

Insulation

There is a wide range of insulation materials available on the New Zealand market. The most commonly used has been glasswool mat or blanket. However, there is now a wider range of products to consider such as:

- sheep's wool
- polyester
- wool/polyester blend
- polystyrene
- mineral wool
- macerated paper.

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GLASSWOOL	
Extraction and manufacture	
Impact of extraction	Glasswool insulation is made from up to 85% recycled glass. Chemicals derived (or partly derived) from non-renewable resources may also be added to act as binders or flame-retardant or anti-microbial agents.
Energy use	Significant amounts of energy are required in glasswool insulation manufacture, but this is offset by durability and low maintenance. Embodied energy of glasswool is quoted ¹ as 32 MJ/kg
By-products/emissions	None known
Sourcing	
Material sources	Glasswool insulation is both manufactured in New Zealand from imported raw materials and imported (Thailand, Australia) as a finished ready to install product.
Availability	Glasswool insulation is readily available throughout NZ.
Cost	Glasswool is generally the lowest cost option.
Construction/installation	
Health and safety during construction/installation	Protective clothing (gloves, overalls) and masks are recommended during installation to protect against fibre/skin contact and from breathing in fibres. New glasswool is generally more operator friendly than in the past – it is no longer considered the risk it once was.
Uses	Glasswool insulation can be used in walls (fitted tight in framing cavities) and ceiling/roof spaces (installed without gaps) as a blanket or mat. There are also glasswool products designed specifically for insulation under suspended floors.
Ease of installation	Correct installation is necessary to ensure no thermal bridges (gaps to the framing) are created. This is extremely important to maximise insulation value.
Performance	
Health and safety during life of building	Material can collect dust – use protective clothing and masks if working with existing insulation during renovations.
Expected durability (assuming correct installation and maintenance)	50+ years

Moisture resistance	Glasswool is resistant to moisture but insulation value will be lost if it gets wet.
Rot, mould and corrosion	Glasswool will not rot.
Thermal insulation	R-value depends on density and thickness of material and installation quality – see specific manufacturer’s literature. High performance glasswool insulation is available. Glasswool insulation is only effective if dry.
Sound insulation	Glasswool insulation may provide small benefit in reducing sound transmission through a wall. Special formulations are available for use in sound rated construction.
Fire performance	Glasswool insulation will not support combustion.
Waste disposal/recycling/re-use	
Re-use	Material can be reused provided protective clothing and breathing masks are used during removal and reinsertion.
Recycling	Glasswool insulation is not currently recycled.
Waste disposal	The use of overalls, gloves and masks is recommended.

1. Embodied energy figures taken from work © J. Andrew Alcorn, 2010. (Alcorn, J. Andrew, *Global Sustainability and the New Zealand House*, a thesis submitted to Victoria University of Wellington in fulfilment of the requirements for the degree of Doctor of Philosophy in Architecture, Wellington, 2010.)

WOOL	
Extraction and manufacture	
Impact of extraction	<p>Wool is a natural, renewable product. Insulation can be made from virgin and/or recycled wool.</p> <p>Virgin wool must be scoured with hot water and detergents to remove grease, dirt and debris and then dried. This uses water and energy, although energy recovery systems are often used in New Zealand. Wool insulation is also treated to be resistant to mould, pests and fire, and the treatment chemical may come from non-renewable sources.</p>
Energy use	Embodied energy of recycled wool is quoted as 14.6 MJ/kg.
By-products/emissions	Wool scouring produces effluent that contains chemicals and grease that must be treated before disposal.
Sourcing	
Material sources	Wool insulation is made in New Zealand.
Availability	Wool insulation is readily available in major centres.
Cost	Wool insulation is higher cost than glasswool.
Construction/installation	
Health and safety during construction/installation	There are no specific handling requirements for wool insulation.
Uses	Wool insulation is available for wall, ceiling and roof installation as a blanket or mat. There are also wool and wool-blend products designed specifically for insulation under suspended floors.
Ease of installation	Correct installation is necessary to ensure no thermal bridges (gaps to the framing) are created. This is extremely important to maximise insulation value.
Performance	
Health and safety during life of building	50+ years.
Expected durability (assuming correct installation and maintenance)	Wool insulation must be kept dry in-service. It is resistant to moisture but insulation value is lost if wet.
Rot, mould and corrosion	Wool insulation may contain suppressants to resist insect attack.
Thermal insulation	R-value depends on density and thickness of material and installation quality – see specific manufacturer’s literature. Wool insulation is only effective if dry.
Sound insulation	Wool insulation may provide small benefit in reducing sound transmission through a wall.
Fire performance	Wool insulation must be separated or protected from sources of heat.
Waste disposal/recycling/re-use	
Re-use	Material can be re-used provided protective clothing and breathing masks are used during removal and reinsertion.
Recycling	Wool insulation can be cleaned and re-manufactured.
Waste disposal	Wool insulation will slowly decompose.

