

My Retrofit Priorities

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Can I get off Gas

*Refer to **My Next Step** topics:*

- **Hot water** What should my next hot water service
- **Heating** What should my heating be
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Can I get an independent assessment

If you are unclear on what priorities you should set, it should be possible to get an assessment by an expert. These are sometimes called energy ratings but should not be confused with the Energy Rating (NatHERS) required for a Building Permit.

The Residential Efficiency Scorecard assessment will assign a star rating to your house based on the energy efficiency of the house as well as the major fixed appliances, including those for the heating, cooling and hot water, and also home electricity generation through Solar PV. This thus looks at rating your energy costs rather than efficiency alone.

See link below.

[Scorecard - Scorecard \(homescorecard.gov.au\)](http://homescorecard.gov.au)

There are a number of videos available via this web site which can be of assistance.

The assessor will identify the items that will give you the best efficiency and cost savings for the dollars spent.

Note there are rebates available to the assessor under the VEU program but the cost of compliance is significant and cannot be justified by assessors in the regions.

The Star Rating (from 1 to 10) is presented in a Scorecard Certificate which summarises your building performance. You may use this as a sales promotion or just in your own renovation planning.

It is possible to have the assessment done without the certificate. This of course does not provide the comparative rating against the standards but should be sufficient to set your priorities and can be done at half the cost.

Should you wish to arrange an assessment contact the MASG office or an accredited assessor from the RE Scorecard website.

What Should My Insulation Be

General considerations:

Insulation is rated by R value.

When considering reflective insulation, foils, insulation, blankets, air cell, foil covered boards, etc, generally the supplier will refer to **“total system”** R value. This is not of much use if comparing materials.

For example:

A board lined with a reflective foil may look like this:

Element Description	R Values
Outdoor air film	0.04
Weatherboard	0.1
Unventilated non reflective space (50mm)	0.17
Permeable membrane	0
25mm expanded polystyrene board	0.90
Reflective foil fixed to board	0
Reflective unventilated air space	0.68
10mm Plasterboard	0.06
Indoor air film	0.12
TOTAL	2.07

The total system R value would be 2.07. However, the material R value, or added value attributable to the product, is actually only R0.90. Note this wall would not comply with the National Construction Code as it is less than R2.8 total. If the stud wall cavity was filled with

bulk insulation of R2.5 then the R0.68 would disappear as there would be no reflective air space.

In the Central Victorian Climate Zone the following minimum material R values should be used as a guide:

- Ceiling: R4.0
- Walls: R2.5
- Suspended Floor: R2.5
- Concrete Slab Floor Not mandatory but at least R1 recommended

Ceiling Insulation:

Any bulk insulation will do. Batts are sized to fit between the ceiling joists. Fiberglass, are the cheapest but should be handled with protective clothing such as gloves, glasses and face mask. Cellulose Fibre does not require protective clothing to handle and are more easily handled without protective clothing. They are more expensive. Rockwool is expensive but more compact. It also requires protective clothing to be handled.

High performance batts, designed for walls can be R2.7 at 90mm and so can also be utilized in tighter spaces.

Should ceiling plaster be replaced a vapour barrier foil could be fitted under the refitted plaster. This will prevent vapour entering the roof cavity. It will escape through the walls only.

Wall Insulation

Wall batts are generally fiberglass or cellulose fibre. A denser batt is now available for the walls which achieve R2.5 or even R2.7 within a 90mm stud frame.

These may be enhanced by an air gap between the batts and the wall cladding. However, note that a permeable membrane (wrap) is best fixed to the studs outside the insulation to allow moisture to be released. Reflective foils are no longer allowed immediately under most cladding. Thus, unless the wall is double battened there is no way to create a reflective space, only a non-reflective one.

Internal walls, particularly those around bathrooms, WCs, garages and laundries should also be insulated. They may require sound proofing as well as thermal insulation. Acoustic batts should therefore be used here. There are batts such as Quiet Stuff in cellulose fibre that address this, but I would suggest Rockwool batts maybe a better option.

