



Your guide to a Smarter Renovation

Improve comfort, save money & avoid renovation regret



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Introduction

Victorians spend more than \$2 billion annually renovating their homes¹. It's the price we are willing to pay for improving our lifestyle and comfort. It can be exciting, challenging and rewarding. Every year, over 40,000 Victorians apply for a building permit to renovate, and an additional 330,000 renovate their kitchens and bathrooms. In total, there are over 370,000 renovations occurring annually², each aimed at making the home more functional, comfortable and stylish.

But how much thought goes into improving the energy performance of our homes when we're planning to renovate? And what are the benefits if we do?

This is a call to action for the home renovator. If you want to know more about the techniques and tips that will improve the comfort of your home and save you money in the long term, or you're a building professional who wants proof of the benefits of energy saving design and alteration, this advice is for you.

Your renovation
is the best opportunity to
improve thermal comfort
save money and add value
to your home long term

> Renovation Regret



After months of planning, enduring the cost, stress and chaos of renovation, you are sitting in your new home. You've pulled off a transformation from out-dated and pokey to desirable and modern. You feel triumphant... and then the first cold day of winter arrives.

The house feels cold, even damp in the older section. You need to rug up every time you leave the lounge room because the heating doesn't seem to cover the whole house. You turn up the thermostat but it doesn't seem to make a difference. You're now staring down months of sniffing kids, sick days and sleepless nights in a cold house³.

Things are looking up with the arrival of spring – until your electricity bill arrives. It's through the roof and much higher than the same time last year. You have added more square meters to your house, made it look beautiful but overlooked two crucial factors; comfort and cost.

What have you done? You have underestimated the importance of making your home more energy efficient during your renovation.

What is energy efficiency?

Energy efficiency is a process. It combines both *physical* (products and techniques) and *behavioural* (living with conscious regard to the energy we use) elements. Both are important: an energy efficient home can still waste energy if the occupants don't pay attention to the energy they use (such as not switching off a light or TV when leaving a room)⁴. Throughout this guide, we link energy efficiency to energy saving and comfort as these are the tangible benefits that you can see and feel.

Why is energy efficiency important?

Most Victorian houses are inefficient in how they use energy. A vast majority (88%) of houses in Victoria were built before minimum energy efficiency regulations were introduced⁵. While homes built since 2005 meet 5 and now 6 Star standards, most housing stock is around 1.8 Stars⁶.

An energy efficient home will cost less to run and be a pleasant temperature all year round. By applying energy saving techniques and products to the whole building fabric, it relies less on heaters and coolers to regulate the inside temperature.

To run our homes we currently consume around 22% of Victoria's total electricity and 37% of Victoria's total gas usage.⁷ Energy efficiency represents an opportunity for Victoria to reduce its overall greenhouse gas emissions, as the majority of our electricity is sourced from brown coal.

Why does it matter during a renovation?

Renovations will often add more floor area to the home, this means a renovation would typically increase the amount of area to be heated and cooled. With the average Victorian household's energy bills at around \$2,800 every year for electricity and gas, and energy costs rising annually, a renovation can easily become an on-going financial burden. Energy efficiency will protect your renovation against rising energy costs. It's as simple as that.

Most (89%) homeowners⁹ say energy efficiency is important to them when preparing to renovate. However, many renovators — either by choice or oversight — fail to use the renovation opportunity to improve the energy efficiency of their existing home losing money as well as affecting their health and comfort⁹.

> *Avoid Renovation Regret*



Imagine that feeling of relief when your energy bill arrives and it's less than the same time last year. As well as being in control of your energy use and no more bill shock, you live in a home where you can feel comfortable all year round. No more draughty breezes and cold hands over the heater in winter, no more sweating in front of the air conditioner in summer. Energy efficiency is the answer.

How much does it cost?

Renovators are pressured by costs and timelines, and good intentions are often compromised. Most say cost is the main reason for not taking up energy efficiency in their renovation¹⁰.

However, this guide will show, smart renovators know additional costs in the short term translate into long term savings, allowing you to live in a more comfortable, healthy home which needs less energy to run.

Your renovation is the best time to improve the energy performance of your existing home. Energy efficiency in a home renovation is critical if you want to save money on energy bills in the future, make your home comfortable and improve its value.

How do you get the best result?

Our Smarter Renovations program is designed to make this process easier and to help Victorians avoid renovation regret. This guide is one part of that program. It includes a snapshot of how some Victorian home renovators have missed key opportunities to include energy saving in their renovation, so that you can avoid their mistakes.

It then takes you through the improvements to consider as part of your smarter renovation, approximately how much these improvements can save you each year and some tips to help you get the best results.

The advice in this guide is general in nature and is complemented by our Smarter Renovations Planner. The Planner is an online tool that provides more tailored advice, and is customised by your house type and the work being planned. It highlights a range of energy savings measures to consider and calculates their overall benefit.

- > Find out more, visit www.sustainability.vic.gov.au/smarter-renovations



Before you get started

It pays to do your research

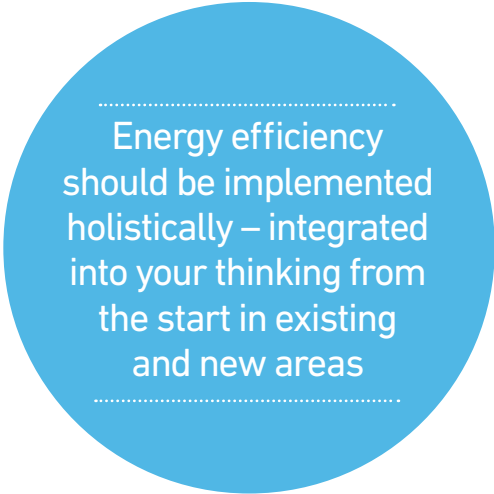
Our findings show that well-informed and motivated renovators achieve better results. Householders who research their options, identify the most-effective energy efficiency opportunities and prioritise them throughout the project achieve the best results¹¹. Inform yourself with information from trusted sources. Be sure to talk to your designer/builder about their energy efficiency knowledge.

- ▶ For a list of Smarter Renovation professionals visit www.sustainability.vic.gov.au/services-and-advice/households/energy-efficiency/smarter-renovations/finding-the-right-renovation-advice

Plan for the future

Thinking about energy efficiency is best done from the start of your renovation, as part of your planning process. This is because energy efficiency measures are best planned along-side any structural changes that will be incorporated in both the existing structure as well as the new parts of your home. Most measures, especially those to the older parts of your house, will save you money in the future so it's important to plan for them in your budget. Planning for energy efficiency saves time and money.

Throughout the process, you (and your designer/builder) should also be on the lookout for additional opportunities to save energy (such as sealing any gaps, or buying the most efficient appliances).



Energy efficiency should be implemented holistically – integrated into your thinking from the start in existing and new areas

Give your home the “Ahh” factor

In a renovation it's really important to have the 'Wow' factor. But, what about the 'Ahh' factor?

The “Ahh” factor is what you will feel when your home is comfortable all year round. It will never be too hot in summer or too cold in winter. In renovations the focus is often on the new parts of the house, the new kitchen, bathrooms, ensuite to give them the 'wow' factor. To get the 'Ahh' factor you need to focus on improving the existing part of the home as well as the new parts of the home. This will provide year-round comfort.

Energy efficiency is a holistic concept, if only the new parts of the house are energy efficient and the rest of the house is still draughty, leaky and uncomfortable, then the costs of heating and cooling the house will continue to rise.

Use your renovation as an opportunity to make the existing walls, floors and ceiling of your home more energy efficient, adding energy saving improvements to both the new and old parts of the house. This will ensure that your home is comfortable and you will avoid renovation regret.

“In a renovation it's really important to have the 'Wow' factor. But, what about the 'Ahh' factor?”

Types of renovations

No matter what type of renovation you are planning there are many ways you can incorporate energy efficiency to save energy and improve comfort.



A Major Renovation

2% Victorians each year plan a **Major Renovation**

A major renovation can be either a rear extension, an upper floor addition and may involve some internal re-modelling of existing parts of the home.

Major home renovations typically involve demolishing a rear kitchen, laundry and bathroom and replacing them with a large, open plan kitchen/living area. These extensions often include the addition of a new laundry, bathroom and toilet. The new open plan kitchen/living areas usually open onto new decks and other outdoor living spaces. Where a second floor is added, bedrooms and bathrooms are most common¹².

Major renovations will often require a building permit from your local council. To get a building permit you will need to meet the energy efficiency requirements of the building code. In Victoria, the building code has specific requirements on how to build energy efficiency into your renovation¹³. This is typically based on how much of the volume of the home you plan to alter (to change in any way). Making your whole house more energy efficient during your renovation will mean that you require an energy rating¹⁴.

Things to consider in major renovations

- › During your major home renovation you might be removing internal or external wall claddings, or removing sections of the existing ceiling, giving you an opportunity to make some very cost effective efficiency improvements to the existing parts of the home.
- › People who build a major renovation are often planning to stay in their home for more than 10 years. This means that any energy efficiency improvements will be very cost-effective.
- › Go beyond the minimum, invest in your home and you will have the benefits for the longer term.
- › Find the best professionals that will give you the right renovation advice by keeping energy efficiency top of mind in your renovation.



A Minor Renovation

20% Victorians each year undertake a **Minor Renovation**

A minor renovation is defined as occurring under the existing roofline of a building and involving no structural changes. These renovations typically do not require a building permit or an energy rating, unless your home is of significant heritage value.

The main trends for minor renovation are refurbishing bathrooms and kitchens, creating ensuites and built in robes, and breaking down internal walls to create open plan kitchen/living areas.

Things to consider in minor renovations

- › During your minor renovation you may be thinking about changing kitchens and bathrooms and perhaps moving some internal walls. This makes a minor renovation a great time to consider energy efficiency.
- › Internal changes often mean removing internal plasterboard and ripping up flooring giving you access to the structure of the house, where energy efficiency measures can be added cost effectively.
- › When you are getting building trades into your home, it's the perfect time to incorporate some energy efficiency measures to reduce labour costs.
- › Bathroom renovations provide the opportunity to add water (& energy) efficient fixtures and efficient lighting.
- › Kitchen renovations provide the opportunity for upgrading lighting and also for upgrading to efficient appliances (if these are replaced as part of a makeover).



Interior Renovation

Even small changes to the interior of your home – such as painting, repairing or small cosmetic changes – present an opportunity for energy efficiency. Interior renovations are the perfect time to identify opportunities – big and small – to save energy and improve comfort.

