Contents

G l o s s a r y

Compost	Biological breakdown of organic material into a stable material which can be stored safely or used in beneficial applications.
Decompose	To break down or rot, such as with fallen leaves
Extraction	The removal of a resource eg. Mining.
Greenhouse effect	The warming of the atmosphere, especially due to the increased concentration of carbon dioxide derived from the burning of fossil fuels.
Invertebrates	Organisms without a backbone eg insects.
Landfill	A “tip” or rubbish disposal dump.
MRF	Materials Recovery Facility where recyclables are taken to be sorted before being transported elsewhere for processing.
Nutrients	Are elements required by organisms to maintain life.
Nutrification	Too many nutrients in soil or water resulting in weed species or algae thriving.
Photosynthesis	Is the chemical reaction that occurs in plants, to convert light energy and carbon dioxide into sugars.
Pollution	Is the contamination of the earth's environment with materials that interfere with human health.
Recycling	The recovery and processing or reusing of materials already used previously.
Stratosphere	Is the upper layer of the atmosphere commencing at an altitude of 12.9 to 19.3 km (8 to 12 mi).
Troposphere	Is the lowest layer of the earth’s atmosphere and is the site of all weather on earth.

Introduction

Wherever there are humans, there is the need to conserve resources and minimise waste so that we can maintain a quality of life.

If we don't conserve our resources, they will run out and we would not be able to maintain our current lifestyles. A world without resources is a world without life.

We need to minimise our waste for two reasons. Firstly, to reduce the rate at which we consume our resources, and secondly, so that we reduce pollutants in the environment in which we are trying to live.

Imagine there were no laws about littering, it would be like living in a rubbish dump.

Our natural resources are precious in maintaining our quality of life, but many of us don't realise just how much is needed to produce all the things we use every day.

For example Alcoa, who make aluminium, have a coal mine in Anglesea, near Geelong. This mine is huge, and just looking at it, you would think that all the coal that comes out of the mine would be used to power the whole of metropolitan Melbourne, when in reality, the coal from the mine powers 70% of Alcoa's aluminium producing plant. It's a scary thought the amount of mining that goes into producing something like a Coca-Cola can. This is yet another reason to "reduce, reuse, recycle". The more we recycle, the less mining will be needed to produce the raw materials to make new products again from scratch. And although many products require less energy to be recycled than to be produced from scratch, it uses no energy, other than our own, to ***re-use*** a product.

Waste **M**inimisation

Waste – What's the problem?

Imagine if you had no waste service at home and you couldn't get rid of any of the waste you produced. You would probably be quite surprised by how much waste you were lumped with…packaging, food scraps, cuttings from the garden, old clothes and furniture!

In the City of Casey, each household creates over 600 kg of waste per year – this is 34,500 tonnes for the whole of the City of Casey.

At the moment our garbage is taken to be buried in a landfill, or tip. Just as we don't have room in our homes to keep all of our waste, landfill space close to our cities and suburbs is becoming rarer as we create more and more garbage.

When a landfill is full, a new one has to be made somewhere else. In 1996, the two previous landfill sites for the City of Casey were filled. At present, all of The City of Casey's waste goes to the Stevensons Road Landfill in Cranbourne, which is expected to be full in 2005.

Creating new landfills creates a series of problems. No-one wants to live near a landfill and suffer the problems of smells, water pollution and litter. Landfills also create gases that contribute to the Greenhouse Effect.

More importantly, rubbish in a landfill doesn't really break down. Some studies have shown that plastic items such as bottles can remain intact for up to 40,000 years. So once a landfill is created, it's there forever.

For these reasons it is important that we do as much as possible to reduce, reuse, recycle and recover.

THE FOUR R'S

Waste minimisation is about reducing the amount of waste and reducing the environmental impact of waste. The four R's of Waste minimisation are Reduce, Reuse, Recycle and Recover.

Reduce the amount of waste you create in the first place by being careful when you use or buy products. For example don't print out more copies of your work than you actually need. Choose products with less wrapping rather than those with excess packaging.

Reuse items rather than throwing them out. Buy a sturdy bag for shopping which can be used over and over again, so you don't accumulate all those plastic bags. Don't use disposable plates and cups.

Recycle all those materials, which can be recycled. Items including glass bottles and jars, aluminium cans, steel cans, milk and juice cartons, plastic bottles, paper and cardboard can be placed in your recycling bin. Other items such as fridges, car batteries and tyres can be taken directly to Council's transfer station and recycling centre.

Recover resources that would otherwise be lost. An example of this is the recovery of energy from waste.

Waste Facts:

- Australians are the second biggest producers of waste per person in the world.
- On average, every Australian family produces enough waste each year to fill all of the rooms in a three-bedroom house.
- The amount of waste placed in landfill each year is enough to cover the state of Victoria.

Activity: WASTE AUDIT

Measure and weigh your school's waste for a day. Calculate how much waste your school would produce in a year and divide by the number of students attending the school.
Discuss in class how each individual can reduce their waste!

WHAT YOU NEED!

A set of scales
Gloves and tongs for all children involved
Activity sheet (see page 13) & pencil
Approximately 10 small containers (used for weighing waste categories). Ensure weight of containers is not used in 'total' calculations.
A small space away from main school yard for sorting and weighing – preferably have a flat space with tarpaulin on the base (at children's height, so there is less bending and sore backs)

Activity

List the waste items you have left over after lunch. Use the City of Casey Waste Services booklet or go to www.casey.vic.gov.au to determine how to best dispose of your waste. Can the items be recycled ? Could you have avoided producing the waste in the first place?

Smart Shopping

A lot of the waste we end up with is non recyclable/ single use packaging.

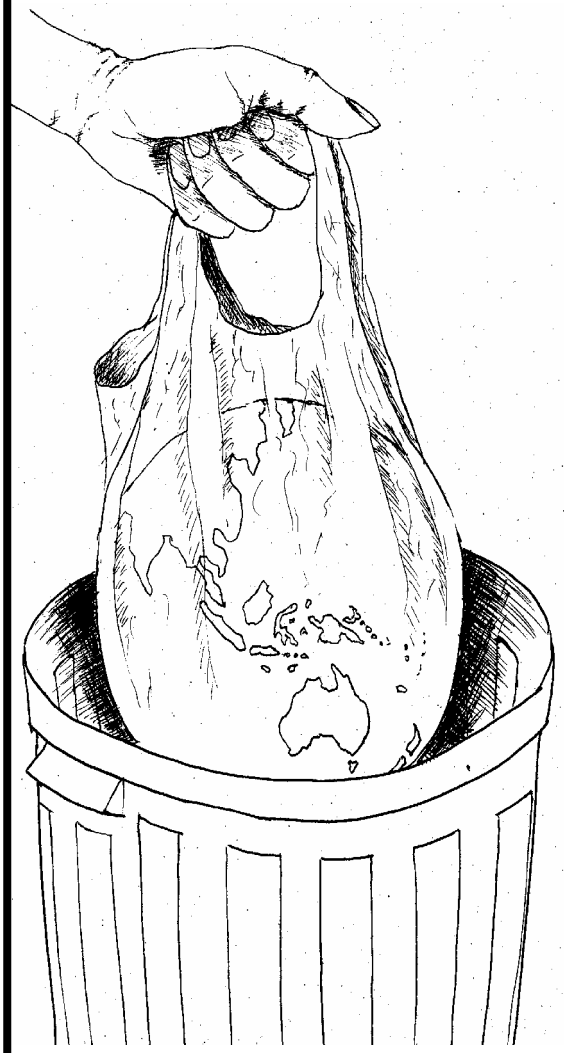
Reducing waste starts at the beginning – when purchasing.

Activity: Shopping To Reduce Waste

See Activity Three on page 14.

Activity: Design an Ad to let others know about Reducing Plastic Bags

Say 'NO' to Plastic Bags!



Graphic Illustrations: Debbi Morris; Picture reprinted from The Home Environmentalist, vol. 8 no.1

In the time it takes you to read this article, over 15,000 plastic bags will have been used Australia wide.

Plastic bags either end up in landfills or as litter in our streets and waterways. It takes thousands of tonnes of natural resources to manufacture your shopping bags each year.

Retailers spend a huge amount of money on plastic bags simply for the convenience of the consumer. The cost is paid directly by you each time you go shopping!
By using durable alternatives such as cloth bags, containers, baskets or boxes you are saving valuable resources and doing your bit for the environment.

Plastic Facts:

☆Tied end to end the amount of plastic bags consumed by Australians each year would tie around the world 37 times (>6 billion bags per year!)

☆There are approximately 46,000 pieces of plastic floating in each square mile of our oceans

☆Plastic shopping bags do not breakdown – they can take between 20 – 1000 years to breakdown

☆Over 100,000 birds, whales, seals and turtles worldwide are killed by plastic rubbish each year

Remember that plastic bags **cannot** be placed into your blue recycling bin, as they contaminate the recycling process at the sorting facility in Hallam. Some plastic bags can be recycled through your local supermarket. Just ask them!

For further information refer to the Clean Up Australia Day website on www.cleanup.com.au

Composting, Worm Farms & Garden Waste Services

Over 45% of household waste can be composted through a worm/compost bin or mulched through Council's Garden Waste Collection service (BIEC, 1997).

The Garden Waste Collection service started in 1999 and provides residents with the opportunity to "recycle" all of their garden waste such as leaves, grass cuttings and small prunings in a 240 litre wheelie bin. Through this service, approximately 350 tonnes of garden waste are diverted from landfill each month and taken to the Regional Composting Facility to become high quality mulch and compost.

The City of Casey Council Offices set up a worm farm for all their tea room food scraps. This reduced the amount of waste going to landfill. This has produced worm castings that can be used in garden beds.

Activity: Worm Farm

Set up a worm farm in your classroom. Refer the attached information sheet explaining what can and cannot be composted.

Garden Makeover

The City of Casey and the students from the Devon Meadows Primary School developed a successful non-dig recycled garden at a property in Devon Meadows.

Materials used in the non-dig garden were an old bike, used clothes, newspapers, recyclable waste materials from households etc which transformed the garden into a picturesque and workable landscape.

A video on how easily a non-dig garden can be developed can be purchased from the City of Casey by phoning (03) 9705 5200.

Recycling, Again And Again

Recyclables being placed in wheelie bins throughout the City of Casey are picked up by trucks and arrive at the Materials Recovery Facility in Hallam. From this point recyclables are sorted into their various categories…made ready for industry reuse. Companies making products using recycled materials pick up large bales of materials from the MRF and make new and innovative products.

