

## WHERE TO FIND OUT MORE

There are many guides to help you find out more about **sustainable building design and materials**.

- ⇒ [www.consumerbuild.org.nz/publish/](http://www.consumerbuild.org.nz/publish/)
- ⇒ [www.smarterhomes.org.nz/](http://www.smarterhomes.org.nz/)
- ⇒ [www.solarsmarter.org.nz](http://www.solarsmarter.org.nz)
- ⇒ [www.level.org.nz/](http://www.level.org.nz/)
- ⇒ [www.branz.co.nz/main.php?page=Sustainable%20Construction](http://www.branz.co.nz/main.php?page=Sustainable%20Construction)
- ⇒ [www.branz.co.nz/main.php?page=Eco-Building](http://www.branz.co.nz/main.php?page=Eco-Building)
- ⇒ [www.mfe.govt.nz/issues/urban](http://www.mfe.govt.nz/issues/urban)
- ⇒ [www.sustainablehouseholds.org/nz/courses1.htm](http://www.sustainablehouseholds.org/nz/courses1.htm)
- ⇒ [www.standards.co.nz](http://www.standards.co.nz)
- ⇒ [www.waitakere.govt.nz/AbtCit/ec/bldsus/shsummary.asp](http://www.waitakere.govt.nz/AbtCit/ec/bldsus/shsummary.asp)
- ⇒ [www.waitakere.govt.nz/AbtCit/ec/bldsus/index.asp](http://www.waitakere.govt.nz/AbtCit/ec/bldsus/index.asp)
- ⇒ [www.climatechange.govt.nz](http://www.climatechange.govt.nz)
- ⇒ [www.seattle.gov/dpd/GreenBuilding/SingleFamilyResidential/Resources/RemodellingGuides/default.asp](http://www.seattle.gov/dpd/GreenBuilding/SingleFamilyResidential/Resources/RemodellingGuides/default.asp)
- ⇒ [www.nzia.co.nz](http://www.nzia.co.nz)
- ⇒ [www.rebri.org.nz](http://www.rebri.org.nz)
- ⇒ [www.wanz.org.nz/](http://www.wanz.org.nz/)
- ⇒ [www.cca.org.nz/toplevel\\_files/welcome.htm](http://www.cca.org.nz/toplevel_files/welcome.htm)
- ⇒ [www.greenbuild.co.nz](http://www.greenbuild.co.nz)

In addition, for further information about **energy efficiency**, visit:

- ⇒ [www.consumer.org.nz/](http://www.consumer.org.nz/)
- ⇒ [www.eeca.govt.nz/residential/index.html](http://www.eeca.govt.nz/residential/index.html)

For further information on sustainable living topics such as waste, water, energy, shopping, gardening and transport go to [www.sustainableliving.org.nz](http://www.sustainableliving.org.nz)

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Marlborough District Council

# Ecological Building



- > Building sustainably means finding ways to maximise the energy efficiency of your home, and to use materials that have a low environmental impact and create a healthy living environment.

## Sustainable Design and Materials for your Home

**Building sustainably means finding ways to maximise the energy efficiency of your home, and to use materials that have a low environmental impact and create a healthy living environment.**

Building sustainably also means building creatively. Sustainable building solutions can require more planning and imagination than a conventional building project.

However, a growing number of people are thinking sustainably when building or renovating. As a result, there is more information, materials and help available than ever before.

This handout, written for Sustainable Living Programme with input from the Dept of Building and Housing, offers practical tips and strategies that can help you make improved choices in sustainable design and materials when building or renovating your home. It will help you be more confident discussing sustainable materials and concepts with your builder, architect or local council.

### THE IMPORTANCE OF SUSTAINABLE DESIGN

**Good design can make your home warmer, drier and more comfortable and enjoyable to live in. It can also make it healthier and safer, cut your energy bills, save water and help the environment.**

Although good design involves using resources wisely, there are no rules. A smart home can stand out from the crowd, or it can be just like the house next door.

Whether you're buying, building or renovating, the earlier you start thinking about smart design the better off you'll end up being. What works for you will depend on your building site, climate, lifestyle requirements and budget.

Once you've considered your options, it's a good idea to make a list of priorities and discuss these with your designer. Make sure your designer's views are compatible with yours.