Things to consider in interior renovations

- › Repairing rotten weatherboards, repointing your brickwork or patching plasterboard are ideal times to improve the energy efficiency of your walls,
- › Painting is a great opportunity to look for draughts in your home in air vents and around skirting boards. Aim to seal up any gaps and cracks.
- › Carefully select appliances, plaster, paint or draught seals, as all affect your home's overall air quality and less toxic options are now available.

What is an energy rating?

An energy rating is conducted by an accredited energy rater. They will use a plan of your home to build a thermal model. The model will predict the potential energy efficiency of the home (*physical*) based on a standard usage profile (*behavioural*). These standard usage profiles are based on a typical way that Australians live in their homes, and are set and maintained by the Nationwide House Energy Rating Scheme (NatHERS).

NatHERS software tools assess the potential energy performance of Australian homes on a scale of zero to 10 stars based on location temperature, orientation, sun and prevailing winds.

| Energy Rating | Energy Performance |
|---------------|---|
| 0 Star | Building shell does practically nothing to reduce the discomfort of hot or cold weather |
| 5 Star | Indicates good, but not outstanding, thermal performance |
| 10 Star | Unlikely to need any artificial cooling or heating ¹⁵ |

- › For a list of energy raters visit www.sustainability.vic.gov.au/services-and-advice/households/energy-efficiency/smarter-renovations/finding-the-right-renovation-advice

“A renovation is an ideal time to make your home more energy efficient”

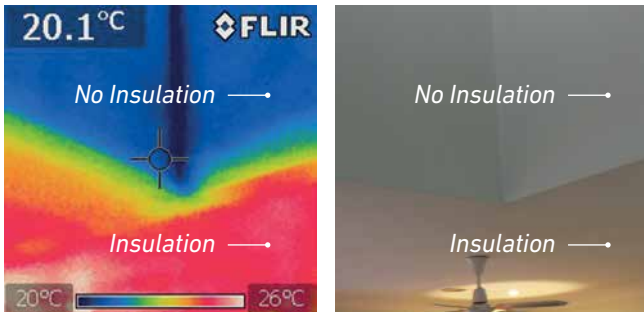
Top 5 Renovation Regrets

A renovation is the perfect time to add energy efficiency measures to your home. Yet many Victorians are still missing this critical opportunity to improve the comfort of their home and as a result suffer renovation regret¹⁶. A Smarter Renovation aims to avoid these pitfalls and maximise the value of your renovation dollars. Our research finds there are 5 top renovation regrets.

1 Inadequate insulation

Ceilings

While many older Victorian houses have ceiling insulation, our research finds that in 30% of cases the level of insulation during the renovation was not as high as it should be for thermal efficiency. In a few cases it was less than the recommended value of the energy rating. With insulation often being installed prior to other trades such as electricians and roofers having access to the ceiling space, they can leave large unnecessary gaps and areas of missing insulation¹⁷. This is especially the case if downlights are installed, as safety clearances must be provided around bare downlights to reduce the risk of roof fires. This means that your ceiling won't be able to stop heat loss from inside to outside. It will be like Swiss cheese – full of holes! The insulation in these ceilings needs to be topped-up or replaced with more efficient insulation.



Floors and walls

Less than 40% of the renovators fit wall insulation to existing parts of the house that are being renovated; yet the removal of wall linings to add insulation is an opportunity that rarely presents (once every 25 years or more). Your walls are one of the weakest points thermally so it important to improve their insulation levels to keep your rooms comfortable.

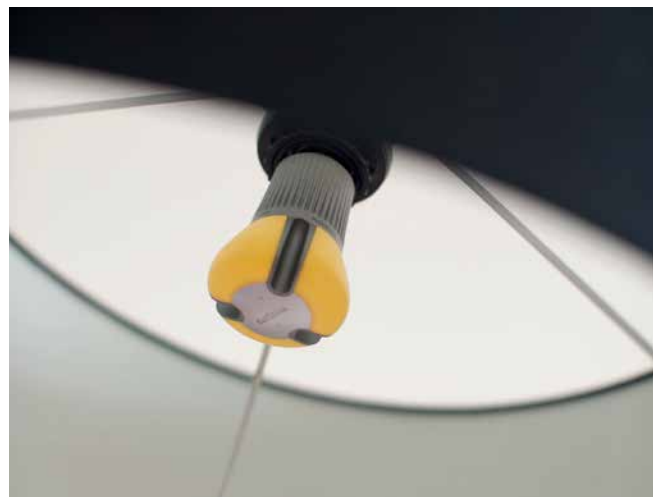
Most renovators (72%) also fail to add floor insulation¹⁸ under timber floors. Without floor insulation warmth can be lost underneath the house in winter – this is especially a concern for children who spend a lot of time playing on the floor.

2 Air leakage

Up to 25% of winter heat loss from existing houses is caused by air leakage (also known as draughts). For example, 30% of homes do not have adequate door seals, despite this being a simple and easy solution to keep out the winter chill. Other sources of air leakage results from unsealed gaps and cracks around doors and windows, exhaust fans, air vents, roof access hatches, floorboards, open fireplaces and chimneys. Draughts create rattling and whistling in doors and windows, as well as cold breezes in winter.

3 Poor lighting

Advances in LED technology have greatly improved the range of energy efficient lighting available. However, around 56% of lighting in Victorian homes is provided by inefficient lamps, and older-style lights such as halogen down lights¹⁹. Halogen downlights use more than four times the energy of an equivalent LED or compact fluorescent (CFL) downlight. They also create large gaps in ceiling insulation as they heat up too much so insulation must be kept well away for fire safety.



4 Not selecting double glazed windows



When renovators select new windows during their renovations they are typically not selecting double glazing. This represents a significant lost opportunity, as these windows are unlikely to be replaced again for 30 or more years²⁰. Only 24% of renovators are choosing to replace existing windows with double-glazed.

Even a basic aluminium framed double-glazed windows can reduce heat loss by at least 30% when compared to single-glazed aluminium windows²¹. More efficient double glazed windows can reduce heat loss by up to 50%²².

Double glazing is typically more expensive than single glazing, however it may be worthwhile considering when selecting new windows to be installed in the addition/extension and if windows need to be replaced in the existing parts of the home. Improving them will make your rooms much more comfortable which means you will be able to reduce your thermostat setting and save energy.

5 Poor design

Many renovators miss the opportunity to improve the energy performance of their home through better design, when practically possible to do so²³. The key design opportunities that renovators are not taking up are:

- › opening the home up to the north to make it light and bright, without this rooms are dark and can feel damp,
- › zoning the home for heating and cooling, by closing off doors to areas that are not commonly used and enclosing stairwells, without this rooms don't stay warm and the air quickly escapes,
- › soft furnishings; rugs and carpets as well as stylish curtains and pelmets add comfort and style, without this windows, walls and floors feel cold and sterile.

Renovating is no easy task. It's an important investment of time and money so it's vital to get it right. By avoiding these 5 renovation regrets you can plan a smarter renovation, and live in a comfortable home that costs less to run.

- › To discover more about the successes and challenges of renovations read the stories of our Renovation Profilers at www.sustainability.vic.gov.au/services-and-advice/households/energy-efficiency/smarter-renovations/renovation-profiles



Smarter Renovations

This section outlines the measures that you can apply to your renovation to give you a beautiful and comfortable home that costs less to live in²⁴.

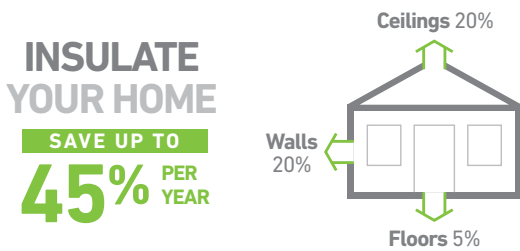
The figures in this report will give you an indication of the costs, savings and comfort benefits of making improvements to the existing parts of your home when you renovate. They will help you prioritise the areas you want to focus on in your smarter renovation.

The type of energy efficiency measures you decide to add to your renovation will depend on your budget, your style of home (its age and fabric), your climate, and your design.

- Use the Smarter Renovations Planner for a customised checklist of the energy efficiency measures you should consider in your renovation. www.sustainability.vic.gov.au/smarter-renovations-planner

1. Insulation

Insulating your ceiling, floors and walls can save you up to 45% on the heating and cooling energy costs of your home. Use the renovation to retrofit your existing home – topping up insulation in the ceiling and adding insulation to your walls and floors.



Ceiling insulation

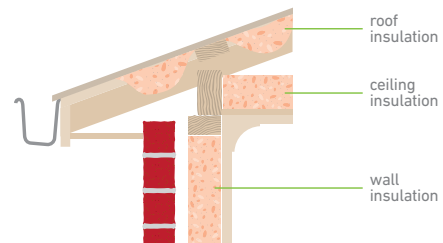
Before you install ceiling insulation it's important to check whether there is already insulation in your ceiling.

- Find out how to check your ceiling insulation here www.sustainability.vic.gov.au/services-and-advice/households/energy-efficiency/toolbox/how-to/check-your-ceiling-insulation

If there is no insulation in your ceiling adding even a minimal level of ceiling insulation of R3.5 will be extremely cost effective, depending on how easy your ceiling space is to access.

Some homes may already have some ceiling insulation installed, for those homes, going beyond the minimum standard and improving the insulation in the ceiling to R5, will have an even greater energy saving benefit²⁵.

Insulation Placement



To get the best result

Know your R values

Consider the R value as a measure of a material's energy saving potential. Aiming for an R value between R3.5 and R5 will provide the most benefit. Different products with the same R value will provide similar insulation performance, so it's not necessarily the thickness of the product or the type of material that counts, but the R value. When comparing prices be sure to compare products with similar R values.

TABLE 1
CEILING INSULATION TO R3.5

| Installation | Cost | Saving/yr | Payback period |
|--------------|---------|-----------|----------------|
| Difficult | \$1,120 | \$100 | 11 years |

Assumed ceiling has some areas that are uninsulated; add in R 3.5 bulk insulation to flat roof or cathedral ceiling with difficult access to minimum building standards, these figures is the average result from the *On Ground Assessment research*. Sustainability Victoria, VHER, 2014

TABLE 2
CEILING INSULATION TOP UP TO R5

| Cost | Saving/yr | Payback period |
|---------|-----------|----------------|
| \$2,440 | \$205 | 12 years |

Assumed R1 in existing ceiling, top up to R5, existing home double fronted brick veneer style with 140m² floor area in Melbourne climate zone, *Always Home* usage profile. Lee, T., Wu, C., Guthrie, K. and Dewsbury, M., 2014

Install it right

To maximise the energy saving performance of your insulation, it is crucial that it is correctly installed. Bulk insulation (batts and loose-fill) should be installed so that the insulation fits snugly between your ceiling timbers, with appropriate safety clearances provided around recessed light fittings, exhaust fans and flues. Butt all ends and edges of the batts to give a tight fit. It is also important that the insulation isn't too thick for the space it is to be installed in. If it is compressed you will reduce the performance of the insulation.

