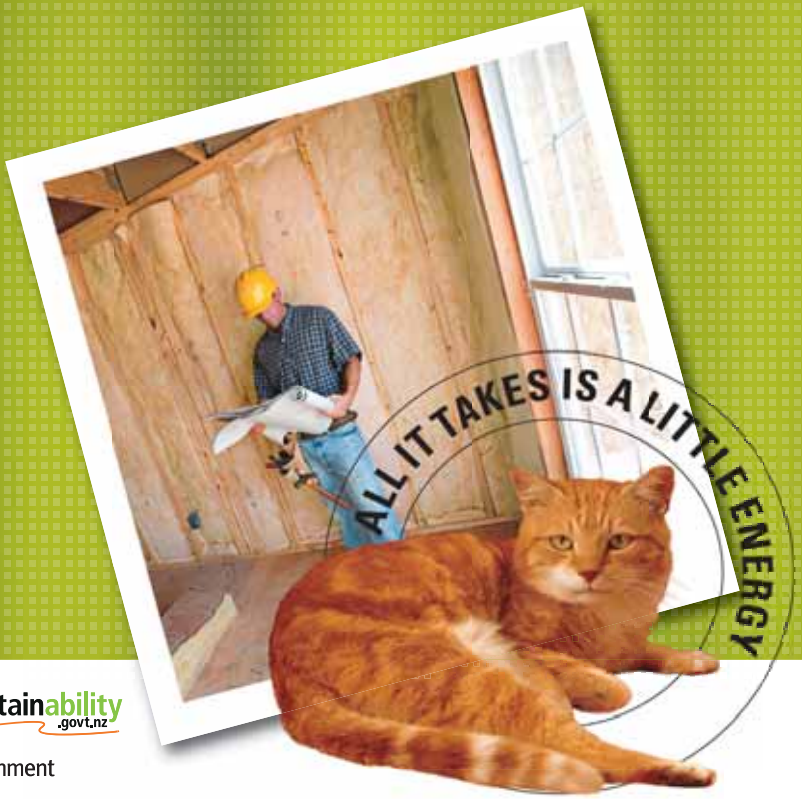
IF YOU'RE BUILDING, THERE ARE IMPORTANT NEW REQUIREMENTS YOU NEED TO KNOW ABOUT

Department of Building and Housing
Te Tari Kaupapa Whare

YOUR GUIDE TO $MARTER INSULATION



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New Zealand Government

What's inside

This booklet is printed on paper from sustainable forests using elemental chlorine-free pulp.

Introduction

Department of Building and Housing
Te Tari Kaupapa Whare

As a nation, we are committed to using energy wisely and efficiently. As a New Zealander, you can do your bit to help. Improving the energy efficiency of your house means both lower power bills and a warmer, more comfortable home.

Much of the energy we use in our homes and buildings is wasted or could be reduced.

A booklet produced by the Department of Building and Housing, *Your Guide to a $marter Home,* tells you how to cut your power bill (available online at www.smarterhomes.org.nz or by ringing 0800 242 243).

This booklet –*Your Guide to $marter Insulation* – provides more detailed information on important Government initiatives to reduce energy use in new homes and buildings.

From 31 October 2007, there are new minimum standards for insulation in every home built in the South Island and Central Plateau of the North Island. In most instances, this will mean the use of double glazing. By 30 September 2008, all new New Zealand homes will need to meet these new insulation standards, resulting in these homes using about 30 percent less energy to stay comfortably warm.

All major extensions to existing homes will also need to meet the new insulation requirements.

From 31 October 2007 there are also new minimum standards for lighting in commercial and other large buildings.

With the publication in October 2007 of an Acceptable Solution, getting a building consent to install solar water heating will also be easier. This clearly lists the necessary design features that a solar water heating system should include to comply with the Building Code and obtain a building consent.

Your Guide to $marter Insulation outlines the changes for those building or considering building. It provides technical details to assist builders, designers and others who are building or renovating.

Some cost is added to a new home by new insulation requirements. See how these costs are more than met over time by reduced power bills in a new, more energy-efficient home and building. There is a payback to your pocket, New Zealand and the planet.