The benefits of recycling include:

- conserving valuable resources
- saving ever decreasing landfill space
- saving energy through reprocessing rather than resource extraction and manufacturing processes.

Some of the valuable resources we save by recycling:

- Oil → used to make items such as plastic bags and bottles
- Iron Ore → used to make steel cans
- Bauxite → used to make aluminium cans
- Sand → used to make glass bottles and jars
- Trees → used to make milk and juice cartons, newspaper, writing paper and cardboard

These raw materials are extracted from the environment using energy intensive machinery and processes. The recycling industry, which also uses energy, is becoming increasingly efficient, making recycling a sustainable alternative.

Materials **R**ecovery **F**acility (MRF)

The recyclable material you put in your recycling bin is sorted at the Materials Recovery Facility (MRF). Recyclable items are sorted out with a combination of machines and manual sorting. The sorted material is then sold to industry for reprocessing into new products.

The MRF in Hallam is operated by Thiess Services.

Recyclable items include:

- Glass bottles & jars
- Milk & Juice Cartons
- Plastic Bottles & Food Containers (Codes 1,2, 3 & 5)
- Steel Cans
- Aluminium Cans
- Paper
- Cardboard

It is very important that only the right things are recycled in your recycling bin. Items other than those listed above are classified as 'contaminants'. Contaminants must be sorted out and are disposed of at landfill. If a recycling truck has too many contaminants, it will be turned away from the MRF and the material will be disposed of at landfill. Typical contaminants include plastic bags, food, disposable nappies, garden waste, car batteries and other household items

Recyclable material is sorted by a combination of machine and hand sorting. Because of potential danger to workers, plastic bags are not opened. Anything in plastic bags is considered contamination and ends up at landfill.

Council and Thiess Services offer free tours of the Hallam MRF for Schools or Community Groups within the City of Casey. To book contact Thiess Services on 1800 649 930.

Close the Loop: Recycling in Casey

Recycling correctly starts in the home. Many items can now be recycled in your recycling bin, and conveniently collected from the kerbside.

These items are then sorted at the Materials Recovery Facility (MRF) into their particular types. Once in compacted bundles or bins, they are transported to specific factories that reprocess these items into new products. You can then select recycled items when shopping and 'close the loop'!

Go to www.casey.vic.gov.au **and look under waste and recycling. Check out Close the loop: Recycling in Casey to see what new products are made from items placed in your recycling bin.**

Activity: Race To Recycling Game

1. Gather a sample of mixed recyclables and a few non-recyclable items.
2. Create teams of 5-10 children and allow one mixed bag for each group.
3. As props you can use existing recycling bins at your school, otherwise mini bins available from hardware stores.
4. Each group must sort the recyclables from non-recyclables and finish first.
5. The first team to sort through their bag *and* recycle correctly wins.

Activity: Waste Audit

1. Write down the locations of rubbish bins at your school.

_____

_____

_____

2. Mark the locations of bins on a school map. Discuss the location. Are they convenient, easily accessible, and aid in minimising litter?

3. Select a full bin. Empty contents onto a plastic tarpaulin away from main schoolyard. Separate rubbish and list the following categories: (ensure gloves are worn and hands washed thoroughly.

	Weight in Kg	% of Total
Paper and cardboard	_____	_____
Milk and juice cartons	_____	_____
Recyclable plastics (codes 1 & 2)	_____	_____
Steel and aluminium cans	_____	_____
Food scraps	_____	_____
Avoidable items	_____	_____
Reusable items	_____	_____
Rubbish items	_____	_____
Total	**_____**	**(100%)**

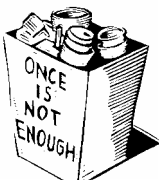
What percentage of the school's rubbish could we prevent by reducing, reusing, recycling or composting? _____

Activity: Shopping to Reduce Waste

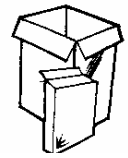
Multiple Choice: Circle the correct answer**(s)**

1. Shopping Convenience

Circle the best way to carry your shopping when you leave the supermarket.



paper bag


cardboard box


plastic bag

calico bag

2. Less Packaging

For each of the following, circle the one with the least packaging.

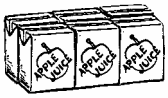
a) butter

plastic container

OR

waxed paper

b) juice

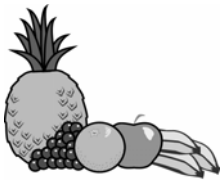


six pack each 200 ml

OR

1 litre carton

c) fruit


fresh

OR

canned

4. Re-using Packaging

Which of the following packaging materials can be **re-used** at home?


plastic cutlery


light globe


glass jar


plastic soft drink bottle

Describe how you could re-use one of these things_____

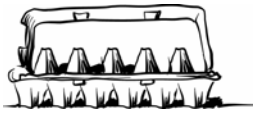
_____

5. Buying Recyclable

Which of the following items can you **recycle** at home?


plastic wrap


polystyrene cups


egg cartons


soft drink bottles

Activity: Composting

Basic requirements for a good compost heap:

- **Food/garden waste** → A mixture of waste from your kitchen and garden.
- **Air** → Turn your compost every few weeks or add compost worms to encourage efficient breakdown of food/garden waste.
- **Water** → Compost heaps should not be too dry or too wet. For optimum moisture levels make sure your compost heap is 'as wet as a wrung out sponge'.

Basic characteristics of a compost heap:

- billions of fungi and bacteria digest the waste you feed them
- heat is produced as a result of microbial activity
- after a few months of decomposition, a dark rich soil will result

Benefits include:

- natural fertiliser for your garden
- helps retain water
- saving valuable landfill space
- avoids the addition of unnecessary chemicals to your garden
- saves money

Yes! – What to feed your compost heap:

- shredded paper
- fruit & vegetable scraps
- cooked table scraps
- egg shells
- tea leaves
- coffee grounds
- flowers
- wood ash
- grass cuttings
- non-woody prunings
- sawdust & wood shavings
- vacuum cleaner dust
- seaweed
- horse, chicken & cow manure
- hair & wool

IMPORTANT: Natives don't need high levels of nutrients to survive, and chicken manure or other rich fertilisers (containing phosphorous) will actually kill them!

No! – What not to put in your compost heap:

- plastic
- meat & fats (attracts mice)
- metal
- diseased plants
- large bones
- thick branches
- glass
- magazines
- cat or dog droppings
- salt

Compost bins and worm farms are available from most hardware stores.

Ways to Minimise Waste in the City of Casey

At the shops

- Buy products that have minimal or no packaging
- Buy products in recyclable packaging rather than wasteful packaging
- Avoid products that come in plastic packaging numbered 4, 6 & 7 as these can't be recycled in your recycling bin
- Buy things in concentrated form rather than bulky watered down products, and buy refills
- Avoid over packaged products
- Choose products that are durable, reusable, recycled or recyclable
- Avoid disposable products
- Avoid packaging made from more than one material that can't be separated, e.g. plastic laminated on paper is difficult to recycle and should be avoided
- Take your own bag to the shops and refuse plastic bags
- Reuse plastic shopping bags you already have, and return them to the supermarkets for recycling
- Buy second hand products wherever possible
- Buy fresh rather than processed or packaged food
- Support organisations or stores that have environmentally conscious products and practices
- Don't buy more than you actually need
- Get a Waste Wise Shopping Guide from EcoRecycle Victoria (phone 1800 35 32 33, or download it at the web site under "downloads" www.ecorecycle.vic.gov.au)
- Buy your fruit and vegetables without packaging (eg those clear plastic bags in the supermarket) and compost the scraps
- Buy fruit and vegetables in season rather than other times of year due to energy and transportation issues
- Buy local produce rather than produce that has had to be transported over a long distance

At Home

- Repair items rather than replacing them
- Compost scraps of food and use that in the garden rather than bought fertilisers
- Pass on old clothing, toys, household goods etc to charity, or hold a garage sale, rather than sending it to the tip

At School/In the Office

- Take a drink bottle to school rather than buying packaged drinks each day
- Use the back of paper documents for other drafts or scrap note paper
- Proof read your work thoroughly before you print it to save paper if you make a mistake
- Use a smaller font, and print on both sides of the paper
- Refill or recycle toner cartridges
- Reuse things wherever possible, eg envelopes
- Try to have "rubbish free" school lunches, e.g. home baked food, nuts, dried fruit etc. in Tupperware rather than processed or packaged food.
- Encourage a recycling program at school

- Get involved in activities such as *Becoming Waste Wise.* Contact EcoRecycle Victoria, Gould League, the EPA and other organisations

Activities

The Gould League have a number of excursions it recommends relating to recycling and compost. Information on these excursions is available on the Gould League web site: http://www.gould.edu.au

Excursion	Year Level	Duration
Compost Capers	K-Year 2	Half-day
Rapt in Recycling	Prep-Year 2	Half-day
Worms Against Waste	Years 3-4	Half-day
Reduce, Reuse, Recycle	Years 3-4	Half-day
Race Against Waste	Years 3-6	Half-day
A Load of Old Rubbish	Years 5-6	Half or full-day
Paper Making	Years 3-6	Half day

The course material that relates to these excursions is excellent as it links to the school curriculum, and contains a wide variety of activities and puzzles for students. At the web site, click on "teacher's notes" for each excursion.

The Waste Wise Schools Program

This program is operated by the Gould League, EcoRecycle Victoria and Department of Education, Employment and Training to promote Waste Minimisation in schools. It is a proven successful program in the City of Casey Schools. The program aims

- to reduce waste produced by schools (landfill/environmental issues)
- to cut costs of waste management to schools…scarce funds in school go to curriculum resources
- to promote attitudes in the adults of the future, to implant RRR as part of the school culture.

The City of Casey has played an active role in the success of the following three schools in this program:-

- Tooradin Primary School – 1999 Regional Winner Waste Wise School, 2000 Victorian Waste Wise School of the Year
- Hallam Valley Primary School – 2001 Victorian Waste Wise School of the Year
- Beaconhills College, Village Campus Berwick – chosen as pilot school for the Sustainable Schools Program

City of Casey provides support through Growing a Green Web/Conservation Initiative Grants/Environmental Expo/general advice.

Many Victorian schools have adopted waste wise actions such as composting and worm composting. Other initiatives have included paper and cardboard recycling, environment clubs, vegetable gardens, using shredded paper as mulch and animal bedding, parent surveys, 'Rubbish Free Lunch Days', school waste audits and community cleanup days. These programs give students responsibility and skills in teamwork, leadership and planning.

Waste Wise Schools Workshops

The free workshops are held in all regions around Victoria. They are suitable for teachers, principals, parents and School Council members.

