

Renovations and additions

Renovations and additions can improve the livability and sustainability of your home with careful planning, thoughtful design and a considered choice of builder.

You'll find more information on the planning process for renovations and additions in *Planning home improvements*. If your renovation work includes repairs to the existing home see *Repairs and maintenance*.

Renovations

Most local governments have planning policies that allow minor internal and external changes that don't alter structure or services to be made without council approval, but it is always best to check first. Alterations to services (plumbing, drainage, gas and electrical) do require approval and inspection by the relevant authority but may not require planning or building approval.

Many publications have advice on home renovation (see *'References and additional reading' at the end of this article*). The information here focuses on those aspects of renovation that improve the environmental performance of your home.

Some of this advice can be applied by tenants with approval from their landlord. Some building owners may be prepared to contribute to sustainable upgrades in the knowledge that they can increase and future proof property values.

Even for minor renovations, some work is likely to require tradespeople.

Even for minor renovations, some work is likely to require tradespeople. Ask for references, sight a current licence and insurance policies, and consider a simple contract that describes the work, its cost (or hourly rates) and any warranty. Simple contracts are available from most building industry peak bodies.

Improving thermal comfort

The options below for improving thermal performance while renovating are described in more detail in *Passive solar heating* and *Passive cooling* and the specific articles noted.

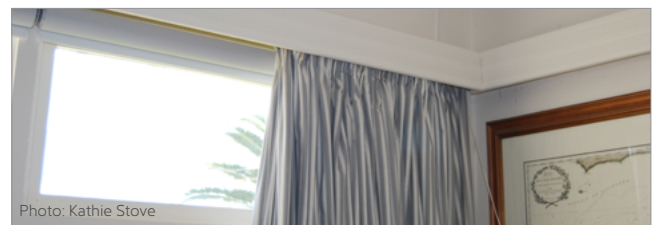
Windows and glazing

- Replace windows or glazing with high performance units appropriate for the climate or consider retrofitting double glazing to serviceable timber windows that you plan to keep. (see *Design for climate; Glazing*)
- Improve air seals as you refit sashes. (see *Sealing your home*)
- Use polycarbonate films with magnetic attachments to emulate double glazing during winter in cool and cold climates – they can be removed and stored in summer.
- Relocate or reduce the size of east and west facing windows and install adjustable shading devices. (see *Shading*)



Install shading that can be adjusted for the time of year.

- Shade problem windows (use temporary shade cloth blinds for windows that will eventually be removed, moved or replaced).
- Remove trees or plantings that are blocking solar access to north facing glass and ask neighbours to prune or remove such trees.
- Install heavy drapes that touch the floor and walls at each side and fix sealed pelmets on top to prevent convective heat loss in cool climates. (see *Passive solar heating*)



Pelmets and heavy drapes prevent heat loss.

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Thermal mass

- Remove carpet or other insulative coverings on slabs and replace with tiles or polished concrete finishes to expose thermal mass, in locations where exposed thermal mass is desirable. Information from building sustainability assessors indicates that this can increase Nationwide House Energy Rating Scheme (NatHERS) ratings by up to one star in many climates. (see *Thermal mass*)



Photo: John Maitland (Energy Architecture)

Polished concrete floors soak up the heat of sunlight.

- Install thermal mass in rooms that have little or none and are exposed to passive heating or cooling, e.g. dark coloured, sealed water containers or phase change materials in solar or breeze exposed positions. (see *Thermal mass*)

