An Taisce – *The National Trust for Ireland* is the foremost environmental organisation in Ireland. Its range of interests extends from the natural heritage of land, air, water, flora and fauna, to the heritage of buildings and gardens. Through its local, national and international networks, it seeks to educate, inform and lead public opinion on the environment and influence policy and development. Strategies to achieve these aims include awareness and education projects, for example:

- *Green-Schools:* an international FEE programme promoting responsible behaviour among school children and the wider community towards the environment. It is also a learning resource raising awareness of environmental issues through activities that link curriculum subjects.
- *Blue Flag:* Co-ordinating the international FEE Blue Flag Awards campaign in Ireland. The goal of Blue Flag in this regard would be towards integrated coastal zone management and sustainable development in coastal areas.
- The 'Clean Coasts Project' has been established to improve the environment of the Irish and Welsh coasts, and to restore the aesthetic appeal and increase the amenity and economic value to the community and visitors. The project organises 'Coastcare' groups who take part in coastal conservation and management and also administers the 'Green Coast Award' which rewards excellent water quality and sound environmental management.
- *National Spring Clean:* A yearly campaign promoted by An Taisce with the aim of encouraging and assisting clean-ups during the month of April, as well as increasing awareness of litter and waste issues and to promote sustained practical involvement in the environment.

FEE (*The Foundation for Environmental Education*) – seeks to promote environmental education by carrying out campaigns and improving awareness of the importance of environmental education. It is composed of a network of organisations which undertake individual projects in their own countries and participate in international efforts. An Taisce as the Irish member of FEE co-ordinates these campaigns in Ireland.

ESB Independent Energy (ESBIE) is a company within the ESB group, providing tailor made energy solutions to business customers throughout the island of Ireland. ESBIE's strategy is to grow long term relationships with its business customers & it does this by delivering a premium level of Service that differentiates ESBIE from other suppliers.

Repak are proud lead sponsors of the Green-Schools programme in Ireland and recognise the important role our younger generation plays in maintaining and sustaining our earth's natural resources. Repak is a not-for profit voluntary member's based packaging recycling scheme established under a voluntary agreement between industry and the Department of the Environment, Heritage and Local Government. It was established as industry's response to the obligations places on Ireland by the EU directive on Packaging Waste (94/62/EC) and is the only government approved packaging compliance scheme under the Waste Management (Packaging) Regulations 2007. Repak, Ireland's Green Dot company, was established to acquire membership from such obligated companies to drive Ireland's packaging recycling rates. Repak succeeded in reaching and exceeding Ireland's EU National Packaging Recovery and Recycling Target of 25% of packaging waste in 2001 and is well on the way to achieving our 2005 EU packaging recovery target of 50%.

Green-Schools is proudly supported in Ireland by Coca-Cola. This sponsorship is part of Coca-Cola's ongoing commitment to developing awareness of a range of environmental issues. Coca-Cola has a strong relationship with Irish schools through its Plant Visit Programme, National Spring Clean and its various sports sponsorships.

The Wrigley Company Ltd. is delighted to support the *Green-Schools* Programme as part of their on-going commitment to promote anti-littering strategies. Other examples of their commitment to schools and young people include sponsorship of ECO UNESCO's CD Rom and web management system and Foróige's Citizenship Programme Awards. All these programmes are designed to promote proper disposal of chewing gum within the overall context of anti-littering strategies and environmental education initiatives.

An Taisce operates Green-Schools in Ireland in partnership with **Local Authorities.** Local Authorities not only provide funding for the programme but also provide an excellent on the ground support network for schools through their Environmental Education and Awareness Officers. This partnership is seen as the key to the success of the Green-Schools programme in Ireland.

"The Green Schools programme is an excellent way of reaching our young people at time when we are increasingly concerned about environmental issues. The Programme engages their interest and encourages them to adopt practical measures to protect and conserve the environment. In the 11 years since it was launched, it has gone from strength to strength and its success can be measured by the fact that over two thirds of the schools in the country are now participating. I am pleased that my Department continues to support the scheme and I wish to acknowledge the commitment and hard work of all those involved – An Taisce, local authorities, parents and particularly the schools."

Mr. John Gormley, T.D.,
Minister of the Environment, Heritage and Local Government

Green-Schools Energy

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This booklet is designed as a resource for teachers and students aiming to inform and guide the successful implementation of the *Green-Schools* programme in relation to the Energy theme. The booklet is divided into 5 main sections:

Section 1 reviews the reasons for choosing Energy as a topic to be undertaken by the *Green-Schools* programme, examines the possible links that can be made to the curriculum through the programme, and examines different energy types and resources;

Section 2 provides some facts and figures about the use of energy in Ireland, examining the history of energy in this country, and highlighting the importance of energy in schools and why energy should be conserved where possible;

Section 3 looks more specifically at actions that can be taken both at school and in the home to reduce energy consumption, including an energy audit, and some tips on monitoring your work and maintaining continuity;

Section 4 provides an example of a detailed environmental review for energy;

Section 5, finally, looks at energy as a global resource and the impacts of non-renewable energy resources. Worksheets on the theme of energy are also provided.

CONTENTS

Section 1 INTRODUCTION

As described in the *Green-Schools* Handbook that accompanies the themed booklets, there are seven elements to the *Green-Schools* programme: Committee, Environmental Review, Action Plan, Monitoring and Evaluation, Curriculum Work, Informing and Involving, and Green Code. You will have already successfully implemented the seven steps of the programme in relation to the first theme of Litter and Waste. This booklet aims to provide a general introduction to the subject of Energy and to contribute particularly to the Environmental Review, Action Plan, and Monitoring and Evaluation stages of the programme in relation to the Energy theme.

Green-Schools covers many different aspects of the environment. Energy was chosen as a theme because:

- The subject slots easily into the curriculum in both primary and secondary schools.
- Simple steps and tips can lead to large reductions in energy consumption both in the school and in the home.
- Despite depleting fossil fuel resources, Ireland as a country continues to rely very strongly on imported fuels for energy production, with very little energy produced from renewable resources.

It is recognised, however, that energy is not a topic to study in isolation. For example, there are many links with other aspects of the environmental performance of schools, such as water consumption, waste and recycling. Furthermore, if schools are looking to reduce their Carbon Footprint in order to help combat Climate Change there are plenty of links to energy and reductions in energy usage. Don't forget that you should be maintaining and improving upon the hard work carried out for your Litter and Waste programme as you develop the Energy theme, and linking these themes where possible. Remember it takes less energy to recycle a can than to make a new one, so we waste energy when we don't recycle! It is assumed that teachers will make these links wherever possible.

To successfully implement the *Green-Schools* programme for Energy, you will be expected to establish the seven elements of the scheme as described in the Handbook and to have made progress in reducing energy consumption in the school. *Remember, the activity ideas described in the booklet are just a starting point – it is quite probable you will develop some interesting and innovative ideas of your own.*

Information and Activity Worksheets

Further information and examples of activities for the school that are outside the remit of this booklet can be obtained from a variety of sources, such as ENFO (Environmental Information Service), EPA (Environmental Protection Agency), and SEAI (Sustainable Energy Authority of Ireland). SEAI has recently produced new booklets for teaching energy in the curriculum, including "The Energy File" and "Guzzler Investigates Energy!" for primary schools and "Exploring Energy" for secondary schools.

There is already a great wealth of educational resources from Junior Infants to Leaving Certificate level to help teach about energy, in particular from SEAI. A list of contacts where such information can be acquired is given at the end of this booklet.

The following page provides an outline as to how Energy as a theme in the Green-Schools programme can be integrated with subjects throughout both the primary and secondary curricula.

ENERGY

Linking *Green-Schools* with the National Curriculum

SPHE (Primary)

- Promote personal development and well being.
- Develop citizenship and a sense of personal and social responsibility.
- Promote communication, co-operation, and working with others.
- Encourage media awareness.

CSPE (Secondary)

- Recognised as a suitable Action Project for Junior Certificate classes.
- Develop citizenship and a sense of personal and social responsibility.
- Promote communication, co-operation, and working with others.
- Encourage media awareness.

SCIENCE

- Study of the many forms of energy and its sources.
- Develop a scientific approach to problem-solving.
- Encourage responsibility for the environment and promote sustainable development.
- Promote communication of ideas, report writing, and presentation.

GEOGRAPHY

- Develop a critical understanding of environmental issues relating to energy at local and global level.
- Study of human and natural environments (sustainable management of renewable energy, etc.).
- Promote communication of ideas, report writing, and presentation.

LANGUAGES

- Source of topics for essays, poetry, etc.
- Promote communication skills, public speaking, debates.
- Potential for many activities involving speaking and writing.

HISTORY

- Examination of changes in energy consumption over time.
- Historical impact of energy resources (e.g. oil, coal, wood).
- Relate to change in lifestyles and society.

MATHS

- Provide real life situations for mathematical analysis e.g. (calculate energy consumption and/or CO_2 production).
- Use of charts and graphs.
- Introduction to database management.

Also:

ART

- Creation of posters/murals/fashion to aid the awareness of the importance of energy.

1.1 What is Energy?

Science defines energy as *the ability to do work*

Energy is all around us and comes in different forms – heat (thermal), light (radiant), mechanical, electrical, chemical, and nuclear energy. We use energy for everything we do, from running to catch a bus to cooking a pizza, from flying a kite to sending astronauts into space! Although there are many forms of energy, most can be put into two categories, *kinetic* and *potential*. The following is a brief description of some of the main energy forms in these categories. Perhaps your class can carry out a project examining kinetic and potential energy in more detail?

POTENTIAL (STORED) ENERGY

Potential energy is the energy in matter due to its position or the arrangement of its parts. A wound spring, a taut bowstring, a stretched rubber band, and an inflated balloon are all examples of potential energy.

Gravitational Energy is the energy of position or place. A rock resting at the top of a hill contains gravitational potential energy. Hydropower, such as water in a reservoir behind a dam, is an example of gravitational potential energy

Elastic Potential Energy occurs when an object (such as our skin, a spring, a trampoline, or a rubber band) resists being stretched out of shape. A stretched rubber band has the potential to do work or change things. For example, toy airplanes fly when a rubber band untwists and spins a propeller.

Chemical Energy is potential energy stored in the bonds of molecules in all living and non-living things. Biomass, petroleum, natural gas, and propane are examples of stored chemical energy that we can harness. Our bodies run on chemical energy from the food we eat.

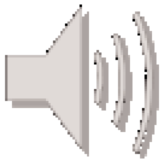
Nuclear Energy is energy stored in the nucleus of an atom holding the nucleus together. Nuclear power plants split the nuclei of uranium atoms in a process called **fission**. The sun combines the nuclei of hydrogen atoms in a process called **fusion**. Much research is currently being carried out in producing energy from nuclear fusion successfully on a large scale.