It is recommended that ceiling insulation is installed by a building professional. When installing ceiling insulation, electrical and fire safety are particularly important issues. Check that your builder/installer has a good knowledge of the relevant clearances for lights, exhaust fans and vents.

- For more information contact the *Insulation Council of Australia and New Zealand (ICANZ)* <http://icanz.org.au/consumers/>

Be mindful that if tradespeople (such as electricians) are entering the roof after installation, the insulation can become compromised, so ask your builder or surveyor to check the final job for you²⁶.

TIP

Top up your existing insulation to an R value between R 3.5 and R 5 in your existing roof space.

- Find out how to install ceiling insulation here www.sustainability.vic.gov.au/services-and-advice/households/energy-efficiency/toolbox/how-to/install-ceiling-insulation

Replacing or adding a new metal sheet roof?

When replacing or adding a roof, installing a foil-backed blanket under metal roof sheeting is a cost-effective way to make your home more energy efficient. Remember to ask your builder about adding insulation to your new roof. In metal roofs, insulation will also help to dampen noise from rain and wind.

Replacing and repairing a tiled roof instead? Simply install foil sarking under a tiled roof. Foil insulation under the roof cladding tends to give the most insulation benefit in summer and provides some additional weather proofing which will reduce rain, dust and leaf litter in the roof space. It is always recommended that insulation is installed by a building professional.

TABLE 3
ADD FOIL BACK BLANKET UNDER METAL ROOF

| Cost | Saving/yr | Payback period |
|-------|-----------|----------------|
| \$815 | \$95 | 9 years |

Assumed addition of R1 foil backed blanket under metal sheet roofing, existing home weatherboard style home with 180.3m² floor area in Melbourne climate zone, *Always Home* usage profile, Lee, T., Wu, C., Guthrie, K. and Dewsbury, M., 2014

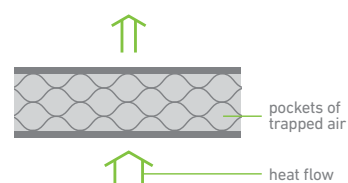
Wall insulation

Retrofitting for energy efficiency involves improving the existing home, often by adding insulation. Renovations are the perfect time for retrofitting, for example, if you are re-cladding your house, replastering walls or removing internal plasterboard sheets. Most homes built before 1990 will have no wall insulation. Different wall types require different types of wall insulation the most common are bulk insulation and pump-in insulation.

Bulk insulation

If you are removing internal plasterboard or external weatherboards bulk insulation can be easily installed, and will improve the performance of your walls and bring comfort to your home. This is considered the cheapest option as you are already removing the wall linings and works particularly well for weatherboard or light-weight framed homes.

Bulk Insulation and Heat Flow



For homes with brick veneer walls, it is also cost effective to consider adding bulk wall insulation if you are removing internal plasterboard.

Aim for an R value of at least R2 for your walls. Ensure that the insulation batts are less than 90 mm thick, this way they will fit snugly within the wall frame. Be careful not to compress the batts as this will reduce their efficiency. The batts should never touch weatherboards or brick as this can cause condensation build-up over time. Protective foils are a good option for sealing off the insulation from the external wall cladding (brick or weatherboard).

Weatherboard Wall Insulation

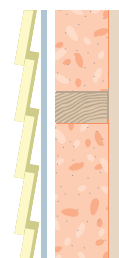


TABLE 4
WALL INSULATION IN WEATHERBOARD HOME

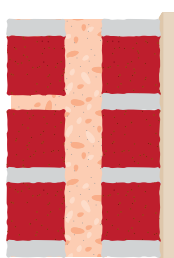
| Cost | Saving/yr | Payback period |
|---------|-----------|----------------|
| \$2,210 | \$455 | 5 years |

Assumed addition of R2.5 insulation into existing weatherboard style home with 180.3m² floor area in Melbourne climate zone, *Always Home* usage profile, Lee, T., Wu, C., Guthrie, K. and Dewsbury, M., 2014

Pump-in wall insulation

If you are not planning to remove any wall cladding or plasterboard, insulation can be pumped into the cavity of the wall lining. Loose fill or expanding foam insulation can be installed by drilling holes into the wall, removing bricks, and in the case of tiled roofs dropping a tube down the wall cavity from above. This option is typically more expensive at around \$4,000²⁷ and should be completed by an experienced professional.

Double Brick Walls



Insulating new walls

New timber framed external walls should be insulated with R2.5 batts. It's also a good investment to add R1 to internal walls for reduced noise transfer and increased privacy between rooms. It is particularly useful to install insulation between areas that are heated and unheated.

TIP
Aim to install R2.5 batts or pump-in insulation into your existing walls.

- Find out how to install wall insulation here www.sustainability.vic.gov.au/services-and-advice/households/energy-efficiency/toolbox/how-to/install-wall-insulation

TABLE 5
WALL INSULATION IN BRICK VENEER HOUSE

| Cost | Saving/yr | Payback period |
|---------|-----------|----------------|
| \$1,900 | \$265 | 7 years |

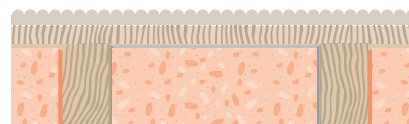
Assumed addition of R2.5 insulation batts into existing double fronted brick veneer style with 140m² floor area in Melbourne climate zone, *Always home* usage profile, Lee, T., Wu, C., Guthrie, K. and Dewsbury, M. 2014

Floor insulation

Timber floors are contemporary and stylish, but can also be a source of heat loss through the floor in winter, making your home uncomfortable in the cooler months. Floor insulation, also known as sub-floor insulation, reduces heat (hot or cold) transfer through the floor. It will be most beneficial in those houses which have suspended timber floors and a poorly enclosed sub-floor space. This makes the temperature at floor level more comfortable, which is particularly important for homes with children playing on the floor. Floor insulation is a cost effective way to maintain a comfortable temperature under-foot.

Adding insulation under floors is more effective for winter temperatures and should always be combined with external shading and ventilation to keep the home cool in summer. The costs of floor insulation can vary based on the difficulty of access to the floor space and the product type²⁸.

Floor Insulation



To get the best result

Know your product – batts or boards

Bulk insulation batts or boards (extruded or expanded polystyrene) can be installed under the floor during your renovation. Choose a product that offers good strength and rigidity. Batts and boards should be cut to fit snugly in between the timber floor joists. They can be held in place with wire mesh, fishing line, or plastic supports if needed. Combine with reflective foil (shiny side down) for the best result. A space of at least 60 cm is needed to access the underfloor space and install the insulation.

Consider your surface materials as well

Many renovators are choosing floorboards – new, floating or original to add style to their renovation. If you are not able to insulate your underfloor space consider adding carpets or rugs. These soft furnishings can actually contribute greatly to energy saving and comfort²⁹.

TIP
Aim for an R value of R 2 to be installed under existing timber floorboards.

- Find out how to install floor insulation here www.sustainability.vic.gov.au/services-and-advice/households/energy-efficiency/toolbox/how-to/install-floor-insulation

TABLE 6
FLOOR INSULATION

| Cost | Saving/yr | Payback period |
|--------|-----------|----------------|
| \$1640 | \$300 | 5.5 years |

Assumed addition of R2 insulation batts under uninsulated timber floor, carpet flooring in bedrooms, existing home interwar double brick style with 135.8m² floor area in Melbourne climate zone, "always home" usage profile Lee, T., Wu, C., Guthrie, K. and Dewsbury, M., 2014

2. Draught proofing

Draught proofing is one of the most cost effective improvements that can be made to an existing house as draughts account for 25% of the winter heat losses in the average existing house³⁰. It should be a critical part of your renovation plan³¹. Sealing gaps and cracks around doors, windows, skirting boards, architraves, wall vents, plumbing penetrations, above exhaust fans and in fireplaces can reduce your heating costs during winter by up to 10 to 20%³². It is a must-do in Victoria's cooler climates where there is maximum gain to be made.

Ask your builder to install draught proofing measures during your renovation. Or you can save on costs by doing it yourself!

Doors and windows

Many people overlook the significance of door seals³³. However, it is one the simplest and cheapest ways to save energy. Install draught excluders under doors and draught strips around doors and windows – most of these products are cheap to buy from your local hardware store.

To get the best result

Mind the gaps

Make sure your new doors and windows are measured and installed correctly to minimise air leakage. Repair large gaps around existing doors and windows – this may require carpentry work to make the gaps smaller. Consider hiring an air sealing professional to ensure a high standard and greater cost savings for you in the long term. Some will be able to conduct a blower-door test to measure the initial air leakage rate and help identify the main sources of draughts, as well as measuring the air leakage rate once the air sealing is completed. This is one way to ensure the best result.

Allow for ventilation

While it's important to seal your home to retain a comfortable internal temperature, controlled ventilation is also necessary to regulate air temperature and keep your home free of condensation build-up, which can result in mould, rot or damp. This could be provided simply by openable windows, exhaust fans or rangehoods (in the kitchen). Controlled ventilation is particularly important in the areas that produce water vapour and odours, like the laundry, bathroom, toilet and kitchen. Ventilation creates a healthier indoor environment by removing warmer, humid air and replacing it with cooler, drier air. During your renovation, plan for cross-ventilation from the front to the back, and between each side of the house, to control the airflow through your home.

TABLE 7
DRAUGHT PROOFING

| Cost | Saving/yr | Payback period |
|---------|-----------|----------------|
| \$1,550 | \$295 | 5 years |

Assumed professional installation of draught proofing measures to doors, windows, skirting boards, exhaust fans and fireplaces in existing weatherboard style home with 180.3m² floor area in Melbourne climate zone, *Always Home* usage profile. Lee, T., Wu, C., Guthrie, K. and Dewsbury, M. 2014

Exhaust fans and fireplaces

Check air vents, skylights, and exhaust fans for gaps where air can escape. It may be possible to seal wall and vents and vented skylights, but you should not do this if your house uses an unflued gas heater, which requires a minimum amount of fixed ventilation – consult your plumber or gas fitter if you are unsure.