Good design is about making sensible choices, such as:

- ✦ selecting a building site with good access to the sun
- ✦ insulating your home so it stays warm in winter
- ✦ orienting windows so they get sun when it's needed

stock a large selection of materials reclaimed from demolished or renovated buildings.

However, the particular material you need may not be available as it would if you were buying new. This requires a bit of advanced planning, some flexibility with the design and some detective work to track down the items you are after.

### Sourcing Sustainable Materials

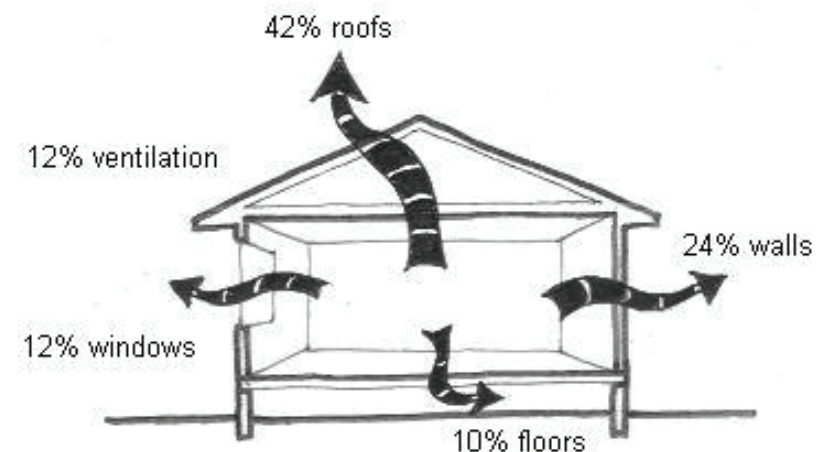
Often it is not easy to determine whether building materials are sustainable. Finding out whether material has been grown or produced sustainably, has low embodied energy or was created using no hazardous by-products, can require a significant amount of research.



A growing demand for sustainable materials has resulted in eco-labels or environmental certification schemes that show whether materials have been produced in a sustainable way and are not harmful to health.

Look for labels and certification that are independent and have government backing - some eco-labels are little more than marketing schemes.

There are several independent timber certification schemes. For other products, look for the independent, government-endorsed Environmental Choice New Zealand label.



therefore breathable) at room temperature and have been linked to health problems, including asthma and skin allergy conditions.

Timber treatments use toxic chemicals such as chrome and arsenic, that might leach out when exposed to weather and plant roots. The sawdust is toxic. For many of the chemicals used in common building materials there is little research about potential health impacts of constant exposure in the home.

Even if a material isn't toxic within your home, toxic chemicals may be used during the manufacturing process. This can be hazardous for workers involved in the manufacturing process. It can also harm the environment.

Information about toxicity of various materials commonly used in building and home interiors can be found on the websites of the National Occupational and Health Advisory Committee, Environmental Risk Management Authority, Ministry of Health, Occupational Safety and Health, and Ministry for the Environment.

### Minimising Waste

An average three-bedroom home generates six tonnes of waste during its construction. You can save yourself landfill costs and reduce harm to the environment by choosing materials that can be reused or recycled at the end of their useful life, or choosing materials that are biodegradable and can be disposed of safely.

When designing any new home or renovation, care should be taken to avoid unnecessary use of materials.

Speak to your designer or builder about reducing waste when designing and ordering materials.

With some materials, even if there's no recycling or reuse option available at the moment, those options may become available in future. Check with your supplier and with local council or landfill about what can be recycled or reused.

### Recycled Materials

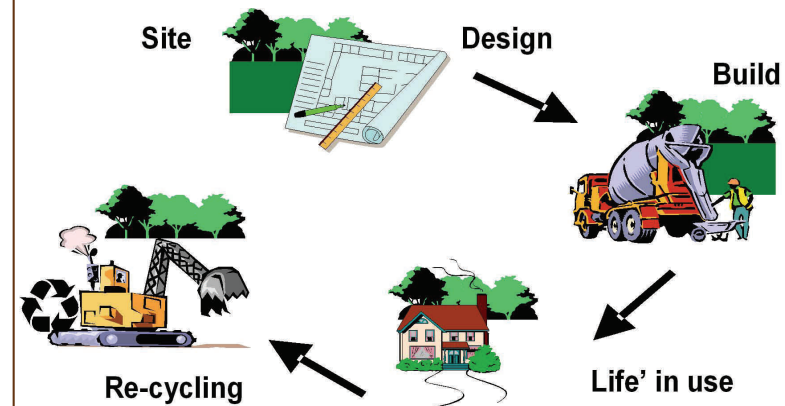
One of the best ways to make positive contribution to the environment is to re-use existing building materials.