KINETIC (MOTION) ENERGY

Kinetic energy is defined as the energy of a moving object. A thrown football, a speeding automobile, a waterfall, or a rock falling from a cliff are examples of objects that have kinetic energy.

Thermal Energy, or heat, is the internal energy in substances – the vibration and movement of the atoms and molecules within substances. Geothermal energy is an example of thermal energy.

Evidence of Energy



Sound, mechanical motion, and light are not easily classified as kinetic and potential energy. *They are evidence of energy.*

Light is an example of electromagnetic radiation and has no mass, so it has neither kinetic nor potential energy. The remaining forms have qualities of both kinetic and potential energy. Sound is made up of vibrations (put your hand on a stereo speaker) and mechanical energy is the combination of kinetic and potential energy of a moving object.

What forms of energy are used in transportation?

Sailboat: *mechanical energy* (source: wind).
Walking, roller skating, cycling, and canoeing: *muscular energy* (source: food).
Train: *chemical energy* (source: fossil fuels) or electrical energy.

The most efficient means of transportation in terms of energy utilisation is the bicycle. Over one kilometre, a cyclist expends 20 to 100 times less energy than a car!

1.2 Energy Resources

There are different sources of energy that we use on a daily basis, many storing energy in different ways. Energy resources are divided into two main groups - *renewable* (an energy source that we can use over and over again) and *non-renewable* (an energy source that once used up cannot be replaced in a short period of time). Renewable and non-renewable energy sources can be used to produce secondary energy sources including electricity and hydrogen. Primary energy sources are found in nature, such as the sun, coal, and oil. Secondary energy sources are produced from a primary energy resource using technology – e.g. electricity produced from solar energy by photovoltaic cells, or from coal or peat using turbines in a power plant. Primary energy resources such as coal, oil, gas, peat, water (hydro-electricity), and wind are used to generate electricity in the Republic of Ireland and Northern Ireland.

Renewable Energy

Renewable energy resources can be replaced in a short period of time. The most commonly used renewable sources of energy include hydropower (water), solar, wind, geothermal, and biomass.

The use of renewable energy is not new. For thousands of years, and indeed up to less than 150 years ago, wood supplied a large percentage of the world's energy needs.

However, due to the convenience and low prices of fossil fuels, the use of wood as an energy resource has fallen, especially in developed countries.

Historically, low fossil fuel prices (especially for natural gas) have made growth difficult for renewable fuels. Also, renewable fuels have some limitations (e.g. their intermittent nature – cloudy days have limited solar gain; quiet days mean no wind blows to drive wind turbines; dams are primarily for flood control, so hydroelectricity production varies as a dam's water levels change). Despite these factors, renewable energy is proving to be of increasing importance throughout the world, especially in respect to the rapid depletion of fossil fuel resources.

Non-renewable Energy

Most non-renewable energy sources are in the form of fossil fuels and take many thousands or even millions of years to form. Most come out of the ground in the form of liquids, gases, and solids. Currently, crude oil (petroleum) is the only naturally liquid commercial fossil fuel. Natural gas and propane are normally gases, and coal is a solid. Coal, petroleum, natural gas, and propane are all considered fossil fuels because they formed from the buried remains of plants and animals that lived millions of years ago. Peat, a 'young' fossil fuel that still takes several thousand years to mature, is also an important non-renewable energy source in Ireland. When all the peat has been harvested from the bogs, there will be no more peat.

Uranium ore, a solid, is mined and converted to a fuel. Uranium is not a fossil fuel, as it was not formed from the remains of living plants and animals. However, while it may last longer than fossil fuels, uranium, like coal, gas and oil, will eventually run out.

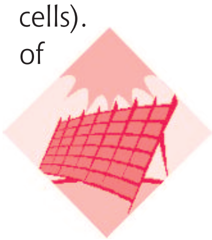
When non-renewable energy resources are used up they cannot be replaced

1.3 Alternatives to Fossil Fuels

To achieve an energy future without serious global warming (see Section 5), we need to turn to clean, renewable sources of energy, such as wind, solar, hydro, and geothermal.These energy sources do not produce the air pollutants that burning fossil fuels does and they will never run out. Another renewable energy source is biomass. There are emissions associated with producing energy from biomass as described below.

Solar power

All the energy stored in the Earth's reserves of coal, oil, and natural gas is equal to the energy from 20 days of sunshine. Solar energy is free and inexhaustible and is the basis for almost every form of energy we use. Solar power can be used to heat buildings and heat water through solar heat collectors. It can also be used to generate electricity using photovoltaic cells (or solar cells). Developing nations can make use of photovoltaic cells to avoid building long and expensive power lines to remote areas.



Wind power

Wind power is often the least expensive form of renewable energy resource. Wind turbines can capture between 20 and 40 percent of the energy in the wind. Large wind turbines typically use less than half an acre of land, so farmers can continue to plant crops and graze livestock right up to the base of the turbines. Wind is projected to supply 3% of world electricity in 2030.

Hydropower

Hydropower is still the most significant source of renewable energy, providing more than 97% of all electricity generated by renewable sources. World-wide, about 20 percent of all electricity is generated by hydropower. Hydro-electric power plants convert the kinetic energy contained in falling water into electricity. Norway produces more than 99% of its electricity from hydropower.

Hydropower is one form of water power – other forms include tidal power and wave power, which can provide renewable energy through the ocean resource.

Geothermal

Geothermal energy is natural heat contained below the Earth's surface. The heat is brought to the surface as steam or hot water (created when water flows through heated, permeable rock) and used directly for space heating in homes and buildings or converted to electricity. The most rapidly growing use for geothermal energy is geothermal heat pumps. These pumps use earth or low-temperature groundwater as a heat source in the winter and a heat sink in the summer. Iceland gets 45% of its energy from geothermal sources.

Biomass Power

Biomass is plant matter, such as trees, grasses, agricultural crops, and other living plant matter. Biomass also includes organic wastes – agricultural wastes, sewage sludge, and manure. Biomass can be used in its solid form for heating applications or electricity generation.

Emissions from solar, wind, hydro, and geothermal technologies are negligible because no fuels are combusted, but biomass is burned to produce energy, releasing CO_2 into the atmosphere in the process. However, this release of CO_2 is balanced by the amount of CO_2 taken up by the same plant matter as it grows. This means that there is no net increase of CO_2 from burning biomass, it is considered to be part of the natural carbon cycle of the earth.

Biomass can be converted into liquids (e.g. ethanol, methanol, and biodiesel) to produce transportation fuels or converted into gases (e.g. methane, hydrogen) to produce electricity. However, it is important to note that Biomass for the production of Biofuel often relies on substantial tillage and inputs of energy, water, fertilizers and various other chemicals which can have a negative impact on the environment.

Irish Situation

Ireland imports over 90% of its fuel supplies and relies on oil to provide for up to 60% of fuel alone. The total share of energy generated from renewables in Ireland increased from 1.8% in 1990 to 2.7% in 2006. As part of The National Climate Change Strategy the Government has set an ambitious target of generating 15% of Ireland's electricity from renewable sources by 2010. Renewable energy can reduce pollution, global warming, dependence on imported fuels, and create jobs, so there is nothing to stop us from really tapping into this limitless resource.

1.4 Energy in Living Systems

Food Energy

Almost everything you eat can be traced back through the food chain to the sun. Energy changes form at each step in the food chain.

For example, using photosynthesis, leaves on a corn stalk convert solar energy to chemical energy allowing it to grow and create ears of corn – its seeds. The energy of the sunlight is stored in the leaves and inside the corn kernels as sugars and starch. The corn is harvested and is fed to chickens and other animals (including humans!). Animals, such as the chickens, use the stored energy in the corn on the cob to grow and to move. Some energy is stored in the animal in its muscle tissue (protein) and in the fat. You buy the chicken at the supermarket, bring it home and cook it (using energy – probably from a non-renewable resource!).

In the same way as the chicken converted the chemical energy in the corn, your body converts that stored energy from the chicken's meat and fat, enabling you to carry out essential life processes, including breathing in oxygen and exhaling carbon dioxide. That carbon dioxide is then used by other plants in combination with nutrients and sunlight to grow. So, it's a big circle.

Food (Energy) Webs and Chains

Energy flow in living systems enables humans and other organisms to survive. Living systems use energy to grow, change, maintain health, move, and reproduce.

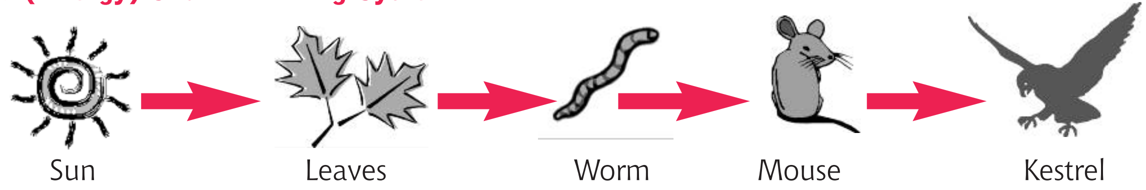
The food chain or food web begins with *producers,* which are organisms such as green plants that can make their own food. Through photosynthesis, producers convert solar energy to chemical energy.

Plants are then eaten by *consumers,* which are organisms that cannot make their own food. *Herbivores* are consumers that eat only producers. Consumers that only prey on other consumers are called *carnivores*. *Omnivores,* like ourselves, are animals that get their energy by ingesting either producers or consumers. Decomposers are also an integral component of all ecosystems, recycling nutrients back into food chains. The remaining potential energy in unconsumed matter is used and eventually dissipated as heat.

The amount of energy that makes it from one level in the food chain to the next can vary, but will generally average about *ten percent*. (However, only about 3% of all the energy a plant receives from the sun is converted into chemical energy).

Human societies, like natural ecosystems, need energy to organise and maintain themselves. The human use of energy follows the natural laws that govern energy flow in all systems.

Food (Energy) Chain in Living System



Energy Chain in Human Societies

How Do We Measure Energy?

Two of the main measuring blocks of energy are the Btu (British thermal unit) and joules or kilojoules. Btu is the amount of heat energy it takes to raise the temperature of one pound of water by one degree Fahrenheit. It takes about 2,000 Btus to make a pot of coffee!

The English scientist James Prescott Joule discovered that heat is a type of energy. One thousand joules is equal to one British thermal unit. ***1,000 joules = 1 Btu.*** So, it would take 2 million joules to make our pot of coffee! Energy tends to be measured in joules rather than Btus, and in values of kilojoules (where 1,000 joules = 1 kilojoule). For example, a piece of buttered toast contains about 315 kilojoules (315,000 joules) of energy. With that energy you could:

- Jog for 6 minutes.
- Cycle for 10 minutes.
- Walk briskly for 15 minutes.
- Sleep for $1\frac{1}{2}$ hours.
- Run a car for 7 seconds at 80 kilometers per hour.
- Light a 60-watt light bulb for $1\frac{1}{2}$ hours.