An OSB panel is sometimes fixed on the studs under the permeable wrap as this will allow vapour penetration but provide a firm base to fit the permeable wrap over. It will enhance the seal achieved.

Suspended Floor Insulation

Bulk Insulation

If there is access under the floor the best insulation is purpose made stiffened batts such as Bradford Optimo. If a newly laid floor these are ideal. These rate R2.5 and are 90mm.

However these are difficult to apply in a retrofit given the need for protective clothing.

Another solution may be found in Expol polystyrene batts. They have edges that can be compressed to fit most floor joist widths and otherwise are easily cut. These rate only R1.4 or R2, their ease of fitting means that a significant contribution to the house comfort can be made. The rating of R1.4 is not sufficient to comply with the National Construction Code for Central Victoria, however the R2 product will go close to complying depending on other elements of the floor.

Reflective Foil Products

There are **Reflective Aircell** type products available. However be aware that to comply they are including the effect of the spaces above and below and even the assumed floor coverings in a Total System R value. They typically assume an R0.52 value for the reflective space trapped above. However over time dust will settle and the worth of this would diminish significantly. It can also make an R1.35 difference if the subfloor is enclosed (mandatory ventilation only) versus open barge boards. Thus the actual material value of the aircell could be as little as R0.12.

For example:

1. Element Description	R Values
Indoor air film	0.11
Carpet and Underlay	0.35
Floor boards or particle board	0.15
Airspace 90mm (reflective)	0.52 / 0.14
Reflective air cell	0.12
Sub floor resistance (enclosed)	0.56 / 0
Outdoor air film	0.80 / 0.04
TOTAL	2.61 / 0.91

With an unenclosed subfloor, this Total System R value could be as low as R0.91 and with no floor covering R0.56.

Note the National Construction Code for this Climate Zone says a suspended floor should achieve R2.75.

Concrete Slab on the Ground Insulation

There are a variety of means of adding an insulation value to a concrete slab. Note in this climate zone there are considerable advantages to insulating the slab. The earth that the slab is connecting with is not deep and so is subject to temperature changes. The heat that a dwelling's heating system may add to the slab can be dissipated into the ground in winter. In summer this may be a good thing but in winter that represents a considerable loss of energy.

Wafflepod Slabs

These are slabs that are poured around a formation of expanded polystyrene (EPS). This reduces the amount of concrete used but also creates an insulation benefit which can be between R0.6 and R0.9, depending on the thickness. It is understood that the CSIRO is reviewing these figures and it is anticipated that the benefits will be reduced somewhat.

Polyvoid Slabs

This is a variation of a Wafflepod whereby a full layer under the slab is EPS. Rather than having concrete piers through the pods it is anchored to the ground through the use of large steel screws. This system claims R2.2 insulation value which is ample.

Underslab Insulation

There are a number of manufacturers, Knauf, Kingspan and Austech to name a few, making product for this application. The insulation value depends on the thickness of the material and can vary from 30mm to 100mm and claim R values of R1 to R2.5. The material varies from Extruded Polystyrene (XPS) to closed cell phenolic insulation.

Water resistance is an important consideration. An issue they all claim to have solved. I personally don't feel comfortable with an Expanded Polystyrene (EPS) product and would prefer an Extruded Polystyrene product or equivalent for this reason.

Note information on slab insulation installation is available from the Mullum Pty Ltd Ground Slab Installation Guide.

The Your Home web site has some useful tips:

[Insulation | YourHome](https://www.yourhome.gov.au/passive-design/insulation)
<https://www.yourhome.gov.au/passive-design/insulation>

If I Reroof – what are my options

In Central Victoria, that probably means replacing corrugated iron.

It will be advisable that a vapour permeable barrier such as Proctorwrap (HT-R) or Solitex Pro Climber, be fitted and would allow moisture to escape the cavity to then to run down to the gutters if condensing to water above this. An OSB sheathing layer may be fitted below this to keep this rigid enough to achieve runoff to the gutters should the roofing be less than 10 degrees pitch.