The workshops cover:

- How to develop effective waste minimisation and litter reduction strategies in your school. This can save your school money and conserve resources.
- How to easily incorporate waste and litter education in to the curriculum at all levels and in most Key Learning Areas.
- How to make full use of the Waste Wise Schools Kit and the other support services of the Waste Wise Schools Program.

Participating schools receive payment towards teacher release to attend the full day workshops.

Accredited Waste Wise Schools

An Accredited Waste Wise School is one that first makes a commitment to becoming waste wise and then meets State-wide, standard criteria for excellence in minimising waste and litter.

This accreditation will show your local community that your school has achieved high standards in waste and litter education and that, in the process, is helping to educate its students to live more sustainably.

There are many opportunities in media coverage and simply by being involved in the program is great for the school profile.

List of Contacts

Gould League / Waste Wise Program	9532 0909
Judie Rundle Beaconhills College	8768 1111
Tooradin Primary School – Marjorie Scarce	5998 3221
Hallam Valley Primary School – Chris Pentland	9705 2561

Casey Study – Hallam Valley Primary School Winner 2002

There are a number of benefits in participating in the program.

Education benefits.

- Radio 3WWW.5 (Waste Wise Wonder Grade 5) program is integrated into the curriculum, with students writing and performing a mix of chat and music.
- Students use a CD player/karaoke machine to broadcast the classroom-based show into the playground.
- The Waste Wise message is integrated across the curriculum.

Environmental Benefits

- Almost one tonne of rubbish re-directed from landfill each semester to compost or recycle.

Social Benefits

- The Grade 5 children are completely engaged in devising ways of reminding and encouraging students to both pick up the litter that blows into the school ground and use the recycling bins.
- The audience enjoys and is motivated by the program, which incorporates competitions and rewards for recycling and reducing rubbish.
- The program is fully supported by the Principal, and plans have been made to purchase a six-microphone public address system to ensure the program continues.
- Judie Rundle motivates students and staff alike with her boundless enthusiasm. She also acts as a mentor for schools wishing to set up Waste Wise Schools programs, as well as supporting the program in her previous school.
- Parents have commented that the children are enjoying school, see purpose in going to school and have improved attitudes towards their own learning.

Economic Benefits

- A number of cash prizes for environment competitions and grants have been awarded to the school, the proceeds have been spent on equipment to increase the scope of the Waste Wise Schools program.

Resource Recovery

NARRE WARREN LANDFILL

Often valuable resources can be recovered from waste. An example of resource recovery in Casey is the landfill gas power plant at the closed landfill in Narre Warren. This is resource recovery because it recovers methane from rotting garbage to generate electricity for the community.

The Narre Warren Landfill was formerly known as the Berwick Regional Landfill. The Landfill is located at the end of Quarry Road in Narre Warren, accessible via Ernst Wanke Road. The site is located on a prominent ridgeline and provides uninterrupted views to the west over the City of Casey towards the Central Business District of Melbourne, with glimpses of Port Phillip Bay, and to the south, Western Port Bay and the Strzelecki Ranges.
Melway Reference 108 J12.

The Narre Warren Landfill was previously a basalt quarry and was opened as a Landfill in October, 1982. The characteristics of the former quarry made the site an ideal location for a landfill. The landfill closed in January 1996 and during the operating 13 years, 1.5 million tonnes of waste was deposited.

Methane is produced by the anaerobic (without oxygen) decomposition of garbage within the landfill. The decomposition produces landfill gas, which is a mixture of methane and carbon dioxide. Typically the landfill gas comprises of 55% methane and 45% carbon dioxide, with minor concentrations of CFC's (chlorofluorocarbons), oxygen and hydrogen.

If not controlled, landfill gas migrates to the atmosphere. This has a number of adverse effects, including the odour emissions, reduction in greenhouse gases, inhibition of site revegetation and safety hazards. Also, methane from the landfill gas is utilised for electricity production and replaces other fuels such as coal, thus transforming an environmental problem into a useful energy source.

A power station was developed and built by Energy Developments LTD (EDL), and it comprises a gas extraction system, gas processing plant and power plant. The power plant comprises Caterpillar 3516 SITA spark ignition reciprocating engine generator sets operating on landfill gas fuel. There are 7 x 1000 kW units.

In general, the project provides substantial environmental benefits which include:

- Reduced odour emissions from the landfill site;
- Reduced methane emissions by approximately 9,400 tonnes per year (methane is a more potent greenhouse gas than carbon dioxide which is produced when methane is burnt):
- Utilisation of a waste product to supplementing electricity from other generation plants: and
- Preventing oxygen being displaced from the root zone of plants and trees planted in the final cover which will result in better and quicker rehabilitation of the site.

There are two companies that are utilising the waste heat produced by the power station.

A horticulture venture that uses waste heat to warm 2,000 square metres of greenhouses which grow roses.

The second is the use of waste heat to recycle paper to produce materials and sound proofing from used newspapers and phone books.

Site Rehabilitation:

The land fill site was capped in 1996 with a 600 mm clay layer as part of the rehabilitation. The cap is being covered with 400mm layer of composted garden waste, soil. It was regenerated with Indigenous and Native plants in 2002/2003.

The landfill site is not open to the public, but tours around the power station and the landfill site are available to school groups. For further information contact City of Casey Environmental Services Ph: (03) 9705 5200.

Power Station at Narre Warren Landfill

Greenhouse at Narre Warren Landfill

Chemical **U**sage & **D**isposal

One of the first things we have to learn is that chemicals are dangerous. Battery acid can burn through skin, detergents pollute water, and spilt oil kills lawns and wildlife such as penguins.

We need to be responsible and only use chemicals when absolutely necessary, and choose the safest chemicals to use. Even simple things like using a phosphorous free detergent or shampoo can make a huge difference to our waterways by preventing nutrification that causes algal blooms, and using a drain guard in the kitchen sink rather than unclogging it with the harsh caustic soda in drain cleaners. Just think about it – if it dissolves away the toughest grease and grime from your drains, imagine what it does to the tender eye tissue of aquatic animals. We must always think of the consequences of the chemicals that we use and think of alternatives to them.

It goes without saying then that these chemicals are also dangerous to humans. Many children are rushed to hospital every year because they have pulled out chemicals from under the kitchen sink and eaten them without knowing that they are dangerous. Many adults also have conditions that have come about from the use of chemicals, such as eczema.

If a pesticide can kill weeds then imagine what it does to our bodies and the bodies of animals and insects in the soil. Some of the most popular pesticides are carcinogenic, meaning they cause cancer.

There are two types of effects from chemical exposure: acute and chronic. Acute is when a person has a sudden reaction to a chemical, and usually requires immediate medical attention. Chronic is when the chemical may be building up in the persons system for some time having a long term effect that is not necessarily apparent, often until too much damage has been done. One example would be long term exposure to a common herbicide (weed poison) resulting in cancer. A person is unlikely to get cancer from one exposure to the chemical, but the long term build up of the chemical can slowly attack cells in the body and result in a serious illness.

The same goes for exposure to animals in the environment. Often they are more sensitive to chemicals than we are. So it is crucial to consider them when we are looking at using chemicals. We all know how important invertebrates are in the soil, transporting nutrients and giving the soil structure. When these animals are killed through the use of chemicals it affects the quality of our soil, and can be unhealthy to us and our pets when they play on the soil.

Correct **D**isposal of **C**hemicals

It is important to dispose of chemicals correctly as incorrect disposal can have severe impacts on the environment and the health of plants, animals and people.

There are different landfills for different types of waste. Most landfills are not designed or equipped for the disposal of many chemicals. If we dispose of dangerous chemicals or heavy metals in the bin, then we place risk on the environment because these chemicals can make their way into the groundwater and streams from a regular tip.

These chemicals and heavy metals are not biodegradable and as such linger in the environment for a long period of time causing harm to humans and animals, particularly aquatic life (refer to "Water" chapter).

There are special ways to dispose of harmful chemicals, where the chemicals are neutralised before they are disposed, to remove or cancel out their harmful properties. It is important that all dangerous chemicals and heavy metals be disposed of responsibly so that they can be treated in this way before disposal or re-use.

The City of Casey has a Waste Management team that can advise residents on where to take chemicals and metals for disposal to keep Casey a clean and safe place to live.

Eco**R**ecycle **F**ree **H**ousehold **C**hemical **C**ollection days

EcoRecycle have chemical collection days where they collect household chemicals from various municipalities in Victoria.

For further details phone Casey on 9705 5200 or EcoRecycle on **FreeCall 1800 35 32 33** or visit www.ecorecycle.vic.gov.au

If you have any of the following or similar surplus chemicals, bring them to a Collection Day depot:

Kitchen:
Aerosol cans, insect sprays, floor care products, furniture polish, metal polish with solvent, oven cleaners.

Bathroom:
Pharmaceuticals, bathrooms cleaners.

Workshop:
Paint strippers, cutting oil, solvent-based glues, oil-based paint, paint thinner, acetone, turpentine, varnish and wood preservative.

Garden:
Fertiliser, fungicide, herbicides and weed killers, insecticides, and rat poison.

Garage:
Transmission fluid, batteries and battery acid, brake fluid, car wax with solvent, petrol, diesel, kerosene and other fuels, motor oils and sump oil, other oils, metal polish with solvent.

Miscellaneous:

Acids and alkalis, artists paints, mediums, dry cleaning solvents, fibreglass resins (not mixed), mercury batteries, mothballs, smoke detectors and extinguishers, photographic chemicals, swimming pool chemicals, safety ammunition and gas cylinders.

If you do not want to wait for a Collection Day:

Select an organisation dealing with the chemical you wish to dispose of, or check the Yellow Pages for 'Waste Reduction and Disposal Services'. Companies listed specialise in treating waste chemicals.

Bringing your chemicals to a depot safely:

Ensure liquids do not spill, ideally they should be placed in a tray. Powders and solids should also be securely packed. Clearly label each item where possible.

The underlining principles for management of household chemical wastes are:

- Waste avoidance through careful purchasing
- Recycling and reclamation, preferably through a manufacturer/seller take-back systems
- Appropriate treatment
- Appropriate residue disposal

Since 1996, EcoRecycle Victoria's program of Free Household Chemical Collection Days has collected over 650 tonnes of chemicals. The majority of the collected materials are oil and paint.

The City of Casey had a collection in July 2002 with over 415 residents dropping off their unwanted chemicals. 26 tonnes of chemicals were handed in. This is an average of 65 kilograms of chemicals per car and is 10 tonnes more than the amount collected at the last chemical collection held in Casey in 1999.