INSULATING HOMES

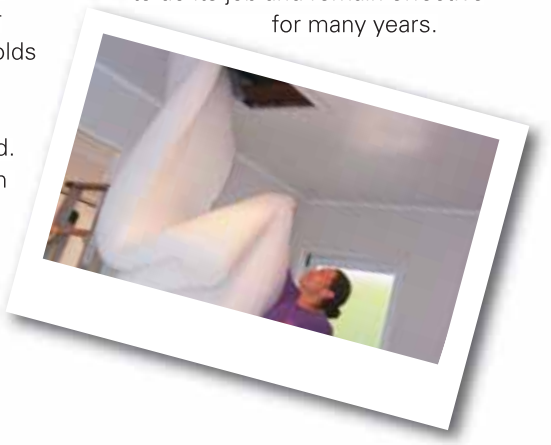
Insulating your home is the single most effective thing you can do to keep your home warm and to save energy and money.

There are new minimum requirements for insulation – but they are only a minimum.

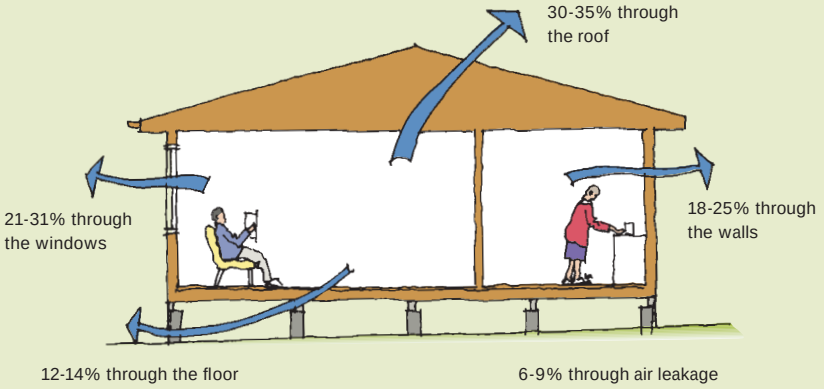
If you really want to improve your home's warmth and comfort and lower your power bills, consider exceeding the new minimum requirements.

A well-insulated home delivers in many ways.

- **Insulate your pocket** – a fully insulated home needs about half the heating an uninsulated home requires.
- **Insulate your family's health** – a well-insulated home provides year-round comfort, a healthier environment and less risk of colds and other respiratory illnesses. Insulation also helps reduce condensation, damp and mould.
- **Insulate your ears** – insulation helps reduce noise levels.
- **Insulate New Zealand's future** – about a third of all the power we consume comes from burning coal, gas and oil, adding to greenhouse gases entering the atmosphere.
- **Insulate up, down and underneath** – insulation reduces the rate at which heat passes through ceilings, walls and floors. Materials such as fibreglass, cellulose, polystyrene, polyester or wool fibre trap air in small pockets and provide a barrier to heat escaping. Reflective foil is commonly used under floors and works by reflecting heat back into the house.
- **Insulate first** – the best time to insulate is when building a new home or during renovations before cavities are closed in. Well-made, good-quality insulation is more likely to do its job and remain effective for many years.



An uninsulated house



Taken from the BRANZ House Insulation Guide, 3rd edition, 2007

New insulation minimums – but you can do more

An uninsulated or under-insulated house loses huge amounts of heat through roofs, walls, floors and windows.

There have been minimum insulation requirements for roofs, walls and floors since the late 1970s. Now, these minimum requirements have been increased – and for the first time, glazing is included.

If you want the best from energy efficiency in your new home or major extension, get professional advice about going beyond the new minimum requirements.

Changes to the Building Code you should know about

CHANGES TO H1 REQUIRE BETTER ENERGY EFFICIENCY

New requirements in the Building Code announced in May 2007 will lower power and gas bills and make homes warmer and more comfortable.

H1 is the route to energy efficiency

The New Zealand Building Code includes all the required provisions for building work. H1 is the clause that spells out the minimum requirements for energy efficiency. The H1 clause has been updated and includes new minimum provisions for insulating new homes and major extensions.

The changes to H1 will deliver:

- **better insulation for new homes** resulting in about 30 percent less energy needed to achieve comfortable indoor air temperatures.

  The actual change to the Building Code is an increase in the stringency of the Building Performance Index (BPI) and a refinement to the definition (refer to NZBC Clause H1.3.2).

  The corresponding change in the H1 Compliance Document updates the Standard, using a modified NZS 4218: 2004 in place of NZS 4218: 1996. The R-values specified in NZS 4218: 2004 are modified with higher values that match the thermal performance required by the new BPI in the Building Code (see H1/AS1 and H1/VM1).

  Note: the new Building Code requirement and the replacement R-values will take effect at different times throughout New Zealand (refer to page 6 for details). The changes affect all houses, and other buildings that have a floor area less than 300m^2.