Ceiling insulation will rest on the ceiling and should be of R4 rating. It will allow vapour to penetrate into the cavity. If possible this should be prevented with a vapour barrier underneath the bulk insulation.

If exhaust fans in bathrooms etc. vent into the roof space rather than to the outside, the roof space must have forced ventilation. With this ventilated roof spacer then the permeable layer under the roof iron may not be necessary and an insulated blanket could be fitted such as an Anticon 60.

The colour of the roof is not important with R4 insulation fitted. However over the year the average performance is slightly better with a dark roof in Central Victoria. Some people feel that the few excessively hot days overrule issues of energy use in favour of health and comfort and opt for a light coloured roof. A recent report in Lancet suggested that more people die from winter cold than summer heat so I suggest this remains a subjective decision. Note Galvanised and Zinc alum are considered medium not light. There are a few colourbond colours considered light.

Can I retrofit insulation to walls

Insulating existing walls will vary on the type of construction. Walls may have reflective sarking in place. If you are fitting other insulation this may be best removed as it may serve to retain moisture in the house and add to condensation issues, depending on what level of seal is attained.

Double Brick or Cavity Brick walls offer few options. One is the fitting of a foam board product on the inside of the walls. It is possible to get products such as Kingspan K18 which have plasterboard fixed to the surface.

Most double brick walls have a cavity. It may be small say 30mm, but it could still be worth using a spray in insulation, see Insulbloc or Enviroflex below.

Brick Veneer walls can have a spray in hydrophobic, granulated rockwool or expandable foam applied to fill the cavity. Ideally access will be from the roof but entry may be necessary through holes under obstructions such as windows or noggins. Companies such as Enviroflex offer products. The householder should clarify what action is taken by the installer to remove condensation.

Another product some recommend is Insulbloc. Insulbloc is a closed cavity wall insulation product that is manufactured from recycled polystyrene which is cut into small cube shapes which and

pumped into house wall cavities. An advantage it has is that it goes not grip on the inside of the masonry wall and allows moisture to drop out.

If plasterboard is being removed for renovations then the opportunity should be taken to fit insulation batts.

Weather board, FC boards or sheet, or metal clad walls may have the spray in options discussed for Brick Veneer applied. Fixing an insulated sheet cladding over the original cladding could be considered.

Recladding or replastering, with insulation batts fitted, are other options that can be considered.

If I reclad walls – what are my options

If you were to replace weatherboards, possibly to fit insulation, you may choose to clad with one of the numerous panel products now available. These will save time and may ultimately save money given the damage done in removing weatherboards.

A choice of FC sheet, composite timber or metal based cladding can include:

- HardiePlank imitation weatherboards
- Weathertex panels
- Cemintal panels
- Barestone panels
- Mordek

You should first fit the R2.5 wall batts. An OSB sheathing could then be added to maintain a permeable yet rigid layer. Then fit a wall wrap, e.g. Enviroseal Proctorwrap (RW) or Solitex Pro Climber, which are vapour permeable but water resistant, to the wall studs. Battens of top hats should be then fitted creating a 35 – 40mm air space before fixing the cladding. This wall space will collect moisture and should drain.

Does My House Leak

You can pressure test a house but I would not recommend this unless you have reason to believe you have addressed all points of leakage.

You can use a thermal imaging camera which will show up not only leakage points but also holes in the insulation providing there is a marked difference between external temperature and internal temperature at the time of testing.

Alternatively, I suggest you hold a lighted candle near the possible points of leakage, notable around doors and windows but may also include skirting boards. With a little practise, you can also wet the back of your hand and hold it close to the possible points. It will feel cold if it is subjected to drafts.

The Your Home web site has some useful tips:

<https://www.yourhome.gov.au/passive-design/sealing-your-home>

Door seal adhesive strips are readily available. With existing doors choose the thinner ones as there will not be room to fit those designed for new doors.