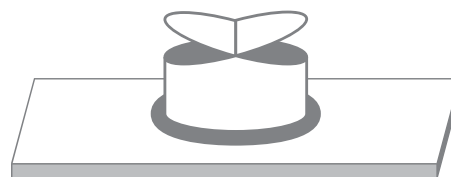
If installing a new rangehood in your kitchen renovation, consider self-closing rangehoods. Ask your appliance retailer about the range available.

To achieve the best result

Close what is open

Install dampers to close off exhaust fans when not in use. Dampers are self-closing covers available for ceiling exhaust fans – the dampers open when the fan operates but close automatically to reduce air leakage when the fan is switched off. The dampers should be installed strictly in accordance with manufacturers' instructions, and you should use caution if the ceiling exhaust fan incorporates a heat lamp or light.

Ceiling Exhaust Fan Cover



Dampers for chimneys and flues are also available but need to be manually operated. Regulations in Victoria require dampers to be fitted to all new fireplaces and exhaust fans. Also check manholes (roof access hatches) for leakage and ensure there are air seals at all sides. Every access point counts.

✓

TIP

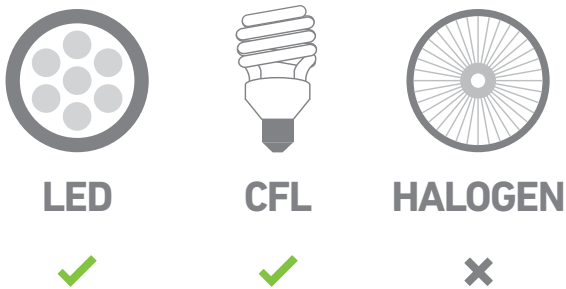
One of the easiest and most cost-effective ways to improve the comfort of your home is to draught-proof.

- › Find out how to draught proof here www.sustainability.vic.gov.au/services-and-advice/households/energy-efficiency/at-home/draught-proofing

3. Lighting

Lighting accounts for around 11% of the average energy bill. Many Victorian homes (around 56%) have inefficient lights³⁴. Choosing the right lighting – such as fluorescent lamps or LEDs – before you renovate can make a big difference to your power bills reducing up to 80% on your lighting costs over the long term.

Energy efficient lighting



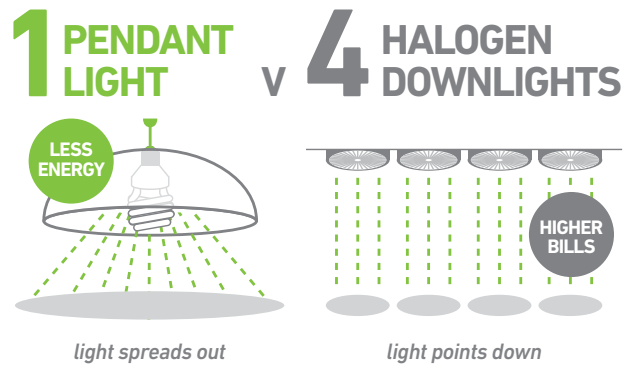
To get the best result

Consider the real cost over time

While low-energy lamps often cost more than less efficient incandescent or halogen lamps to purchase, they have much lower energy costs and often have a much longer life. This means that not only are they cheaper to run, they will need to be replaced less often.

Design for maximum efficiency

Where you position lights can determine how many you need. Designing for downlight fittings or lamps with multiple globes will mean that you require more globes or lamps to light the space, making running and replacement costs higher. Plan for low-energy lighting before you commit to your design, so you won't have any nasty surprises later on³⁵. Your renovation is also the best time to consider replacing your existing lights with low energy lamps which can be done by a qualified electrician.



TIP



Choosing the right lighting options can be daunting. Consider consulting a specialist lighting retailer or lighting designer – they are aware of the latest technology and can advise you on the best products for your needs.

Find out how to plan for low-energy lighting here www.sustainability.vic.gov.au/services-and-advice/households/energy-efficiency/at-home/lighting

TABLE 8
LIGHTING SAVINGS

| Cost | Saving/yr | Payback period |
|---------|-----------|----------------|
| \$1,050 | \$120 | 8 years |

Assumed purchase and professional installation of high quality LED light fittings to existing weatherboard style home with 180.3m² floor area in Melbourne climate zone, *Always Home* usage profile Lee, T., Wu, C., Guthrie, K. and Dewsbury, M., 2014

4. Windows

The opportunity to replace windows occurs only every 30 years or more, so it is important to do your research and choose the best option for your house and budget. Once you have installed good insulation and have taken care of draughts around the home, then your windows will be the weak link in terms of winter heat loss and summer heat gain. Up to 40% of a home's heating energy can be lost through windows so it's important to invest and plan thoroughly³⁶. There are three key times to improve the energy efficiency of your windows during a renovation;

- › designing new windows,
- › buying new windows, or
- › improving your existing windows.

Designing new windows

To get the best result

Plan now and save later

Assess the existing windows in your home and make a long-term plan for improving their energy efficiency. It may make financial sense to upgrade windows in the rooms you use the most now, and then plan to upgrade the others later. Start by improving any large metal framed windows first as they are the least efficient.

Bigger is not always better

The bigger the window, the bigger the glass area. Rooms with lots of glass will use more energy for heating and cooling. As a general rule of thumb, the total glass area of your home should not be more than 25% of its floor area.

Open up to the north

North-facing windows receive valuable winter sun. In summer, they can easily be covered with external shadings to keep the sun out on hot days. However, if north-facing windows are too large they will lose a lot of heat in winter and gain too much heat in summer, so you need to get the size, location and specifications right. East, and especially west-facing, windows receive a lot of sunlight in summer so should be kept small and well shaded. South-facing windows receive early morning and late afternoon sun in summer, but do not receive any direct sunlight in winter. They should be kept smaller and opened during summer to allow cooling breezes to ventilate your home³⁷.



Cover up

Install adjustable external shading (awnings) for your windows to make your home more comfortable all year round. External shading will stop the sun entering your home in summer and reduce your need for air conditioning.

Buying new windows

To get the best result

Consider double glazing

Double-glazed windows are popular with renovators and can reduce heat loss by at least 30% when compared to single-glazed aluminium windows. More efficient double glazed windows can reduce heat loss by up to 50%³⁸. However, installing double-glazed windows for a whole house at once can greatly increase your budget. Instead, consider prioritising and replacing your windows over time.



Double-glazed windows can be effective in reducing the transfer of heat through the glass improving the comfort of your renovated home. Aluminium frames are a popular choice for windows in renovations, the differential cost between a standard double glazed and a single glazed window can be cost effective³⁹.

GOOD

- +** Add double glazing
- \$** Cost an additional \$100/m²

COMFORT

1/3

However, standard aluminium double glazed windows may not bring you the most comfort. There are a few things you can consider to select the best windows that will make your home as comfortable as possible⁴⁰.

Low-e coatings for warmth

In Victoria, adding a low-e or low emittance coating to the internal pane of glass will help to make your house warmer in winter. It can be applied to single or double-glazed windows for an additional \$100/m² ⁴¹.

| | |
|--|-----------------------|
| BETTER + Add a low-e coating \$ Cost an additional \$100/m ² | COMFORT 2/3 |
|--|-----------------------|

It's all in the frame

Aluminium framed windows are popular in new constructions, but they transfer heat and cold quickly. Instead, choose thermally broken aluminium frames, which contain rubber seals that stop the heat transferring through the frame and glass. This makes the windows more efficient and keeps you more comfortable in your renovation.

| | |
|---|-----------------------|
| BEST + Improved aluminium frame \$ Cost an additional \$130/m ² | COMFORT 3/3 |
|---|-----------------------|

Timber or uPVC frames are typically more efficient than improved aluminium frames and have even greater benefits for thermal performance.

Know your window rating

The Window Energy Rating Scheme rates and labels windows for their annual energy impact in both summer and winter. Window makers obtain energy ratings for their products from a rating organisation that is accredited by the AFRC (Australian Fenestration Rating Council).

You can check the energy rating of your windows at www.wers.net/wers-home. The more stars, the more efficient the windows will be. Work with your windows supplier to ensure that the windows that are installed are the correct WERS star rating.

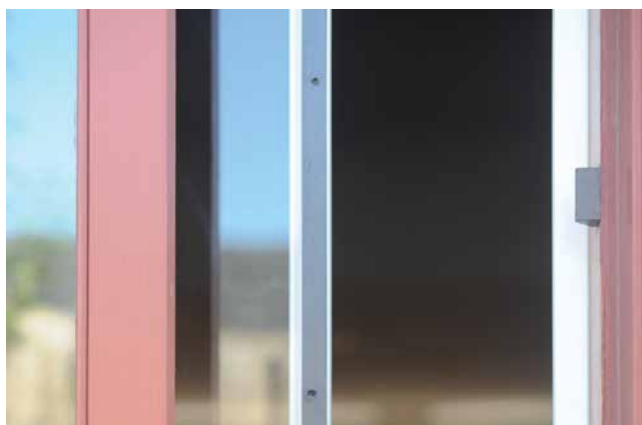
- ▶ Learn more about how to plan for energy efficient windows here www.sustainability.vic.gov.au/services-and-advice/households/energy-efficiency/at-home/windows

| |
|---|
|  TIP Choose well-fitted, heavier fabrics (or insulated) fabric and pelmets for the best thermal protection. |
|---|

Improving your existing windows

Consider secondary glazing

Secondary glazing is roughly the same price as replacing your existing windows with single glazed aluminium frames and around 60% of the cost/m² of double glazing.



| | |
|--|-----------------------|
| BETTER + Secondary glazing \$ Total Cost \$350/m ² | COMFORT 2/3 |
|--|-----------------------|

Secondary glazing can be retrofitted to existing windows through the addition of an extra pane of glass or clear acrylic fitted to an existing single glazed window. The glazing can be attached through magnetic strips or built onto the existing frame. Depending on the product and its ability to create an air space between the existing window and the second layer, secondary glazing may be able to mimic the properties of a double glazed window.

Secondary glazing treatments are a popular solution for improving the energy efficiency of heritage windows as they maintain the existing character.

Window tints and films can also add some benefit, but can be less effective than secondary glazing. It is not advisable to use window tints or reflective window films on north facing windows, as this will reduce the entry of sun through the windows in winter.

