recognise that we form opinions on the basis of limited evidence. Have the discussion with minimal information gathering but then, in the plenary discussion, establish what information being used is well established and what is conjecture. Discuss the ways in which we can be better informed – but note that would not necessarily lead to 'better' decisions. Information alone is not sufficient – we use our understanding of values, people and society to make judgements.