

# Sustainable Home Design Guide

Quick tips for new builds



## Sustainable Home Design Guide

When you are building or renovating your home, make these smart design decisions to create a warm, healthy and resilient home that costs less to run and is kinder to the planet

### Find out how to:

- Design a home that takes less energy to keep you warm in winter and cool in summer
- Reduce your ongoing costs for power and water
- Reduce the carbon footprint of your home
- Future-proof your home to be compatible with solar power and electric vehicle charging
- Be more resilient in the face of power outages and water shortages

### Why build more sustainably?

Building a more sustainable home is not just better for the planet, it's better for your health, happiness and wallet. A home with typical sustainability features costs on average 1.5% more to build than a standard home, but you'll quickly recover this money through lower power and water bills and enjoy ongoing savings into the future.

### Should I get a sustainability assessment for my home?

Homestar is a common independent rating tool that certifies the sustainability of New Zealand homes. The advice provided in this guide aligns with design features that are considered by the Homestar rating system. You don't need to use the Homestar system to benefit from the recommendations in this guide, but you might benefit from having an independent sustainability assessment of your home's design. This will ensure your home is warm, health and has the lowest carbon footprint possible for your budget.

A growing number of Aucklanders are using the Homestar system to help design and certify their homes. International research shows environmentally certified homes sell for around 9% more than non-certified homes in the same market and early NZ evidence suggests the same trend. Surveys of NZ home buyers show a large majority value the warmth and efficiency of a sustainably designed home.

<b>Layout and Orientation</b>	Aim to maximise the sun's warmth during winter and to limit overheating in summer.
Face the sun	Orient the house so it faces north and is longer in the east-west direction. Place the living areas (or any rooms you use a lot) on the north side.
Take care with window size and placement	Bigger windows aren't always best as they let more heat in during summer, and let more heat out in winter. Place most windows on the northern side and least on the southern and western sides.
Consider shading	Use deciduous trees, eaves, or external shading to reduce overheating in summer especially on the north and western sides. Eaves on north side should be 600 – 900 mm deep.
Consider the wind	Our cold winter winds come from the south-west, so try to provide shelter or avoid locating outdoor areas and extensive windows in areas exposed to SW winds.
Weigh up pros and cons of a concrete slab floor	<p>A concrete slab floor may be a good choice if you have a flat site and winter sun can shine directly on it (without a covering such as carpet), or you plan to install underfloor heating. Then the floor acts as thermal mass to absorb heat in the day and release it in the evening.</p> <p>If you can't take advantage of its thermal mass, concrete should be minimised as it has the highest carbon footprint of all building materials.</p>
Keep it small	Bigger isn't always better. Prioritise higher quality and better building performance over size. A well designed but smaller home can feel just as spacious. It's also friendlier to the environment, easier to heat and costs less to run and maintain. Research shows that extra rooms get used less than 5% of the time which makes it a very expensive storage system.
Keep it simple	Every join and corner requires more framing which reduces the space for insulation, allowing more heat to escape from the home. Simpler home designs that minimise corners usually work better and cost much less.
Design for standard material sizes	Design your building to accommodate standard building material dimensions. This will minimise off-cuts and waste, and make it quicker and cheaper to build. Materials commonly have dimensions that are a multiple of 300mm (i.e. 600mm, 1200mm or 2400mm).

<b>Boost Insulation Levels</b>	Going above the minimum building code levels of insulation will save money in the long term on heating and cooling costs	The R value is a measure of the effectiveness of the insulation - higher numbers mean less heat loss, so the bigger, the better. Aim for the values below.
Ceiling insulation	Add more insulation than minimum building code levels	R 3.6 - 4.0
Underfloor insulation	Add more insulation than minimum building code levels	R 1.9
Concrete slab	Most heat is lost at the edge of a concrete floor so insulate around the perimeter as well as underneath.	R 2.2
Walls	R 2.8 wall insulation typically fits a 90mm cavity. For better wall performance, remove the nogs from between the studs and run battens horizontally along the studs to create an extra 40mm space for a second layer of insulation and for running wiring and plumbing.	R 2.6 - 2.8
Windows	<p>Choose high-quality double-glazed windows with thermally broken frames to avoid condensation and/or Low-E glass (low emissivity).</p> <p>On western windows the low-E coating can be placed on the outer rather than inside pane of glass to reduce summer heating.</p> <p>Even the best windows are still the largest area of heat loss in a modern home. Install double-layered curtains, roman blinds or honeycomb blinds to further improve window insulation. They need to seal snugly around around the window frame with a close fitting track or pelmet, and ideally reach all the way to the floor.</p>	R 0.31 - 0.40