Not only do recycled materials require little or no further processing so their environmental impact is low, but they are generally cheaper to buy than new materials and have the benefit of adding character to your building.

Building recyclers can now be found throughout New Zealand. They

- ✦ choosing materials that don't use or emit harmful chemicals
- ✦ thinking ahead to make sure your home or renovation will meet future needs as well as current ones.

### A building's Lifecycle



### Choosing a Site

Good design starts with understanding your site. Does it face north to maximise the heat and light of the sun, which will reduce energy use and cut power bills? Is there space to extend the building without making extensive alterations to the site? Will your building cause the site to become unstable?

If you're building or renovating you'll get better results if, early in the design process, you think about any features of the site that you want to preserve, and any features you want to make the most of.

Many potential problems can be avoided if a home is designed to be in harmony with the site's natural features. An aim of sustainable design is to minimise the effect of the building on the site's biodiversity, and improve or restore the site's biodiversity after construction.

Earthworks add to the risk of erosion, ground instability and flooding through stormwater runoff. Removing vegetation also adds to the risk of erosion. Interfering with existing drainage patterns increases the risk of flooding by stormwater runoff.

Work on the site by developers or previous owners can cause problems further down the track. The more a building site is altered - through earthworks, removal of vegetation, and diversion of waterways and runoff channels - the greater the risk of problems such as slips,

slumping, erosion and flooding.

Good design reduces these risks by minimising the impact a home has on its site.

## Passive Heating and Cooling

A well-designed home can be kept at a comfortable temperature through most of the year while reducing the need for mechanical appliances such as heaters or air conditioners.

In winter, a well-designed home will catch and retain the sun's heat. In summer, shading will keep the sun out, and breezes will keep the building cool. This is known as 'passive' heating and cooling.

To achieve these benefits you'll need your home to be well insulated. Without good insulation, you'll gain and lose heat through the ceiling, walls and floor.

If your home is well insulated, the biggest source of heat loss is windows and other glazed areas, so it's worth considering double-glazing and window frames that don't conduct heat.

You can achieve significant benefits from small alterations to an existing home, such as insulation, adding a north-facing conservatory, or even just putting up thermal drapes.

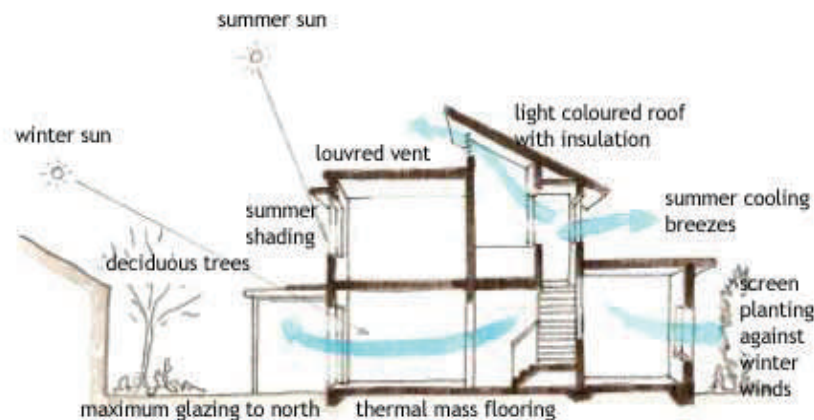


Diagram of a house showing key elements of passive heating and cooling.

Source: [www.smarterhomes.org.nz/design/design-overview](http://www.smarterhomes.org.nz/design/design-overview).

environmental issues relevant to each material. It follows an eight-step process that looks at use of the material in the building, manufacturing or processing of the material, and extraction or sources of raw materials.