Use curtains and pelmets

Curtains and pelmets prevent heat loss and gain as they trap a layer of still air next to the window. One of the renovators in our survey used single glazed windows and no internal blinds or curtains, only to receive a fourfold increase in heating bills⁴³! You only have to move in to a new house with no furnishings to appreciate the value of soft furnishings to your overall comfort.

| | |
|---|-----------------------|
| BEST + Heavy curtains and pelmets \$ Total Cost \$160/m ² | COMFORT 3/3 |
|---|-----------------------|

5. Appliances

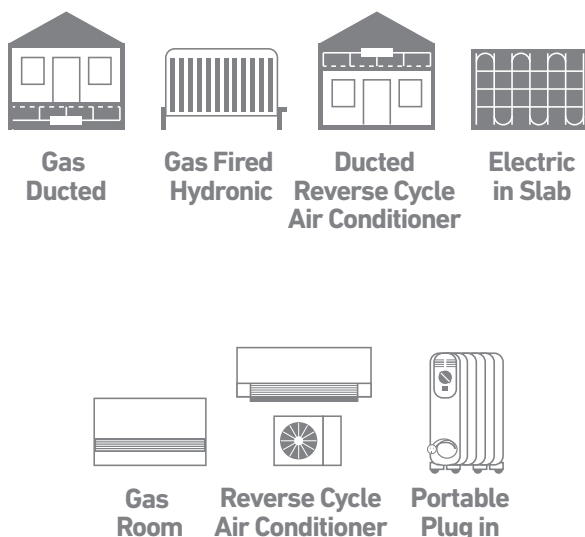
Once you have improved the energy efficiency of your house, you should consider replacing some of the key appliances to maximise the energy saving potential of your renovated home. If you are replacing existing appliances as part of your renovation, this is a good time to consider upgrading to a high efficiency option. If not, consider upgrading when the existing appliances reach their end of life and need to be replaced.

It's better to first spend money on improving your existing ceiling, walls and floors, than on the heating and cooling systems, as smart design reduces your reliance on heaters and air conditioners.

Heating systems

With heating accounting for more than a third (32%) of the average Victorian household's energy bill, there are significant savings to be made from getting it right. There are many types of systems available and choosing the right system depends on factors such as the size of the area, what type of fuel (gas or electric) is available to you and your budget.

Choosing a more efficient option has its benefits, even more so when combined with energy efficiency measures such as insulation and draught proofing. The figures below highlight the benefits of replacing an existing gas ducted heating system with a high efficiency model rather than the market average model.



To get the best result

Choose more stars



Gas ducted heaters, gas room heaters and room reverse-cycle air conditioners all carry Energy Rating labels, which have a star rating displayed at the top of the label to allow consumers to compare the energy efficiency of different models. The more stars, the more efficient the heater and the lower running costs will be. It may be that the more efficient system or appliance is more expensive, but it can save you hundreds of dollars each year. Choose a gas ducted heating system with at least a 5 star rating, gas room heaters with at least a 4 star rating, and room reverse-cycle air conditioners with at least a 3 star rating.

Get in the zone

Zoning means to close off different sections of a house (such as upstairs and downstairs; front and back; or one room at a time) so that you only heat or cool the area you need⁴⁴. There are heating and cooling systems (such as ducted gas heating and/or ducted reverse-cycle air conditioning) that include zoning controls for different areas. Zoning should also be a consideration when you are designing your renovation, particularly large areas and open stairwells. Hot air can be lost up an open stairwell in winter, travelling from the heated area up to upstairs, which is less frequently inhabited. Similarly, cold air will be lost down an open stair well in summer. Consider reconfiguring the design so that the stairwell is cut off from the main living area.

TIP

In winter keep the thermostat in the range of 18°C to 20°C – every degree over will add 10% to your bill

- Find out how to select a higher efficiency heating system here www.sustainability.vic.gov.au/services-and-advice/households/energy-efficiency/toolbox/how-to/choose-an-energy-efficient-heater

TABLE 9
HIGH EFFICIENCY GAS DUCTED HEATING

| Additional cost | Saving/yr | Payback period |
|-----------------|-----------|----------------|
| \$1,100 | \$145 | 7.5 years |

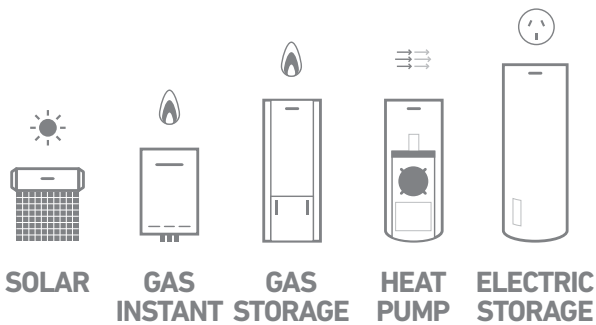
Assumed additional cost of purchasing a 5 star gas ducted heating system, compared to a lower efficiency system. Lee, T., Wu, C., Guthrie, K. and Dewsbury, M. 2014

Hot water systems

If you're putting in a new kitchen, bathroom or laundry you might also be thinking of replacing your old hot water system. It's a smart move, because hot water accounts for around 16% of the average Victorian household's energy costs. When choosing a hot water system you need to consider fuel type, system size and running costs. Higher efficiency gas systems are very cost effective and efficient, and solar water heating systems can give even bigger savings – the higher the star rating, the more efficient the system. The figures below highlight the benefits of replacing an existing gas water heating system with a high efficiency model compared to lower market average efficiency model.

Consider upgrading to solar to lower overall hot water costs over the long term. The figures below highlight the benefits of replacing your existing systems with a higher efficiency solar model compared to lower market average efficiency gas model.

Electric systems are generally the most expensive to run, unless you don't have access to natural gas. If you have an electric system but have gas connected to the property you could replace the existing electric with a high efficiency gas system.



If you don't have gas connected you could consider replacing this with either an electric boosted solar system or a heat pump system.

TIP

When replacing your hot water system, ensure that your hot water heater is located as close as possible to the rooms that use hot water. Most hot water is used in the bathroom, followed by the laundry and the kitchen.

- Find out how to select your hot water system here www.sustainability.vic.gov.au/services-and-advice/households/energy-efficiency/toolbox/how-to/select-the-right-hot-water-heater

TABLE 10
HIGH EFFICIENCY GAS HOT WATER SYSTEM

| Additional cost | Saving/yr | Payback period |
|-----------------|-----------|----------------|
| \$695 | \$60 | 11.5 years |

Assumed additional cost of purchasing a 6 star instantaneous gas hot water system, compared to a lower efficiency 4 star system. Lee, T., Wu, C., Guthrie, K. and Dewsbury, M., 2014

TABLE 11
SOLAR HOT WATER SYSTEM

| Additional cost | Saving/yr | Payback period |
|-----------------|-----------|----------------|
| \$3,200 | \$245 | 13 years |

Assumed additional cost of purchasing a high efficiency solar hot water system, compared to a lower efficiency 4 star gas system. Lee, T., Wu, C., Guthrie, K. and Dewsbury, M., 2014

Solar PV Systems

Around 18% of Victorian homes have installed solar PV and the number is continuing to grow⁴⁵. A renovation is a great time to consider adding solar panels to your roof, or plan to incorporate them for some time in the future. The size of the system will depend on your energy consumption and your budget.

Your location is also important in deciding to choose solar (and what size to choose) as a PV system installed in northern Victoria can produce up to 20% more energy than in southern Victoria. The average system size for PV systems installed in Victoria is 2.4 kW⁴⁶. However, even a smaller 1.5 kW system can reduce your energy bill by up to \$485 annually and pay for itself within 6 years.



To get the best results

Orientation

A north facing roof is the best location for your PV system. If there is no suitable north-facing roof available, a north-easterly orientation will provide more electricity than a north-westerly orientation. However, within 45 degrees of true north, there is less than 10% decrease in output. If a flat roof or an unsuitable orientation is the only option, then racks to tilt and orientate the PV modules can be used. This can add approximately 15% to 20% to the installed cost⁴⁷.

- Find out how to select your PV system here www.solaraccreditation.com.au/consumers/purchasing-your-solar-pv-system.html

TABLE 12
SOLAR PV SYSTEM

| Total Cost | Saving/yr | Payback period |
|------------|-----------|----------------|
| \$3,000 | \$485 | 6 years |

Assumed 1.5kW system on a >15m² hipped roof with northern orientation. Lee, T, Wu, C., Guthrie, K. and Dewsbury, M., 2014

Whitegoods

A fridge is the single biggest power consumer in many households because nearly all households have at least one fridge, and they run for 24 hours a day. On average, around 13% of Victorian household energy costs go on running refrigeration! Washing machines and dishwashers are also hard workers in the average house. Choose wisely, and only purchase an item based on your need. Turn off extra freezers and fridges when not using them – and use dryers sparingly.

To get the best results

Reach for the stars



Use the star rating at the top of the energy rating label to compare the energy efficiency of different models. Every extra star will reduce your running costs by at least 20%, even more for fridges and freezers.

Ask for help

The Smarter Choice retail program provides advice on energy efficient appliances. Seek out their advice – it could save you thousands.



Find out how much you could save with our Smarter Choice calculator www.sustainability.vic.gov.au/services-and-advice/households/energy-efficiency/smarter-choice/smarter-choice-calculator



Tips for specific house types

The energy performance of a house will depend on its location, siting, its age and the materials used in its construction. New houses will usually be more efficient than older houses, due to changes in regulations, building and design practice. Below are some specific measures to consider for standard housing types⁴⁸.



The Weatherboard house (c.1900–1940)

Weatherboard houses are lightweight constructions, typically built with timber framed walls, timber framed floors on stumps, timber windows and roof tiles. Their walls contain a simple timber frame and external weatherboard cladding. This means that the lightweight frame of the house will easily transfer heat and cold, cooling down quickly in winter and heating up quickly in summer. Most weatherboard houses are likely to have uninsulated walls. Because the fabric of the weatherboard is less robust than brick, adding wall insulation is a must do for the weatherboard renovator.

“ This means that the lightweight frame of the house will easily transfer heat and cold ”

Smarter Renovation tips

Add bulk

Install bulk insulation into the external walls when an extension is added or rotting timbers are replaced, as this is when the builder often removes walls linings. Your builder or installer should ensure that the insulation product supplied is less than 90 mm thick so that the insulation is not compressed when installed.