- **improved efficiency of lighting in new and refitted commercial buildings**, and certain other large buildings, which will reduce the average power consumption of lighting installations by around 33 percent.

  No change has been made to the Building Code but the Acceptable Solution, H1/AS1, has been amended to use the recently updated Standard NZS 4243: 2007 Parts 1 and 2, instead of NZS 4243: 1996. This update reduces the maximum allowable lighting power density in COMMERCIAL buildings from 18 W/m^2 down to 12 W/m^2 on average, with corresponding changes to COMMUNAL NON-RESIDENTIAL buildings. The update also accounts for lighting controls.

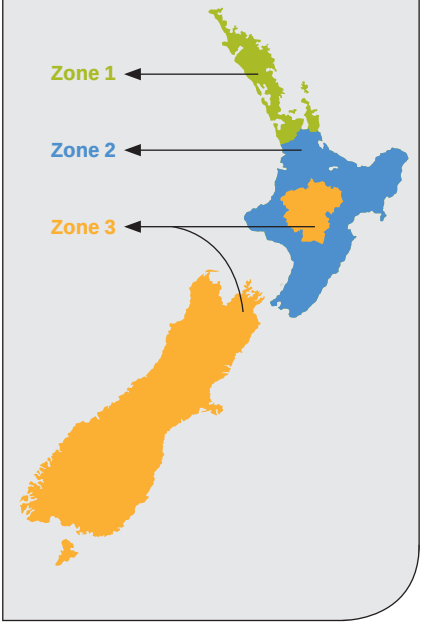
- **easier approval of solar water heating systems** across New Zealand are being introduced through a new Compliance Document. This specifies a way for installing solar water heaters to comply with the Building Code. It includes all necessary features and requirements.

  No change has been made to the Building Code but a new Acceptable Solution, G12/AS2, has been published that brings together all the relevant Building Code requirements for installing solar water heating systems. Consideration is given to the structural integrity, weathertightness and durability of the installation, and the health, safety and efficiency of the system's operation.

When do these changes affect you and your region?

The new minimum insulation requirements, including double glazing for most new homes, are being introduced in stages to allow industry to gear up. The country is split into three zones and changes start taking effect from 31 October 2007. By October 2008, all new homes and major extensions across New Zealand will be required to meet the new insulation requirements.

MAP OF CLIMATE ZONES



TIMELINE

August 2007
- Building Code amendments and Compliance Document published

31 October 2007
- amended Building Code and Compliance Document become effective
- increased thermal performance and R-values in zone 3
- increased stringency for commercial lighting everywhere in New Zealand

30 June 2008
- increased thermal performance and R-values in zone 2

30 September 2008
- increased thermal performance and R-values in zone 1

EXAMPLES OF PAY BACK: NEW HOMES TO USE 30 PERCENT LESS ENERGY

New, tougher insulation requirements by the Government will result in new homes using about 30 percent less energy to achieve comfortable indoor air temperatures.

NEW HOMES

Location	Average cost of constructing a medium-sized house now	Average additional cost of construction after the changes	Annual saving in energy bills	Return period on investment (in years)
Auckland	$254,000	+$3,000 to $5,000	$760	7
Wellington	$253,000	+$3,000 to $5,000	$940	6
Christchurch	$251,000	+$3,000 to $5,000	$1,340	4
Dunedin	$250,000	+$3,000 to $5,000	$1,800	3

Note: this assumes the entire house is heated to 16°C all day, and the living areas are heated to 20°C in the morning and evening. While this heating regime is greater than most New Zealanders currently follow, it is similar to measured heating regimes in new houses (based on cost benefit analysis from October 2006).

CASE STUDY: BUILDING RIGHT BRINGS HOME THE BENEFITS

A home built for optimum energy efficiency has meant lower energy bills, a cosier home and better health for a Wairarapa couple.

Their previous home was "the classic uninsulated Wellington villa with leaks and mould problems and freezing in winter".

To build their dream home, the couple used an architect with experience in building energy-efficient homes.

Double-glazed windows and doors from the living area face north to get as much sunshine as possible heating the home. To maximise heat gain, the living area is on an east-west axis. Eaves and windows were designed to let the sun in during winter but provide shading in summer.

The walls, ceilings and floors were all insulated at double what the Building Code required at the time. The house also uses thermal mass for heating purposes – it is built on an insulated concrete pad and uses rocks (under a window seat and around a woodburner) to radiate heat around the home. The only heater is the woodburner. Vents allow air to circulate and heat to travel to the upstairs bedrooms.

