

Buying and renovating an apartment

Multi-unit housing offers different challenges and opportunities for comfort and sustainable living from separate dwellings.



Greenery can be part of a high-rise apartment block.

Apartments are subject to specialised design and planning regulations with stringent demands on fire and noise separation. Issues of privacy, overlooking, and the role of private and common areas should be inherent in multi-unit and apartment design. Apartment design and use have implications for both environmental and social aspects of sustainability.

Strata title apartments are managed by a body corporate or owners' corporation, which owns structural elements, common areas (e.g. entrances and foyers, carparks, stairs,



Communal spaces can be part of apartment living.

corridors and gardens) and services (e.g. lifts, lighting in common areas) in apartment complexes. Options for sustainable alterations and additions by individual unit owners are thus often limited. Before you purchase an apartment, seriously consider these options:

- choose a unit that already includes important sustainable features
- use a consultant to identify potential needs and problems and, where possible, obtain written in-principle approval from the body corporate for any proposed minor improvements
- choose an apartment in a development with a progressive, sustainability focused body corporate that is more likely to approve and implement innovative upgrades
- avoid buying an apartment with a conservative body corporate that is likely to oppose or delay sustainable retrofits
- check the rating under the Green Building Council of Australia's GreenStar Multi Unit Residential tool which gives a good indication of sustainable performance in recently built apartments.

Choose a unit that already includes important sustainable features in a development with a progressive, sustainability focused body corporate.

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What to look for when buying an apartment

In your apartment

- Affordability in your preferred suburb
- Minimum 6 star NatHERS rating (where available)
- Adequate, controllable solar access (see *Design for climate*)
- Well-designed cross ventilation (see *Design for climate*)
- Appropriate glazing and well-designed natural daylighting (see *Glazing*)
- Practical, furnishable floor plan with usable balconies or courtyards
- Pleasant outlook, high level security and sound separation
- Inclusive, consultative management with a sustainability upgrade agenda
- Multi-bin sorters for waste and recycling

In your building

- Close to good public transport links (see *Transport*)
- Effective communal recycling and waste disposal facilities
- Individual water meters that are read and billed individually
- Photovoltaic systems on common property roofs grid fed through common property meters (see *Renewable energy*)
- Co- or tri-generation energy systems
- Efficient heating, ventilation and air conditioning (HVAC) plant including variable speed drives and efficient management systems that monitor energy and water demand in real time
- Solar hot water pre-heating for centralised systems or individual solar hot water service in smaller developments
- Efficient central extractor fan systems for common areas and bathrooms
- Carbon monoxide monitoring and efficient lighting in car parks (see *Lighting*)
- Energy efficient lighting in common areas, with appropriate controls such as motion or light sensors
- Spaces and facilities for community interaction with lifestyle facilities on your wish list (e.g. pool, gym)
- On-site food production potential
- Communal composting
- Bicycle storage and parking for car share vehicles

- Rainwater capture for low water use gardens and carwash facility (see *Outdoor water use*)
- On-site water treatment



Photo: Paul Downton

Apartment buildings can be designed to be energy and water efficient.

Renovation options in apartments

Under most forms of strata title, the body corporate owns and maintains everything beneath your paint, wallpaper or floor coverings. You do have control over things in the apartment such as kitchen joinery, appliances, plumbing fittings and floor coverings.

Progressive bodies corporate across Australia are embracing sustainability and undertaking innovative upgrades to reduce their environmental footprint.

You cannot alter common property without permission. Such permission particularly applies to external changes such as shading or glazing. Body corporate rules intended to maintain the streetscape presentation and structural integrity of a complex often limit the level of renovation achievable.

Other common limitations are your capacity to install a solar hot water service, efficient heating and cooling (if central system heating/cooling is provided), photovoltaic panels, rainwater harvesting and wastewater reuse.

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The good news is that body corporate attitudes are changing rapidly. Progressive bodies corporate across Australia are embracing sustainability and undertaking innovative upgrades to reduce their environmental footprint. Take a pro-active role in your body corporate and lobby for sustainable improvements. Sharing the cost of improvements with other unit owners often makes them more affordable and effective.

For examples of innovative common property apartment retrofits, visit Green Strata.

With clever renovation you can substantially reduce your apartment's environmental impact.

Bathrooms and laundries

The biggest water users inside a home are the shower, toilet and washing machine. As an apartment dweller, you have plenty of opportunities to save water.