› Learn more www.sustainability.vic.gov.au/services-and-advice/households/energy-efficiency/toolbox/how-to/install-wall-insulation

Seal the gaps

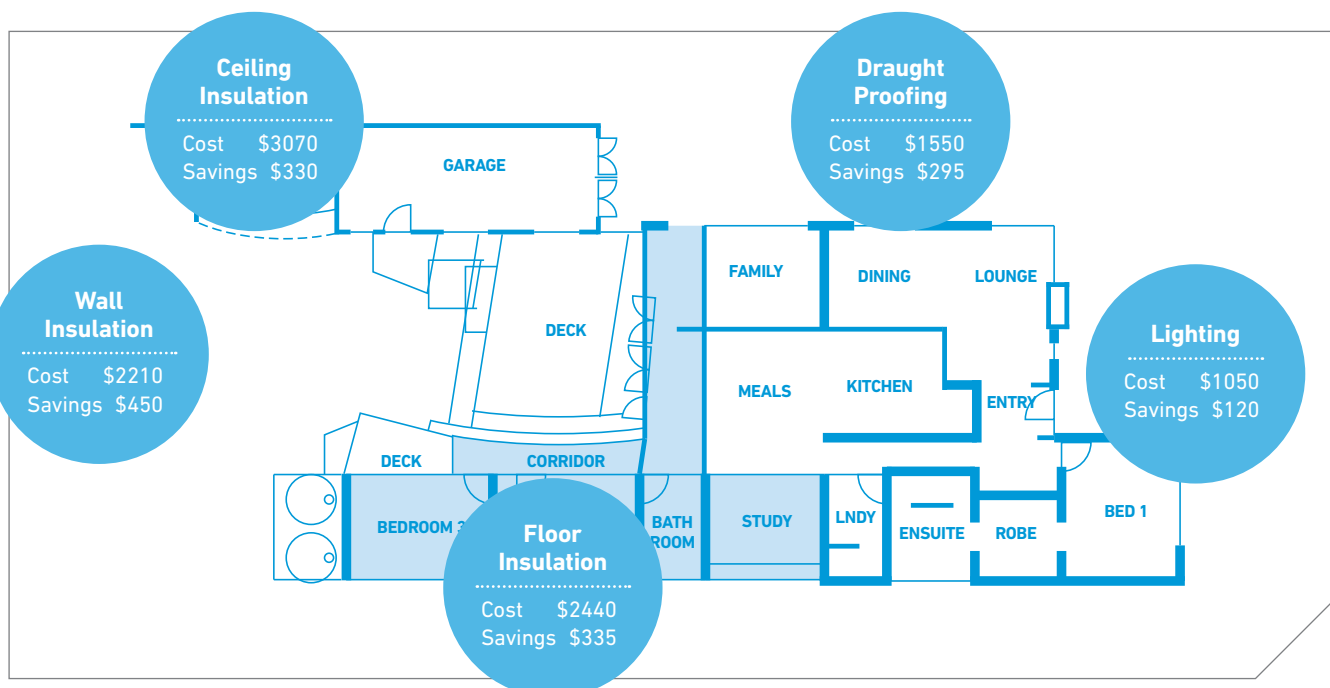
Rotting timber and/or general wear and tear can create gaps between weatherboards in walls, floors and around doors and windows. Repairing and sealing these gaps is worth the effort, preventing air loss. (See draught proofing). Your renovation is also an ideal time to have a pest inspection completed.

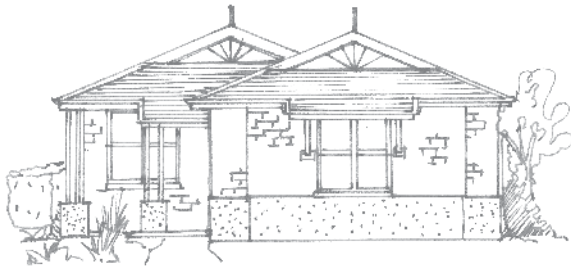
› Learn more www.sustainability.vic.gov.au/services-and-advice/households/energy-efficiency/smarter-renovations/finding-the-right-renovation-advice

Retain character

Many weatherboard renovators are keen to maintain the character of the home by retaining existing windows. One option is secondary glazing. Lightweight acrylic panels sit on the original glass panes, adhered via magnetised frames.

› Learn more www.sustainability.vic.gov.au/services-and-advice/households/energy-efficiency/toolbox/how-to/select-energy-efficient-glazing





The Double Brick house (c.1920–1940)

These houses are typically built with double brick walls, timber windows, and timber framed floors on stumps. Double brick walls are constructed of two skins of brickwork with an air gap in between. Brick has thermal mass properties, meaning that it takes heat from the sun and releases it slowly into your home overnight. These homes will store heat from the sun and then release it slowly into the home; this is great for comfort even during summer as the house warms up during the day and cools off at night. However, during extended hot spells the heat can build up in the walls and is released into the home for days afterwards, adding to the discomfort.

Double brick homes have a lot of character – they also have lots of gaps where air can escape, such as decorative wall vents, so it's important to consider draught proofing when renovating your double brick home.

“ These homes will store heat from the sun and then release it slowly into the home; this is great for comfort ”

Smarter Renovation tips

Plug the gaps

Best practice draught proofing (done professionally or DIY) is the most cost effective option for double brick homes, at around \$2,100. Look to seal up air vents in walls and fireplaces in particular.

➤ Learn more www.sustainability.vic.gov.au/services-and-advice/households/energy-efficiency/at-home/draught-proofing

Top it up

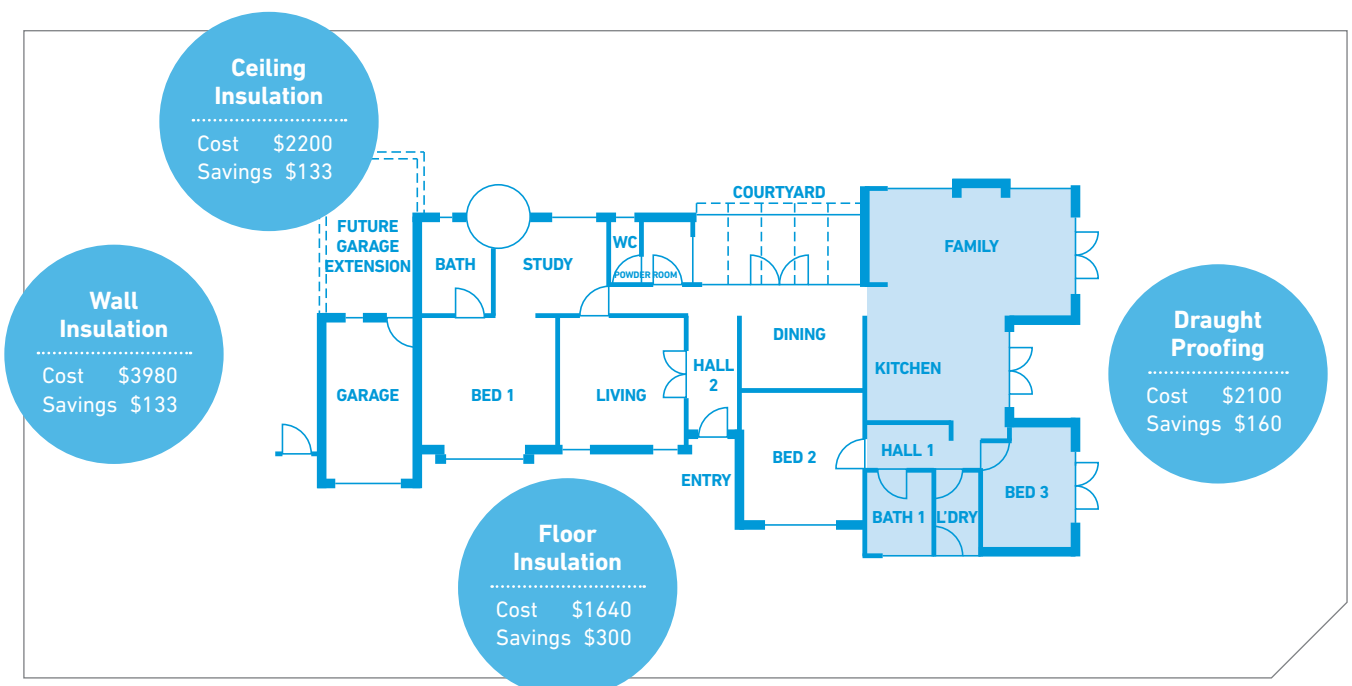
Most homes have some form of ceiling insulation. Getting your ceiling insulation to best practice standard (R5) should be a priority (at an additional cost of around \$2200).

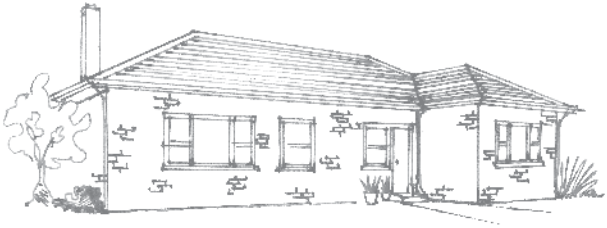
➤ Learn more www.sustainability.vic.gov.au/services-and-advice/households/energy-efficiency/toolbox/how-to/check-your-ceiling-insulation

Don't get cold feet

Timber floors are fashionable but can be a source of air leakage in winter. Consider floor insulation if you have underfloor access. Carpets and rugs are a good choice over original timber floors too.

➤ Learn more www.sustainability.vic.gov.au/services-and-advice/households/energy-efficiency/toolbox/how-to/install-floor-insulation





The Double Fronted Brick Veneer house (c.1960–1970)

These houses are typically built with brick veneer walls, metal-framed windows, tiled roof and timber floors. Brick veneer walls have a higher R value than weatherboard walls, and will lose less heat in winter. Double fronted brick veneer homes are likely to have no insulation in the walls or floors and only a small amount in the ceiling. So improving the walls with insulation as well as topping up the ceiling insulation will generate effective energy savings. Insulating under the timber floors will add additional comfort, with a good financial return.

Over a quarter of houses in Victoria were built between 1960–1979. Houses built during this period are ripe for renovation as the epitome of the retro-style.

“ Brick veneer walls have a higher R value than weatherboard walls and will loose less heat in winter ”

Smarter Renovation tips

Consider your windows

Replacing older metal framed windows with new double glazed options is your best bet for making a double front brick veneer more comfortable. However, this is not always cost-effective.