For water heating, the house has a solar hot water system meeting all of the household's water heating needs for 9 months of the year. Supplementary heating comes from a wetback connected to the wood-burner and by an electric booster.

The upfront costs of additional insulation, double glazing and solar water heating are balanced by ongoing cost savings. The average New Zealand household spends about $1,800 a year on energy, but this home's last annual energy bill was only $1,075 (over a third lower).

Was it worth it? “Absolutely!” the owners say. “Doing a few things differently at the beginning meant we got some really big benefits. It’s an incredibly easy, comfortable place to live in. We have less health issues, lower living costs, and people who come to stay notice how dry and warm it is.”

WHAT ARE R-VALUES?

R-values are used to rate the insulation of building materials and assembled walls, windows, floors and roofs. The bigger the R-value the better the insulation provided.

Technically speaking, R-values describe the resistance to heat flow, including conduction, convection and radiation. Be careful when comparing the R-values of overseas products as the R-values may not be directly comparable.

Changes to the Building Code mean that new houses will typically need to achieve higher R-values for the walls, windows and roofs. Most new houses are currently built to a standard set of R-values, shown in Table 1. These R-values will change as the new insulation requirements take effect.

The **new** R-values are listed in Table 2. These show the overall R-values for each part of the building, and are different to the R-value of the insulation that is actually installed. For example, a timber-framed wall will need insulation with an R-value of between 2.2 and 2.8 to achieve an overall R-value of 2.0 (the higher insulation R-value offsets the lower R-value of the timber framing).

TABLE 1: EXISTING R-VALUES

	Zone 1 BEFORE 30/09/08	Zone 2 BEFORE 30/06/08	Zone 3 BEFORE 31/10/07
Roof	R 1.9	R 1.9	R 2.5
Wall	R 1.5	R 1.5	R 1.9
Floor	R 1.3	R 1.3	R 1.3
Vertical glazing	–	–	–
Skylights	–	–	–

TABLE 2: NEW R-VALUES

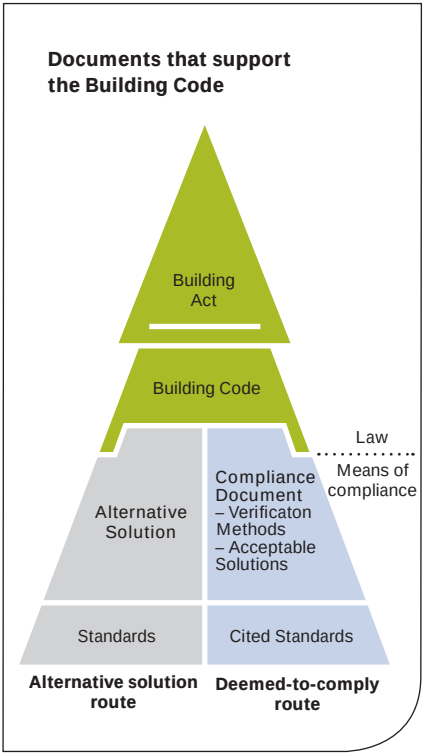
	Zone 1 AFTER 30/09/08	Zone 2 AFTER 30/06/08	Zone 3 AFTER 31/10/07
Roof	R 2.9	R 2.9	R 3.3
Wall	R 1.9	R 1.9	R 2.0
Floor	R 1.3	R 1.3	R 1.3
Vertical glazing	R 0.26	R 0.26	R 0.26
Skylights	R 0.26	R 0.26	R 0.31

Note: see p 6 for climate zone locations

Insulation values can be found in the BRANZ House Insulation Guide 2007 see www.branz.co.nz

BUILDING CODE STRUCTURE

The laws covering new building work and the performance of new buildings are set out in the Building Act and Building Code. The Compliance Documents specify ways the performance requirements of the Building Code can be met. Building to the Compliance Documents guarantees compliance with the Building Code.



Helpful definitions:

1 Building Act 2004 – regulates building work to ensure buildings are safe, healthy and sustainable.
2 Building Code – is part of the building regulations and sets the performance standards for buildings. All new buildings must meet these standards.
3 Compliance Documents – are made up of Verification Methods and Acceptable Solutions and are published by the Department. These documents describe ways that the performance standards specified in the Building Code can be met.
4 Verification Methods – describe ways of proving that a building design meets Building Code performance.
5 Acceptable Solutions – describe ways of constructing a building that meet Building Code performance.
6 Standards – may be used in Compliance Documents and form part of the compliance methods or solutions. A number of Standards may be used in a Compliance Document, each covering a different aspect of building design or operation.