- Replace inefficient showerheads and taps with efficient models or install flow regulators.
- Check toilets for leaks and have them fixed — a leaking toilet can waste up to 95,000L of water a year. Consider replacing old inefficient toilets, particularly if they are single flush, with at least 4 star toilets. (see *Reducing water demand*)
- Choose an efficient washing machine with a high star rating. (see *Appliances*)
- Use a clothes line or rack instead of a dryer, to save energy and laundry space.

Kitchens

When choosing products like kitchen joinery, benchtops and flooring, use eco-product selection databases such as Ecospecifier.

- When upgrading kitchens, consider reusing the existing joinery carcass and only installing new cupboard fronts.
- Choose kitchen joinery, benchtops and flooring with low environmental and health impact (see *'Joinery' below*).
- Include multi-bin sorters under sinks to make recycling easier.
- Choose a dishwasher that's sized correctly for your household (no bigger than you need) with high star ratings for energy and water. (see *Appliances*).
- Consider creating a small vegetable or herb garden if you have suitable space, e.g. balcony, or communal spaces.

Living areas, home offices and bedrooms

Your appliances and other electronic equipment can contribute substantially to energy bills.

- Choose home entertainment and home office equipment with the Energy Star logo (see *Home entertainment and home office equipment*).
- Ensure TVs and whitegoods have high star ratings — check the Appliance Energy Rating Label displayed on all products and check the energy consumption figures as well as the stars. A large 4 star model may use more energy than a smaller 3 star model, so size is also important. (see *Appliances*)
- Choose joinery, floor coverings and paints with low environmental and health impact (see below).



Photo: Paul Downton

Fit out your apartment with sustainability in mind.

Lighting

Choose low energy fluorescent or LED lighting instead of halogen lighting. Avoid downlights as you need more of them to light a room than ceiling or pendant lights.

Paints

Choose paints with very low or zero volatile organic compound (VOC) emissions, which are readily available at no extra cost.

Joinery

For wardrobes and cabinets that use laminates or veneers, specify low VOC products. Timber veneers should be Forest Stewardship Council (FSC) certified. In the bathroom, make sure joinery is highly moisture resistant. Databases like Ecospecifier can help guide product selection.

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Floor coverings

Ensure timber flooring comes from sustainably managed sources with PEFC (Programme for the Endorsement of Forest Certification) or FSC accreditation. Bamboo flooring can also be a good option. Ensure all hard flooring has high levels of acoustic insulation and specify low VOC finishes. For soft flooring consider natural products like sisal or coir, or choose carpet using the Environmental Certification Scheme (ECS) for carpets. Soft flooring also minimises noise problems.

Furniture

If buying new furniture, look for Furntech's 'Green Tick' system for furniture. Using vintage or recycled furniture is an option that helps to save money and resources.

Thermal performance

Extremes of temperature and more frequent extreme weather events are likely outcomes from global warming and climate change. (see *Thermal mass*)

Apartments that feature high levels of natural ventilation and the capacity to reduce or internally insulate problematic thermal mass (see '*Thermal mass*' below) can facilitate adaptation to climate change.

Orientation

Although it is not always possible to achieve optimum orientation in urban, higher density environments, correct positioning of apartments and multi-level dwellings can greatly assist with passive heating and cooling. If possible, choose a north facing apartment (except for tropical climates) with adequate passive shading and breeze exposure.

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Windows and glazing

Glazing type, size and orientation is generally the most important consideration when buying an apartment because of its critical role in thermal comfort, daylighting, natural ventilation and outlook. It is also often the most difficult to upgrade due to implications for the external appearance of the complex.

The information in *Design for climate* can guide your assessment of the glazing in units you are inspecting. Pay particular attention to orientation, shading, total area of glass on each elevation and type of opening mechanism.

Double glazing provides the best thermal and acoustic insulation.

Daylight penetration

Natural daylighting in all habitable rooms and bathrooms is an important component of psychological comfort in any apartment. Artificial lighting is not needed during the day and it maintains your connection with natural diurnal (day–night) and seasonal cycles.

Well-designed daylighting should be adjustable to suit occupant needs, allow direct sunlight penetration in winter and exclude it in summer. The exception is tropical climates, where direct sunlight should be excluded year round. Desirable features align with those outlined in 'Natural ventilation' below.

The use of light colours on walls, ceilings and other surfaces, and light shelves to reflect natural daylight into deeper spaces facilitate daylighting. Also useful are summer shading and glare control in winter when sun angles are low.

Except in tropical climates, choose a unit in which living and private open spaces receive at least three hours of direct sunlight in mid-winter and have pleasant, private outlooks.