POLYESTER	
Extraction and manufacture	
Impact of extraction	Polyester is a product of the petrochemical industry. Some polyester insulation includes recycled material from sources such as plastic bottles.
Energy use	Embodied energy of polyester insulation is quoted as 53.7 MJ/kg.
By-products/emissions	None known
Sourcing	
Material sources	Polyester insulation is locally made from imported raw products.
Availability	Polyester insulation is readily available in main centres.
Cost	Polyester insulation is more expensive than glasswool.
Construction/installation	
Health and safety during construction/installation	There are no specific irritants currently identified. A dust mask is recommended during installation.
Uses	Polyester insulation is available for wall, ceiling and roof installation as a blanket or mat. There are also polyester products designed specifically for insulation under suspended floors
Ease of installation	Correct installation is necessary to ensure no thermal bridges (gaps to the framing) are created. This is extremely important to maximise insulation value.
Performance	
Health and safety during life of building	None currently identified
Expected durability (assuming correct installation and maintenance)	50+ years.
Moisture resistance	Polyester insulation is resistant to moisture but insulation value will be lost if wet.
Rot, mould and corrosion	Polyester insulation is will not rot
Thermal insulation	R-value depends on density, thickness of material and installation quality – see specific manufacturer’s literature. Insulation is only effective if dry.
Sound insulation	Polyester insulation may provide small benefit in reducing sound transmission through a wall.
Fire performance	Polyester insulation must be separated or protected from sources of heat.
Waste disposal/recycling/re-use	
Re-use	Material may be removed and reused.
Recycling	No current data
Waste disposal	Some New Zealand manufacturers advise that their products are fully recyclable, but no recycling data is available.

WOOL/POLYESTER BLEND	
Extraction and manufacture	
Impact of extraction	<p>Wool is a natural, renewable product. Insulation can be made from virgin and/or recycled wool.</p> <p>There are environmental concerns related to wool scouring operations.</p> <p>Polyester is a synthetic by-product of the petrochemical industry.</p>
Energy use	A small amount of energy is used in manufacture. No specific embodied energy figures are available.
By-products/emissions	None currently known
Sourcing	
Material sources	Raw material is sourced from within and outside of New Zealand.
Availability	Wool-polyester insulation is available throughout New Zealand.
Cost	Costs for wool-polyester insulation are similar to glasswool.
Construction/installation	
Health and safety during construction/installation	A dust mask is recommended during installation
Uses	Wool-polyester insulation is available as wall and ceiling blanket or mat insulation.
Ease of installation	Correct installation is necessary to ensure no thermal bridges (gaps to the framing) are created. This is extremely important to maximise insulation value.
Performance	
Health and safety during life of building	No issues currently identified
Expected durability (assuming correct installation and maintenance)	50+ years
Moisture resistance	Wool-polyester insulation is not affected by moisture but should be kept dry in use.
Rot, mould and corrosion	Resistant
Thermal insulation	R-value depends on density, thickness of material and installation quality – see specific manufacturer’s literature. Insulation is only effective if dry.
Sound insulation	Wool-polyester insulation may assist in reducing sound transmission.
Fire performance	Wool-polyester insulation must be separated or protected from sources of heat.
Waste disposal/recycling/re-use	
Re-use	Product can be removed and reinstalled.
Recycling	Not known
Waste disposal	No specific requirements identified.