If you overeat, the energy in food is not "burned" but is stored as potential energy in fat cells.

Changing Energy

- A television changes electrical energy into light and sound energy.
- When you talk on the phone, your voice is transformed into electrical energy, which passes over wires (or is transmitted through the air). The phone on the other end changes the electrical energy into sound energy through the speaker.
- Chemical energy in food is converted to mechanical energy (moving our muscles) by a process similar to burning called respiration.
- A toaster changes electrical energy into heat and light energy. (If you look into the toaster, you'll see the glowing wires.)

- Green plants convert radiant (solar) energy into chemical energy in the form of starches and sugars.
- When you turn on a device that is battery-operated, the electrical potential energy stored in the battery is converted into other forms of energy such as sound, mechanical motion, thermal energy, and light.

Energy Conservation and the Laws of Thermodynamics

Energy is vital to every aspect of our lives. However, energy can be difficult to conceptualise as it is continually changing from one form to another.

First law of thermodynamics:	Second law of thermodynamics:
"Energy can neither be created nor destroyed; it can only be converted from one form to another."	**"With each energy conversion from one form to another, some of the energy becomes unavailable for further use."**

1.5 Children's Ideas About Energy

Many misconceptions about energy are carried into adulthood so that the need for energy efficiency and the environmental consequences of energy use are not seen as important. Some common misconceptions and over-simplifications are explained below:

Energy is a substance like a fluid

Energy is not a substance. Fuels, for instance, are *sources*, not *forms* of energy. It is not uncommon to talk about energy as flowing; however this is only an analogy. The term preferred by the national curriculum is transfer. For instance "energy is transferred from a hot area to a cold area". Electricity is a form of energy that is transferred from a power station to your homes and schools.

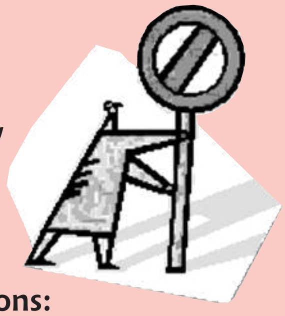
Hot and cold things are different

Phrases such as "leaving the door open lets the cold in" lead to this misunderstanding. All energy is transferred from materials containing a lot of energy to those containing less. Heat is transferred from high temperature areas to those at a lower temperature until the levels of energy equalise. Leaving the door open in cold weather allows heat energy to be transferred from inside the school to the colder, outside environment. Hot and cold are just points on a continuous scale.

Heat rises

This very common expression gives rise to much confusion. When materials are heated they expand. Hot air is less dense than cold air and therefore "floats" or rises above it. Heat energy will always be transferred from a hot area . . . but not necessarily upwards.

Safety Note



It is essential that schools must be operated safely and that safety considerations take precedence over energy issues. The authors of this booklet shall not be held liable for the safety impact of any of the suggestions made herein.

The following is a non-exhaustive list of some safety considerations:

- **Sufficient light must be present for safe use of the building.**
- **Windows must not be kept closed or school made weather-tight such that the air is not kept fresh.**
- **Schools should test for the presence of radon and seek professional advice if unacceptable levels of radon are discovered.**
- **Domestic hot water in cylinders and other water heaters should be kept above 55°C whenever heaters are on, to help minimise the risk of bacteriological growth.**
- **Students should not be allowed access to areas that are dangerous or where insurance does not allow access.**

Section 2 ENERGY IN IRELAND

The development of a fully sustainable society will be highly dependent on how we source and use our energy. It is important that we ensure that maximum value is obtained from the energy resources that we currently have and will have in the future. The aim in the long term should also be to move towards the use of renewable energy resources and limit dependence on fossil fuels. It is vital that future increases in economic growth will not automatically correspond to increases in energy consumption.

Traditionally, energy has been studied under the curriculum and managing of school energy use left to the caretakers and visiting engineers. Teachers and pupils have not, in the past, been at all concerned with energy management. However, separating these functions is no longer an option. Educational, environmental, and financial pressures are forcing schools to integrate these aspects into a single whole-school policy for energy.

Some Facts and Figures

Ireland is one of the world's highest contributors to Global Warming on a per capita basis.

- In 2006 97% of Ireland's energy was provided by fossil fuels. 91% of which was imported. Ireland has massive indigenous renewable resources available. The EU has set a target of generating 12% of Europe's total energy from renewable sources by 2010.
- Ireland aims to increase the percentage of electricity generated from renewable sources from 4.5% in 2006 to, at the very least, 15% by 2010. It is estimated that we only have enough oil in the world for another 40 years.
- The recommended temperature for classrooms is 18ºC. Every 1ºC increase in temperature over this figure will add up to 10% to cost of heating bills.
- A photocopier left switched on overnight wastes enough energy to make 5,300 A4 copies.
  By turning your appliance off standby you can save 20% of your energy usage.
- On average, a car in Ireland travels 20,000km a year, releasing 2,895kg of carbon into the atmosphere. A school bus carrying 72 passengers can travel 7 miles on one gallon of fuel. That is approximately 500 passenger miles per gallon. A car can only carry 5 passengers for 40 miles. That is approximately 200 passenger miles per gallon.

Green-Schools Objectives

- To raise awareness that simple actions can cut down energy consumption substantially.
- To help students and the wider community understand that conserving energy is vital in order to help protect our environment from the impacts of Climate Change and to protect our future.
- To show students the link between energy consumption and financial cost – and how it impacts on home as well as school life.
- To monitor energy consumption wherever and whenever possible.
- To use data for curriculum work.
- To learn about the different types and sources of energy.

Teaching Objectives

- To learn about the importance of the different energy sources to everyday living.
- To carry out calculations using suitable number strategies and techniques.
- To collect, interpret, and present data in different forms, using information and communication technology where appropriate.
- To present findings to others in a way that will persuade them to change their attitudes or behaviour.
- To work co-operatively with others.

2.1 History of Energy in Ireland

It is over three hundred years since the production of combustible gas from coal was demonstrated in Dublin. This coal gas was initially being used to light Dublin streets. In 1927, the Electricity Supply Board (E.S.B.) was established. This was shortly followed by the commissioning of Ireland's first large scale hydro-power station at Ardnacrusha, Co. Clare.

Peat has been a source of energy for Irish people for centuries and industrial peat briquettes have been sold since the 1850's. Bord na Móna was established in 1946 and, in the 1950's, the E.S.B. began building peat fuelled power stations.

In 1976, Bord Gáis, the state gas utility, was established. Shortly afterwards, natural gas from Kinsale gas field was used at an E.S.B. power station. Many advancements and huge changes were made within the Irish Energy industry during the 1990's. In 1990, 68% of the energy sources required were imported. In 1991, the Irish Hydropower Association was formed, while in 1992, Ireland's first wind farm was commissioned in Co. Mayo. In 1993, the Irish Wind Energy Association was established. In 1994, the Irish Energy Centre (now SEAI – Sustainable Energy Authority of Ireland) was set up and the Alternative Energy Requirement (AER) was launched by the government to support investment in renewable energy.

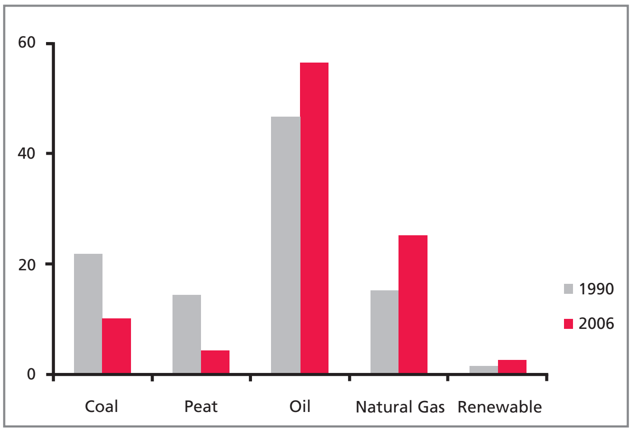
In 1996, the government policy document "Renewable energy: a strategy for the future" was published and Ireland's first landfill gas generating station was commissioned. In 1998, Ireland signed the Kyoto agreement while, in 1999, the government produced a Green Paper on "Sustainable Energy". In 2000, the market for electricity generated from renewables opened up to free competition. Ireland has also recently shown increased commitment to the development and promoting of more energy efficient technologies and practices across all end-use sectors.

Present Day

World-wide energy demand is expected to continue to grow steadily and Ireland is no exception. Forecasts predict that our energy demand will increase by 84% between 1990 and 2010 and that CO_2 emissions will increase by over 25%. The Kyoto agreement has set legally binding targets to limit and reduce greenhouse gas emissions. Renewable energy accounted for 2.7% of Ireland's total primary energy requirement (TPER) in 2006 compared with 1.8% in 1990. The EU White Paper target is to achieve a 12% contribution EU-wide from renewables to TPER by 2010.

The following table illustrates Ireland's total growth rates and shares of TPER in 2006 compared to 1990. A percentage share of each sector is given.

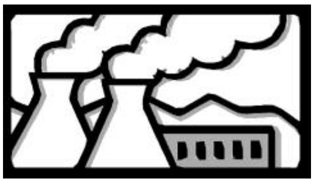
Ireland's Total Growth Rates and Shares of (TPER) in 2006 *(Source: SEAI website)*



From the table above we see that very little of our energy is produced from renewable resources. This is changing slowly, but it is up to the consumer to demand a cleaner form of energy, as well as becoming more energy efficient in the home, school, and workplace.

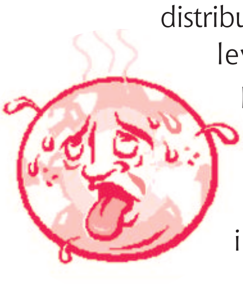
2.2 Why Schools Should be Concerned About Energy

Fossil fuels, the source of much of our energy, are formed under intense pressure and heat over millions of years from the buried remains of plants and animals. By burning these fossil fuels to release heat from the chemical energy they contain, steam can be raised in a power station boiler. The heat and pressure energy in the steam is turned into work in a turbine, which drives a generator to produce electricity.



Not all the energy in the fuel can be changed into electricity; some heat goes up the chimney in the gases formed when fuels are burned, some more is radiated from the outside of the boiler, and some of the work done by the turbine will be turned to heat by friction in the generator. For example, in a typical power station using coal, up to 80% of the fuel could be dispersed in the form of heat and noise. So although energy cannot be destroyed, it can all too easily be "lost".