Avoid units with a south only aspect except in hot humid climates where it is desirable, and avoid apartments with large amounts of west facing glazing.

Natural ventilation

Good cross ventilation is of critical importance in apartments and units (see *Passive cooling*). It allows you to control your thermal comfort and reduces or eliminates the need for energy consuming mechanical HVAC.

Good natural ventilation is usually impossible to achieve through retrofit. It must be included in the design from the outset through optimal orientation, floor plan configuration and optimisation of the external façade including window type, size and orientation, breeze catching projections and recesses.

All habitable rooms (and non-habitable rooms wherever possible) should have direct access to fresh air and natural daylight. The building floor plan and cross-section should be designed and orientated to catch and direct local breezes as shown in the diagrams. Landscaping and neighbouring buildings should not inhibit air flow.

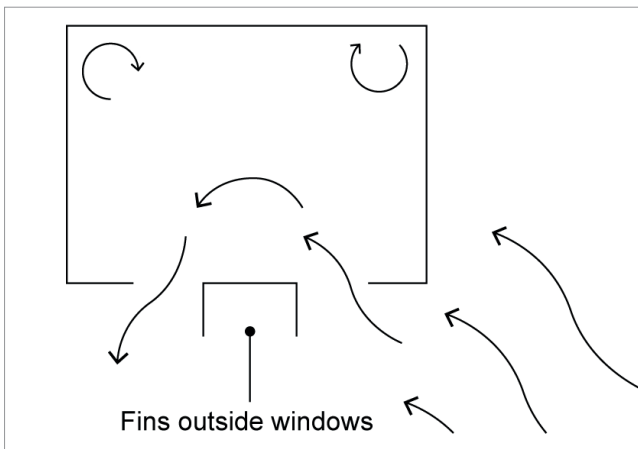
Useful solutions include:

- split level or crossover apartments
- narrow floor plans

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- well-designed window openings on at least two façades
- windows with maximum opening area and capacity to catch breezes (casement, louvre and bi-fold doors)
- floor plans that minimise airflow obstruction including narrow building depth, dual aspect, crossover and corner apartments
- multi-level apartment design that uses convective ventilation to draw in cool air at lower levels and allows warm air to escape at higher levels
- open plan living areas with full height doors or openable transom or fanlight panels above (can be retrofitted)
- projecting fins for breeze direction on single façade units.



Projecting fins can redirect breezes inside.

► Natural benefits

Recent research by the Queensland University of Technology showed that apartments with natural light and views of natural surrounds provide beneficial social and psychological effects including reduced stress, better emotional health, improved communication and a sense of belonging to a community or place.

Preferred layout and building shape

Choose a plan that meets your space requirements and consider flexibility to meet changing future needs. Open plan designs usually allow more flexible furniture layouts, reduce waste space in hallways and allow better ventilation and daylighting.

A layout is efficient if it allows functional furniture arrangements and good circulation between rooms while maintaining sound and visual privacy, natural daylight and ventilation.

The NSW Residential Flat Design Code shows many examples of preferred apartment layouts.

Access to private and communal open spaces is a critical component of a good floor plan. Every apartment should include a private outdoor space with a pleasant outlook. Ideally, these are linked to living spaces. Veranda or balcony apartments facilitate outdoor living and can help reduce internal floor area without loss of amenity or lifestyle. When well designed, they increase natural daylighting and can funnel cooling breezes.

Narrow floor plans and corner apartments improve cross ventilation and natural daylight, as do 'crossover' floor plans where split level designs can allow access through upper or low level common entry spaces.

In taller buildings, smaller/thinner floor plates allow for cross ventilation, daylight and views. Smaller floor plates also create smaller shadows and are less likely to block breezes and views from surrounding developments.

Garden and courtyard outlooks are difficult to achieve in taller buildings. For this reason, views are important – preferably to parks, water or undeveloped landscapes.

Three-dimensional layouts with double height, split level or mezzanine options can maximise outlooks and provide visually interesting, space-efficient living. However, they limit access for people with restricted mobility.

In taller buildings, courtyards and podiums within the building and between floors can provide shade and access to major landscape views.

Other important floor plan features include adequate storage space and access for furniture removal and replacement. Use cupboards to insert sound privacy between rooms and apartments.

Thermal mass

Multi-storey buildings usually require dense concrete cores for elements like stair and lift wells. Multi-unit dwellings demand good fire separation that is often most economically and effectively provided by concrete construction.