Compliance with H1 for home insulation

The following approaches can be used to show compliance with the new H1 amendments affecting insulation.

BUILDING CODE – CLAUSE H1.3.2	
BPI (Building Performance Index) ≤ 1.55	The annual heating energy is calculated using ALF (Annual Loss Factor method). The result is adjusted for house size and climate.
ACCEPTABLE SOLUTION – H1/AS1	
Schedule Method (NZS 4218: 2004)	Simple R-value tables are used that specify the overall R-values for walls, floors, roofs and windows.
Calculation Method (NZS 4218: 2004)	Simple heat loss calculation is used that allows the insulation in one part of a house to be traded-off against the insulation in another part of the house.
VERIFICATION METHOD – H1/VM1	
Modelling Method (NZS 4218: 2004)	Computer modelling of the thermal performance of a building. Gives maximum flexibility for design and is able to take account of site orientation and passive solar design.

The following pages show some examples of common ways houses can be built to meet the new insulation requirements. If building new, get advice so you can get the benefits of high mass materials.

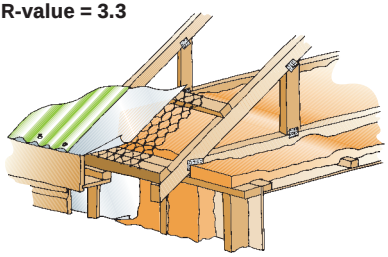
ROOF INSULATION

In an uninsulated house more heat is lost through the ceiling and roof than any other part of the house, making the roof the top priority for insulation.

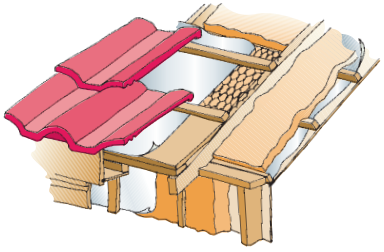
Insulation R-values for common roof construction methods can be found in the BRANZ House Insulation Guide.

Typical details for roofs in zone 3 – R-value = 3.3

pitched timber-framed roof
corrugated iron cladding
90 mm bottom chord
chord spacing 900 mm
insulation with R-value = 3.5



skillion roof
concrete tiles
190 mm rafters and battens
rafter spacing 900 mm
insulation with R-value = 3.1



Adapted from the BRANZ House Insulation Guide, 3rd edition, 2007

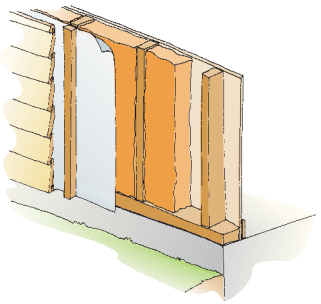
WALL INSULATION

About 22% of heat from an average uninsulated home is lost through the walls. It can be difficult to insulate walls in homes that are already built, but it's well worth insulating walls in new houses.

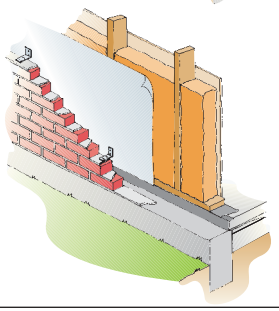
Insulation R-values for common wall construction methods can be found in the BRANZ House Insulation Guide.

Typical details for walls in zone 3 – R-value = 2.0

timber-framed wall with a cavity
bevel-back weatherboard cladding
90 mm framing
stud spacing 400 mm
dwang spacing 800 mm
insulation with R-value = 2.2



timber-framed wall
brick veneer cladding
90 mm framing
stud spacing 400 mm
dwang spacing 800 mm
insulation with R-value = 2.5



Adapted from the BRANZ House Insulation Guide, 3rd edition, 2007

FLOOR INSULATION

Around 14% of heat is typically lost through the floor. In houses with damp basements, a well-installed layer of underfloor insulation will also help to prevent moisture from penetrating into the house through gaps between floorboards.

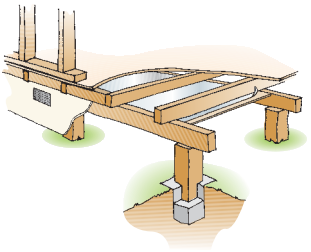
This results in a significantly higher room temperature and drier air.

Insulation R-values for common floor construction methods can be found in the BRANZ House Insulation Guide.