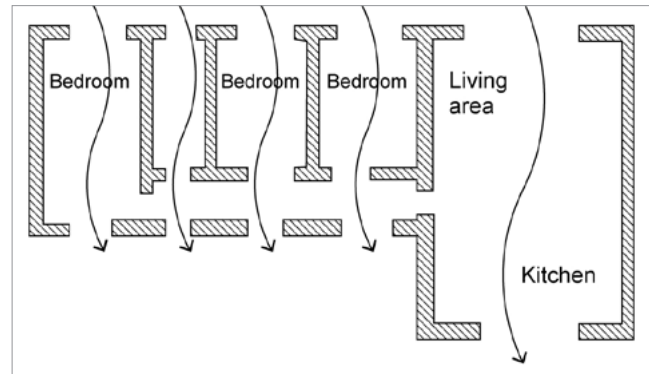


Photo: Mike Cleaver, Clever Design

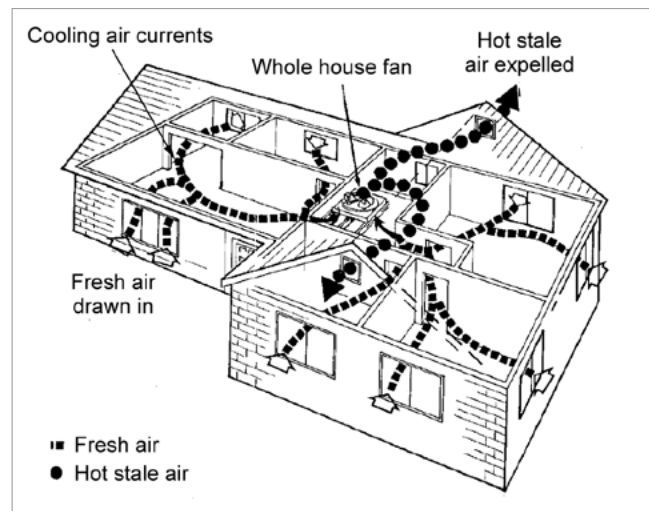
Water containers make excellent thermal mass.

Ventilation, air movement and draughts

- Improve cross ventilation by:
 - retrofitting fully openable, breeze catching windows and doors
 - creating new openings in non-loadbearing walls and above doors
 - moving doors to improve breeze paths
 - designing landscaping planting, outbuildings or fences to direct breezes through the home
 - removing planting that blocks breeze access, unless needed as a windbreak.



Allow cross ventilation by prevailing breezes on summer afternoons.



Source: Breezpower

Whole of house fans should be positioned centrally, e.g. in the roof, stairwell or hallways.

- Install ceiling fans or whole of house fans. (see *Passive cooling*)
- Install fans that ventilate your roof space in summer and can be sealed in winter. (see *Passive solar heating* and *Passive cooling*)

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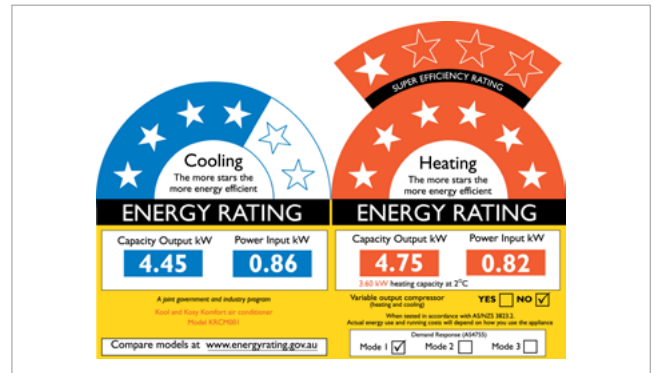
- Install doors in hallways and stairwells to control winter draughts and air movement and create heating and cooling zones.
- Draught seal the whole building. (see *Sealing your home*)