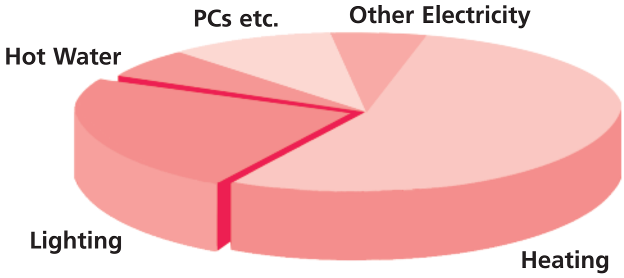
Also, by burning fuels we are releasing carbon dioxide (CO_2) into the atmosphere faster than plants can absorb it. CO_2 is a major contributor to the greenhouse effect; as more fuels are burnt, the atmospheric concentration of CO_2 increases, causing the average global temperature to rise (see Section 5). This influences the distribution of climatic regions, sea level and ultimately, the planet's ability to support human communities. Burning fossil fuels also contributes to acid rain, which is implicated in the loss of wildlife in lakes and rivers, the reduction of land fertility, and the destruction of trees.



The energy required for heating, lighting, and powering equipment in an ordinary classroom involves the release of about 3,000 kg of CO_2 every year. That's enough to fill five balloons of 10 meters in diameter!

Most schools spend a significant percentage of their annual budget on energy. However, some schools spend up to four times more per student than similar schools due to inefficient energy management. Surveys indicate that schools can reduce their fuel bills by up to 10% through no cost and low cost measures (see Section 3.7 for some examples). Electricity costs in Ireland are already amongst the highest in Europe and these costs are on the increase due to soaring fuel prices. These environmental and financial considerations should make energy use and conservation an important part of the school curriculum.

Energy Use in a Typical School

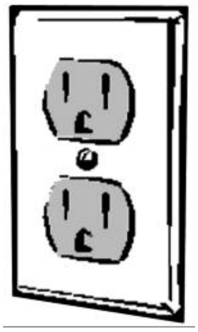


(These percentages depend on the types of appliance and energy saving measures)

Heat Loses in the School

All schools lose heat through the walls, windows, doors, and roof. If a building is well insulated and draught proofed the rate of heat loss will be lower and, therefore, less heat energy will be required to keep the internal environment at a comfortable temperature. Ensuring doors and windows are closed whenever possible will also aid in reducing heat loss. However, enough fresh air must be provided to maintain indoor air quality levels, especially in laboratories and other specialist rooms.

Section 3 WHAT YOU CAN DO



As mentioned in the previous section, a large proportion of the expenses in running a school go towards energy costs, primarily heating and lighting. However, implementing a few simple "no cost" and "low cost" ideas for conserving energy can dramatically reduce bills for electricity and heating within the school (see Section 3.7). As for litter and waste, we shall tackle the *Green-Schools* theme of Energy through four stages as detailed below:

1 Analyse the problem

Before you even start to think about the solution you need to find out more about the problem. What are the main sources and uses of energy in the school? What areas have the greatest potential for wastage of energy? Use the energy survey described in Section 4 to find out where energy usage is highest and where possible improvements may be made.

2 Devise an action plan

Once you understand the problem you have to think of ways to solve it. Try to involve as many people as possible. Have a brainstorming session where everybody comes up with lots of ideas, however crazy they may seem. Your action plan should identify *quantifiable targets and goals* and detail how you are going to achieve them (see Section 3.3).

3 Measuring success

You must plan from the beginning how you will measure the success of your energy action plan. This will involve some method of comparing the amount of energy used (e.g. units of electricity per month, litres of oil, etc.) after the implementation of your action plan with the initial findings. Adjustments to your action plan may then be made if necessary.

4 Maintenance

The most difficult thing will be to keep the rate of energy consumption in the school permanently low. In order to achieve this, your energy action plan should be ongoing. You will need to monitor energy consumption regularly and make sure any sudden increases are noted and acted upon, where possible.

Curriculum Relevance

Energy is clearly related to science, geography, technical drawing and home economics. *Energy and Forces* and *Environmental Awareness and Care* are two of the four main strands of the primary school curriculum science programme. But, energy topics can also be integrated across the curriculum, even at nursery level, and can provide an interesting way of developing key skills. The study of energy and the environment is as much about process as it is about content.

What Schools Have Done

Roscommon Community College has made huge progress towards reducing their energy consumption. A 'lights off' campaign at lunch and break was initiated. They visited Arigna Mines to see where coal comes from and learnt about energy production. The students also visited the Leitrim Windfarm and learn about renewable energy. They replaced old double strip lights with single strips. Light switches painted red to ensure use only when necessary. Heating oil per student has reduced from 16.9 litres per student in 2004 to 15.2 litres per student in 2006 attributed to the new energy saving system installed 2005. ESB costs have also significantly reduced from €42 per student per year in 2004 to €39 per student per year in 2006. Students constructed a model house powered by alternative energy sources. Solar panels were fitted to the roof and wind turbines powered the light fittings, aided by the fieldtrips and a visit from Duncan Stewart

Top Tip! *Think before you buy!* How much of the food you will eat today will be locally produced? And how much will travel hundreds, if not thousands, of miles before it is delivered to your plate. Next time you go grocery shopping stop and see if you can think of any 'hidden' energy costs! For example, in order to produce beef for your hamburger there are a number of hidden costs. Energy is required to produce farming infrastructure, transport goods for the cattle such as food, water and medicines, Energy is required to run the farm machinery and all the transport costs to get from the farm to the shop shelf to you plate! The production of 1kg of beef alone requires huge amounts of energy and approximately100, 000 litres of water!

3.1 Establishing an Energy Committee

As you have already successfully implemented the *Green-Schools* programme for the Litter and Waste theme, your school will understand that the development of an effective committee is the most important driving force for successfully implementing the programme. When creating a committee for the energy theme, remember that you will still be maintaining and developing the work carried out for Litter and Waste. You may wish to use your current committee to tackle Energy as well as Litter and Waste, or you may wish to develop a specific committee dedicated to the Energy theme.

As is detailed in the *Green-Schools* Handbook, you will need the help and support of students, teaching, and non-teaching staff and it is important that all groups are represented on the committee. *(Remember, the committee should be as student-led as possible!)*. The person responsible for the general maintenance of the school will be a particularly important person to involve. He or she is likely to have most information on the building's heating and lighting systems. You will need the help and co-operation of whomever usually deals with the energy bills.

Remember also that your Local Authority can also provide additional information and support.

For more ideas on who should be involved, as well as the purpose and function of the committee, you should refer back to the relevant page of your *Green-Schools* Handbook. At this stage it is important to decide on your general aims and objectives. They should be realistic and achievable. Success increases confidence and encourages further success. *Remember, the activity ideas described in the booklet are just a starting point – it is quite probable you will develop some interesting and innovative ideas of your own.*

The next step is to undertake the *environmental review*. This review should include an energy audit, followed by an energy review. An energy audit involves the assessment of the school's energy costs and efficiency by examining past electricity/heating bills and other energy costs in the school. The audit is detailed on the following page, while the detailed energy review is given in section 4 of this booklet.

Once the energy audit and environmental review have been carried out satisfactorily, the committee should then work carefully on a detailed *action plan* (or plans). The action plan should specify your own targets and goals for the Energy theme, and detail and assign specific tasks identified in order for these targets and goals to be achieved within specified time frames. See the excerpt of the Sample Action Plan for Energy in Section 3.3.

3.2 Energy Audit

Remember a detailed Environmental Review for energy is outlined in Section 4 of this booklet.

1. In order to undertake an effective energy audit of the school, you will need to examine energy bills for previous months and/or years. These will be electricity bills and bills from any other source of energy used by the school (e.g. oil, gas, etc.).

In the case of electricity for example, the following information may be obtained:

- Total electricity used per month.
- Total cost per month.
- Total number of billing days.

2. Now, taking into account the number of students present in the school at the time of the bills, the following information may be calculated:

- *Daily use:* total use per month divided by number of billing days per month (kWh/day).
- *Personal daily use:* daily use divided by size of school population (kWh/person/day).
- *Daily cost:* total cost per month divided by number of billing days per month.
- *Personal daily cost:* daily cost divided by size of school population.

3. Using the electricity meter, an overnight reading can be carried out by taking a reading of this meter at the end of a school day and then again as soon as the school opens the next morning. To record the amount of electricity consumed throughout the night, simply subtract the 'end of school day' reading from the morning reading. This will give a figure for the minimum or *base-load* for electricity use in the school.

4. Follow the same guidelines to work out hourly, daily, weekly, and monthly readings for different periods during the school day/week/month/year. Where possible, values can be compared between successive months and years. Perhaps your calculated rates of energy consumption can be compared with that of other schools in your area? You can also find out how much people pay for energy in other parts of the country, or the world, and adjust the bill using those rates.

5. While every school will have electricity bills, you may also have bills for other energy sources, such as gas and/or oil. Similar calculations should be carried out for these bills to allow effective monitoring and evaluation of energy/fuel use.

Action Plan

6. Once a detailed energy audit and environmental review have been carried out, it is important to carefully design your action plan taking into account the results of your review and audit. As mentioned in the main Handbook, and on the previous page, the action plan must be comprised of identified targets and goals with a breakdown and description of the actions to be implemented (and by whom) within specific time frames in order to achieve those goals. An excerpt from a sample energy action plan is given on the following page.

3.3 Excerpt of sample Action Plan for Energy

Goal 1: ***To ensure entire school is fully aware of the Green-Schools Energy programme and to encourage full participation in the programme by Christmas***

Action	Person/Group Responsible	Time Frame
Design posters to promote the results of the energy audit and review to put up on *Green-Schools* notice board.	*Green-Schools* committee.	Within the next two weeks.
Organise a "Switch it off" campaign, with posters in both Irish and English in every classroom to remind students and teachers to switch off lights when leaving room or when not needed, and to switch off appliances when not in use.	Posters to be designed with help of teachers in 4th,5th, and 6th classes. Posters to be laminated by co-ordinating teacher and put in classrooms by committee.	Posters to be put up in every room by 2nd week in October at the latest.
Organise a "Low Energy Day" for November 21st for whole school participation and awareness-raising. Inform the school of plans over intercom, school assemblies, and posters in classrooms and on *Green-Schools* notice board.	Principal to inform school over intercom; committee members to speak at school assemblies and design promotional posters.	Posters to be put up by start of November and reminders over intercom and during assemblies to be ongoing up to the 21st of November.
Inform parents of aims and efforts of Energy programme through Christmas newsletter. Include results of review and details of "Low Energy Day" successes.	Information to be written up by committee in co-operation with newsletter team.	Information to be written up and prepared by 1st week in December in time for Christmas newsletter.