Activity:
1) Identify the dangers from chemicals in your household in relation to the local environment

2) Research one household or garden chemical and the dangers it can have on humans and the environment. Pesticides for example often have chemical data sheets on the web, or the "enviroweeds" mailing list on the web will be able to point you in the right direction for garden chemicals.

P o l l u t i o n

Pollution is the contamination of the earth's environment with material that can be harmful to humans, plants or animals. Pollution can effect the air, land or water.

The community has an important role to play in environment protection. By reporting pollution incidents as soon as possible to Environment Protection Authority (EPA) or the City of Casey, action can be taken to stop the pollution from continuing, and to fine offenders to hopefully stop them doing it in the future.

All types of pollution can be reported.

EPA should be contacted when you notice pollution occurring from an industry or business, or a problem in a creek or stream.

If an activity from a house is causing a problem you should contact the City of Casey for assistance. Examples include silt from stockpiles of sand being washed onto the road or paint or oil being spilt down a drain.

EPA report line contact details are:
(03) 9695 2777 (24 hrs) Melbourne Metropolitan Area or
1800 444 004 (24 hrs) Rest of Victoria (ie outside 03 area)

WHAT ELSE CAN WE DO?

Look at the alternatives to driving:

- Contact the City of Casey for a plan of all the Bike paths to get around.
- Look into all the Public transport options within Casey and connecting Casey to the rest of Melbourne.

Activity:

Identify clean air sites and/or polluted air sites in the City of Casey and explain reasons why this is the case.

Visit the EPA's Air Quality Site for more information at http://www.epa.vic.gov.au

The EPA has a number of contacts for each of the areas as well as a student information line and a library that might be useful to students:

(03) 9695 2777	Pollution Watch Line (24 hrs) Melbourne Metropolitan Area
1800 444 004	Pollution Watch Line (24 hrs) Rest of Victoria
(03) 9695 2755	Smoky Vehicle Reporting (24 hrs) Melbourne Metropolitan Area
1800 444 051	Smoky Vehicle Reporting (24 hrs) Rest of Victoria
(03) 9695 2733	Beach Report Line
(03) 9695 2744	Student Information Line
(03) 9695 2766	Library
(03) 9695 2665	Litter Offences Enquiries
(03) 9695 2722	Motor Vehicle Enforcement Enquiries
(03) 9695 2662	Waste Transport Enquiries

The Dandenong EPA Office serves the City of Casey:

45 Princes Highway
Dandenong Victoria 3175
AUSTRALIA

Contact Numbers
TEL (03) 9794 0677
FAX (03) 9794 5188

Air **P**ollution

What is Air Pollution?

Air pollution is caused by emissions from factories, transport, domestic wood heaters, burning off, and other sources, and can build up over a city under certain weather conditions.

The EPA has a system in place to forecast high pollution days, and alert the community on such days with a 'smog alert'. To reduce the level of smog on these days, motorists are requested to limit their vehicle use. The public are also requested not to burn off or to light incinerators. If an alternative source of heating is available residents are asked to avoid using wood-heaters. For more information the EPA has a Pollution Watch website and phone number at http://www.epa.gov.au/havesay/polwatch.htm

Sources of Pollution

Air pollutants mainly come from the discharges of gases and particles mainly from industry, motor vehicles and domestic wood burning. There are also natural sources such as wind-blown dust and smoke from bush fires.

Major sources of air pollution in Casey:

- Industry
- Motor vehicles
- Wood Fires
- Burning off/incinerators
- Lighting (lights emit greenhouse gases)

Winter smog

In colder months domestic wood heaters are the major source of winter smog. The very fine particles in wood smoke can build up over a day or a number of days when the winds are very light resulting in winter smog. The particles in the air can affect visibility or how far you can see, and may be seen as a layer of brownish smudge on the horizon.

High levels of very fine particles or winter smog in the air can cause health problems in people who have existing respiratory conditions such as asthma and bronchitis. The very young and elderly can also be affected by these particles.

Summer Smog

Photochemical or summer smog occurs when ozone gas builds up at ground level. Ozone is formed when car and industry emissions such as nitrogen oxides and organic compounds react with oxygen under strong sunlight. Summer smog is a problem in many Australian cities, but people often don't notice it because, unlike winter smog, it is mostly invisible.

High levels of smog can cause respiratory problems in healthy people and exacerbate existing respiratory conditions in others.

Smoky Vehicles

Motor vehicle emissions make up 70% of total air emissions in Melbourne. Of the individual pollutants found in our air, car emissions contribute 94 per cent of the lead, 85 per cent of the carbon monoxide, 45 per cent of hydrocarbons and 75 per cent of nitrogen oxide levels.

Smoke: How much is too much? EPA regulations state that no motor vehicle (including diesel vehicles) is allowed to emit visible smoke for a continuous period of 10 or more seconds.

Smoke is usually caused by wasted unburnt fuel or from burning excessive oil – both things that cost the driver money. In maintaining a car properly to prevent it from smoking, we not only save the environment but we save money as well.

Fact

In the last 40 years, the number of cars in the world has increased from 38 million to 350 million.

What can you do to improve air quality in the City of Casey?

- Where possible, walk, ride a bike or catch public transport rather than drive the car.
- Make sure your car is properly maintained, regardless of it's age. You will cut pollution and save on fuel.
- Drive smoothly, avoid rapid stop start traffic and car pool wherever possible.
- Report smoky vehicles using the EPA website, see *How to Report pollution*.
- Home wood fires are the main source of winter smog. If possible use alternatives to fire places and wood heaters for home heating and limit their use to special occasions.
- Use dry clean wood for fires – wet wood creates more smoke.

B u r n i n g **O** f f

Burning off is another major contributor to unclean air. As discussed in this chapter, there are many ways we can dispose of garden waste and other seemingly 'burnable' material.

CASEY'S LAWS ON BURNING OFF

A person must not, except with a permit or in an area exempt by council, light fire or allow a fire to remain alight in the open air or on any land of less than 20,000 square metres.

During the CFA declared Fire Danger Period (generally between November and March) burning off is not permitted without a permit, issued by the Municipal Fire Prevention Officer, and there must be a good reason or no other practicable option available.

Under no circumstances are rubber or plastics, petroleum/oils, paints, manufactured chemicals or foods wastes allowed to be burned off.

If you suspect illegal burning off during a fire danger period you should report it to the police on 000.

If you suspect illegal burning off during any other time of the year or the use of incinerators you should report it to the Council on 9705 5200

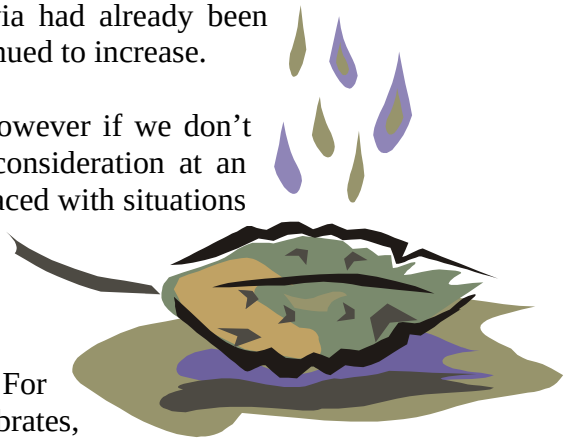
A c i d R a i n

Rain is naturally slightly acidic due to the presence of carbon dioxide. However the burning of fossil fuels and other human activities have increased the level of acidity in the precipitation. Many of the chemicals we release into the atmosphere every day, for example sulphur in unleaded fuel, also react with water and become acidic. When this rains down, it has the effect of a mild acid and eats away at surfaces, and can cause problems with the leaves of plants and the skin of humans and animals. You may remember after the Coode Island leak that there were many skin complaints reported for both humans and animals.

Plants need their leaves to photosynthesise (convert solar energy from the sun into food). When acid rain lands on the leaves, it damages them and affects their ability to photosynthesise, resulting in dieback, which then naturally affects all the wildlife that depend on the plants, and the air quality as the plants are needed for converting carbon dioxide into oxygen for us to breathe.

Highly acidic rain can damage or destroy aquatic life, forests, crops and buildings, as well as posing a threat to human health. Athens in Greece is an example of just what acid rain can do to buildings, where it can be seen that the stone buildings and monuments are gradually dissolving due to the acid rain.

Acid rain was first discovered over a hundred years ago, but was not a cause for concern until the 1950s. However as with many environmental issues, it took another 20 years for concern to be raised, once thousands of lakes in Canada and Scandinavia had already been declared dead. Unfortunately, emissions of acid gases continued to increase.



Luckily there have been no incidents like this in Casey, however if we don't take the possibility of such environmental disasters into consideration at an early stage *before* they do become a problem, we could be faced with situations like this in the future.

Impacts of Acid Rain

Acid rain can affect soils, water, forests and wildlife. For example, the reproduction of aquatic life such as invertebrates, fish and amphibians such as frogs is hindered or destroyed by acid rain. It also reduces the amount of calcium available for aquatic life such as fish, and it increases the concentration of toxic heavy metals in lakes and streams.

These problems often result in deformed bone structures and poor growth. As discussed in other chapters, the decline of any one member of the food chain can be devastating to the entire food

web. Many bird species, which eat fish, would become extinct without their main source of food. Similarly many mammals depend upon aquatic organisms such as crustaceans for their food.

Land (terrestrial) animals are affected as the acid rain affects the soils and plants. The acid helps many heavy metals dissolve into the soil, which then get into the plants' roots and prevent the uptake of other nutrients. In Poland and other Eastern European countries there are areas where there is 40% dieback due to acid rain.

Financial Cost of Damage

Acid rain is also expensive, costing $197 million in damage to commercial forests in Canada alone each year. With blue gum plantations becoming more popular in Victoria, there is the threat that this will be affected also if we allow acid rain to worsen. The value of the damage caused by acid rain to buildings in Canada 15 years ago was estimated at $830 million.

Human Health

Acid rain can aggravate respiratory ailments such as bronchitis and asthma. Humans may also be affected by drinking water, which contains higher levels of toxic metals as the acid in the water dissolves the metals out of the soils and water pipes.

Preventing Acid Rain

There are two obvious ways of reducing acid rain.

1) Burning less high sulfur fossil fuels by turning to sustainable energy sources as explained later in this chapter

2) Emission control preventing acidic gases being emitted, and treatment methods to neutralise the acids, such as utilising a limestone slurry. The resulting slurry can then be utilised in other industrial processes. However this is an expensive option which reduces the operating efficiency of the plant, and results in increased emissions of carbon dioxide, contributing to the Greenhouse Effect.