Insulation

- Replace halogen downlights with low energy models, seal openings and replace insulation over them. Electrical retail outlets can supply sealed, heatproof boxes for downlights that seal them and allow you to insulate over them without fire risk.
- Add insulation to accessible floor, wall and roof sections (it can be easily removed and reused later if these sections are demolished).
- If crawl spaces are adequate, simply install underfloor insulation in sheet or roll form with additional bulk insulation on top in cooler climates. See *Insulation installation* for safety considerations and further installation details.
- In colder climates, or where slab heating is used, insulate slab edges, without creating termite access.
- Consider placing a foam insulation layer up to 900mm wide under paths or paving around the home to prevent heat loss from the ground surface and maintain higher earth-coupled temperatures under the slab. (see *Passive solar heating; Thermal mass*)
- For cavity brick walls seek advice from insulation specialists about insulation solutions that do not breach the waterproofing integrity of the cavity.
- Where timber framed walls are being reclad, fit new insulation under the new external cladding and create an air gap adjacent to an inward facing reflective insulation layer using spacer battens. This gap simplifies installation of new services. (see *Insulation installation*)
- Install roof insulation when roofing is being replaced. Fit bulk insulation at ceiling level and downward facing reflective foil under roofing.

Improving energy efficiency

- Consider installing an active solar heating system, particularly if your home has no solar access to north facing glass. (see *Heating and cooling*)
- Upgrade your heating and cooling system with one that:
 - has the highest energy star rating you can afford
 - only heats or cools rooms that are in use
 - can be expanded to include future additions. (see *Heating and cooling*)



- Install a solar or energy efficient hot water service. (see *Hot water service*)
- Improve natural daylighting by removing or pruning plants that obstruct light and adding skylights or daylight tubes. (see *Lighting*)
- Replace low efficiency lighting with LED or other efficient lighting. (see *Lighting*)



Philips Master LED bulbs, Brightgreen LED D900 Cube and a selection of CFL bulbs

- Install smart metering and control systems when rewiring. (see *Smart meters, in-home displays and smart appliances; Home automation*)
- Choose the highest energy star rating when replacing appliances. (see *Appliances; Home entertainment equipment and home office equipment*)
- Consider installing rooftop renewable energy generation. (see *Renewable energy*).

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Photo: pvsolar@optus.com.au

Older houses can easily take photovoltaic panels.

Improving water efficiency

- Retrofit the highest WELS star rated toilets, showers and taps available. (see *Reducing water demand*)
- Install flow restrictors on taps that deliver too much water (e.g. handbasins, sinks).
- Install rainwater tanks (some councils require approval over a certain size so check first). (see *Rainwater*)

- Reduce lawn areas and convert parts of your garden to mulched, low water planting beds to save work and improve privacy and air quality. (see *Outdoor water use*)
- Restore biodiversity by planting local native plants, which also reduce your water consumption because they are adapted to your climate's rainfall regime.
- Consider reusing grey water for your garden but have a soil expert explain the implications for your soil type and plants, and check which systems are approved by your council. (see *Wastewater reuse*)

Improving indoor air quality

- Ensure high levels of controllable natural ventilation or fans in rooms that are difficult to ventilate.
- Consider heat recovery ventilation systems in cooler climates. (see *Sealing your home*)
- Neutralise out-gassing paints and finishes already in the home with specialised sealants. (see the appendix *The healthy home*)
- Use only low/no emission paints and E0 (zero formaldehyde emissions) or super E0 manufactured timber and joinery. Focus on the largest surface areas first: walls, ceilings and especially floor coverings.



Photo: Kathie Stove

Shading, rainwater and greywater can help create a backyard oasis.

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- Ventilate wet areas to the outside to reduce mould and mildew.
- Check that existing exhaust fans are vented externally – not just into the roof space.
- Ensure subfloor spaces are dry, well drained and ventilated to eliminate mould growth.
- Use house plants to absorb VOCs (volatile organic compounds) and other toxins.
- Avoid floor coverings and furnishings that harbour dust mites or allergens.
- Consider a ducted vacuum system to remove toxins and allergens from the home to an externally mounted receptor.