## Choose efficient space and water heating

Space and water heating typically account for two thirds of your home energy costs so it pays off to build in an efficient system from the beginning

Choose an energy efficient hot water system

Gas hot water heating produces 50% more carbon emissions than a standard electric hot water cylinder.

If you are in a sunny spot, installing a solar hot water system (solar thermal) gives you free hot water in the summer but requires a boost in the winter from electricity or a wetback.

Hot water heat pumps deliver energy savings year round and can be installed indoors or outdoors. They reduce running costs and carbon emissions by around 65% compared to a standard electric hot water cylinder and make good economic sense for larger water uses.

Choose an energy efficient space heating system

Heating using sustainably sourced wood, or electricity produces lower greenhouse gas emissions than gas heating systems.

Heat pumps are among the most energy-efficient forms of electric heating appliance available. Heat pumps for space heating can be installed either as single room units, or a whole-of-home ducted system.

A hot water heat pump is an efficient way to heat a concrete slab to provide underfloor heating, or heat radiators.

A wood burner has the advantage of operating during a power outage. The Ministry for the Environment website has a list of approved clean burning models. Eco or heat saver flue kits improve the efficiency of a woodburner.

A heat transfer system can be added to transfer excess heat to nearby rooms. Wrap insulation around the ducting to improve performance.

Join the growing trend for all electric homes

Homes that have efficient electric hot water and space heating systems can benefit from the additional of solar panels to generate some of the electricity to run them. You can't take advantage of solar power as effectively if you have gas heating systems.



Zero Energy House, Pt Chevalier Auckland. Example of best practice sustainable building design – uses current best practice passive solar design, low impact storm water design, low energy use building systems and onsite energy generation to have zero net overall energy use. Find out more at

<http://www.aucklanddesignmanual.co.nz/resources/case-studies#/resources/case-studies/zero-energy-house>

<https://zeroenergyhouse.co.nz/>

<b>Control moisture and ensure adequate ventilation</b>	Ensure healthy indoor air quality and prevent the condensation and mould
Choose bathroom and kitchen extactor fans with a high flow rate	Bathroom and kitchen extractor fans should be vented to the outside. Connect the bathroom fan to timer switch so it runs automatically for 15-20 min after it's turned off. Fans need to have sufficient flow rate to extract moisture effectively. Aim for 50L/sec (minimum 25L/sec) for bathroom fans and 200L/sec (minimum 50L/sec) for kitchen rangehoods.
Install a ground moisture barrier	If you have a space between your home's the floor and the ground, lay a ground moisture barrier to prevent dampness rising up from the earth into the house.
Design for natural ventilation	Place windows to allow breezes to flow through windows on opposite sides (cross-ventilation) and between levels of the house (stacked ventilation). New buildings are much more airtight than in the past, so ventilation is important to provide fresh air and remove stale, moist or contaminated air.
Consider if you need a mechanical ventilation system	<p>If your home will not be able to ventilate effectively naturally, consider installing a mechanical ventilation system.</p> <p>Positive pressure ventilation systems are the most common but make the house colder if they continue to operate at night, bringing cool air from the roof space into the home.</p> <p>Balanced pressure ventilation systems that provide fresh air from the outdoors and have a built in heat recovery system, perform better. Ducting should be insulated for optimum performance.</p>