These high density concrete elements have excellent thermal mass because of their ideal placement in the core of an apartment or as party walls in well insulated units.

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In warmer climates and in poorly ventilated units with limited night purging capacity, thermal mass can overheat, causing thermal discomfort. (see *Thermal mass*)

In medium rise developments, multi-residential timber framed construction can give a better outcome. This certified fire and sound rated timber construction system conforms to the requirements of the Building Code of Australia (BCA) for multi-residential buildings.

In cooler climates, uninsulated thermal mass can reduce response times to heating or necessitate additional heating. Both cases can be identified by a thermal performance consultant using a thermal imaging camera at summer or winter discomfort times, and the problem can be overcome by retrofitting thin, insulating linings to problem walls only.

Insulation

Insulation levels are often difficult to ascertain in units that are already built. Units approved for construction after 2006 are required to achieve minimum thermal performance standards that include insulation; however, many pre-2006 units were not insulated. Some bodies corporate and local councils keep records of architectural drawings that may include insulation details.

Party walls, floors and ceilings become thermal buffer zones that reduce temperature differential and limit heat flow. Problematic external walls can often be insulated internally with high efficiency insulation boards under a new plasterboard layer.

Shading

Effective shading of all windows is a critical prerequisite for apartments because it is very difficult to retrofit due to the need to maintain external façade consistency. Well-designed shading should be integrated into the architectural detailing of the building through the use of balconies, awnings, projections and adjustable louvres.

Shade north facing glass with passive solar external projections to exclude summer sun and allow winter sun penetration. (see *Passive solar heating; Shading*)

In tropical climates, exclude sun all year round.

East and west facing glass should have adjustable or fixed vertical shading (see *Shading*). Adjustable shading is particularly useful in instances of poor orientation (west or east) because it allows user control of summer sun exclusion and winter solar access if needed.



Adjustable external shading blinds.

Energy use

Energy use and carbon emissions vary widely between different types of apartment. Size, type and management of common areas can contribute significantly to these variations.

Building energy use

Energy used within an apartment, such as electricity for appliances and gas for cooking, is separately metered and paid for by the occupants. Energy used for central hot water systems is usually paid for by occupants based on individually metered hot water use. Energy used for common areas, such as corridor and car park lighting, is paid by owners through annual levies or body corporate fees, usually in accordance with their unit entitlements.

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Research by Energy Australia and the NSW Government found that average annual energy consumption and carbon emissions per unit and per person for apartments increase with density as demonstrated in the table below.

Energy use with housing density

Building type	Energy use per unit (electricity + gas) (MJ/dwelling/year)	Greenhouse gas emissions per unit (tonnes CO ₂ /year)	Greenhouse gas emissions per person (tonnes CO ₂ /year)
High-rise	49,063	10.4	5.4
Mid-rise	30,954	7.3	3.8
Low-rise	27,158	6.5	3.4
Townhouse/villa	25,547	5.1	2.1
Detached	39,974	9.0	2.9
Average	36,309	8.0	4.1

Source: Myors et al. 2005

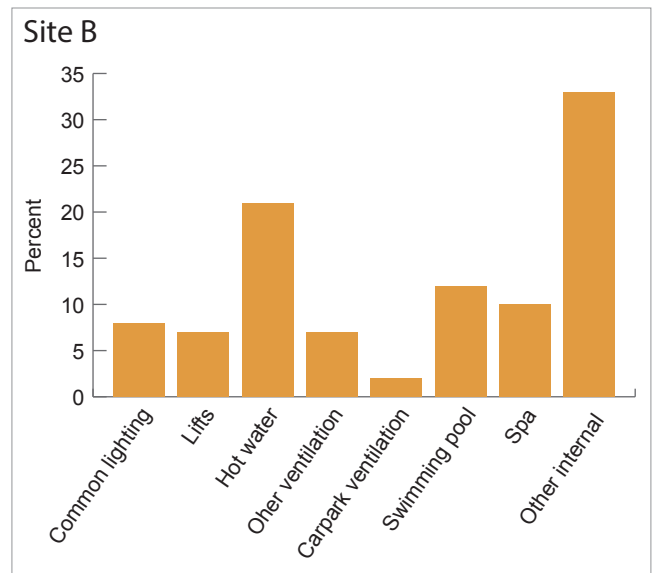
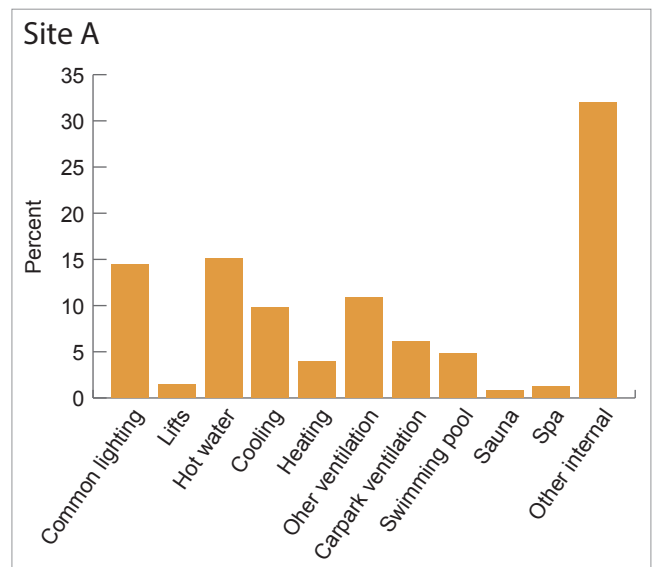
This research also identified significant variations in energy use and carbon emissions between two similar high-rise apartment buildings in Sydney: on the basis of total energy consumption per unit, one used 50% less energy than the other (see table and figure below). This finding indicates that high-rise apartments can use much less energy and produce much lower greenhouse emissions than the current average.