Spring loaded draft stoppers can be fitted to external doors but also may be fitted to doors to rooms such as laundries, storerooms and bathrooms.

Draft Stoppers are available to fit above exhaust fans that are not self sealing. Exhaust fans are generally in non-conditioned rooms where doors should be shut to retain heat, so the impact is not significant. Note that current standards dictate that exhaust fans, including the kitchen rangehood, have to be self sealing and should be vented to the outside of the building, not the roof space. This may not have been the practise when existing ones fitted.

Tapes and expander foams can be used to seal other gaps found at architraves, cornices and skirting boards. Batwing seals (Kilargo) enable old doors to be sealed without the foam strips which often don't easily fit and often don't last.

My Windows Upgrading

Window performance is measured in two criteria:

- Conduction or U value
- Solar radiation or Solar Heat Gain Coefficient (SHGC)

The U value of a window is an average over the surface area of the U value of the glass and the U value of the frame. The lower the better.

The SHGC is complex whether to be higher or lower can depend on the orientation of the window. To the north where winter sun may be beneficial, then it may be best to be lower. To east and west, it would be better to be higher.

Frames performance can have an impact and should be considered when choosing the windows.

- The best performing frames are timber, uPVC and fibreglass.
- Composite Timber/aluminium frames are designed to perform like timber but to have a low maintenance exterior.
- Thermally broken aluminium is an improvement on standard aluminium
- Aluminium or steel frames are the worst. Some manufacturers have attempted to limit the conduction from outside to inside by the design of the aluminium profiles but they still don't perform well.

Glazing performance can be enhanced by Low E treatment, Laminated glasses also perform well. A Low E glass is a treated glass, such as I Plus, Lightbridge and can be quite clear. It is designed to lower the conductance, the U value.

This should not be confused with Low E films which are added to fitted windows the lower solar heat gain. It is also possible to get low SHGC glass to achieve the same. These solutions should not be used to the north as they will also cut down desirable winter sun penetration.

Double glazing is almost essential in new house to achieve the 6 stars. These days all double glazed units are argon filled, which enhances its performance.

If retrofitting glazing to existing window frames the thickness of the glass units may be an issue. Composite laminated glass can be a compromise at 6.38mm or 4.38mm thickness, where the 0.38 is the thickness of the laminate. These can be enhanced by one of the glass layers being a low E glass.

If there is the space to retrofit a double glazed unit then this would be preferable with or without a Low E pane.

Magnetite, Ecoglaze and Stop Noise offer products that fit a second Perspex or similar second pane, creating a still air gap and providing much of the double glaze benefit.

There are films that can be affixed to the glass to reduce the conductance as well as SHGC where other more radical changes are not possible. The 3M Thinsulate film is one.

<https://multimedia.3m.com/mws/media/11748430/3m-thinsulate-window-film-climate-control-75-product-card.pdf>

[ecoGlaze® Retrofit Double Glazing System](#)

[Australian Retrofit Double Glazed Windows | Magnetite](#)

[Soundproof Windows | Residential Noise Reduction | Noise Proofing \(stopnoise.com.au\)](#)

The Your Home web site has some useful tips:

<https://www.yourhome.gov.au/passive-design/glazing>

Is my Shading Sufficient

The need for shading is dictated by the orientation of the house in relation to North and the positioning of the windows.

The North facing windows require enough shading to prevent entry of the summer sun but not enough to limit entry of the winter sun. This is explained in the My Home document linked below, however in our latitude. it is achieved by a projection of 45% of the height from the sill to the level at which the projection is anchored.

East and West, particularly west, orientations need to have retractable shading so that sun penetration can be totally blocked at all times of the day in warm weather and opened to allow cool weather penetration. This means retractable awnings, shutters or external blinds.