<b>Install efficient fixtures</b>	Cut down on ongoing running costs by choosing energy and water efficient fixtures and appliances
Install LED Lighting (Light emitting diode)	<p>Where possible, avoid the use of recessed down lights. They require a hole to be cut in the ceiling which can allow heat to escape and moisture to enter. Instead use ceiling mounted, hanging pendant, up-lights or wall mounted lights.</p> <p>If you do choose down lights, specify 'IC' or 'IC-F' type fittings. These allow insulation to be placed over the top of the light fitting, reducing heat loss. LED's are the most energy efficient and longest lasting type of light bulbs.</p>
Install water efficient fittings and appliances	Toilets, taps, showerheads, dishwashing and clothes washing machines have to be rated under the Water Efficiency Labelling Scheme (WELS) – look for models with three stars or more.
Choose energy efficient appliances	Cut down on ongoing running costs by choosing the right size and type of appliance for your needs. Choose the most energy efficient model – the one with the most stars. Aim for at least 3.5 stars for fridges, 4 stars for dishwashers and clothes washers. Use EECA's Rightware tool to compare the efficiency and running costs of different models of various appliances on the NZ market, including heat pumps.
Install ceiling fans for summer cooling	With hotter summers, it's tempting to use the heatpump for air conditioning but this only adds to the problem of global warming. A 50W fan uses 1/20th of the power and can be a cheap and effective way to keep cool.

<b>Future proof your home</b>	Even if you don't have the money for solar panels or an electric car yet, it's cheap to lay the conduit in the walls so you can easily connect up later
Pre-wire for solar	Run conduit through the walls sufficient to carry heavy-gauge DC wires from your roof to a location (eg garage) that is suitable for a wall mounted inverter, ideally near your switchboard. This will avoid unsightly conduit being added later, and speed up the future installation of a solar power system.
Pre-wire for EV charging	Install a separate sub-circuit from your switchboard to where you would charge an electric car (eg garage), with a cable capable of supplying 32-50 Amps. You can connect this to a wall-mounted car charging unit later.



## **Harvest rainwater** Not collecting free rainwater is like pouring money down the drain

Install a rainwater tank Consider installing a 2000 to 5000 litre rainwater tank for garden, toilet and laundry (non potable) use. You may require a diverter, backflow prevention device, and pump. This will reduce your water bills, provide resilience during times of water shortages and help detain stormwater. Some tanks can be partially or wholly buried if space is an issue. Some tanks can be installed along the wall of a house or double as a privacy screen.

## **Landscape in harmony with nature**

Landscape with native plants Reduce lawns and use native and drought-resistant plants to save water and provide food and habitats for native birds and wildlife.

Reduce hard surfaces Avoid using asphalt or concrete for driveways which add to stormwater run-off and contribute to flooding and pollution. Use porous surfaces and permeable paving where possible.

## **Reduce waste** By designing out waste you can save money and help reduce the amount of waste sent to landfill.

Design to avoid construction waste Have a waste minimisation plan for your building project. Include waste minimisation conditions in construction contracts and make sure all site workers are made aware of it.

Follow the waste hierarchy - reduce, reuse, recycle. Use materials efficiently and avoid wastage by relocating or deconstructing existing structures, using prefabricated and modular design of core building elements, using second-hand building materials, and carefully handling and storing materials. See Auckland Councils 'Building Out Waste' guide for more information.