Typical details for floors in zone 3 – R-value = 1.3

suspended timber floor

both foil and lining under joist

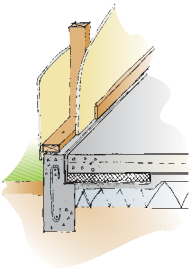


concrete slab on ground

area/perimeter ratio = 1.9

90 mm timber-framed wall

1.2 m x 50 mm perimeter EPS insulation



Adapted from the BRANZ House Insulation Guide, 3rd edition, 2007

WARNING: Installing underfloor foil insulation can be risky. Be careful not to pierce electrical cabling with staples. Existing foil insulation, if improperly installed, can be live. If you are unsure about anything, hire a professional installer or get an electrician to check things out.

WINDOWS

Windows are the weakest link when trying to retain heat inside during winter or keep it out during summer. Single-glazed windows conduct heat 10 times more readily than insulated walls. Windows are cold during winter because they lose so much heat, which can produce a downdraft of cold air and condensation.

Limiting the number of windows in a house will improve the overall insulation. Smart design and placement of windows will help limit the negative effects.

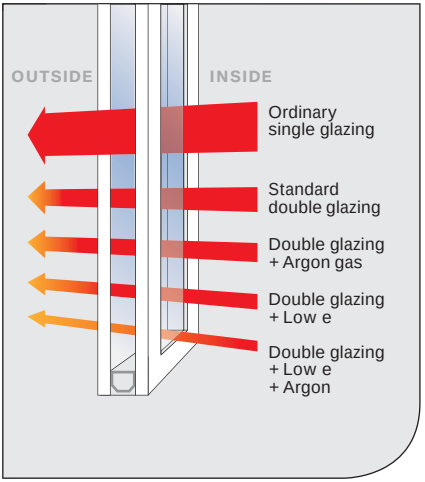
Windows also have a large influence on overheating during summer. The use of tinted or low-e glass, eave overhangs or other shading can limit summer heat and fading.

On the other hand, windows provide useful natural light and, if well-placed, can absorb and trap much warmth from the winter sun.

Double glazing is a big improvement over single glazing, although double-glazed windows still conduct much more heat than walls, floors or roofs.

Window frames have a big effect on heat loss and should be carefully selected if maximum insulation is desired. Aluminium window frames conduct heat from inside to outside very easily. Inserting thermal breaks into aluminium frames reduces the heat flow considerably. Further improvements to window performance can be made by using wood or PVC window frames, by the type of glass used and by the gas pumped between the panes of glass.

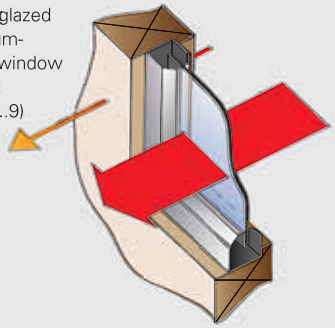
Heat loss reduction through glass



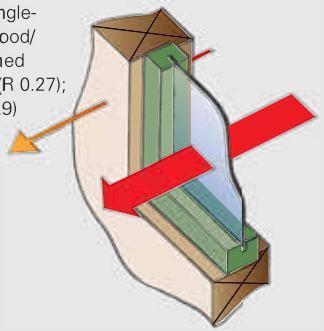
The new insulation requirements will make double glazing necessary in most new houses to meet the new glazing R-value of 0.26.

Heat loss in different window systems

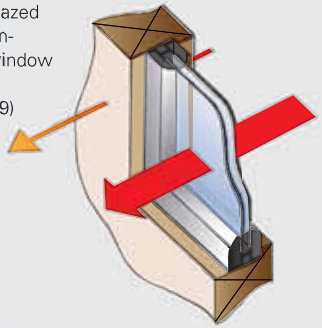
Singled-glazed aluminium-framed window (R 0.15); wall (R 1.9)



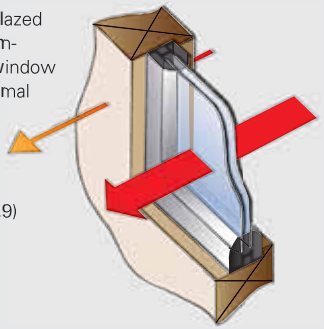
Low-e single-glazed wood/PVC-framed window (R 0.27); wall (R 1.9)