› Learn more ways to improve your windows www.sustainability.vic.gov.au/services-and-advice/households/energy-efficiency/at-home/windows

Top it up and down

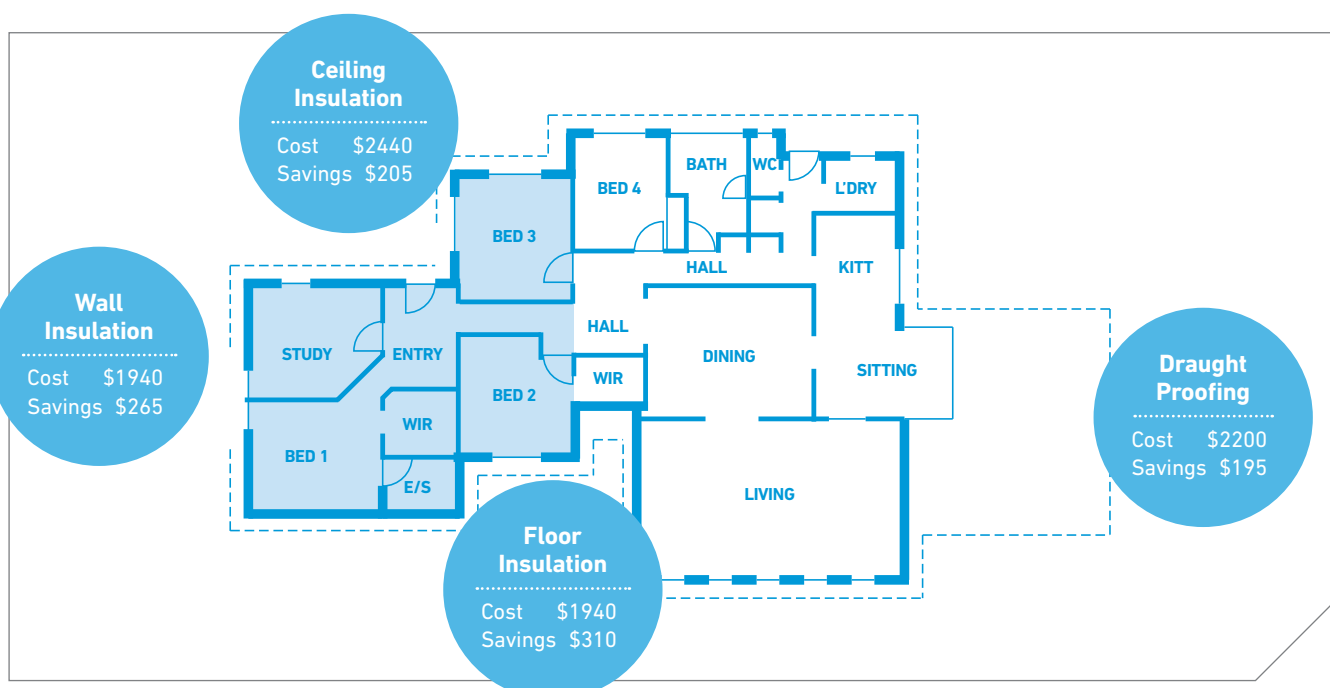
Topping up your existing ceiling insulation will cost around \$2440 and greatly improve your winter comfort. Consider installing floor insulation (around \$1940) under your timber floor if you have access to your underfloor space.

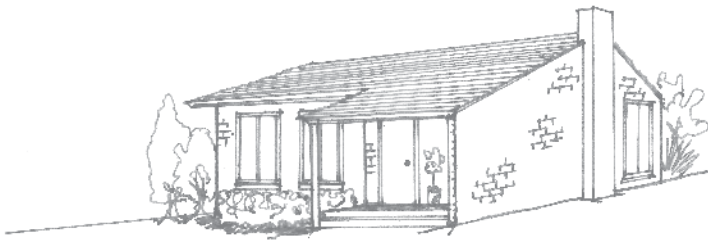
› Learn more www.sustainability.vic.gov.au/services-and-advice/households/energy-efficiency/toolbox/how-to/check-your-ceiling-insulation

Stop gaps and cracks

Older homes will develop gaps and cracks over time. Draught proofing can cost up to \$2,200 but is well worth the investment and if you install it yourself it's even cheaper.

› Learn more www.sustainability.vic.gov.au/services-and-advice/households/energy-efficiency/at-home/draught-proofing





The Brick Veneer, Estate Style house (c.1980s onwards)

These houses are typically built with brick veneer walls, a concrete slab on the ground, aluminium windows and a metal roof. Estate style homes are built on concrete slabs which are more efficient than uninsulated timber floors. Over a quarter of houses in Victoria were built between 1980 and 1999. Any home that was built before 1990 is likely to have no insulation in the walls and very little in the ceiling, making those the priority areas for energy efficiency improvements.

Concrete floors can provide excellent thermal mass when paired with areas of north facing glass. The sun will heat up the concrete or tiles in winter and release the heat during the night.

“ Estate style homes are built on concrete slabs which are more efficient than uninsulated timber floors ”

Smarter Renovation tips

Smart lighting

Adding LED lighting options will give you a well-lit and energy efficient renovation. Pendant lights are great in smaller rooms and over dining tables. Downlights should only be over kitchen or bathroom benches where you need direct light.

› Learn more www.sustainability.vic.gov.au/services-and-advice/households/energy-efficiency/at-home/lighting

Update windows

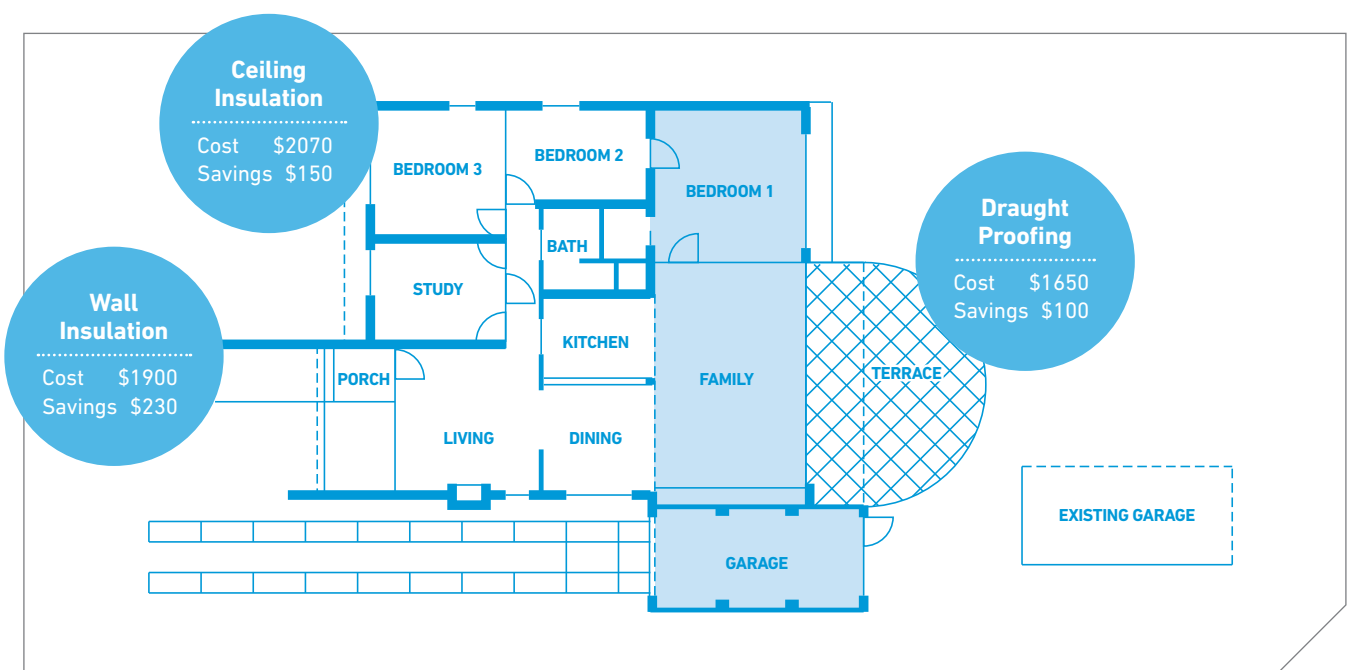
Any uncovered, aluminium windows may be the cause of a house that's too hot or too cold. Consider upgrading your windows over time or as part of your renovation. Add stylish curtains and pelmets to stay warm in winter.

› Learn more www.sustainability.vic.gov.au/services-and-advice/households/energy-efficiency/at-home/windows

Seal your vents

Place covers over any air-conditioning vents during winter. This will keep the warm air in your rooms. Install covers in your roof space over exhaust fans in the bathroom and kitchen. This will prevent air from leaking in your roof.

› Learn more www.sustainability.vic.gov.au/services-and-advice/households/energy-efficiency/at-home/draught-proofing



Where to now?

Sustainability Victoria's website

Sustainability Victoria's website has all your need to plan a Smarter Renovation.