You can ask your designer to consider life-cycle analysis of materials as part of the design process. In the diagram below, one arrow curve is missing - can you spot which? (for answer see footnote).

## Durability and Functionality

You won't be helping the environment if you choose products that wear out quickly or don't do the job you need them to do.

Products that aren't durable or functional will have to be replaced, which means more raw materials will have to be extracted and more energy used. This costs you as well as the environment.

In some cases, decisions about building and interior materials will involve judgement calls between natural materials that may wear out more quickly, and synthetic or modified materials that may last longer but also contain chemicals or produce emissions that can harm the environment and damage your health.

In these cases, you'll have to balance the benefits of a more durable material against the potential harm the material can do.

## Construction Systems

The type of construction system used for a building project can affect its sustainability.

It is important to find the best construction system for your location and climate.

Many New Zealand homes are built using a mixture of heavy and light construction – a heavy concrete slab on the ground and lightweight framed construction above.

But there are other options available, including steel, straw bale, earth, timber and several forms of concrete.

## Toxicity, Emissions and Health

Some materials used in home construction and home interiors contain chemicals that can be harmful to human health as well as the environment.

For example, some paints, carpets, engineered timbers such as MDF, glues and synthetic textiles can contain volatile organic compounds (VOCs). These are chemicals that escape from materials (and are

How do I build to last? – Replacing materials less often, means a lower environmental impact. When building, choose materials made of low-impact materials that will last a long time (durable).

### Looking at the Whole Life of a Building Product

To determine what makes one building material environmentally friendlier than another, you have to look at the entire life of that product.

'Life-cycle analysis' considers the total environmental impact of a material or product through every step of its life - from obtaining raw materials (for example, through mining or logging) through manufacture, transportation, use in the home and disposal or recycling.

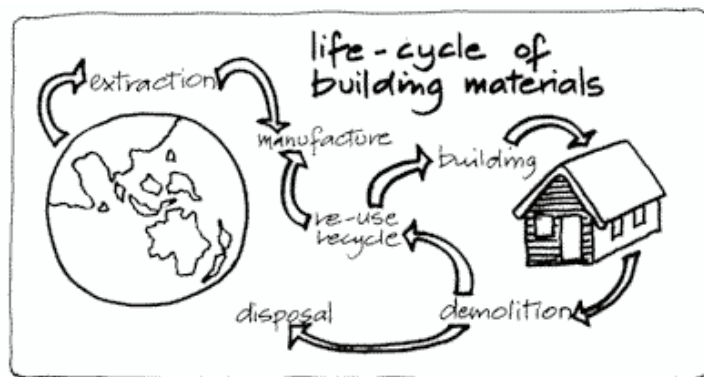
A life-cycle analysis will also consider a wide range of environmental impacts including:

- ✦ depletion of resources
- ✦ chemical degradation
- ✦ energy and water use
- ✦ greenhouse emissions
- ✦ waste generation
- ✦ toxicity to people and the environment.

A life-cycle analysis can be applied to a whole house, to an individual element such as a wall, or to a service such as heating or lighting. It is considered the most comprehensive way of understanding a home's full environmental impact.

Life-cycle analysis is a complex process. An international standard (ISO14040) has been agreed for life-cycle assessments. New Zealand-based life-cycle analysis data is not yet widely available.

The eco-hierarchy tool is a useful way of assessing the most important



*It is the link arrow from manufacture to building construction. This might be when you choose an item in a DIY store or a builder buys for you. This is your key decision point.*

### Thermal Mass

Thermal Mass refers to the ability of building materials to store heat. Building materials that have a high thermal mass, such as bricks, masonry and concrete can store large amounts of heat without a significant temperature change.

In places where there is a lot of difference between day and night temperatures, there are benefits in using high levels of thermal mass inside north living zones to stabilise internal temperatures in both summer and winter.

The correct use of thermal mass inside a house can significantly improve both thermal comfort and energy efficiency.

A balance, however, needs to be achieved between the thermal mass, window areas, and insulation levels, to suit the climatic conditions.

### Energy Efficiency

In a well-designed home, resources are conserved and used efficiently in ways that keep your costs down without sacrificing comfort or convenience.

Passive heating and natural light can reduce the amount of electricity or gas you use. So can solar water heating and energy efficient appliances. By using less energy, you'll save yourself money and help reduce greenhouse gas emissions.