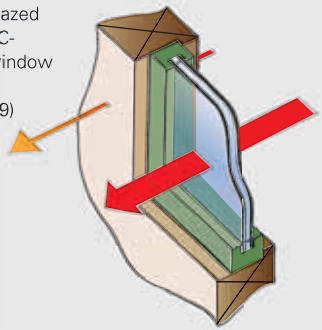
Double-glazed aluminium-framed window (R 0.26); wall (R 1.9)



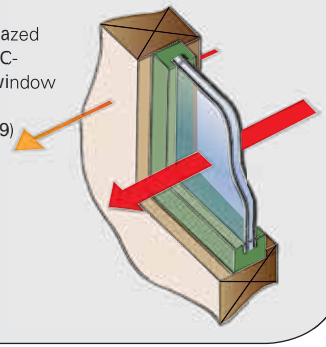
Double-glazed aluminium-framed window with thermal break or low-e glass (R 0.31); wall (R 1.9)



Double-glazed wood/PVC-framed window (R 0.36); wall (R 1.9)



Low-e double-glazed wood/PVC-framed window (R 0.48); wall (R 1.9)



Other important energy efficiency changes

SOLAR WATER HEATING

Solar water heating is an environmentally friendly way to produce hot water using free energy from the sun. It is particularly effective in sunnier parts of the country.

The Government is committed to supporting the uptake of solar energy in New Zealand where appropriate. Subsidies for installing solar water heating systems are available and information for consumers can be found at www.energywise.org.nz

The rules for installing solar water heating systems have been clarified by the Department in an Acceptable Solution, G12/AS2. No change has been made to the Building Code, but the new Acceptable Solution brings together all the relevant Building Code requirements for installing solar water heating systems. Consideration is given to the structural integrity, weathertightness and durability of the installation, and the health, safety and efficiency of the systems' operation.

The Acceptable Solution, G12/AS2, specifies the necessary features some solar water heating systems need to comply with the Building Code and the information to be provided when applying for a building consent. This will make it easier to get a building consent when installing solar water heating systems in New Zealand.

COMMERCIAL LIGHTING

Lighting in commercial buildings forms a significant proportion of their overall energy consumption. It also adds to the cooling needed during summer, further increasing the energy demand of commercial buildings.

Often there is little incentive for the people using commercial lighting to save electricity as they do not pay the power bills. Therefore, it is important to ensure the initial lighting design and installation is energy-efficient.

The Building Code requirements for artificial lighting remain unchanged, but the Acceptable Solution has been amended to use the recently updated Standard, NZS 4243: 2007 Part 2 – Lighting.

NZS 4243: 2007 now restricts the lighting power density for commercial buildings to 12 W/m^2 on average with different limits for other types of buildings depending on their purpose. The Standard also includes provision for lighting controls. These changes reflect developments in lighting technology since the Standard was last revised.

The following approaches can be used to show compliance with the H1 requirements for artificial lighting.

BUILDING CODE – CLAUSE H1.2(C) & H1.3.5	
Applies only to COMMERCIAL and COMMUNAL NON-RESIDENTIAL buildings (see Building Code Clause A1 (Classified Uses) for definitions).	
ACCEPTABLE SOLUTION – H1/AS1, 6.0	
Schedule Method (NZS 4243: 2007, Clause 3.3)	Specifies lighting power density limits for various types of buildings. Limits are for the overall lighting energy density.
Calculation Method (NZS 4243: 2007, Clause 3.4)	Simple calculation procedure that provides a more accurate value for the lighting energy density. Takes account of specific building features that allow for more efficient lighting design.

Home maintenance

After you've bought or renovated, properly maintaining your home is the next smart choice.

Just like you and your car, good maintenance of your home brings a fleet of benefits.

A well-maintained home:

- keeps you safe and secure
- rewards your family's health
- assists with lowering power bills
- reduces impact on the environment
- saves money by fixing problems before they get bigger
- protects what is usually your biggest financial investment.

HOME MAINTENANCE TIPS

- Know your DIY limits – sometimes it's cheaper and less stressful to hire a building professional rather than make costly mistakes.
- Combat damp through insulating, ventilating and quality heating.
- Seek advice and get your place thoroughly investigated if you think it could be a leaky home. Often this may be a maintenance issue.
- Maintain all claddings – whether they are monolithic fibre-cement, weatherboard, brick or concrete block. Follow the manufacturer's maintenance recommendations and inspect annually.
- Check that balconies and decks allow water to run to a collection point. Check for rotting, swelling, cracks, rust and keep drainage points clear.
- Check your roof, chimneys and flashings annually. Look for corroded or lifted flashings and crumbling chimney mortar.
- Be an active body corporate member and make sure your townhouse or apartment complex has a long-term maintenance programme.