Visit www.sustainability.vic.gov.au/smarter-renovations

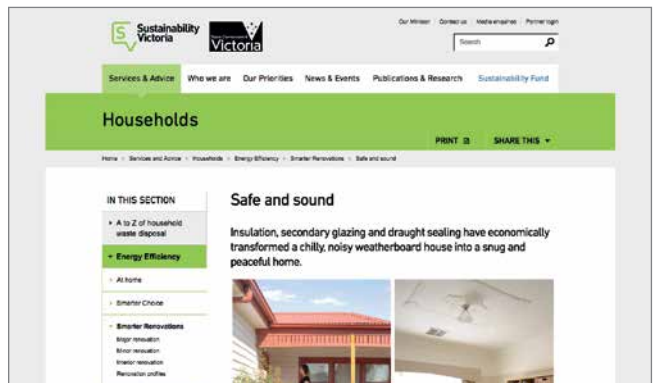
Smarter Renovations advice

- ▶ Practical How to guides



Stories from real renovators

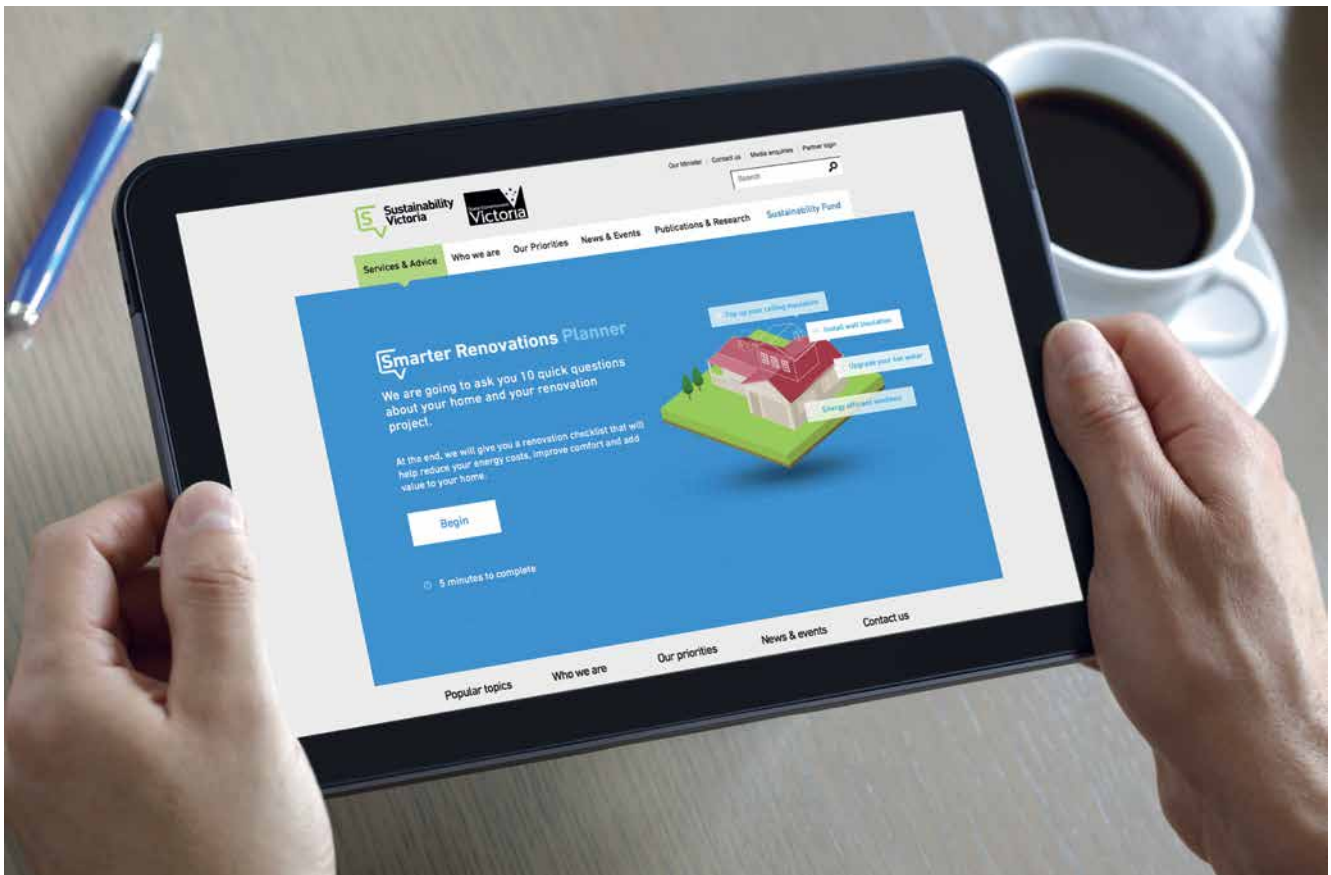
- ▶ Renovation profiles



Smarter Renovations Planner

Use the Smarter Renovations Planner for more tailored advice for your type of house and renovation.

Visit www.sustainability.vic.gov.au/smarter-renovations-planner



Endnotes

1. BIS Shrapnel, 2011
2. BIS Shrapnel, 2011
3. Williamson, T. Grant, E. Hansen, A., 2009
4. Couper, K. and Ferguson, M., 2013, p.3
5. Fifty-five per cent (55%) of all single dwellings in Victoria were built between 1960 and 1999. Warren-Myers, Dr. G., Vines, M. and Carre, A., 2012 p.29
6. Sustainability Victoria, *Victorian Household Energy Report*, 2014 p.6
7. Sustainability Victoria, 2014, based on Bureau of Resource and Energy Economics, Table F, 2013
8. Couper, K. and Ferguson, M., 2013
9. Williamson, T. Grant, E. Hansen, A., 2009
10. Couper, K. and Ferguson, M., 2013
11. Foster, R. and Isaacs, T., 2013 p.32
12. BIS Shrapnel, 2011
13. www.vba.vic.gov.au
14. Unless National Construction Code (NCC) Deemed To Satisfy (DTS) provisions are being used.
15. www.nathers.gov.au/eer/index.php
16. The research involved physical inspections of 20 renovations in Melbourne and regional Victoria by qualified experts. (See Foster, R. and Isaacs, T., June 2013, p.6)
17. The study involved a survey by qualified staff to review and analyse 20 recent renovation projects. The work involved the review of building plans, undertaking physical inspections of the outcomes of the renovation process and the conducting of an interview with the householder. Foster, R. and Isaacs, T., p.34
18. Most renovators installed suspended timber floors and of these, only 28% had installed sub-floor insulation. Foster, R. and Isaacs, T., 2013, p.30
19. Sustainability Victoria, *Victorian Household Energy Report*, 2014, p.11
20. Foster, R. and Isaacs, T., 2013, p.8
21. Foster, R. and Isaacs, T., 2013, p.47
22. The selection of higher efficiency double glazed windows such as timber framed double glazed can reduce heat loss by up to 50% compared to standard aluminium single glazed windows. Sustainability Victoria, 2014
23. Some options for improving energy saving can be difficult due to the nature of the pre-existing dwelling and its siting. Foster, R. and Isaacs, T., 2013, p.43
24. The costs used in this section show the total cost for improving the efficiency of the existing house shell during a renovation/retrofit and exclude the amount required to meet energy efficiency standards for building application approval of any additional floor area. All costs are rounded to the nearest \$5 (See assumptions & methodology).
25. The energy saving benefit begins to flatten out after about R5.5, meaning that going beyond R5.5 will not provide as much benefit in energy efficiency.
26. Foster, R. and Isaacs, T., 2013, p.31
27. Lee, T., Wu, C., Guthrie, K. and Dewsbury, M., 2014, p.47
28. Lee, T., Wu, C., Guthrie, K. and Dewsbury, M., 2014, p.45
29. Foster, R. and Isaacs, T., 2013, p.52
30. Sustainability Victoria, *Victorian Household Energy Report*, 2014
31. Sustainability Victoria, *On Ground Assessment Pilot*, 2010, cited in Foster, R and Isaacs, T., 2013, p.45
32. The On Ground Assessment study estimated that average savings of around 18% could be achieved if houses had their air leakage reduced to only 0.5 air changes per hour (ACH). Sustainability Victoria, *Victorian Household Energy Report*, 2014, p. 8
33. Foster, R. and Isaacs, T., 2013, p.31
34. Sustainability Victoria, *Victorian Household Energy Report*, p.11
35. Foster, R. and Isaacs, T., 2013, p.41
36. Sustainability Victoria, 2014
37. www.sustainability.vic.gov.au/services-and-advice/households/energy-efficiency/smarter-renovations//energy-efficient-windows
38. This figure could be significantly higher for more efficient window units.
39. Comfort factor is relative to energy efficiency, greater energy efficiency equals greater comfort. Feeling comfortable can have additional benefits, which lead to further energy reductions, for example turning down the thermostat, saving on heating costs. These benefits have not been quantified in this research. Single glazed aluminium windows have been used as the baseline for the comparison with an assumed comfort value of 0 out of 3.
40. Glazing cost assumptions – SG Standard Aluminium \$350/m², DG clear (12 mm Air) Standard Aluminium, \$454/m², DG Low-e (12 mm Argon) Standard Aluminium, \$558/m², DG Low-e (12 mm Argon) Improved Aluminium Frame, \$687/m² Lee, T., Wu, C., Guthrie, K. and Dewsbury, M. 2014
41. Lee, T., Wu, C., Guthrie, K. and Dewsbury, M., 2014, p. 16
42. Sustainability Victoria, 2014
43. Foster, R. and Isaacs, T., 2013, p.47
44. Foster, R. and Isaacs, T., 2013, p.44
45. www.cleanenergycouncil.org.au/technologies/solar-pv.html
46. Lee, T., Wu, C., Guthrie, K. and Dewsbury, M., 2014, p.28
47. Lee, T., Wu, C., Guthrie, K. and Dewsbury, M., 2014, p.44
48. The costs used in this section show the average differential cost for improving the efficiency of the existing house shell during a renovation based on our research into specific housing typologies (See assumptions & methodology). These costs exclude the amount required to meet energy efficiency standards for building application approval of any additional floor area.

Resources

Behaviour Works Australia, (January 2014), *Household Energy Efficiency and Behaviour Change: A review of key principles informed by behaviour change research and practice*

BIS Shrapnel, (November 2011) *The home improvements market in Australia 2010 VOLUME 1: Additions – Ground & Upper Floor*, BIS Shrapnel Pty Limited

Couper, K. and Ferguson, M., (June 2013) *Sustainability Victoria Renovations Market Research Report*, Colmar Brunton

Lee, T., Wu, C., Guthrie, K. and Dewsbury M. (July 2014), *Renovation cost benefit analysis report*, Energy Partners and Sustainable Energy Transformation

Warren-Myers, Dr. G., Vines, M. and Carre, A. (November 2012) *Existing Buildings Research Report*, RMIT University

Fiess, S., (March 2013) *Desktop research on the home renovations market*, Sustainability Victoria

Fiess, S., (July 2013) *Home renovation market research*, Sustainability Victoria

Foster, R. and Isaacs, T., (June 2013) *Survey of Home Renovators Influences and Energy Efficiency Outcomes, A study for Sustainability Victoria.*, Energy Efficient Strategies and TI Consulting

Sustainability Victoria (June 2014) *Victorian Household Energy Report*

Williamson, T. Grant, E. Hansen, A. (Sept 2009) *An investigation of Potential Health benefits from Increasing Energy Efficiency Stringency Requirements*, University of Adelaide,

Assumptions & Methodology

This Data is based on the technical measurement of energy and cost benefits that can be achieved by going beyond minimum National Construction Code (NCC) requirements and implementing best practice energy efficiency measures. Costs show the average differential cost for improving the efficiency of the existing house shell during a renovation. These costs exclude any costs required to meet energy efficiency (NCC) standards for building application approval of any additional floor area.

The range of costs and savings is based on four different housing typologies, Prewar, Interwar, Double Fronted Brick Veneer and Estate housing styles, with assumed orientations, usage profiles and Victorian climates.

The heating and cooling outputs was produced by thermal modelling software and combined with data on heating system type and efficiency, to estimate the savings from upgrading the building shell and heating equipment. Modelling of different lighting and water heating options, as well as other solar options (e.g. solar PV panels and solar water heating) were undertaken to assess the potential costs and benefits of the upgrades during a renovation.

Refer to Lee, T., Wu, C., Guthrie, K. and Dewsbury M. (July 2014), *Renovation cost benefit analysis report*, Energy Partners and Sustainable Energy Transformation

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