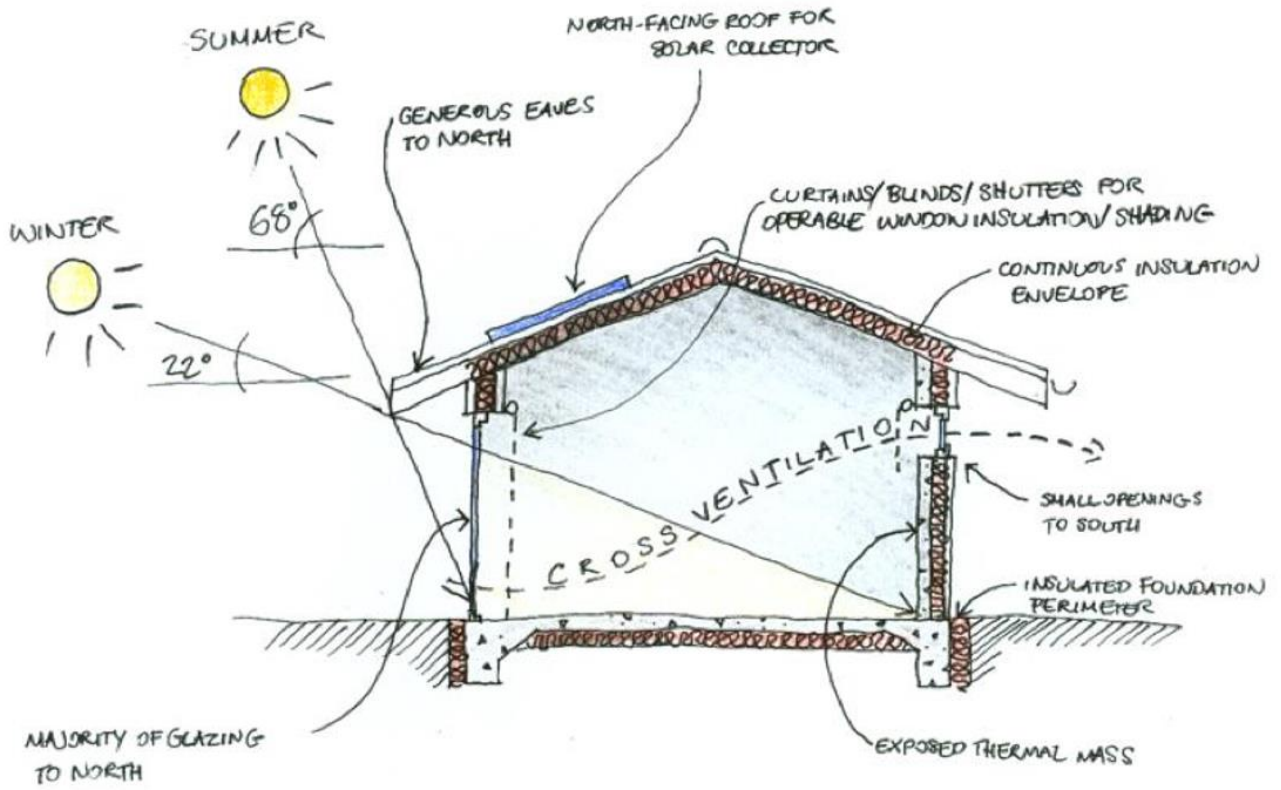
Recycle waste products Have separate clearly labelled bins for off-cuts and waste products that can be re-used or recycled. Companies in Auckland will recover timber, steel, plasterboard, concrete, cardboard and soft plastics. Community organisations are often interested in deconstructed materials for reuse.

## Links

For more information on smart and sustainable building see the following websites:

Website	Description
<a href="http://Aucklanddesignmanual.co.nz/sustainability">Aucklanddesignmanual.co.nz/sustainability</a>	Tips for designing sustainable homes, guides for achieving good design and case studies of outstanding buildings.
<a href="http://Smarterhomes.org.nz">Smarterhomes.org.nz</a>	More detailed information on the topics covered in this booklet, and more.
<a href="http://Ecodesignadvisor.org.nz">Ecodesignadvisor.org.nz</a>	Information guides and personalised advice from the national network of Council based eco-design advisors.
<a href="http://Level.org.nz">Level.org.nz</a>	BRANZ website with research and technical information relating to all aspects of sustainable building.
<a href="http://nzgbc.org.nz/homestar/forhomeowners">nzgbc.org.nz/homestar/forhomeowners</a>	Find out about the criteria and process for achieving Homestar certification.
<a href="http://Superhome.co.nz">Superhome.co.nz</a>	Not-for-profit organisation with educational events and home tours profiling healthy and efficient homes in NZ.
<a href="http://genless.govt.nz/individuals/lower-energy-homes/">genless.govt.nz/individuals/lower-energy-homes/</a>	Contains information, tools and calculators to help you choose energy efficient options for your home





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Find out more:  
visit [aucklandcouncil.govt.nz/](https://aucklandcouncil.govt.nz/)  
and search “eco design”.