The Your Home web site has some useful tips:

<https://www.yourhome.gov.au/passive-design/shading>

What Should My Internal Window Coverings Be

If you want to leave your windows without coverings, perhaps to make the most of a view or natural light, the most effective way to control heat flow is by selecting systems with appropriate U and SHGC values. Alternatively, window furnishings, blinds and curtains can enhance performance and can be an effective way to overcome problems with existing windows.

Blinds can reduce solar heat gain by reflecting incoming heat back out through the window. This is not as effective as preventing the solar heat from entering the window in the first place because only a portion of the heat is reflected back to the outside. To reflect solar heat, the external surface of blinds should be white or near-white. Some offer a metallic, reflective film on the external surface, with a decorative fabric facing in. The space between the blind and window traps a lot of heat, which a ventilation opening in the window can allow to escape.

Products like Renshade can be fitted on the inside surface of a window in direct sunlight, such as those facing West or North if unshaded. This will reduce visibility somewhat and could be removed in Winter.

Reduce convective heat transfer through windows with snugly fitted blinds and curtains with pelmets that trap a layer of still air next to the window. Eliminate air gaps around all perimeters of the curtain and pelmet to improve performance.

Heavy fabrics and multiple layers of fabric help increase the insulation provided by curtains by reducing the amount of heat conducted between the air in the room and the air adjacent to the window. This benefit is reduced if there is air movement around the curtain.

*Extracted from **The Your Home website***

What should my Lights be

All lighting can now be LED. The NCC requires that there be no more than 5W/m² in any room.

If using 12V lights the wattage of the driver/transformer needs to be included. However with LED lights, it is almost impossible to exceed this limit.

240V LED lights are now readily available and much cheaper than the 12V plus driver.

Downlights, recessed into the ceiling have in the past been Halogens. These generated much more heat than light and thus required 200mm clearance in the insulation. This is almost

half a ceiling batt. IC-4 compliant downlights can be used and do not require clearance from the insulation. These are a full light replacement, whether 240V or 12V with driver. Note the driver may require clearance.

The VEET scheme can be used to find an accredited contractor

<https://www.victorianenergysaver.vic.gov.au/save-energy-and-money/discount-energy-saving-products/save-with-these-energy-efficient-products>

Having replaced these with LEDs, there is still a hole left in the insulation. This should be repaired. Replacement programs often only replaced the bulb with an LED that was compatible with the driver. A 50mm clearance was still required and clearance around the driver.

There are thermally approved covers that can be placed over non IC-4 standard LED lights. The insulation can then be run over the covers.

Gimbles, often used to focus on art works, etc, cannot be sealed and are therefore not compatible with achieving a good standard of sealing.

Should I have a Skylight / Skywindow

Skylights or skywindows are massive holes in ceiling insulations. If you consider that the best of glazing will deliver the equivalent of R1 and the ceiling insulation is R4, you will see what this represents.

Skylights in a non-conditioned room, that is a room that is not part of the house heating or cooling system, will not have much impact and can safely be used. Skytubes are a relatively efficient form of skylight.

Skylights in a living room are a bad idea for obvious reasons and would make it difficult to get an acceptable Energy Rating should they be part of a renovation.

Re-Roofing / Colour

If refitting roofing, you should consider insulating the roof space. A permeable foil should then be directly under the roofing.

Roof colour is not a major factor in the house comfort. A metal roof has minimal thermal mass and will not hold heat. It will get hot while in the sun and cool immediately when not. If adequate ceiling insulation is fitted in the roof cavity, say R4, then colour will have little impact. A permeable foil should then be directly under the roofing.

A tiled roof will retain some heat but not a significant amount.

In fact, over the space of the year, in terms of energy efficiency, a dark roof performs marginally better than a light one in the cool Climate zone of central Victoria.

If you are unable to bring the ceiling insulation, then a light roof can be justified. Note a galvanised or Zinalume roof is considered a medium colour, not light. A pale Colorbond can be considered light as indicated by its Solar Absorbance.

A bigger issue for the environment of the dwelling is the concrete and bitumen paved areas around the house. These should be shaded wherever possible.