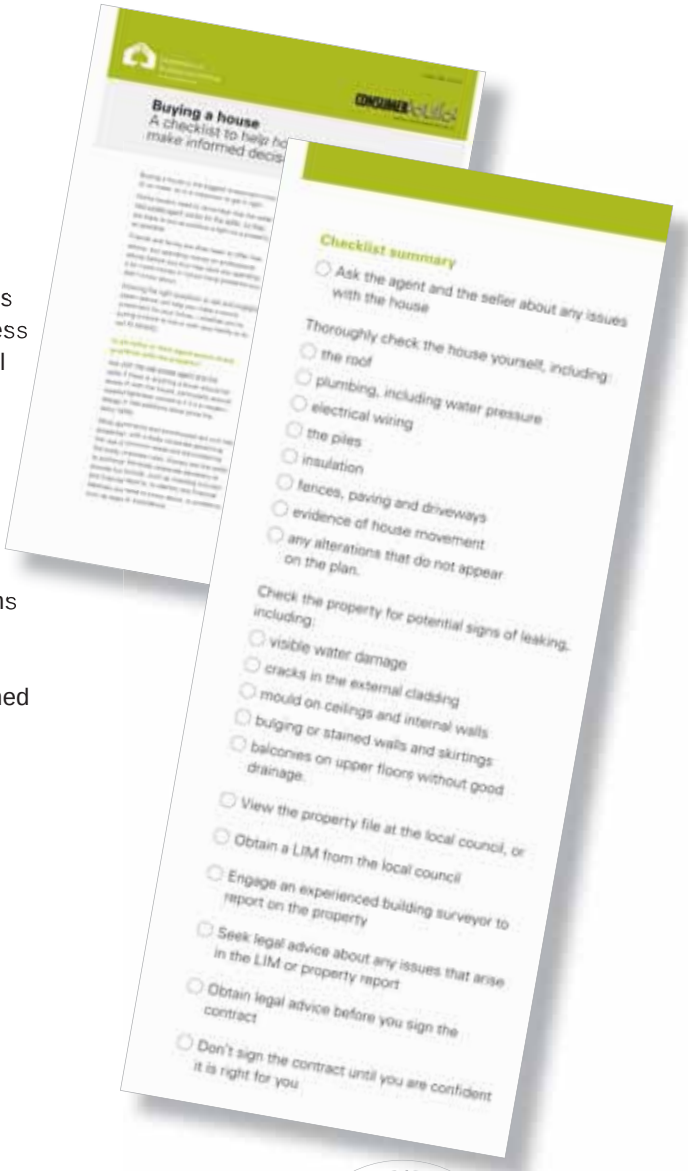
There is no such thing as a maintenance-free house.

Having a no-maintenance house is a myth. Modern homes require less attention than older homes but all properties need maintaining.

Maintenance covers:

- preventative work, such as gutter cleaning – this can stop water and dampness entering your home
- repairs to prevent small problems growing
- major maintenance tasks like reroofing which should be planned for time and budgetary reasons
- preparing for emergencies, like knowing how to turn off water, gas and electricity.

For home buyers' and home maintenance checklists, go to
www.consumerbuild.org.nz



Department of Building and Housing
Te Tari Kaupapa Whare

MORE INFORMATION

www.dbh.govt.nz
The Department of Building and Housing website provides information on building law and compliance, weathertight homes and advice for tenants and landlords. For New Zealand Building Code Clause H1, Acceptable Solution H1/AS1 and Acceptable Solution G12/AS2, go to www.dbh.govt.nz/compliance-docs-get-copies (download free).

www.smarterhomes.org.nz
Tools and advice to help you make your home warmer, healthier and more cost-effective while being kinder to the environment (look for *Your Guide to a $marter Home*).

www.consumerbuild.org.nz
Advice on buying, building, renovating and maintaining a home.

www.energywise.org.nz
Practical advice on how you can save energy and money in your home.

www.standards.co.nz
NZS 4218: 2004, NZS 4243: 2007 Part 2 (for purchase).

www.branz.co.nz
House Insulation Guide – Third Edition 2007 (for purchase).

www.sustainability.govt.nz
This is the Government's new sustainability portal. Through it you will learn how to live smarter, reduce your impact on the environment and save money.

Published in October 2007 by Department of Building and Housing, PO Box 10-729, Wellington, New Zealand

978-0-478-19467-8 (document)
978-0-478-19470-8 (website)

everyone can have sustainability.govt.nz

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