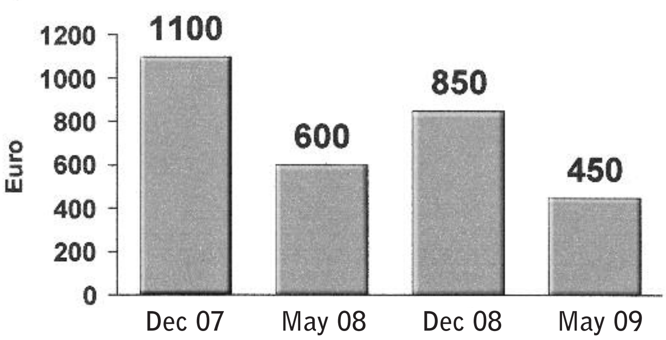
Goal 2: ***To reduce rate of electricity consumption by 10% through "low cost" and "no cost" methods within 6 months of programme implementation***

Action	Person/Group Responsible	Time Frame
Read electricity meter daily and formulate weekly and monthly graphs on electricity consumption. Weather also to be recorded daily to aid in long-term comparisons of energy consumption in successive years.	Rotate responsibility among student committee members with help from caretaker. 5th and 6th classes to create graphs. All classes to record weather.	Ongoing.
Form an "Energy squad" (with volunteers from each class – not committee members) to ensure "switch it off" campaign is being fully implemented – classes to be checked daily.	Each teacher to organise and rotate responsibility within classroom.	To be up and running by last week in October.
Compare monthly rate of energy consumption with same months from previous year (i.e. comparing with results of energy audit).	Committee members (students and teachers) to carry out calculations.	Comparisons to be carried out continually, but target for 10% reduction by February.
Publicise results of monitoring and evaluation and make adjustments as required.	*Green-Schools* committee.	Ongoing from February.

3.4 Monitoring and Evaluation

For a successful energy campaign, changes must be demonstrated. The energy audit can be extremely effective to help compare current and past energy consumption levels. It is most important that behaviour and practical measures are monitored over an extended period of time.

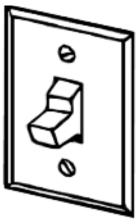
ESB Bill Seasonal Comparison



Students can:

Monitor changes in behaviour

- Are doors and windows left open causing heat loss from school buildings?
- Are lights still left on unnecessarily?
- Is supplementary electric heating still used?
- Are room temperatures correct?
- Display the information on a room by room basis, congratulating the best rooms!.



Monitor progress on practical improvements

- Are draughts reduced?
- Is furniture moved away from the radiators?
- Are radiator fins clean?
- Are thermostats correct?
- Are the heating times appropriate?
- Is single glazing replaced?

Compare Consumption with other Schools

Compare energy consumption between successive weeks/months and corresponding weeks/months of different years. Can you identify anomalies? Is there a school nearby that you can work with and compare rates of energy consumption with? Or visit the Green Schools website to see some case studies of schools near you! *www.greenschoolsireland.org*. If you are comparing costs of energy consumption between different time periods, don't forget to take inflation and other price increases into account!

Measurements

There are several indicators that can be used to measure energy efficiency and to quantify the success of schemes to reduce consumption. You may decide to invite a representative of the ESB to visit and explain how to read the meter and give you practical advice on how to reduce your electricity bill. You may have just one meter, or quite a few. Gas meters are easier to read, but again may need translating. Ask your local gas company. Oil tanks often have meters, and sometimes boilers do too. Ask the caretaker about these.

Annual cost per student is a basic indicator, but can be particularly useful at times when schools are expanding. Annual cost per square metre of (treated) floor area compensates for differences in the physical size of schools.

N.B. The Green Schools website includes an example of a Green Schools CO_2 Calculator – allowing you to determine CO_2 emissions from the home, school, school bus, cars, planes, etc.
www.greenschoolsireland.org

Accounts

There is more to good administration than just paying electricity and fuel bills promptly.

Students can:

- Use information technology to help monitor meter data.
- Identify anomalies if there is a regular flow of meter data.
- Investigate the cause of the anomalies.

3.5 Informing and Involving the School and Wider Community

Energy management is a team effort. All members of the school community should be aware of what is going on and be encouraged to contribute to the process.

Building Use Improvements

Students can:

- Use *Green-Schools* noticeboard and/or newsletter to report on problems and progress. Content should be appropriate to student age and audience comprehension.
- Produce a large-scale plan of the school and use to record results of surveys, for example, results of "switch it off" campaign.
- Display weekly energy consumption figures on your *Green-Schools* noticeboard. Raw figures need interpretation for different audiences, so graphical representation is important.
- Highlight trends in consumption whether caused by changes in season, school activities, holidays, or student and staff action – these can be illustrated in graphs.
- Place labels next to appliances and light switches giving annual running costs and CO_2 emissions.
- Arrange events for your "Day of Action" that involve families, friends, and neighbours of the school.
- Compile an "energy trail" around the school and neighbourhood, explaining how different forms of energy are provided and controlled.
- Organise drama, music, and art productions.
- Host discussions.
- Write articles for the local paper.

Any school that can demonstrate improvement should take real pride in its achievement. This success should be drawn to the attention of both the school and of the local community. Department of Education school inspectors should also be informed of the school's energy saving achievements.

Practical Improvements

The Board of Management control the budget and therefore, ultimately control any practical improvements. Presentations by students may have greater effect than reports by school staff! Presentations should take account of constraints (money/practicalities) so as not to demotivate students with the response from the decision-makers.

Rewards

It is vital that student and staff contribution to energy management is recognised and rewarded, such as:

- Awards to students, classes, and staff who come up with good ideas.
- Articles in the local paper.

If your school meets or does better than the target you have set, some of the savings could be used to:

- Purchase equipment selected with the students.
- Make school improvements requested by students.
- Finance a school trip or disco.
- Make a donation to a charity of the students' choice.
- Provide a budget for further energy saving to be spent on student recommendations.

The EU Eco-Label, which takes the form of a "Flower", has become a European-wide symbol for products, providing simple and accurate guidance to consumers. All products bearing the "Flower" have been checked by independent bodies for complying with strict ecological and performance criteria.

3.6 Maintaining Continuity

This is probably the hardest part – keeping the whole process going. Involve your students in encouraging new members of the school.

Set Up An Energy Action Squad

Students can:

- Compile presentations for the notice boards.
- Report regularly in assemblies (remember: dramatic presentations make more impact).
- Reward the most energy efficient classes.

New Member Induction

Students can:

- Prepare an induction day for new members of the school. New members may be students, teaching and non-teaching staff, parents or members of the Board of Management.
- Arrange presentations, displays, and help-desks to encourage new members of the school to participate in the energy efficiency campaign.

Helping Other Schools

Students can:

- Encourage neighbouring or feeder schools to become more "environmentally friendly".
- Produce a newsletter for neighbouring schools.
- Act as consultants, advising on energy efficiency (and litter & waste).
- Link up with another Green-School – remember the International Eco-Schools website: *www.eco-schools.org.*

If momentum is flagging, why not organise a special event to promote your success and to encourage support?

Low Energy Day

Just how little energy can your school use in a day? Remember that you must leave on equipment that is needed for:

- Health.
- Safety – for example, fire alarms.
- Hygiene.
- Management – for example, phones.

The energy used by such equipment constitutes the minimum or *base-load* of the school.

Students can:

- Determine the base-load by reading meters before and after a weekend and making adjustments for the length of the school day.
- Record energy consumption on a normal day – this could be done for the day before Low Energy Day, so that the weather and other activities will be similar, ensuring a reasonably fair comparison.
- Publicise Low Energy Day.
- Encourage all in the school to do their best to minimise energy consumption.
- Display updated figures frequently.
- Compare figures with those of a normal day – an opportunity for graphs.

Moving Energy Efficiency into the Home

The need for changing lifestyles goes beyond the school boundary.

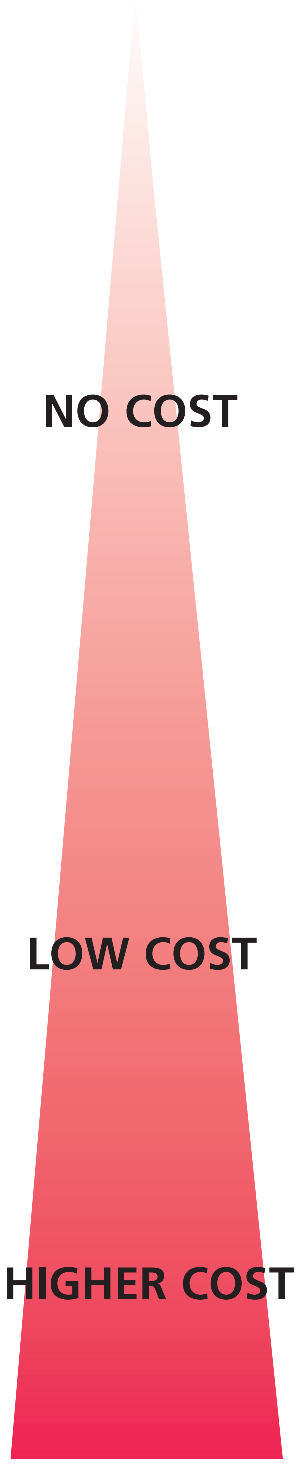
Students can:

- Educate other members of their own family.
- Carry out home energy surveys (visit the Green Home website for great ideas on how to make your home more energy efficient *www.greenhome.ie*).
- Act as "energy consultants" to community groups – this will help develop communication skills for different audiences in different settings.

3.7 Saving Energy – A Summary

We can use a no cost/low cost/high cost hierarchy to help us catagorise the many methods of energy conservation. Here are just a few tips:

Energy Conservation Hierarchy



- **Have a "switch it off" campaign. Make sure to turn off all lights when leaving a room and to turn off all computers and other electrical appliances when not in use or when not required.**
- **Organise an "Energy Squad" to help implement and monitor your "switch it off" campaign. Use posters and stickers near switches to promote the campaign.**
- **Close doors and windows to avoid draughts. Have students locate areas of energy loss using "draftmeters" made from plastic wrap and papers to find where drafts are coming in.**
- **If rooms are too warm, turn down the temperature or turn off radiators rather than opening windows.**
- **Adjust thermostats and time clocks of heaters to more efficient levels if possible.**
- **Use assemblies and discussions in classrooms to promote awareness of energy conservation within the school and in the home.**

- **Fit reflective foil behind radiators.**
- **Install automatic door closers, block draughts.**
- **Insure hot water cylinder and pipes are properly insulated.**
- **Replace incandescent bulbs with CFLs.**

- **Service and tune boiler.**
- **Use photovoltaic cells on security lights.**
- **Replace fluorescent fittings with modern high efficiency reflectors and tubes.**
- **Install double glazing.**
- **Insulate the attic.**
- **Install zone heating systems.**
- **Switch to renewable energy!**

Section 4 ENVIRONMENTAL REVIEW

The terms 'environmental review' and 'environmental audit' are becoming increasingly common as more companies and Local Authorities commission or carry out surveys to assess the environmental impact of their activities. A comprehensive survey of such serious intent is usually accompanied by a statement that specifies planned improvements, their timescales, and also an administrative structure to allocate responsibilities, monitor progress over time, and evaluate success (*i.e. an Action Plan!*).

The environmental review is an open-ended checklist of all aspects of a school's impact on the environment, in this case looking at energy. The review, along with the energy audit detailed in Section 3.2, also provides an educational function, whereby the process of gathering data raises awareness and gives you a basis for developing your action plan.