Acid Rain Chemistry

For older students, there is much information on the chemistry of acid rain at http://www.iclei.org/efacts/acidrain.htm.

Activity:

Study the chemistry of acid rain and design a system which may reduce the acid in our rain. This system could cover emission control or alternative powering of various industrial and/or domestic machinery, transport and appliances.

Global **W**arming

Many argue that the greenhouse effect is a hoax as the earth's temperatures have only risen 0.5 degree Centigrade in the past 85 years. However studies are being conducted regularly and it is predicted that if current rates of emissions continue, then the earth's temperature could rise by 2-5 degrees in the next 50 years, which could have dramatic effects on sea levels, alpine regions, glaciers, water temperature, and rainforests. Just imagine how hot it will be in summer if it gets to 5 degrees more than it does already! This could have serious effects on plants, animals and water levels. Frogs for example already seem to be suffering in alpine areas from warmer temperatures and exposure to harmful UV Rays with the deterioration of the ozone layer.

Humans have the greatest impact on global warming, contributing to 60% of the problem. Use of chemicals is also a major contributing factor to increasing the level of greenhouse gases in the atmosphere. Chemicals such as chlorofluorocarbons (CFCs) (15%), agriculture (e.g. methane) (12%), land-use modifications (9%), and other human activities (4%) are the biggest contributors. Despite all the meetings, agreements, technology and knowledge about the problem, world-wide greenhouse gas emissions are increasing every year.

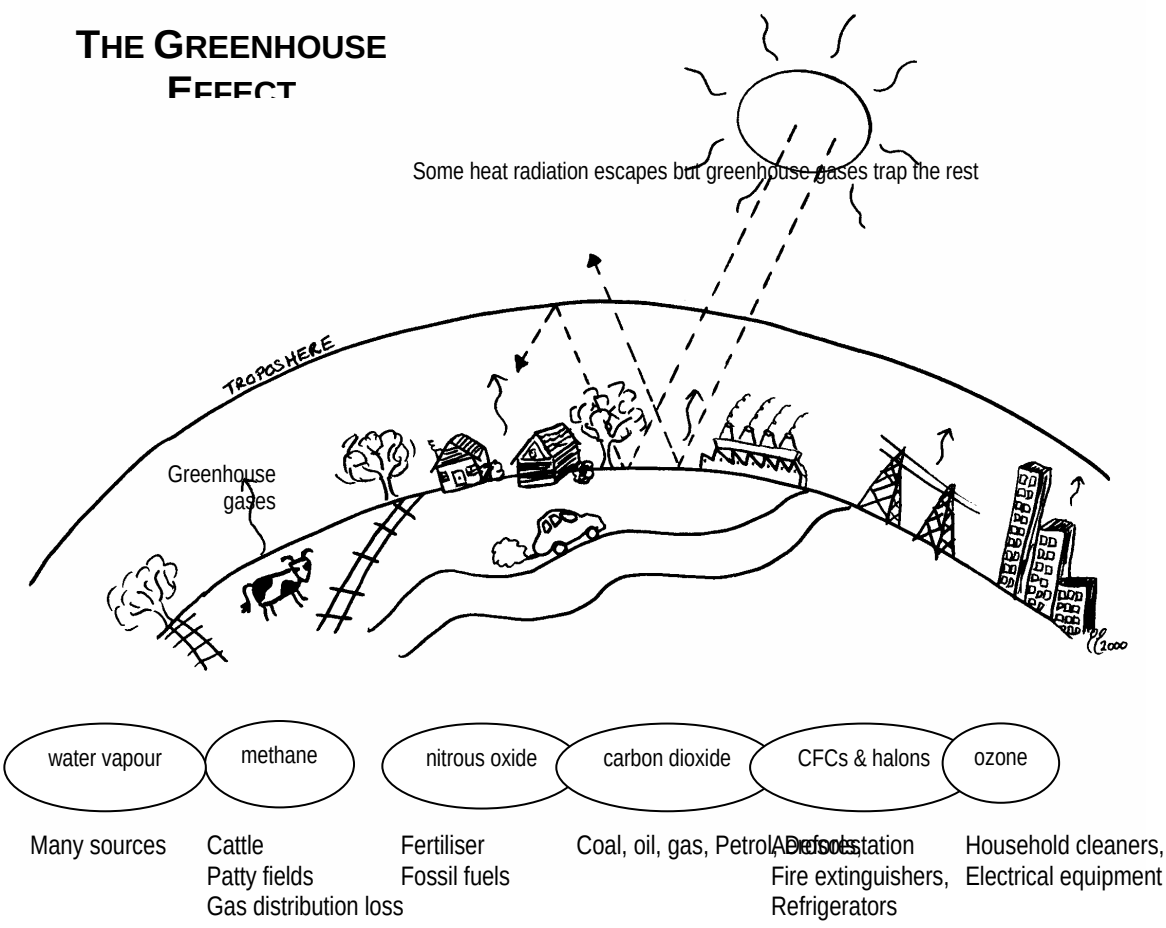
THE GREENHOUSE EFFECT

WHAT IS IT?

The Greenhouse effect is a natural feature of the Earth's atmosphere to trap in solar energy (heat) and keep the earth warm enough to sustain plant and animal life on earth.

Carbon dioxide (CO_2) and methane (CH_4) are naturally occurring greenhouse gases from respiring animals and decomposing plants and animals, which trap some of the radiation from the sun in the earth's atmosphere. Though these gases make up only a very small percentage of the earth's atmosphere, they act as an insulating blanket for the earth. Without them, the planet's surface temperatures would be about 33°C colder on average than they are today.

Naturally, these greenhouse gases were balanced and maintained at a certain level. Due to human interference, from the burning of fossil fuels and our use of chemicals, there is now much more CO_2 and CH_4 in the atmosphere than previously existed. This has thickened the insulating blanket around the earth, trapping in more heat than before.



WHY IS IT A PROBLEM?

Changes in the earth's temperature throughout history have been gradual over thousands of years. However due to human activities, we have made changes that are rapid, and nature can't evolve to support such a rapid change in a short period of time.

The changes in the past 150 years from human activity has increased CO_2 and other greenhouse gases in the atmosphere more than the earth has experienced in the past 160,000 years.

It is likely that such a dramatic climate change will be too rapid for various ecosystems to adapt. This will result in mass extinctions as plants and animals at the base of the food chain are affected, which will have catastrophic effects throughout the rest of the chain.

IMPACTS OF GLOBAL WARMING

With extra gases in the atmosphere, it gains a greater ability to trap heat. As the earth's atmosphere warms up, icebergs and alpine regions will start to melt, raising the sea level. This will flood mangroves and coastal mudflats where many fish and other marine creatures at the bottom of the food chain begin their lives. Therefore all creatures that are at all reliant on the sea for food will be in trouble. This includes all sea creatures.

With a higher sea level, waves will also crash further inland, further risking plant, animal and human life.

The sea level is predicted to rise between half to one metre. This might not seem like much, but for the City of Casey it would mean the flooding of many of our coastal towns and villages, we would lose our mangroves and saltmarsh throughout Western Port Bay, and our coastal wetlands would be destroyed. Tourism through Tooradin and our other coastal villages would be affected, and many of our geological and geomorphic features would be hidden or damaged by the risen sea and waves. Salt water would flood into our rivers and streams so that the amount of fresh water would be decreased, which would affect aquatic life and stream vegetation. Stream bank erosion would also then become a major threat.

With a rise in sea level, millions of people worldwide who live near existing coastlines would lose their homes. Vegetation, animals, and agriculture in these areas would also be affected. Some countries such as Bangladesh and the Maldive Islands would be virtually wiped off the map.

A global temperature increase will result in higher evaporation and precipitation in some areas (particularly coastal), and a decrease in precipitation (e.g. rain) in others, such as the inland areas of continents. As such much of the plants and wildlife in central Australia would die, the red soils would erode, and we would be left with a wasteland of what we currently know as a beautiful living landscape.

This would also affect our farming, food, and economy, as much of our farming is carried out inland throughout Victoria, NSW and Queensland.

The climate will adjust too quickly for many plants and animals, and many will simply die, as they can't adapt quickly enough. As some species die and others don't, there will be an imbalance in the ecosystem, and some animals, such as insects, will reach plague proportions if their predators die before they do.

On the other hand, if the insects die before the predators, then everything that preys on the insects will die also as their food source will no longer exist.

CONTROLLING GLOBAL WARMING

Atmospheric scientists are hard at work looking at what can be done. It is understood that we must reduce our current level of emissions by about 60%. Preventing or minimising global

warming requires worldwide cooperation. With the rate at which we are releasing carbon dioxide and methane into the atmosphere, and destroying the forests that can convert them into oxygen and water vapour, there is no balance. Waiting until we have run out of fossil fuels before we convert to sustainable energy sources will be too late because the damage will already be done.

For more in-depth information about the methods of prediction of global temperatures, and sampling of the past, visit http://www.iclei.org/efacts/globwarm.htm.

WHAT CAN WE DO ABOUT IT?

There is a lot that we can all do to reduce the amount of greenhouse gas emissions. We can limit our use of aerosol products, and reduce our consumption of fossil fuels such as coal, oil and natural gas, by turning off lights, wearing an extra jumper instead of turning on the heater, and not using appliances such as clothes dryers unnecessarily. Using sustainable energy (wind or solar power) is another way to reduce your impact on the environment.

The City of Casey is involved in the Cities for Climate Protection™ Program. The Milestone 1 Assistance Program provided support to council in auditing Council and community greenhouse gas emissions within the City.

The program provided funds for additional staff to undertake the auditing, and also provided training for those involved in the Climate Protection Program. The Program aims to identify priority areas within the shire and follow up with locally relevant reduction actions. It will be used as a 'yardstick' to compare greenhouse emissions in future years and make predictions.

For more information contact:

Australian Greenhouse Office
PO Box 621
Canberra ACT 2601
Info line: 1300 130 606
Email www.iclei.org.anz

International Council for Local Environmental Initiatives
Level 5, 267 Collins St, Melbourne 3000
Phone 9639 8688
Fax 9639 8677
http://www.iclei.org/anz

Cities for **C**limate **P**rotection (**CCP**)

Cities for Climate Protection (CCP) is a campaign of the International Council of Local Environmental Initiatives (ICLEI), with over 550 local governments from around the world participating.

In Australia, the CCP program is delivered by ICLEI in collaboration with the Australian Greenhouse Office. In August 2003, 176 councils representing 72% of Australia's population have already joined the CCP campaign.