Annual energy consumption and per capita greenhouse gas emissions for two high-rise apartment sites, Sydney

Site	Number of dwellings	Annual site total energy consumption (MJ/year)	Annual per capita greenhouse gas (tonnes CO ₂ /person/year)
High-rise A	~175	11,215,214	6.5
High-rise B	~158	5,853,856	3.5

► BASIX savings

In NSW, greenhouse gas emissions from new high-rise apartments are more than 50% lower than from pre-BASIX (Building Sustainability Index) buildings.



Myors et al. 2005

Greenhouse gas emission breakdown for two high-rise apartments, Sydney.

This comparison demonstrates how much influence your choice of building or development can have on your energy bills and carbon footprint. Choose very carefully!

Your choice of building or development can have a large influence on your energy bills and carbon footprint.

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Hot water service

A very large amount of gas and electricity goes into heating hot water.

Apartments can have either centralised or individual hot water services.

Individual systems are similar to those in detached housing (see *Hot water service*). The type and energy source have significant implications for carbon emissions. Instantaneous electric or small electric storage systems are common in older units. They have the highest carbon emissions and should be replaced if possible with solar, if a north facing roof is available, or heat pump or gas (instantaneous or storage). If you are considering upgrading the hot water service, check on the feasibility with a plumber before you commit to the apartment purchase. Permission is required for systems installed on common property, and care needs to be taken with heat pumps to avoid noise issues for neighbours.

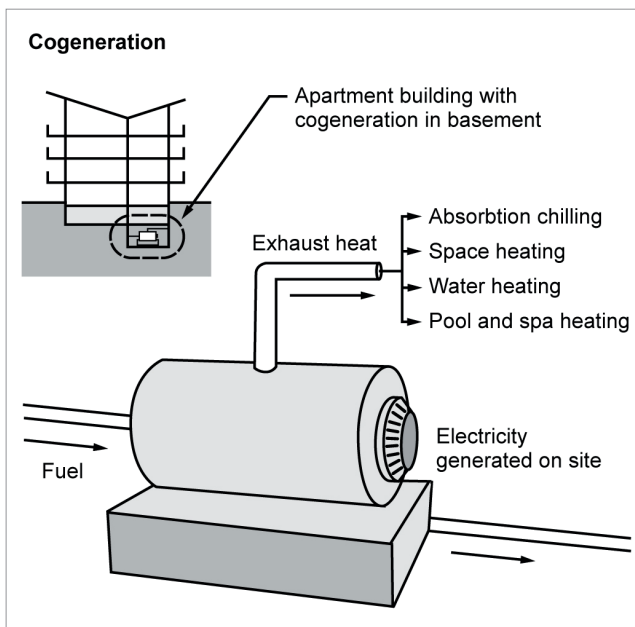
Centralised systems use a ring main to circulate centrally heated hot water past each unit and back to the source. Ring mains are always full of hot water and are often a permanent source of substantial heat loss through poor insulation. Branch feeds from the ring main to outlets in individual units do not recirculate. Depending on pipe length and other plumbing details, this can cause long waits for hot water that waste both water and energy. When inspecting a unit, ask for details of the hot water service and run a tap to check wait times.

