

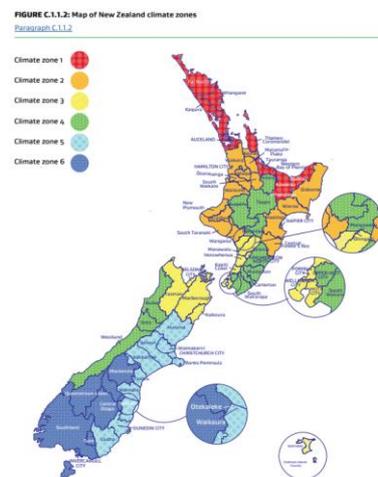
INSULATION: HOW MUCH DO I NEED?

INFORMATION SHEET 7

Two of the most common questions asked of Eco Design Advisors are how much insulation should be installed, and how do you know what difference it will make. To answer these questions there are a few basic concepts to understand.

- Heat always tries to flow from a warmer place to a colder place.
- Insulation reduces this heat flow by slowing it down.
- The unit used to measure resistance to heat flow is the R-value ($m^2 \text{ }^\circ\text{C/W}$). The bigger the number, the better the resistance to heat flow.
- All insulation products sold in New Zealand are required to be labelled with the R-value, and when building new you need to demonstrate you can meet the insulation requirements of the New Zealand Building Code (NZBC).
- The table below shows the minimum R-values required to meet the NZ building code for building elements (that do not contain embedded heating systems).
- New Zealand is divided into six different climate

zones - refer to the map below.



Building element	Construction R-values ($m^2 \cdot K/W$) ⁽¹⁾					
	Climate zone 1	Climate zone 2	Climate zone 3	Climate zone 4	Climate zone 5	Climate zone 6
Roof ⁽²⁾	R6.6	R6.6	R6.6	R6.6	R6.6	R6.6
Wall	R2.0	R2.0	R2.0	R2.0	R2.0	R2.0
Floor						
Slab-on-ground floors	R1.5	R1.5	R1.5	R1.5	R1.6	R1.7
Floors other than slab-on-ground	R2.5	R2.5	R2.5	R2.8	R3.0	R3.0
Windows and doors ⁽³⁾	R0.46 ⁽³⁾	R0.46 ⁽³⁾	R0.46	R0.46	R0.50	R0.50
Skylights	R0.46	R0.46	R0.54	R0.54	R0.62	R0.62

Notes:

- R values stated are total construction R-value, considering heat losses through framing members.
- Refer to BRANZ House Insulation Guide 6th Edition, for options on achieving these desired construction R-values.
- Consult with your window supplier to ascertain what R_w value different options will give, or refer to BRANZ Bulletin 670; Specifying windows and doors under H1, for guidance: ([Specifying windows and doors under H1](#))



WHAT CAN WE LEARN?

- Insulation is your friend, the more the better, especially in the ceiling, as warm air rises (replacing the cold air that sinks).
- Windows perform poorly thermally; even double-glazed windows lose 10 times as much heat as a well-insulated wall, hence there's still a need for good curtains (see Information Sheet: **Windows**).
- Avoid too much glazing, especially on south and west sides, and limit skylights.
- Insulation works in both directions, slowing heat from entering in summer, and will reduce overheating, provided windows are well shaded.
- The cost of upgrading to higher insulation levels is relatively modest compared to the overall build cost. Any additional upfront cost will usually be recovered by lower operating costs over the life of the building.

HEATING SAVINGS

Let's look at a typical 1960s/1970s house and what insulation can do to improve the occupants' comfort and reduce the heat requirements and running costs of the house.

Reduce heating requirement through more insulation (from no insulation to best levels)

	Existing house with no insulation	Heat Load (Watts)	Insulated to NZBC minimum	Heat Load (Watts)	Insulated to better level	Heat Load (Watts)	Insulated to best levels	Heat Load (Watts)
Floor 120m ²	R0.4	4,500	R2.5	720	R4.0	450	R4.8	375
Walls 92m ²	R0.44	3,140	R2.0	690	R3.3	418	R3.8	363
Ceiling 120m ²	R0.3	6,000	R6.6	273	R7.8	230	R9.0	200
Windows 34m ²	R0.15	3,400	R0.46	1,109	R0.76	671	R1.01	505
Total		17,040		2,792		1,769		1,443

The house with no insulation requires a massive 17kW of heat to keep the temperature at 20°C when it is 5°C outside. The biggest heat loss is through the ceiling, followed by the floor, with the windows and the walls losing similar amounts. That equates to \$5.37 an hour to heat this small uninsulated house (at 2022 prices, ~31.5c/kWh).

Once insulated to the NZBC minimum, the heating requirement drops to 2.8kW, to maintain a comfortable 20°C. Now the biggest heat loss is through the glazing even though the house has been double glazed. The heating cost drops to 88 cents per hour, a saving of almost \$4.50 per hour. If you can build to the better levels, the cost drops to only 56 cents an hour to heat the whole house!

If the house was able to be insulated to best levels, including installing the best windows, and higher spec insulation, savings will be even greater. Best levels may require a deeper ceiling cavity and wider than normal wall framing to accommodate thicker insulation, an insulated floor slab (including around the perimeter of the slab). In a well-oriented, solar designed house, it is possible in the more temperate parts of New Zealand to achieve a good level of thermal comfort with little or no space heating.

Ideally energy modelling should be carried out to confirm likely performance. Other areas that should be considered are thermal bridging, air tightness and avoiding summer overheating.

FOR FURTHER INFORMATION

Contact your nearest Eco Design Advisor visit our website ecodesignadvisor.org.nz

View helpful resources at:

- smarterhomes.org.nz
- Level (Sustainable building authority): level.org.nz
- Building Research Association of New Zealand: branz.co.nz
- Beacon Pathway: beaconpathway.co.nz
- [The high Performance Construction Details Handbook](#); available to download free from BRANZ