CCP empowers local governments to cut governments gas emissions. It provides local governments with a strategic milestone framework, which helps them to identify the emissions of their councils and communities, set a reduction goal and develop and implement an action plan to reach that target.

The City of Casey has joined the CCP campaign and are evaluating current greenhouse emissions and projecting emissions. To enable the development of programs to reduce the Local Communities greenhouse gas emissions, a reduction target of 20% has been set for corporate activities and 10% for community activities (milestone 2).

A Greenhouse background paper and implementation or local Action Plan were adopted by Council in June 2002 www.casey.vic.gov.au (milestone 3).

Currently Casey is implementing the local Action Plan (milestone 4).

For Further Information Contact

The City of Casey
(03) 9705 5200

International Council for Local Environmental Initiatives
Level 5, 267 Collins St
Melbourne, 3000
Ph: 9639 8688
Fax: 9639 8677
www.iclei.org/anz

Community Partnerships Australian Greenhouse Office
Ph: (02) 6274 1888
Fax: (02) 6274 1814
www.greenhouse.gov.au

Ozone

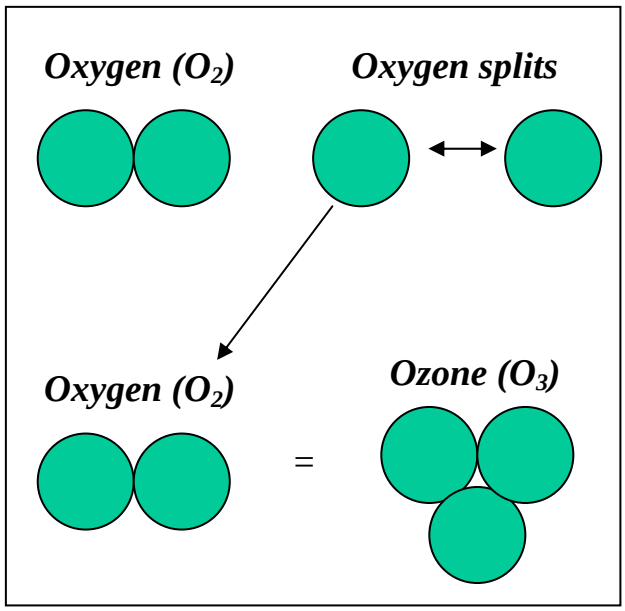
The hole in the ozone layer was first discovered in 1985. With the recent news that the hole in our ozone layer is now more than three times the size of Australia, there is increasing cause for concern.

WHAT IS OZONE?

Ozone is a gas made up of three oxygen atoms that acts as a protective shield over the earth's atmosphere, kind of like a "sunscreen", stopping harmful UV rays from the sun reaching the earth.

The ozone layer protects us, plants, animals and crops from these harmful UV rays which can cause skin cancer.

Ozone is a naturally occurring gas in the earth's atmosphere. It is thinnest at the equator, and thickest at the poles. It occurs in the stratosphere, which is the layer of the earth's atmosphere above the troposphere, which is the part in which we live and our weather occurs. When ozone occurs in the troposphere, it is a big contributor to smog and can also be harmful to humans. But we could not live without it in the stratosphere.



HOW IS OZONE FORMED?

Oxygen is made up of two oxygen atoms to form a molecule.

The sun's UV (ultra violet) rays can break up an oxygen molecule, leaving individual atoms, which then want to bind to other molecules. Thus, ozone is created.

Just like ozone is easily created through this simple reaction, it is easily destroyed through the introduction of halogen chemicals which break the ozone molecules apart and bond with either the chemicals themselves or other free oxygen.

WHAT IS DAMAGING THE OZONE LAYER?

Lots of things are damaging the ozone layer. Chlorofluorocarbons (CFCs) and other ozone-destroying chemicals (known as "halogens") react with the ozone, breaking up the ozone molecules to form other gases such as oxygen.

CFCs and other "bad" chemicals were banned in 1996, but their effects are still being felt by the ozone layer, which is at an all time low over Antarctica.

There is also the issue that greenhouse gases are contributing to ozone depletion, and the temperature variations from the Greenhouse Effect are providing the conditions for further ozone breakdown.

These gases gather around the south pole in late winter, which is why the hole is centred over Antarctica.

HOW BAD IS THE HOLE?

The man made hole is the worst it has ever been, stretching more than 32.9 million square kilometres (more than three times the size of Australia) in September 2000, which is several million square kilometres bigger than the previous record in 1998. The hole is said to have reached a peak in depth in 1993, and nearly reached the record again in 2000.

The hole stretches across to South America, southern Tasmania, Antarctica.

IS THERE ALWAYS A HOLE IN THE OZONE LAYER AND WILL IT EVER GO AWAY?

The hole in the ozone layer varies over the seasons of the year. Ozone depletion normally begins around the end of August and peaks in October. It usually recovers by November or early December.

Scientists predict that even with the banning of CFCs and other harmful chemicals, the ozone layer will not recover for decades.

WHAT HELPS REPAIR THE OZONE LAYER?

Ozone is naturally occurring, it is just that ozone is breaking down faster than it can re-form naturally in the atmosphere, and with the help of electric storms. In time, if we stop using harmful chemicals, much of the hole will recover. However if continue to use halogens and greenhouse gases then the problem will only get worse.

WHAT IS HAPPENING LOCALLY ABOUT IT?

The laws about CFCs operate throughout the world as it is part of an international agreement called the Montreal Protocol.

This means that all countries have a law as to the amount of reduction of harmful chemicals that is required.

In Victoria, CFCs and other chemicals (halons, methyl chloroform, and carbon tetrachloride) had to be phased out by 1996. Victoria has had a reduction of 60% CFCs and the use of halons in now almost zero.

Another type of chemical that is also used for aerosol cans and refrigeration, called hydrochlorofluorocarbons (HCFCs), will also have to be phased out soon under the international agreement.

Now, instead of CFCs, cans use “hydrocarbons” which are less harmful. However doing away with aerosol cans altogether is an even better option.

Locally, we can do things like finding alternatives to aerosol cans which don't require the chemicals. Products such as pump spray hair spray rather than in a can, can make a big difference.

WHERE CAN I GO FOR MORE INFORMATION?

Newspapers – such as *The Age, The Australian, Herald Sun,* and local papers in the City of Casey.

The local libraries in Casey contain a wide range of books on ozone.

The Internet:

Encarta – Ozone
http://encarta.msn.com/find/Concise.asp?ti=01076000

The Ozone Layer
http://www.soton.ac.uk/~engenvir/environment/air/oz_intro.htm

Discovery.com – Ozone
http://www.discovery.com/news/briefs/20000830/we_ea_reu_ozone.html

The Science of Ozone Depletion
http://www.epa.gov/docs/ozone/science/science.html

Ozone Protection in Victoria
http://www.epa.vic.gov.au/aq/info/pub409.htm

CFCs and Ozone Depletion
http://www.ciesin.org/TG/OZ/cfcozn.html

Ozone Reality Check
http://www.foe.org/ozone/intro.html

EPA Ozone Depletion
http://www.epa.gov/docs/ozone/index.html

Greenpeace – Ozone Campaign
http://www.greenpeace.org/~ozone/

Ozone Action
http://www.ozone.org/

Montreal Protocol on Substances that Deplete the Ozone
http://www.unep.org/ozone/mp-text.htm

USA EPA – Ozone
http://www.epa.gov/ozone/

Ozone Depletion
http://www.ciesin.org/TG/OZ/oz-home.html

World Conservation Centre
http://www.wcmc.org.uk/

Activity:

Read the information from the above websites and then take on the "Ozone Crossword" from THE USA's EPA website: http://www.epa.gov/docs/ozone/puzzles/scipuzzl.html

Litter – Visual Pollution

WHAT IS LITTER?

Litter is the most visible sign of environmental pollution. It is anything that is deposited where it is not meant to be.

Litter is unsightly and dangerous. Moreover, carelessly discarded litter can cause injury to people, through cuts and needle stick injuries. It is also a threat to wildlife which can be poisoned, choked or strangled. It encourages pest animals such as rats, mice and seagulls as well as the spread of pathogens.

- EPA, 2000

Lots of different materials make litter. Junk mail that blows out of letterboxes, cigarette butts, icy-pole sticks, lolly wrappers… It is also illegal to place advertising material on car windscreens as much of this blows away. Much of what ends up in the streets makes its way through our stormwater system to our waterways, ultimately affecting beautiful creatures such as seals and dolphins. Many plastics in particular are a serious threat, including plastic bags (which look like jelly fish when floating in the water), and the plastic ring shaped holders on six-packs of beer.

LITTER: WHERE DOES IT GO?

Litter that is carelessly dropped on our streets is often washed into the stormwater system and ends up on our beaches and in our rivers. When you wash paintbrushes in the gutter, or pour oil or pesticides into the gutter, it flows directly into our stormwater system, and into our waterways, polluting them, and putting people and animals at risk. Shopping bags for example look like jelly fish when floating in the water and are eaten by marine creatures, choking their intestines and killing them. Polystyrene beans from beanbags or broken boxes look appetising to turtles, and when eaten, make the turtles so buoyant they can no longer dive for fish and end up starving to death.

Litter can be classified by its type or location. By type, litter is usually broken up in to how dangerous it is. Hazardous waste needs to be disposed of quickly and carefully, as it is often poisonous to humans and animals, and can affect our water quality as it seeps into the water table. Syringes are simply dangerous and you should contact the City of Casey on 9705 5200 if you see littering of this kind. Other hazardous waste includes heavy metals, acids, and motor oil. The City of Casey has a transfer station in Cranbourne for the disposal of these potentially dangerous goods. Wastes accepted by the transfer station include oils and car bodies.

The Cranbourne Transfer Station also has free recycling of car batteries, aluminium, scrap metals, and white goods, as well as all the standard recyclables such as paper, cardboard, bottles and cans.

CSR/Minibah is the other local transfer station, and accepts paper, cardboard and all metals for recycling, in addition to the other waste products mentioned above. They also have free disposal of car bodies, which will hopefully one day reduce the number of dumped cars we see on roadsides and in the bush.

LITTER IN THE LOCAL COMMUNITY

Local issues such as overflowing bins in streets and schools, and rubbish that has been dumped in your local area are always a problem. Schools are able to purchase an education kit focusing on litter from The Gould League. You are also able to report rubbish from building sites to your local council. If you are concerned about litter in shopping centres, you should contact Centre Management at the shopping centre, who will be able to assist you.

If someone litters or dumps rubbish in your local community you need to contact your Council By-Laws Officer at Casey on 9705 5200.