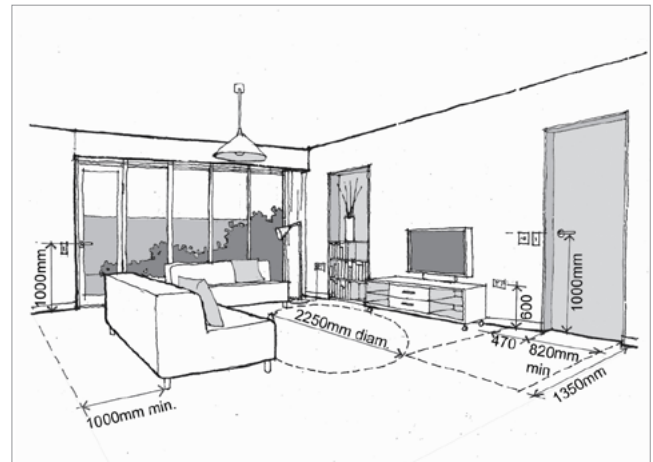
Improving space and amenity (to reduce need for new construction)

- Build or improve outdoor living spaces close to kitchen and indoor living areas and consider summer shade, insect proofing and winter sun.
- Install additional, purpose built storage.



Many spaces can be used to make storage areas.

- Consider relocating the laundry to a cupboard off a living area or circulation space to improve the connection to outdoors or access to future additions.
- Experiment with more space-efficient furniture layouts to make room for additional functions and storage.



Make room for movement and efficiency.

- To renovate your kitchen (if the final position is fixed in your staged concept plan):
 - choose durable, non-dating finishes
 - ensure the refrigerator is well ventilated and not next to the oven or other heat source
 - choose low or no VOC materials with E0 or better finishes
 - consider traffic flow and safety
 - choose energy and water efficient appliances
 - include effective facilities for composting and recycling.
- To renovate your bathroom (if it is to be retained in its current position):
 - choose toilets, showers and taps with the highest WELS star rating
 - consider a two or three way design to eliminate the need for additional bathrooms (a vanity and mirror can sometimes be located in a waste space or relocated cupboard to allow simultaneous showering and tooth brushing)

Plan well, measure twice and cut once.

Council approval is not required for all these renovation actions but always check with your council before proceeding. Prepare detailed sketches, plans and instructions to communicate to trades or, if you are doing it yourself, to avoid costly, wasteful mistakes.

Before you begin

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Additions

If your design includes additions or extensions (significant 'new build' areas that connect to the existing home), read this section in conjunction with the previous section on renovations.



Additions can be made in surprising ways.

Further thermal performance considerations for additions

New additions to your home require detailed thermal performance design to make sure they integrate with the renovation improvements to existing sections.

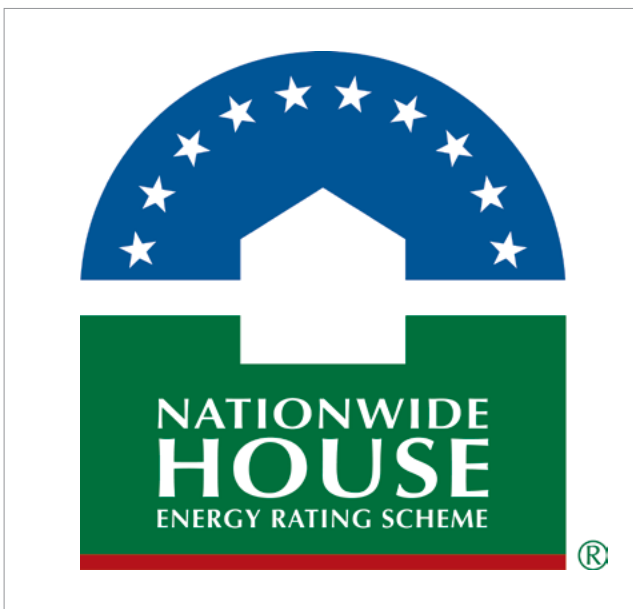
Thermal performance

Consider engaging a building sustainability assessor to model the whole home if this was not done during the concept design stage. Most states now require that minimum sustainability benchmarks be met as a condition of approval for substantial additions. A NatHERS rating may not be required but provides valuable input to your design development process.