Check with the body corporate to see if they plan to upgrade inefficient boilers or ring mains to reduce energy costs and carbon emissions before purchase. Recirculating loop pumps should operate efficiently and be appropriately maintained by building management.

A co-generation system (also known as combined heat and power) produces power and usable heat for hot water and space heating and can be the most efficient centralised system to install in developments of suitable size and configuration. The next most efficient systems are usually centralised solar (gas boosted) and heat pump, followed by solar (electric boosted) and high efficiency gas systems (www.basix.nsw.gov.au).

Co-generation technologies are a relatively simple option to retrofit when cooling towers and other heat generating technologies are located near the hot water boiler (common in most plant rooms).

Tri-generation systems (also known as combined cooling, heating and power) produce electricity and hot water, and produce and recover energy from heating and cooling systems, making them more efficient.



Source: BASIX

Co-generation plant in an apartment building.

Renewable energy

Photovoltaic panels are less cost effective on apartment buildings as there are more dwellings per site area than the roof area available to carry the panels. Nevertheless, photovoltaics can be very worthwhile for capturing energy to offset the energy use for common areas and services.



Photo: Paul Downton

Skylit central stair and lift well uses integrated semi-transparent photovoltaics as roofing material.

Water use

Research by the City of Melbourne found that its residential sector accounts for 22% of the city's water consumption and that city apartments use almost as much water as a suburban home with a garden (City of Melbourne 2008). It is likely that these figures are typical of multi-residential buildings throughout Australia.

At building management level, excess consumption was largely attributed to poorly designed and maintained ring main hot water systems causing long delays in hot water arriving at a running tap. Other causes were system leaks and inefficient cooling towers.

At individual unit owner level, it was attributed to failure to retrofit water efficient fixtures, fittings and appliances and inefficient water use (City of Melbourne 2008). Audits of 22 high-rise apartment buildings by Sydney Water found that over 90% of the building water use was inside apartments, contrary to views that pools, spas, gardens and retail tenants were responsible for using most water in these complexes (Sydney Water 2011).

Reducing water demand has detailed advice on these issues.

Upgrading inefficient taps, toilets and showerheads is relatively simple and cost effective. Upgrading common property water-consuming infrastructure can be far more difficult and expensive (particularly centralised hot water services and inefficient centralised heating and cooling). Investigate the efficiency of these carefully before purchasing.

Investigate the efficiency of common property water-consuming infrastructure, particularly the hot water service and centralised heating and cooling, carefully before purchasing an apartment.

Individual water meters to each unit deliver the benefits of retrofitted water saving features to the owner rather than the body corporate. However, in many strata properties there is only a single water meter for all water consumed and owners and tenants never see an individual water bill. They thus have no direct financial incentive to reduce water use. Billing arrangements vary widely around the country. In some places the cost may simply be equally divided among all the units; in others it may be allocated according to unit entitlements based on the number of bedrooms and physical location in the property. Someone making an effort to use less water pays the same as or even more than someone who wastes water. Check how water is billed for your apartment.

A plumber can inspect and assess quality, efficiency and maintenance standards for body corporate facilities.

Acoustic privacy

Sound can be insulated by:

- using high performance acoustic materials and construction systems to ensure sound insulation between apartments, in particular beneath hard flooring, and from external sources
- designing internal room layouts to buffer quiet rooms, such as bedrooms, from noisy spaces like living areas, lifts, corridors and lobbies, and common areas. Design for acoustic privacy considers both the location and separation of apartments. (see *Noise*)

When inspecting an apartment, establish:

- the noise potential of all spaces adjacent to bedroom party walls
- the potential for your noise to impact your neighbours
- traffic patterns, street noise and noise from adjacent buildings.

Transport

Higher density dwellings can place more people close to shops, schools and other daily destinations with greater economy than conventional low density subdivisions. They make public transport and car sharing options more economically viable, which can significantly reduce the overall energy use and greenhouse gas emissions from high density apartment buildings. (see *Transport*)

Transit oriented developments

Transit oriented developments (TODs) are planned and designed to locate more people within easy walking distance of public transport to reduce private motor vehicle use. TODs must be located on efficient public transport links and, in the case of larger developments, developers contribute to their upgrading.

They may be multi-storey buildings around a railway station; 4–6 storey housing, shops and offices near rail or light-rail stations; or a mix of duplex, small lot housing and 2-storey apartments around a local bus route.

Convenient, secure bicycle storage is an important feature of any apartment. Also, look for dedicated car share spaces in resident car parking or nearby on the street.

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Authors

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