Green **W**aste

Garden waste can contribute to the pollution problem because so many people burn it off. There are a few alternatives to this.

1) Register for a Casey Garden Waste Collection Bin (240L) from the Council (collected fortnightly)

2) Buy or hire a home mulcher to mulch the garden waste and use it on your garden (which in turn saves water)

3) Have a private contractor come to your property and mulch the garden waste for you

4) If the waste is small enough, compost it, and then use it in the garden

5) You can put a bundle of branches in your monthly hard waste collection, which is then mulched at Casey's Cranbourne transfer station

6) Take your waste directly to the City of Casey Transfer Station in Cemetery Road, Cranbourne.

TEN THINGS WE CAN DO TO KEEP OUR STREETS AND WATERWAYS CLEAN

1. **Don't litter**. Simple. Put it in the bin or take it home. If you smoke, carry a personal ashtray.

2. **Don't leave things out where they can blow away**, particularly if they can blow into a drain and end up in our waterways where they will impact on aquatic and marine creatures.

3. **Cut up plastic rings** such as those on the necks of milk and orange juice bottles, and on cans of beer. If these blow out of the bin and into a drain, they end up in waterways where they strangle marine creatures.

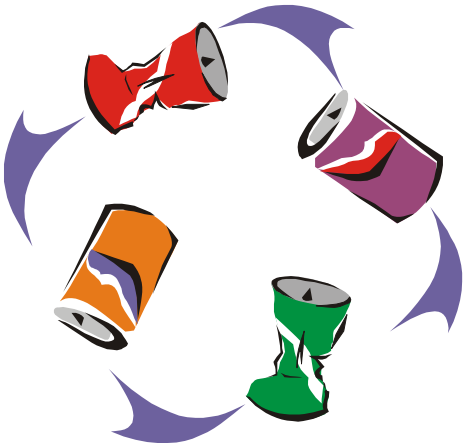
4. **Report offenders** by sending your forms into the EPA's Litter Report Line, phone 1800 352 555

5. **Reduce, Reuse, Recycle**, so that less is going into land fill

6. Buy products with **less packaging**

7. **Refuse a bag** when you go shopping. Take a backpack, satchel or a hessian bag

8. **Educate** those around you. If you see someone littering tell them it's wrong. Convince your family and friends to do the right thing. It's their environment and yours that they're destroying, not to mention the wildlife.



9. **Pick up litter.** If you see litter in the street, pick it up before it can make its way into the storm water system. Sometimes littering occurs accidentally, for example during rubbish collections. If it happens regularly then contact the council. But the best thing to do is just pick it up. Imagine how much cleaner our world would be if we could all just pick up one piece of rubbish every day.

10. **Buy recycled**. It is one thing to recycle our waste, but if we don't buy it back, it is still waste, isn't it? Buy products made from recycled materials or waste products. For example, cane sugar paper is a bi-product of sugar production, or post consumer office paper (such as "Cyclus" or "Steinbis") is made from almost all post consumer recycled paper. Beware of false recycled paper claims. Toilet paper and tissues can also be made from office paper. Contact Friends of the Earth or the Buy Recycled Alliance (www.mav.asn.au/buy recycled) for a list of recycled products, or read the packaging carefully in shops. Buy plastics with the number 1, 2 or 3 marked on them as these are the plastics that can be recycled in Victoria.

Litter Related Activities for VCE

ACTIVITY: VCE ENGLISH WORK REQUIREMENT 5 – COMMUNICATION PROJECT

"If we rubbish our streets, we rubbish our creeks, rivers and the bay. The evidence of our wasteful, overpackaged lifestyle hangs in the branches along our creeks and regularly washes up onto the beaches. Litter is a very serious issue with dire consequences for marine animals. Just how far can the litter we create travel? Plastic can cause serious problems for animals such as seals and penguins. In what other ways can litter harm habitats?" - EcoRecycle Victoria, http://www.ecorecycle.vic.gov.au/frames_schools.asp

EcoRecycle have a comprehensive web page on this VCE work requirement, and areas that students can cover for the Communication Project on a number of environmental issues, litter being one of them. It provides a positive approach to the issues looking at solutions rather than problems. A very worthwhile topic to consider for this work requirement. Go to the web site above for more information.

Activity: VCE LOTE Work Requirements 3 and 4 - Communications Activities

Curriculum resources for VCE LOTEs using a waste and litter theme have been developed for: Arabic, Chinese, Croatian, Macedonian, Spanish, Serbian, Turkish and Vietnamese.

All schools teaching these LOTEs received a hard copy version of this material during the latter part of 1996. If you can't find your copy, visit the EcoRecycle web page on LOTEs at http://www.ecorecycle.vic.gov.au/frames_schools.asp

More comprehensive LOTE information is also available at this web site, including some activity charts, learning outcome information, and CSF levels 2 and 3 activities and work requirement ideas. Key topics include Seasons and Waste; Festivals, Gifts and Waste; Shopping and Waste.

Further VCE Activities and Work Requirements

CSF Key Learning Areas:

Information on all the following can be found at
http://www.ecorecycle.vic.gov.au/frames_schools.asp

- ***Arts***
  Resources including a number that are relevant to various aspects of education for the Arts area can be found at - "Key Resources for Waste and Litter Education"
- ***English***
  CSF Levels 4 & 5 – "Waste not, want not"
- ***Health & Physical Education***
  CSF Level 4 – "The environmentally designed hamburger that tastes great"
  CSF Level 6 –"Waste is my problem too"
- ***Studies of Society & Environment***
  CSF Levels 4 & 5 – "Waste not, want not"
- ***LOTE***
  CSF Levels 2 & 3 – "Waste and Litter Minimisation"
- ***Maths***
  CSF Levels 6 & 7 – "Waste Less"
- ***Technology***
  CSF Level 4 – "The environmentally designed hamburger that tastes great"
  CSF Level 6 – "Waste is my problem too"
- ***Science***
  Resources including a number that are relevant to various aspects of education for the Science area can be found at "Key Resources for Waste and Litter Education"

Also at the web site, The Waste Wise Schools Kit includes comprehensive information on "*Learning to Be Waste Wise. A Curriculum Resource*", an in-depth guide to curriculum planning and implementation, with particular emphasis on meeting requirements of the Curriculum and Standards Framework and VCE Study Designs, giving specific guidance for the Science area.

ACTIVITY: PRIMARY SCHOOL - LITTER

Litter survey activity for primary students.

There are lots of different waste products that litter our streets and waterways. Choose an area to survey, and collect all the rubbish in that area. Sort it into tupes of rubbish, either source (e.g. fast food, business) or by type (recyclable, garden waste, hard rubbish).

What do you think can be done about this rubbish? Make some posters targeting the biggest offenders, or make a litter newsletter. Then keep surveying the area to see if your communication has made any difference to the amount of litter in the area.

Good sites to tackle would be the schoolyard, a Fast Food Restaurant Carpark, the local shopping centre, your street, or a local waterway. Target your poster or newsletter to the people littering your environment illustrating the impact this litter has on the environment, the animals, and also how it makes you feel.

Resource Conservation

Energy Conservation

Did You Know?
The electricity needed to keep a 100 watt light globe burning for 10 hours results in 1.4 kilograms of carbon dioxide to be released into the atmosphere, contributing to the Greenhouse Effect. 1.4 kg might not seem like much, but imagine the volume of air you would have to weigh to get 1.4kg.

Australian society is highly reliant on power. We rely on it for cooking, heating, lighting, transport, and manufacture so that we can have all the products that we rely on so heavily everyday.

Just remembering the disruption to our lives the recent gas and power shortages caused to our lives. We have become so reliant on energy from fossil fuels we've almost forgotten how to live without it!

Activity:

1) Choose an energy resource and write down how you would cope without using this resource for a day.

2) Rank our energy resources in which you think is the most important to the least important.

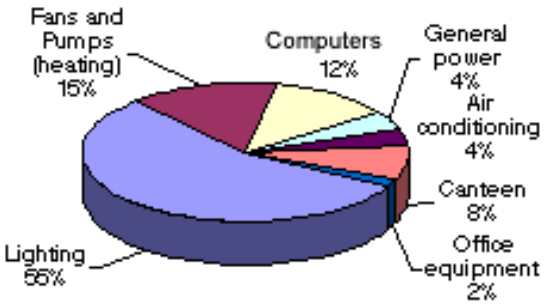
3) Identify appliances within the household that are energy efficient, and those that use high amounts of energy

4) Write a "Reduce, Reuse, Recycle" program for your house or school to save on power through less manufacture, less lighting and less wastage.

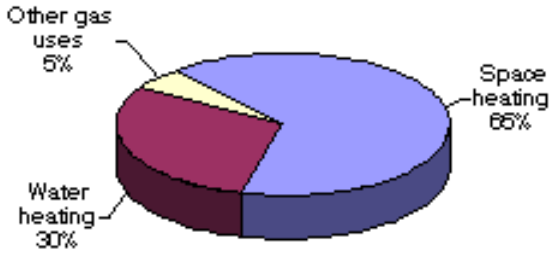
Energy Smart

Saving energy cuts greenhouse gas emissions and saves money. Schools can save about $200 per classroom on utility costs simply by being more responsible in their energy usage.

Energy in schools is mainly used for lighting and heating. The graphs below show the amounts used.



Typical school electricity use



Typical school gas use

"Energy Smart Schools" is a Victorian Government initiative that encourages schools to reduce power usage, and enter awards for the best efforts.

So how can we reduce our energy usage in schools? The following schools won an award for energy saving initiatives.

CASE STUDY

Energy Smart Best School - *Sponsored by Ergon Energy*
The Best School Award recognises achievement in the energy management of school premises and facilities.

Winner

Ringwood Heights Primary School came up with an innovative way of involving staff and students in the school's energy efficiency and conservation program. Each class selects two HEROS (heating and energy reduction/recycling officers) The HEROS monitor the switching off of lights, ensure computers and printers are turned off during recess, fans are turned off when not in use and doors and windows are closed to keep in the warmth or opened to allow for cool ventilation.

Ringwood Heights Primary School was one of the first schools to be accredited under the Energy Smart Schools program. Over the last year the school achieved a 20% reduction in energy consumption.

Outstanding Achievement

Erinbank Secondary College were awarded an outstanding achievement award for energy reduction.

During the last year they reprogrammed time clocks for the school's heating system, lights were delamped with triphosphor tubes, timers were installed on the hot water system, a more efficient light switch system for the car park and corridors were installed so that lights did not remain on unnecessarily, and a switching off lights program was introduced with staff.