MINERAL WOOL	
Extraction and manufacture	
Impact of extraction	Mineral wool contains an average of 75% post-industrial recycled content, which reduces the impacts of mineral extraction.
Energy use	A high energy input is needed to break down the raw material (rock). No specific embodied energy figures are available.
By-products/emissions	Low levels of respirable rock and slag wool fibres may be released during installation. There is no consistent association between exposure to rock and slag wool and respiratory disease or cancer in humans.
Sourcing	
Material sources	Mineral wool insulation is made from local and imported raw materials.
Availability	Mat or blanket mineral wool insulation is widely available. For blown-in material, there is not always an applicator in a particular locality.
Cost	Blown-in mineral wool insulation is generally cheaper.
Construction/installation	
Health and safety during construction/installation	Protective clothing and breathing apparatus are recommended during installation.
Uses	Mineral wool insulation is available as a mat material for walls and ceilings, or as a blown-in ceiling insulation.
Ease of installation	Correct installation is necessary to ensure no thermal bridges (gaps to the framing) are created. This is extremely important to maximise insulation value. For blowing-in, specialised installation equipment is required.
Performance	
Health and safety during life of building	None currently identified.
Expected durability (assuming correct installation and maintenance)	50 years. Blown-in insulation may move in ceilings that have a lot of wind-induced air movement.
Moisture resistance	Mineral wool insulation is not affected by moisture but should be kept dry in use.
Rot, mould and corrosion	Resistant
Thermal insulation	R-value depends on density and thickness of material – see specific manufacturer's literature. Insulation is only effective if dry.
Sound insulation	Mineral wool insulation may assist in reducing sound transmission.
Fire performance	Non-combustible
Waste disposal/recycling/re-use	
Re-use	Blown-in material cannot be reused.
Recycling	Not currently recycled
Waste disposal	Mineral wool insulation is inert – it will decompose very slowly.

POLYSTYRENE	
Extraction and manufacture	
Impact of extraction	Polystyrene is a petrochemical based product.
Energy use	Embodied energy of EPS and XPS polystyrene is quoted ¹ as 58 MJ/kg.
By-products/emissions	Current material does not contain CFC. Polystyrene foam products are now manufactured primarily using two types of blowing agents: Pentane and CO ₂ (manufacturers capture excess blowing agent).
Sourcing	
Material sources	Raw material is sourced overseas, individual products are locally made.
Availability	Polystyrene insulation is readily available.
Cost	Polystyrene insulation costs more than glasswool insulation.
Construction/installation	
Health and safety during construction/installation	None currently identified
Uses	Polystyrene insulation is available for wall, ceiling roof and subfloor as rigid sheets fitted to or between framing.
Ease of installation	Correct installation is necessary to ensure no thermal bridges (gaps to the framing) are created. This is extremely important to maximise insulation value.
Performance	
Health and safety during life of building	No issues identified
Expected durability (assuming correct installation and maintenance)	50+ years
Moisture resistance	Low moisture absorption
Rot, mould and corrosion	Will not rot
Thermal insulation	Polystyrene insulation has lower thermal conductivity than most other insulation materials. R-value depends on density and thickness of material – see specific manufacturer's literature.
Sound insulation	Polystyrene insulation may provide some sound reduction.
Fire performance	Polystyrene insulation must be protected from the interior by a flame barrier.
Waste disposal/recycling/re-use	
Re-use	Inserted panels may be able to be removed and reused.
Recycling	Materials can be recycled. Some manufacturers of polystyrene products such as insulation offer recycling services for their customers.
Waste disposal	Polystyrene insulation won't quickly degrade in land fill.

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PAPER FILL	
Extraction and manufacture	
Impact of extraction	Paper fill insulation is made from waste paper so there are no impacts from extraction.
Energy use	Embodied energy of paper fill insulation is quoted as 3.3 MJ/kg.
By-products/emissions	None currently identified
Sourcing	
Material sources	Local
Availability	There are a limited number of applicators (not always an applicator in a particular locality)
Cost	Paper fill insulation is usually cheaper than fibreglass.
Construction/installation	
Health and safety during construction/installation	No issues identified.
Uses	Paper fill insulation is available for use as blown-in attic ceiling insulation.
Ease of installation	Specialised installation equipment is required. Correct installation is necessary to ensure no thermal bridges (gaps to the framing) are created. This is extremely important to maximise insulation value.
Performance	
Health and safety during life of building	No issues identified
Expected durability (assuming correct installation and maintenance)	50 years in dry environments. Wind movement in roof space may displace or move the material.
Moisture resistance	None
Rot, mould and corrosion	Paper fill insulation will rot if wet – binders may corrode metals if damp.
Thermal insulation	R-value depends on density and thickness of material – see specific manufacturer’s literature. Insulation is only effective if dry. Paper fill insulation will settle and lose performance over time.
Sound insulation	Limited
Fire performance	Paper fill insulation has a fire retardant added but will burn – it must be separated or protected from sources of heat.
Waste disposal/recycling/re-use	
Re-use	Paper fill insulation cannot be reused as insulation.
Recycling	Not currently recycled
Waste disposal	Paper fill insulation will degrade in a landfill.