Your designer should have a good working relationship with a building sustainability assessor. Many designers are accredited building sustainability assessors but other assessors specialise in rating completed designs rather than in design itself. Choose an assessor who is able to advise on design as you develop the final details.

Building simulation using building sustainability assessment software identifies opportunities to be exploited or weaknesses to be overcome through placement of new rooms or the deletion or 'thermal renovation' of poorly located ones. Once your basic

details are entered into the software, simple modelling of options can be an inexpensive way to fine-tune your design as it progresses.



► Building sustainability assessment software

Often a single room or window can be a source of unwanted summer heat gain or winter heat loss. Building sustainability assessment software can model various window sizes, orientations and glazing types to see which combinations add thermal comfort most cost effectively. The summary software outputs show 'degree hours' outside an acceptable range of thermal comfort temperatures for each room and identifies the need for addition or reduction of thermal mass and glazing, and appropriate shading and insulation levels for your climate. Make sure your building sustainability assessor can provide this level of service. Some don't.

With the initial analysis in hand, you and your designer can detail the incorporation of its recommendations. Use the checklist below for the most common recommendations and see more detailed advice in other relevant *Your Home* articles. This advice is for climates requiring varying levels of both heating and cooling (95% of Australian homes). For detailed advice for cooling only (tropical) climates see *Passive cooling*.

Windows and glazing

- **Fine-tune size and orientation** of your windows. Minimise the size of east and west windows and maximise those facing north where they receive solar access. Where solar access is unavailable, use only moderate amounts of glazing, consider low mass construction and maximise insulation levels. (see *Design for climate; Orientation; Glazing*)
- **Specify appropriate glass type** for climate and each orientation. Orientation-specific glass types are often used to overcome adverse orientations or the need to capture views. Check that climate appropriate solar heat gain coefficients (SHGC) and U-values are specified. (see *Glazing*)
- **Specify climate appropriate opening styles and frames.** Use insulative frames (timber or PVC) or ensure that aluminium frames have a 'thermal break' in cool and cold climates. Use maximum opening area (casement or louvre) in warmer climates. (see *Design for climate; Passive solar heating; Passive cooling; Glazing*)
- **Fine-tune shading details.** Use horizontal overhang for eaves above north facing glass and adjustable or vertical shading devices for east and west. (see *Orientation; Shading*)
- **Balance glass to mass ratios.** Take into account thermal mass in the existing structure and design adequate air movement pathways to transfer solar gains or night-time cooling enabled by your addition to these existing sources of storage. (see *Passive solar heating; Passive cooling; Thermal mass*)
- **Skylight and clerestory window** specifications should be climate appropriate. Double glaze them in cool and cold climates; design for stack ventilation in temperate and hot climates. Thermally separate light tubes by sealing at ceiling level or have controllable fans in warmer climates. (see *Skylights*)

Insulation

- **Retrofit insulation** to the existing building.
- **Insulate all new construction** to climate appropriate levels as recommended by your building sustainability assessor. Ensure that it is correctly detailed and positioned. (see *Insulation; Insulation installation*).

Thermal mass

- **Adjust thermal mass** to levels recommended by your building sustainability assessor and the climate appropriate glass-to-mass ratios in *Thermal mass*. The amount of useful thermal mass depends on climate, availability of passive heating and cooling, auxiliary heating and cooling systems, and likely occupation patterns. Too much thermal mass slows response times to auxiliary heating and cooling. Insufficient mass wastes valuable warmth and 'coolth'. (see *Thermal mass*)
- **Where passive heating or cooling is not available,** use low mass construction systems and insulate existing mass by lining it with plasterboard and reflective insulation. Use high mass construction to match available passive input. (see *Thermal mass; Construction systems*)

Incorporating the software analysis into your final plans ensures that your home achieves the best possible level of thermal performance at least cost.