All these measures resulted in an overall 2% reduction in energy consumption, with projected savings of 5–10% for the next year.

How to participate in the Energy Smart Schools Program:

1. *Nominate a school energy manager/coordinator.*
2. Complete and return the How to Participate form at http://www.seav.vic.gov.au/schools/about/form.html

Further Information Contact:

Energy Smart Schools
Sustainable Energy Authority
Ground floor, 215 Spring Street
Melbourne Victoria 3000

Telephone: 61 (03) 9655 3260
Facsimile: 61 (03) 9655 3255
E-mail smart.schools@sea.vic.gov.au

There are also a number of information sheets, tracking and auditing help and project material at the Sustainable Energy Authority website:
http://www.seav.vic.gov.au/schools/dnload/dnload.html.

ENERGY SMART SCHOOLS

Ergon Energy Grants for Energy Smart Schools

The Ergon Energy grants are available only to schools that become accredited as Energy Smart. In doing so they demonstrate a commitment to implement a comprehensive energy management program. The grants are intended to contribute towards the costs of minor works that will reduce energy consumption in schools. This funding cannot cover routine maintenance or major capital works. Examples of appropriate use of this funding include the installation of:

- heavy duty door closers
- occupancy sensors
- time clocks or key switches
- efficient hot water systems

More information on the Energy Smart School activity Program, go to
http://www.seav.vic.gov.au/schools/offer.html.

Activity

The Gould League have a great "Environmental Makeover Program", which teaches students, teachers and families to improve the school in the areas of waste, litter and pollution, biodiversity, energy and greenhouse, water usage, and aesthetics.

This can be an ongoing activity which involves the whole school, and different areas can be implemented by different year levels.

For more information go to the Gould League Web site at
http://www.gould.edu.au/programs/fsa5_makeover.htm.

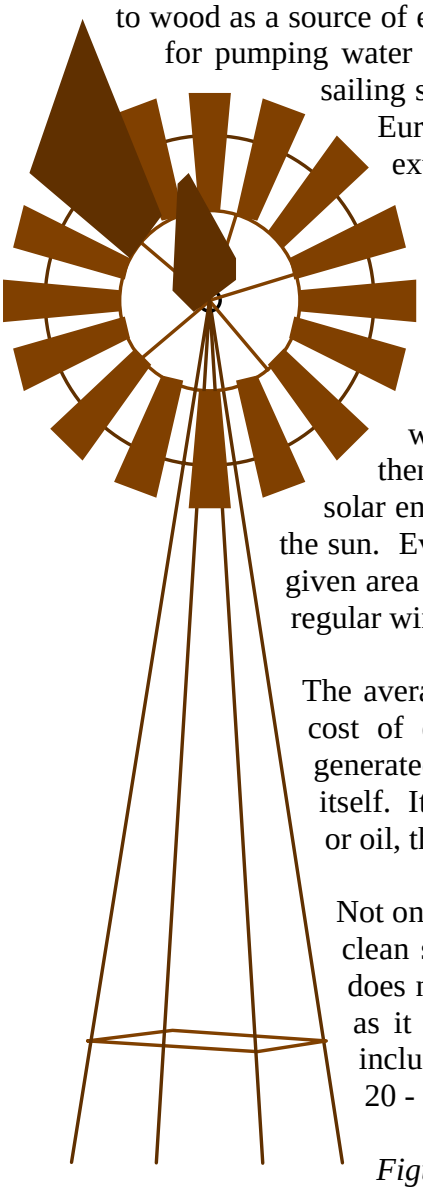
Sustainable **E**nergy

Sustainable Energy is energy that will not run out, or that is renewable. In being "sustainable", it must also be less damaging to the environment so that we are not destroying our future.

As fossil fuel supplies are being depleted, we have to find a new, environmentally friendly source of power. The following are viable methods that we have already to some degree adopted, and should push for today to see a lot more of these alternative energy sources used in the future.

Wind

Wind energy has been used for over 5000 years. Two thousand years ago wind was second only to wood as a source of energy. Predominantly it has been used for transport (sailing ships) and for pumping water for agriculture. Not much has changed and wind is still popular for sailing ships and pumping water on farms. When Australia was first settled by Europeans, they were dependent entirely on the wind. However the extension of electricity grids into rural areas and cheap electricity prices resulted in the replacement of wind pumps with electrically powered water pumps.



How does wind energy work?

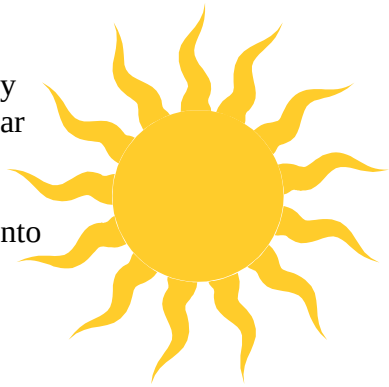
Winds are caused by the heating of the earth's surface by the sun, which causes localised rising of the warmer air, and the surrounding air then move in to balance out the instability. The wind is an indirect form of solar energy, and is therefore "renewable", as it is always being replenished by the sun. Every location on earth experiences wind, but the amount of wind in any given area at a particular time is highly variable. Naturally, areas that experience regular wind at high speeds will be more effective for wind energy generation.

The average wind speed of a site is a very important factor in determining the cost of electricity generated from wind turbines. The main cost of wind generated electricity comes from the cost of manufacturing the wind turbine itself. It costs very little to run. Unlike other sources of electricity such as coal or oil, the fuel for wind turbines – wind – is free.

Not only is wind energy renewable and will therefore never run out, it is also a clean source of energy as there is no burning of fossil fuels and therefore it does not pollute. It is difficult to estimate the total size of the wind resource as it is so variable. However it has been estimated that many countries, including the U.S.A, England, Denmark and Holland could easily generate 20 - 40% of their total electricity from wind power.

Figures and more information from http://www.iclei.org/efacts/wind.htm

S o l a r



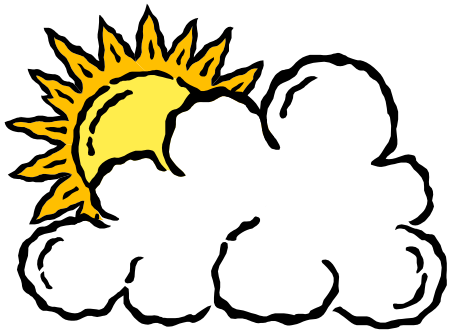
You may not realise it but you use solar power every day. How? By simply walking outside and using the sun as your source of light. Solar power is a very useable power but it is often taken for granted.

There are two ways we can harness the sun's energy and convert it into electricity.

Passive Solar Energy

Passive Solar Energy can be used to heat and cool buildings and water, and for lighting. Many households in the City of Casey already use this to a degree, in heating pools and water, and in efficiently designing houses to take advantage of sunlight.

The government also offers grants to new houses that are designed to be energy efficient, but having solar hot water rather than a traditional hot water service.



Photovoltaic (PV) Cells

Photovoltaics have the ability to convert the sun's energy directly into electricity, without the greenhouse or acid gas emissions associated with fossil fuel based electricity.

Photovoltaic Cells can capture solar energy even under very cold conditions. The main obstacle in adopting this technology is the cost.

Environmental Impacts

Once in use, PV cells use no fuel other than sunlight, give off no pollution and require no cooling water, and as such, do not contribute to global warming or acid rain, or radioactive risks.

The negative environmental impacts come from the potentially toxic chemicals required in their manufacture, and the ecological impacts in cell location, as a large area of land needs to be covered to produce electricity (therefore any vegetation in the area will be shaded out, impacting the wildlife within the area). However the amount of land required is similar to that of traditional electricity production, and with solar cells, roof tops of buildings and houses could also be utilised.

Disposal of PV cells after their 30 year life is finished will also raise some issues in waste disposal, because of the bulk of the cells and the chemicals contained within. However many of the toxic materials in the cells can often be recycled.

H y d r o - **E** l e c t r i c **P** o w e r - **E** n v i r o n m e n t a l **I** m p a c t s

Hydro-electric power plants convert the kinetic (movement) energy contained in falling water into electricity. Hydro power currently accounts for 6% of worldwide energy supply or about 15% of the world's electricity. However there is a lot of debate over the environmental impacts of hydro-electricity, as it often involves the damming of rivers, causing a number of problems to the

waterways such as disrupting fish migration, water flow, and impacts on all the aquatic life in that waterway.

Though it was once thought of as a clean source of energy, studies now show that some reservoirs are giving off large amounts of greenhouse gases equivalent to those from burning fossil fuels, from the flooded decaying vegetation.

The quantity of land required for hydro-electricity generation is the most pressing environmental issue. In Quebec for example, the La Grande project has already submerged over 10,000 square kilometres of land already, and it is planned in the future that the eventual area of flooding in northern Quebec will be larger than the country of Switzerland.

Although huge reservoirs such as this can be used for water supplies, irrigation and recreation, it is also a huge area of land that now has no trees left on it to convert carbon dioxide into oxygen. It may also produce vast quantities of greenhouse gases as the vegetation decomposes, and it compromises the homelands of Quebec's aboriginal population, whose way of life has been destroyed. Many rare ecosystems are also threatened by hydro-electric development.

Ocean Energy Systems

Ocean Energy Systems might prove to be a better option as they harness the energy in the waves in the ocean which does not compromise ecosystems on land or produce greenhouse gas emissions.

However the technology to utilise this wave energy is still in the very early stages of development and currently very expensive. It will take many years before the effectiveness of this source of power, and the environmental impacts, have been fully discovered.

Energy **E**fficiency

Overall house designs can save huge power bills and the environment, simply by designing the house for the block to take advantage of sunlight, solar heat, using double glazed windows, and better insulation.

The Jolly family, has an energy efficient house built in Lysterfield South just near Endeavour Hills, illustrating that energy efficient house design is accessible now in the City of Casey.

Our local electricity company, TXU (Eastern Energy and Kinetik Energy) have developed "EnviroEnergy options" to offer households the option of chosing cleaner energy. This gives householders in the City of Casey the option of chosing a percentage of their daily power supplies to come from green power, utilising renewable resources like the ones explained above.

Activity:
Using one of the maps of the City of Casey (e.g. the topographic map), make a plan for the sustainable electricity production for the City of Casey. Aspects such as land elevation above sea level are important for both wind and water movement.

Don't forget to look at the viability of your options, for example, if you make a recommendation for a hydro-electric plant, where would you put it and what impacts would it have on the area in terms of the houses/people, the environment, and the flora and fauna.