Heating water is the biggest part of the power bill in most New Zealand homes. There are many easy ways to reduce water use. By fitting low-flow showerheads and choosing water-efficient washing machines and other appliances, you'll use less hot water. Depending where you live, you'll pay less in water charges.

### Dampness and Unhealthy Air

The air inside your home could be making you sick. Solvents, allergens, toxic spores - you could be breathing them all.

Because of our cold and moist climate, many New Zealand homes suffer from dampness that can contribute to health problems such as asthma.

Building materials in many homes – particularly newer homes - may contain airborne chemicals such as formaldehyde (e.g. from carpets, MDF glued particle board) that can also contribute to health problems.

Effective ventilation helps dry out a home and bring in fresh air, which reduces biological contaminants from bacteria, moulds, animal fur, dust

mites and pest droppings - such damp and particles contribute to allergies and respiratory disease.

Effective ventilation also helps remove poisonous gases such as carbon monoxide and nitrogen dioxide from un-flued portable gas heaters, wood and gas stoves, vehicle exhaust from attached garages, and tobacco smoke.

The placement of windows and doors affects ventilation, as does the internal layout of your home. With good design, you can get air to flow where it's needed, without creating strong draughts. Warm air venting at high points, helps.

## Water and Wastewater Management

In New Zealand, it's easy to think there will always be plenty of water. But increasingly, towns and cities are facing water shortages. Some will have to invest in infrastructure in coming years to ensure that supply can keep up with demand.

Water and wastewater infrastructure is expensive, and the costs are borne by home occupiers through rates and water supply and disposal charges.

Careful design can reduce the amount of water used in a home and save energy costs without inconveniencing the people who live there.

Reducing water use also benefits the environment by reducing the need to draw more water from rivers and waterways, and reducing the need to build new infrastructure for supply and disposal.

You may even be able to use greywater, the soapy waste from your bathroom, laundry and kitchen, in the garden on shrubs (not veges) or to flush your toilet. By re-using greywater instead of sending it down the drain, you may be able to save on water and wastewater charges, and reduce demand on treated water supplies in your area.

## CHOOSING SUSTAINABLE MATERIALS

**By choosing your building and home interior materials carefully, you can enhance the life of your home, reduce maintenance costs, and protect human health and the environment.**

Many materials require significant amounts of energy to extract and process for use in your home. Some can be recycled or re-used, while others are hard to dispose of safely.

Building and home interior materials may contain solvents and chemicals that can release fumes into your home for years after

construction. Some of these chemicals have been linked to asthma and skin conditions.

By choosing carefully when buying building materials, you'll be making your home healthier, and doing your bit to reduce harm to the environment.

The best materials for your building and home interior will be:

- ✦ sourced sustainably
- ✦ durable and strong enough to do the job required of them
- ✦ create minimal environmental impact during manufacture or treatment
- ✦ non-toxic reusable or recyclable.

## Thinking Sustainability

A building material is unsustainable if it is extracted and used in amounts that will cause it to run out in future and thus limit choices available to future generations.

Some materials used in building structures and interiors are renewable, such as timber, wool, cotton and natural raw materials used in textiles. Timber that is felled faster than it can regenerate is not sustainable. In many parts of the world, for example, hardwood forests are being felled at an unsustainable rate.

While the basic material used on your building might be plentiful, chemicals used to manufacture, process or preserve it might potentially be discarded into waterways or the environment. This may apply more to some extraction and industrial and processes in less regulated developing countries than it does to NZ made.

Things to think about when choosing building materials:

[Do I really need it?](#) – Is the renovation fixing a fitting that is worn out, or just replacing a feature that is currently unfashionable?

[Can I use recycled materials?](#) – Recycled, re-used materials have low environmental impact and can add character to your building.

[How do I minimise the amount of waste?](#) – Careful planning can reduce the amount of offcuts and packaging that have to be disposed of. For example, re-sizing rooms to fit multiples of 1.2 metres can drastically reduce trimming of plasterboard and lining sheets.

[Which materials can be replaced easily?](#) – Many building materials need to be replaced over time. Design your building so they can be replaced easily and with a minimum of waste.