Termite proofing additions

- Use termite resistant materials where practicable (e.g. steel, concrete, masonry, fibre cement).
- Use treated timber products with current best practice.
- Use a licensed, insured installer of reputable physical termite barriers to recommend, install and guarantee them.
- Allow good subfloor clearance and ventilation.
- Avoid slab-on-ground construction in high risk areas and ensure the slab edge is exposed (min 100mm) and all tree roots or waste timber are removed under slabs and footings.
- Avoid all timber contact with soil.
- Manage moisture sources.
- Fix leaks, waterproof wet areas, divert groundwater and stormwater.
- Design, detail and build for easy inspection access.
- Paint existing subfloor timbers white while they are accessible to highlight termite tubes during future inspections.
- Ensure gardens stop clear of walls.

By also applying the advice in *Your Home* about energy and water efficiency, environmentally preferred constructions systems and materials, you add value to your home and reduce its impact on the environment and the future generations who will live in it. (see the sections *Energy; Water; Materials*)

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Finalising your design and working with your builder

For more detail on the specific guidance below on finalising design documentation, tendering for a builder and the renovation construction process, see *The design process* and *The construction process*.

Design detailing and documentation

Complete your design before beginning this stage. Design changes made during this stage may add to design costs.

Start by revisiting the environmental goals specified at concept stage to ensure they are carried through to the detailed plans and specifications, which are submitted to council, tendered by builders and annexed to your building contract.

During detailed design complete:

- final floor plan
- design of structural support and construction systems (see *Construction systems*)
- final choice and specification of materials
- adjustments to room sizes and dimensions to suit standard material sizes where possible
- choice of construction systems and materials with known low waste rates (see *Waste minimisation*)
- design of services such as lighting layout, smart metering and switching, water systems and drainage including recycling or reuse (see *Lighting; Smart meters, in-home displays and smart appliances*)
- detailing of fixtures and fittings including cupboards and joinery
- window and glazing schedule including size, location, style and glass type
- detailing of shading, thermal mass and cross ventilation enhancements
- specification of insulation type, rating and installation details
- specification and installation details for heating and cooling system, hot water service and other fixed appliances (see *Heating and cooling; Hot water service; Appliances*).

Choosing a builder

Before choosing your builder/s, see the detailed information in *The construction process*.

The processes of building a new home and renovating have much in common but your renovation and addition builder needs a set of specialised skills, which vary depending on the stage you are at.

For example, do you require the builder to include design services, council approvals, engineering certification, construction certification (if private), and survey or geotechnical reports or is your designer handling these?

Check the builder's history – especially in renovations and additions. Extensive renovation experience is critical. Ask the builder these questions:

- How long have you been in business?
- Are you familiar with and enthusiastic about sustainable practices?
- What experience do you have in this type of project?
- Have you done renovations and additions like these before?
- How do you approach reuse, recycling and waste minimisation?
- What aspects of environmentally sound construction do you see as most important?
- How do you ensure that materials come from environmentally preferred sources?
- Are you familiar with certification protocols like GreenTag, GECA or FSC certification?
- Are you willing to order materials from nominated, preferred suppliers?
- Are your subcontractors environmentally aware?
- Which insurances do you carry and what warranty do you provide?
- What facilities will you require on the project (e.g. toilet and kitchen access, materials storage in garage or garden area)?
- How might you separate the site (and dust, noise, vibration) from the living areas?

Ask to visit a current project. Speak to previous clients and inspect their homes where possible. Ask the clients about and check for evidence of a well-organised, clean and tidy and safe site; polite and considerate employees and contractors; and environmentally sound practices including energy efficient windows, durable eco-certified materials, sediment fences and waste separation.

Before signing a contract, make sure you are comfortable that you can work with the builder and that they have sufficient finances to carry out the project, sufficient skill and experience to build it, and are committed to sustainable outcomes.

DIY caution

Within many a householder is a builder or home renovator just looking for their first (or next) project. Renovating your own home can be a rewarding experience in creative expression and skill building but inexperience often leads to unforeseen social, environmental and financial cost.