The checklist

As for the review of litter and waste, each question in the checklist can be answered 'yes' or 'no'. 'No' indicates that improvement is possible. Subsequently, areas can be highlighted for action and targets for improvement can be set and monitored. Space is available on the right of each question for making notes on the timescale.

After the checklist

The checklist includes some ideas for action. These are not intended to be comprehensive; they are starting points for further planning. The questions themselves will also suggest further ideas.

Remember, it is vital not to take on too much. Small and successful actions build confidence and encourage more success. The checklist will raise many issues and indicate a wide choice of areas that require attention, but they should be discussed widely, put in the context of other factors (time, money, skills), and grouped by priority. You should allocate responsibilities and monitor and publicise progress. The selected goals will have a much greater chance of success and can then be fitted into the curriculum.

While the terms 'audit' and 'review' are often used interchangeably, here we refer to the energy audit as an analysis of previous rates of energy consumption either in cost or units of energy (e.g. units of electricity, litres of oil, etc.), while the environmental review is a survey of the environmental impact of the school in relation to energy (e.g. insulation, lighting, heating, etc.).

4.1 Energy Review

Draughts and Ventilation

	YES/NO	COMMENTS	ACTION NOTES:
Does everyone in the school ensure windows are closed when weather is cold and heating is on?		This helps retain heat within rooms.	
Are curtains or blinds closed during cold winter nights?		This helps retain heat within rooms.	
Are windows opened when it gets too hot in the classroom?		This is not energy efficient. Can the heating be turned down in the room instead?	
Are external doors draught-proofed?		This prevents excessive ventilation.	
Are draught strips and seals intact?		Fitting them is inexpensive.	
Do all outside doors close automatically? Does everyone shut doors?		This prevents heat loss.	
Are the floors carpeted?		On solid floors, carpets reduce heat loss to the ground and on wooden floors, reduce draughts.	
Are window frames and glazing tight fitting?		If not, excessive heat loss can occur.	

Students can:

- Record which doors/windows are left open regularly.
- Design simple experiments to identify draughty windows and doors.
- Design a simple questionnaire to investigate why people do/don't shut doors/windows.
- Input data into spreadsheets and charts.

Insulation

	YES/NO	COMMENTS	ACTION NOTES:
Are windows double glazed?		Double glazing can be very expensive to install unless windows need replacing anyway.	

Students can:

- Record the type of window.
- Record the type of insulation on the hot water tanks and pipes. Insulation in walls, floors, and ceilings is harder to investigate and may be beyond the ability of students.
- Design experiments to investigate the insulation effect of double glazing.

Lighting and Appliances	YES/NO	COMMENTS	ACTION NOTES:
Does everyone switch off lights when they leave the room? Is there a "switch it off" policy in the school?		Modern fluorescent strip lighting is robust enough to withstand frequent switching on and off.	
What type of lighting is used in the school?		Filament lamps can be replaced with low energy types of equivalent light output such as fluorescent fittings.	
Are banks of lights nearest to windows switched off if daylight is adequate?		If this is not possible perhaps changes can be made to the wiring.	
Are overhead projectors, computer monitors, television sets, and videos switched off completely and not just left on standby?		A PC monitor left switched on overnight wastes enough energy to laser print 800 A4 sheets of paper.	
Are photocopiers and similar appliances switched off when not in use?		Typically, the standby facility uses 25% of the machine's daily consumption.	
Are computers left on all day?		Screen savers do not reduce the power consumption of a computer monitor unless they actually turn the monitor off. Monitors account for a large percentage of the energy consumption of a typical PC.	
Do school appliances and products carry the EU Eco-Label or Energy Labels?		Products such as light blubs, electrical appliances, detergents, and paper carrying the EU Eco-Label guarantee to have a reduced impact on the environment.	

Students can:

- Assign teams to different parts of the school and create a list of the electrical appliances and lighting in use throughout the school.
- Run surveys of lights left on in classrooms during break/lunchtimes.
- Record whenever equipment is left on standby.
- Calculate electricity used while equipment is on standby.
- Calculate savings in costs and CO_2 emissions if the equipment is switched off.
- Input the data into spreadsheets.
- Calculate the cost of running an appliance, for example, a computer for a week.
- Check that replacement appliances are more energy efficient.

Heating Systems

	YES/NO	COMMENTS	ACTION NOTES:
Is there free space around the radiators and hot air grille? Are the fins behind a radiator clean?		This ensures that hot air is free to circulate. Paper and other waste can be removed.	
Are electric fires and fan heaters routinely used?		Consider using less expensive forms of heating. If radiators aren't working, find out why.	
During winter, are rooms hotter than required?		For example, the recommended temperature is 18°C for classrooms and 15°C for corridors and washrooms. Every 1°C increase in temperature over the above figures will add up to 10% to cost of heating bills.	
Do thermostats read the actual temperature?		If not, you may be wasting energy.	
Does heating equipment switch on and off at appropriate times?		As for above, if not, you may be wasting energy.	

Students can:

- Record room temperatures, identify hot and cold spots, and investigate problems.
- Record room usage.
- Record weather data – an increase in consumption may be due to a spell of colder weather rather than energy wasting.
- Record room temperatures in problem areas over a 24-hour period.
- Graph results and explain anomalies. Relate to heating times and building usage.
- Measure the temperature at different places and different heights in the room.
- Input the data onto spreadsheets.
- Use the students knowledge of convection currents to suggest repositioning furniture.
- Design simple floor plans to demonstrate ideas.
- Identify supplementary heating and investigate its necessity.

Hot Water

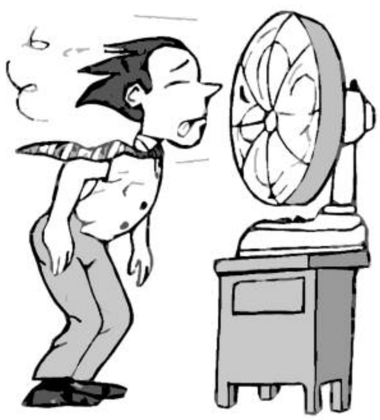
	YES/NO	COMMENTS	ACTION NOTES:
Are there any dripping taps around the school?		A dripping tap can waste up to 90 litres a day. It's money down the drain, especially if that's a hot tap!	
What is the temperature of hot water at hand basins?		Apart from the kitchens and cleaners' room it should be no hotter than 43°C. However, to stop bacteria growing in hot water heaters, the water there must be maintained above 55°C. It may not be practical to change water temperature.	
Is water heated unnecessarily at night, weekends, and holidays?		If so, energy is being wasted.	

Students can:

- Record water temperature.
- Record dripping taps.
- Comment on more efficient hot water usage.
- Check with the caretaker on time-clock settings.

Running Costs

	YES/NO	COMMENTS	ACTION NOTES:
How much does the school pay for oil, gas, and electricity per year?		One tonne of greenhouse gases is released by every 1000 kilowatt hours of electricity from non-renewable resources.	



Students can:

- Calculate total energy consumption in kWh/m²/year, energy cost (Euro)/m²/year or CO_2 emission in kg/m²/year (*see Energy Audit in Section 3.2*).
- Determine the general trend in energy consumption – up or down.
- Identify any unexpected changes in consumption.
- Suggest what has caused the changes.
- Relate to changes in weather and building use.

Section 5 ENERGY AS A GLOBAL RESOURCE

Global Energy Use

Despite continued high energy prices today global energy consumption growth remains high driven by above-average economic growth. World primary energy consumption increased by 2.4% in 2007. China accounted for half of global energy consumption growth. EU energy consumption declined by 2.2% in 2007, with Germany registering the world's largest decline in energy consumption.

In 2000, one billion people consumed over 50% of the world's energy supply. By contrast, the one billion poorest people used only 4%. At present, the industrialised countries account for approximately two-thirds of total world energy use. Their demand for energy is expected to increase by a relatively modest 35% between now and 2025. In contrast, demand in the developing world is soaring - energy demand is expected to rise by 90% in the next 20 years. In 2007 Indian consumption grew by 6.8%, the third-largest volumetric increment after China and the US. By 2025, developing countries are projected to hold a startling half-share in total world energy consumption. When their added demand is combined with that of the industrialised countries, that means a jump in demand in excess of 50% during the first quarter of this century.

The Kyoto Protocol

The Kyoto Protocol is a legally binding agreement under which developed countries will reduce their collective emissions of greenhouse gases by 5.2% compared to the year 1990 over the five-year period of 2008-2012. Ireland ratified the Kyoto Protocol in 2002, committing itself to limit the increase of emissions of greenhouse gases to 13% above 1990 levels. Today, Ireland stands closer to 35% over 1990 levels.

The Greenhouse Effect

The greenhouse effect has operated in the Earth's atmosphere for billions of years due to the presence of naturally occurring greenhouse gases: water vapour, carbon dioxide, ozone, methane, and nitrous oxide. These gases act like a greenhouse to keep the sun's heat in and help make our planet habitable. Without a natural greenhouse effect, the average temperature of the Earth would be about -18°C, which would be too cold to support life. Instead the average temperature is currently 14°C.

Human activities such as burning fossil fuels release more greenhouse gases into the atmosphere, which trap more heat – hence, the temperature of the Earth rises – this gives rise to the enhanced greenhouse effect. It is the possible impacts of this enhanced greenhouse effect on global and regional climate that is of increasing concern to scientists.

Climate Change

We know that the Earth's climate has changed over time and will continue to do so. Throughout the Earth's history, there have been periods of glaciation followed by warming trends in which the glaciers retreated toward higher altitudes and latitudes. There are a number of natural factors responsible for climate change, including continental drift, ocean currents, the Earth's tilt, and volcanoes.

However, today's concerns focus on the current and projected rate of climate change based, in large part, on human activities. The Intergovernmental Panel on Climate Change recently stated that: *"there is new and stronger evidence that most of the warming observed over the last 50 years is attributable to human activities."* It predicts that global average temperatures are *likely* to rise between 1.4 to 5.8ºC over this century.

Uncertainty

Most atmospheric scientists believe that the global climate is warming at least partially because of a build-up of CO_2 from fossil fuel use, but what that means to humans and natural ecosystems is largely unknown. Therefore, controversy exists as to the magnitude and danger of global warming induced by greenhouse gases.

Energy Terminology

Cavity Wall

Most modern schools will have been built with cavity walls. These walls are made of two layers of bricks or blocks with a gap in between. Insulation such as cavity foam is usually placed in the gap.

Draught proofing

Outside doors, windows, and letterboxes can be fitted with special gasket-like seals to prevent draughts. These may look like small brushes or rubber strips. Most buildings also have purpose built ventilation openings to give a minimum of background ventilation. These must not be sealed up as this can lead to dangerous operation of gas or oil or solid fuel appliances and of fire places. It can also lead to a build up of moisture in the building which may result in damp walls and mould growth. It may also lead to increased radon gas levels. Further details about radon can be obtained from the Radiological Protection Institute of Ireland.

Energy efficient light bulbs/compact fluorescent lights

These use about a fifth of the electrical energy used by ordinary (tungsten filament) bulbs and last about ten times longer.

Geothermal Heat Pump

A device that utilises the relatively constant temperature of the Earth's interior, using it as a source and sink of heat for both heating and cooling. When cooling, heat is extracted from the space and dissipated into the Earth; when heating, heat is extracted from the Earth and pumped into the space.

Insulation

Insulation materials do not allow heat to pass through them very easily. Materials like fibreglass and polystyrene foam are commonly used in schools.

Nuclear fusion

A nuclear process in which the nuclei of two light, non-radioactive elements are forced together at ultra-high temperatures and pressures to form the nucleus of a slightly heavier element (such as helium) with the release of substantial amount of energy. The sun's energy comes from nuclear fusion.

Leaking electricity/Standby consumption

The energy used by an appliance when the appliance is in its lowest power mode (typically when the appliance is off). A variety of appliances, especially those with remote control devices, consume electricity even after they are turned off. Other appliances, including those with built-in clocks, never stop using electricity.

Solar heat collector

A device that uses curved mirrors or lenses which focus the sun's rays to heat water which is either used directly for heating or to generate electricity using steam.

Storage heater

Electric storage heaters are designed to store up heat automatically at night when the cost of electricity is less. Special bricks inside the heater are heated during the night and then release the energy slowly during the day.

Photovoltaic cell

A device that converts solar energy directly into electricity. For example, photovoltaic cells provide electricity for handheld calculators, watches, battery chargers, homes, and satellites.

Thermostat

This is a device used to control temperature. The temperature is set on a dial or digital display. When the temperature of the room falls below this, the thermostat switches on or increases the heating. When the room temperature becomes too hot the thermostat switches off or reduces the heating. Thermostats are also used to control water temperature in radiators and hot water tanks.

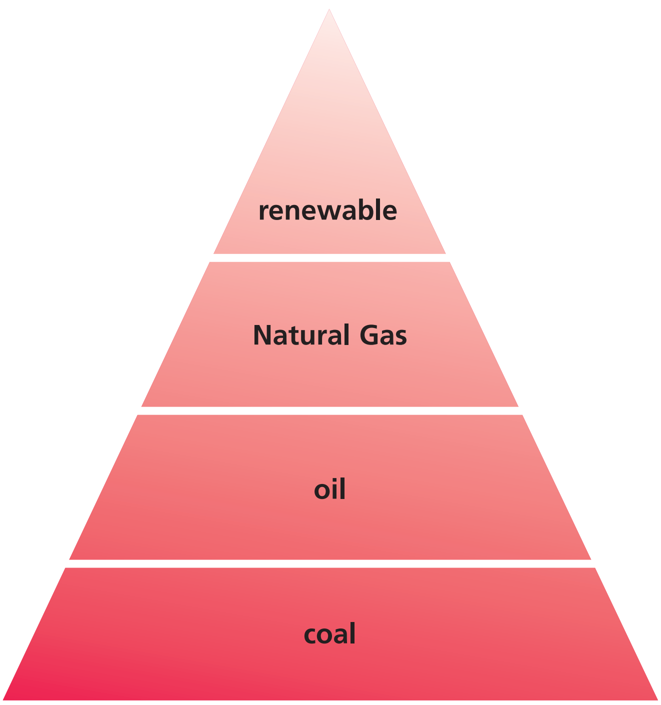
Energy and Climate Change

Introduction

Whether it is in the home or in the school, when we talk about energy we are mostly talking about heating, lighting, and electrical appliances. In Ireland over 95% of our energy comes from the non-renewable sources of energy such as coal, gas, oil and peat.

Fossil Fuels and Climate Change

The energy produced when we burn fossil fuels such as coal, natural gas and oil comes from carbon and hydrogen. When we burn these fossil fuels we release carbon (in the form of CO_2) drawn from the atmosphere by plants millions of years ago. Approximately two thirds of Ireland's CO_2 emissions currently arise from the consumption of fossil fuels. Fossil fuels such as coal, natural gas and oil are composed almost entirely of hydrogen and carbon. When we burn fossil fuels we produce energy and release the carbon they contain.

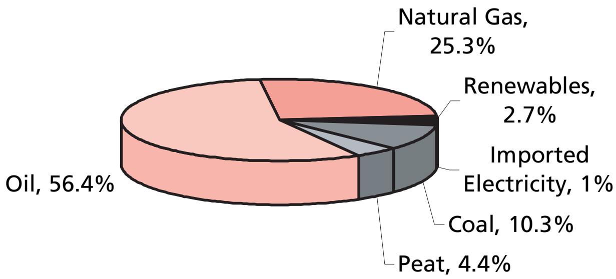


Black coal is almost entirely carbon; a ton of coal when burned produces 3.7 tonnes of CO_2. Oil is less carbon rich than coal, containing two hydrogen atoms for every atom of carbon, and so produces less CO_2 and more heat when burned. Natural gas (Methane) is the least carbon-rich of the fossil fuels containing just one atom of carbon for every four hydrogen atoms.

Renewable Energy

Energy generated from renewable sources such as wind, solar, hydro, and geothermal power produces minute amounts of CO_2 when compared to energy generated from fossil fuels. Generating electricity from renewable sources is the most effective way of reducing Ireland's energy-related CO_2 emissions.

% Breakdown of Ireland's total energy consumption by fuel type in 2006



Breakdown of Ireland's Energy Consumption in 2006

Electricity Generation in Ireland

The total share of electricity generated from renewables in Ireland increased from 1.9% in 1990 to 4.5% in 2006. As part of The National Climate Change Strategy the Government has set an ambitious target of generating 15% of Ireland's electricity from renewable sources by 2010. Whilst the amount of electricity generated from renewable resources remains low relative to this target, the progress made thus far along with the introduction of more efficient gas-powered plants has already reduced the amount of CO_2 emitted per kilowatt of electricity generated.

What you can do

As we have seen in the energy theme of the Green-Schools programme, small changes can make a big difference. We can reduce our energy-related CO_2 emissions through energy saving measures both at school and at home.

You can:

• Turn off lights and appliances (fully!) when they are not needed • Use energy efficient light bulbs and appliances; over it's lifetime just one CFL bulb can reduce your lighting costs by up to €60 and avoid 400kg of CO_2 emissions. • Turning down the thermostat by even 1°C can reduce your heating bill by up to 10% and results in massive CO_2 savings. • Buying renewable energy from your supplier may also be an option available to you. Much of Ireland's electricity is now generated from renewable sources; purchasing electricity generated from renewables reduces CO_2 emissions and provides funds for further investment in renewable energy generation.

Each of these small steps can help you not only reduce your CO_2 emissions, but can also be very effective in saving you money! Other methods of saving energy may require a greater initial investment, but should save money over the long term. This could include the use of solar panels, geothermal heating, double glazing, improved insulation, and wood-chip boilers to name a few.

Environmental Review

Calculate your energy-related CO_2 emissions

Use the Green-Schools Carbon Calculator to estimate your school's energy-related carbon emissions. You can download the Green-Schools Carbon Calculator from the Green-Schools website www.greenschoolsireland.org

The number of kWh of electricity consumed can be worked out by looking at past bills. Similarly, the quantity of gas or oil consumed can be worked out by looking at bills. What kind of changes can be seen in energy consumption during different months of the year? Why?

If you have a record of the electricity and heating usage prior to joining the Green-Schools programme you can compare present and past usage levels to determine the CO_2 savings you have made through implementation of the Energy theme!

(NB. If some or all of your electricity comes from a renewable energy source, such as hydro, wind or solar power, then this is exempt from your calculation)

In order to reduce your energy-related emissions further refer back to the energy conservation measures outlined in this booklet.

Energy Footprint - An energy footprint is a measure of land required to absorb the CO_2 emissions. According to the Living Planet Report, 2002, the total size of the energy footprint in 1999 was 6.72 billion hectares. The earth has about 11.4 billion hectares of biologically productive space and the total global ecological footprint in 1999 was 13.65 billion hectares. So energy use comprises about half of humanity's footprint on the earth. Individuals and communities can help reduce our energy footprint. The first step is to know what your energy footprint is, look at your usage, get a handle on the amount of gas, electricity and fuel oil it takes to do everything from boiling the kettle to playing DVDs and then take steps towards reducing your energy usage. Planting trees is one simple way in which the energy footprint can be reduced. While switching to renewable energy sources such as solar and wind would greatly reduce our energy footprint!

Worksheet 1 POTENTIAL ENERGY

Elastic Potential Energy - Elastic Band Experiment

A simple way to demonstrate elastic energy is to stretch an elastic band and not let go, the stretch demonstrates potential energy. Let go of the elastic band aiming it toward a wall and it is converted to kinetic energy. Repeat this but get the class to close their eyes and say when they think the elastic band hits the wall. How do they know?

The elastic band can also illustrate energy conversion. Place the band against your upper lip to measure its temperature. Stretch and release the band repeatedly. Test the temperature again. It should feel warmer.

Why does it feel warmer and where do you think the heat energy came from?

Gravitational Potential Energy - Basketball Bounce

To demonstrate gravitational potential energy hold a basketball over your head, then release it, allowing it to fall on to the ground or classroom floor. Gravity pulls the ball towards the Earth creating kinetic energy as it drops until it hits the pavement converting it back to potential. This conversion from potential to kinetic is repeated as the ball bounces up and down on the floor. (Remember that your body has converted chemical energy from food and transformed it into motion energy, allowing you to lift the basketball).

Make a record of what height the ball is initially dropped from. When you drop the ball, note how high it bounces back. Why doesn't it bounce back to the same height at which you let it go? If you let the ball keep bouncing, notice that it bounces back a little lower each time.

If the ball were to bounce back to the same height at which it was dropped, that would mean all the gravitational energy was converted to kinetic energy. It isn't all movement, though is it? Listen (that's a hint), what other forms of energy can you detect or identify? Think back, too, to the rubber band experiment—can you think of another energy form?

Worksheet 2 CHEMICAL ENERGY

Make a Baking Soda Volcano

This may not be a real volcano, but it's a good demonstration of chemical energy in action!

Materials

- 6 cups flour
- 2 cups salt
- 4 tablespoons cooking oil
- warm water
- plastic water bottle
- washing-up liquid
- red food colouring
- vinegar
- baking dish or other pan
- 2 tablespoons of baking soda

Directions

1. First make the 'cone' of the volcano. Mix 6 cups flour, 2 cups salt, 4 tablespoons cooking oil, and 2 cups of water in a large bowl. The resulting mixture should be smooth and firm (more water may be added if needed).
2. Stand the bottle in the baking tray and mould the dough around it into a volcano shape. Don't cover the hole or drop dough into it!
3. Fill the bottle most of the way full with warm water and a bit of red food colouring (can be done before sculpting if you don't take so long that the water gets cold).
4. Add a small squeeze of washing-up liquid to the bottle contents.
5. Add 2 tablespoons baking soda to the bottle.
6. Slowly pour vinegar into the bottle. Watch out - eruption time!