Popular television home renovation programs may make it look easy, but lifecycle outcomes from these renovations are often poor.

Popular television home renovation programs may make it look easy, but lifecycle outcomes from these renovations are often poor. Critical medium and long term details such as thermal performance, and water and energy efficiency, are commonly overlooked to achieve a quick turnover that conceals problems and passes them on to the next owner.

Inexperience often skips critical steps like termite proofing, damp proofing and adequate surface preparation before fixing finishes, which reduce the life span and waste valuable resources. To be cost effective, choosing materials on an environmentally preferred basis requires careful sourcing, scheduling and quantity estimation to avoid waste.

If you choose the DIY path, evaluate your skills objectively at the outset and use professional tradespeople at critical stages. Consider using a licensed builder to get your renovations and additions to 'lockup' stage (completed structure and external building shell, so the home is waterproof and able to be locked up).

Tenders and contracts

This brief summary is specific to renovations and additions. For more complete information see *The construction process*.

Make sure your contract documents cover:

- all environmental performance outcomes
- site access, materials and waste storage requirements
- working hours, dust, noise and access to facilities (it is *your* home)
- site separation and safety issues
- definite timeframes for construction
- when/if the home needs to be vacated
- damage to existing property (who pays)
- insurance and warranty.

Getting a price

To provide a lump sum tender for renovations and additions, your builder needs to allow for many unforeseeable contingencies. Even with their extensive experience, specialist renovation companies usually allow for the worst case scenario.

It is sometimes useful to nominate lump sums for quantifiable areas of work and contingency allowances based on detailed materials invoices and agreed hourly rates for unquantifiable work. Simpler projects with a trusted builder are often better managed on a cost plus basis with detailed weekly or fortnightly invoices.

Whichever option you choose, make sure you agree a budget cap for each stage of the project, to be fully invoiced at each stage to avoid a massive bill at the end. Negotiate any variations or overruns as you go. Do not defer them.

Quarantine sustainable features in the budget to make sure these are not consumed by cost overruns towards the end of the project.

Quarantine sustainable features in the budget to make sure these are not consumed by cost overruns towards the end of the project, when they are often installed (e.g. environmentally preferred finishes, solar hot water system, efficient heating/cooling, photovoltaic panels).

Tips for environmentally preferred outcomes

- Ensure that drawings and specifications clearly indicate sustainability requirements and include penalties for substitution of inferior materials and products.
- Consider nominating important, high cost items such as windows in a prime cost schedule to avoid substitution by competitive tenderers.
- Clearly describe sustainable methods or materials that are not yet standard building practice and include advice on how to implement or source them.
- Include unambiguous instructions that prevent changes or substitution without approval by you or your designer.
- Ask tendering builders to check tender documents for sustainability compliance risks and note or allow for any contingencies in their tender.
- Ask builders to recommend alternative solutions that suit their trades and supply chains while delivering equal or improved environmental outcomes.
- Consider the use of contracts that link payment to the achievement of specified environmental outcomes (e.g. details of environmentally certified materials, window and glazing specifications, and reuse or recycling details).
- Develop a schedule of reusable materials and negotiate their reuse with your builder.

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Construction supervision or project management

Supervision

Decide who will supervise the project and ensure they are fully conversant with all specified environmental performance features. With alterations and additions, it is usually you or your designer. Larger projects may warrant the appointment of a project manager.

Use checklists to ensure sustainability outcomes and specified standards, materials and practices are implemented on site. Builders are often required to make quick decisions about alternative materials due to delivery times or unavailability. You or your supervisor should be in a position to make rapid, well informed decisions.

Compliance certification

Choose a certifier to check that environmental objectives have been met at each stage before signing off. This can be your local council building inspector or a registered private certifier (see Australian Institute of Building Surveyors, www.aibs.com.au). It is critical that your certifier be knowledgeable about sustainable practices and committed to ensuring environmental standards are upheld.

References and additional reading

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