Tips and Tricks

- You can do the basic reaction with just the bottle, water, detergent, baking soda, and vinegar. The cinder cone and food colouring are just for added fun. You could even make and decorate a volcano cone from papier-mâché!
- The cool red lava is the result of a chemical reaction between the baking soda and vinegar, releasing stored chemical energy.
- In this reaction, carbon dioxide gas is produced, which is also present in real volcanoes. As the carbon dioxide gas is produced, pressure builds up inside the plastic bottle, until the gas bubbles (thanks to the washing-up liquid) out of the 'volcano'.
- Adding a bit of yellow food colouring too will result in a lovely red-orange lava!

Worksheet 3 APPLIANCE SURVEY

There are two factors that determine how much energy is used by an electrical appliance, i.e. power and time duration of use of the appliance. Power is the rate at which energy is used (or work is done) per unit of time. Electrical power is usually measured in watts; hence, electrical power is often referred to as wattage. One watt is the power which supplies 1 joule of energy per second. For example, a 100-watt light bulb uses 100 watts; a typical desktop computer uses 65 watts.

If the voltage and current are listed on an appliance but the wattage is not, a *rough estimate* of the wattage can be calculated by multiplying the voltage by the current:

Voltage x Current = Wattage

For example, the label on a microwave oven may only tell us that it needs 220 volts of electricity to operate, and that it draws 5 amps of current during its use.

220 volts x 5 amps = 1100 watts

Note: The wattage listed on an appliance label is the maximum power drawn by the appliance. For example, a 900W refrigerator will only run at 900 watts when the compressor is running. Most of the time the fridge uses very little power (approx. 10 watts or so) for its electronics.

The relationship between the wattage, time duration of use, and the energy used by an appliance can be expressed by this formula:

Wattage (Power) x Time = Energy Use

A Note on Safety

Students should be reminded about the potential dangers of using electricity. Adult supervision is strongly recommended when handling any electrical device. Students need to unplug any electrical appliance before investigating it for its wattage rating.

By using this formula, we can compare the energy used by electrical appliances and equipment to see which ones use the most electricity.

For example: the wattage of a standard television with remote control is 250W. If it is used an average of 4 hours each school day, the average amount of energy it uses per day is

250W x 4hours = 1000 watt-hours per day

Watt-hours are small units, so, electrical energy is usually measured in kilowatt-hours (kWh). 1 kWh = 1,000 watt-hours. The electricity and gas boards use this unit to measure the amounts of energy they supply. The energy used by the television each day, therefore, is 1 kWh.

You can then calculate the daily/weekly/monthly/yearly cost to run an appliance by multiplying the number of kWh used by your electricity suppliers standard electricity charge per kWh consumed:

Cost = kWh x rate

For example, if an electricity supplier charges €0.12 for each kWh of energy used, the operation cost of the television is 12 cents per day.

Column A	List all the electric appliances in your school.
Column B	Insert the wattage rating (i.e. amount of watts used) for each appliance.
Column C	Insert the number of hours per day each appliance is used.
Column D	Multiply the total hours by the wattage rating.
Column E	Convert to kWh: Divide by 1,000 to determine the kilowatts consumed per day.
Column F	Total kWh per month. 22 days is the average number of school days per month, (excluding school holidays).
Column G	Operational cost of the appliance per month.
Column H	Rank of appliance according to its electricity use i.e. rank the item using the most electricity #1, the second #2, and so on.

A	B	C	D	E	F	G	H
Appliance	**Wattage**	**Average hours of use per day**	**Average Watt hours per day**	**Average kWh per day**	**Total kWh for month (22 days)**	**Operational cost for month (€)**	**Rank of appliance's electricity use**
Television	**250**	**4**	**1000**	**1**	**22**	**2.68**	
Photocopier							
Electric Heater							
PC							
Printer							
Dishwasher							
Kettle							
Toaster							
Etc.							

To work out the operational cost for your school, you will need to check your electricity bill or contact your electricity supplier for the rate per kWh used.

Be sure to factor in increases in electricity charges into your calculations when comparing bills from one year to the next. Seasonal variations will also need to be taken into account, i.e. some appliances will be used more at different times of the year. You could also give the item's relative importance**.** Use a scale of 1 to 5 where 5= Must have this item; 3= Item is somewhat important; 1= Don't need item.

Extended activities

Electrical appliances that are plugged in draw electricity when on standby and sometimes even when switched off, but not plugged out. Energy is wasted by these appliances when they are not performing any useful function. For example, if a television has a remote, then part of the TV is always on, waiting for a signal from the remote; if there is a clock on the microwave then the microwave is always using some electricity. This usage of energy is called standby consumption or leaking electricity because people are often not aware that the appliance is using electricity.

Students can identify which appliances leak electricity in this way, including televisions, video recorders, PCs and monitors, microwave ovens, Hi-Fi's, DVD players, etc. Once identified, students may attempt to calculate how much energy these appliances use while on standby and off-mode power. They can then take action to eliminate the leakage i.e. switch off power at the socket, or, if no switch at socket, unplug appliance.

According to the International Energy Agency, it takes about four nuclear power plants to supply the standby power consumed annually in Europe. By 2010, it's expected the number will grow to eight nuclear plants.

Measuring Home Electricity Use

Students can read the power rating on electrical appliances at home and calculate, as explained above, how much electricity each uses and the cost over a certain time period. Students can identify which appliances are the major energy users in the home and how the home electricity bill might be reduced by using more energy efficient appliances. Many appliances have energy labels that enable comparisons to be made with the energy consumption of different models. Energy consumption is rated from A-G with A being the most efficient.

Some students may wish to take this study of electrical energy use in the home further and look at other energy demands, such as fuel oil/natural gas for home heating. Students also may wish to calculate greenhouse gas emissions from such fuels. See Section 3.4 for link to the National Energy Foundation website to access the CO_2 calculator.

Worksheet 4 PAY YOUR WAY FOR ENERGY

To highlight energy use, students and staff can be issued with special energy tokens representative of one unit of energy, and asked to pay for energy as they go.

Students can:

- Establish cost for the use of energy consuming appliances (see Worksheet 3 on previous page).
- Older students will be able to calculate total daily energy consumption in kWh and accordingly the number of tokens each student requires.

Below are some suggestions to get you started:

Energy Tarrif	Token
Room lights	1 per hour
Corridor lights	20 per day
Bells, clocks or phone	5 per day
Heating a room	100 per day
Cleaning a room	20
Journey by bus	1 per km
Journey by car	10 per km
Journey by foot or bike	Free

Energy tariff Tokens

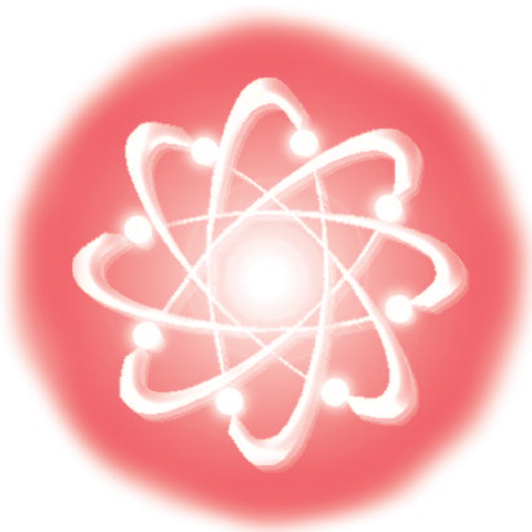
Students who live further away might be issued more tokens than students who live near the school. Decide which of these charges should be paid by individuals and which shared by the school as a whole. Arrange on the day before the Pay Your Way Energy Day for each student to be issued with energy tokens and explain when they have to be used. After the action day, students can provide feedback and collate experiences. They can also let everybody know the outcomes, such as:

- How much less energy was used compared to a normal day?
- What was its cash value?
- Which source of energy was most affected and why?
- How much did the action day change what people did?
- Did it affect the comfort, convenience or effectiveness of doing their job?
- What "gimmicks" actually worked and should they be adopted?

Students can also discuss these questions:

- How can students apply what they have learnt and incorporate it into daily life at school and home?
- What prevents these savings being made every day?

Arrange for a reward for the class that saved most energy or did not use all its allocation of energy tokens.



Useful Contacts

Department of Environment, Heritage and Local Government
Custom House, Dublin 1
Telephone: (01) 8882000
LoCall: 1890 20 20 21
Website: www.environ.ie

ENFO
Online Environmental Information Service
Telephone: (01) 676 1167
Website: www.askaboutireland.ie

EPA
Environmental Protection Agency
Johnstown Castle Estate
Co. Wexford
Telephone: (053) 60600
LoCall: 1890 335599
Website: www.epa.ie

Sustainable Energy Authority of Ireland
Wilton Park House
Wilton Place
Dublin 2
Telephone: (01) 808 2100
Fax: (01) 808 2002
Email: info@irish-energy.ie
Website: www.seai.ie
Energy Hotline: 1850 376666 (LoCall)

Regional Offices

Sustainable Energy Authority of Ireland
Renewable Energy Information Office
Unit A,
West Cork Business & Technological Park,
Clonakilty,
Co. Cork.
Telephone: (023) 42193
Fax: (023) 63398

Sustainable Energy Authority of Ireland
Finisklin Business Park, Sligo
Telephone: (071) 59705
Fax: (071) 59702

Sustainable Energy Authority of Ireland
Energy Policy Statistical Support Unit
Building 2100, Cork Airport Business Park, Cork
Telephone: (021) 4547050
Fax: (021) 4547059

Energy Saving Trust
Northern Ireland, Enterprise House,
55/59 Adelaide Street,
Belfast, BT28 8FE
Telephone: (028) 90726007
Fax: (028) 90239907

Local Energy Agency Joint Initiative

The Department of Environment and Local Government and the Department of Public Enterprise have joined forces and are planning to extend the existing network of Local Energy Management Agencies.

City of Dublin Energy Management Agency
Unit 50, Guinness Enterprise Centre
Taylors Lane, Dublin 8
Telephone: (01) 410 0659
Fax: (01) 410 0576
Email: codema@codema.ie
website: www.codema.ie

Galway Energy Agency
Mr. Peter Keaveny, City Hall
College Road, Galway
Telephone: (091) 566954
Fax: (091) 567493
Email: peter.keavney@galwaycity.ie

Kerry Energy Agency
Mr. Willie Moynihan, Aras an Chontae
Rathass, Tralee, Co. Kerry
Telephone: (066) 7183576
Fax: (066) 7120927
Email: wmoynihan@kerrycoco.ie

NOTES

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