Lighting

Lighting in homes consumes 8–15% of the average household electricity budget (or about 6% of its energy use) although the makeup of the installed lighting technologies, lighting design and user behaviour can make a difference. Efficient and well-designed lighting can yield household energy savings.

Projected average home energy use in 2012 — actual energy use varies from state to state (particularly with climate) and from home to home depending on the lighting in the home and how it is used.

<table>
<thead>
<tr>
<th>Household energy use</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heating and cooling</td>
<td>40</td>
</tr>
<tr>
<td>Water heating</td>
<td>21</td>
</tr>
<tr>
<td>Appliances and equipment including refrigeration</td>
<td>33</td>
</tr>
<tr>
<td>and cooking</td>
<td></td>
</tr>
<tr>
<td>Lighting</td>
<td>6</td>
</tr>
</tbody>
</table>

Source: DEWHA 2008

Aim to light your home to:
- provide a safe, comfortable, visually appealing and desirable environment
- be as energy efficient as possible.

Design for light

Thoughtful lighting design combines many daylighting and electric lighting strategies to optimise the distribution of light inside the building. It considers whole building energy impacts to minimise the building’s overall energy usage and integrates the design of daylight entry (through windows and skylights) with electric lighting, including controls. It takes advantage of shading strategies and glazing technologies to moderate the intensity and spectrum of the daylight admitted to the home, to minimise heat gain during the cooling season and heat loss during the heating season. It chooses the best window aperture sizes, glazing and shading design for each orientation to reflect the expected solar angles, heat gain and glare criteria. (see Passive design; Design for climate; Orientation; Shading; Glazing; Skylights)

Effective lighting design means putting light where it’s wanted and needed, and reducing or eliminating light elsewhere.

Daylighting design aspects

The science of ‘daylighting’ deliberately uses daylight to reduce or negate the need for electric light. Sources of daylight include sunlight, which is an intensely bright, directional beam, and skylight, a diffuse light of about one-tenth the illumination of sunlight. Daylight is dynamic, constantly changing its characteristics (intensity, colour, direction).

A goal of all new homes should be to not require any electric lighting during daylight hours. Siting, orientation and size of the home come into play but every consideration should be given to minimising reliance on electric lighting during daylight hours.

Done correctly, daylighting design can deliver a net saving on energy consumed by the building. Done incorrectly, it most commonly increases the heat load on the home and its cooling energy consumption. If the daylight control system is poorly implemented, building occupants have to deal with glare and/or thermal discomfort using the most expedient means at hand (e.g. curtains drawn, operating air conditioner), which in turn negates any benefit that daylighting might have offered (see Passive design; Shading).
Some principles for daylighting in Australia

- North facing windows introduce sunlight and daylight into the home, particularly in winter when the sun is lower in the sky and direct sunlight contributes to heating the house.
- South facing windows (for latitudes below the tropic of Capricorn) predominantly introduce daylight without heat gains of direct sunlight — making them an ideal orientation for houses in warmer climates where home cooling is the main imperative.
- Skylights and light tubes of appropriate sizing and design can let in light without adding heat in summer or losing warmth in winter.
- Externally reflected daylight contains less heat than direct penetrating sunlight (i.e. the infrared heat is predominantly absorbed by natural and built environments).
- Light coloured interior surfaces reflect more light and reduce the level of artificial lighting required.
- Clerestories (with the associated eaves appropriately sized) are very effective at delivering daylight to the core areas of a home.
- Sunny locations can exploit tubular daylighting devices — tubular skylights — which send direct-beam sunlight into the space below and are capable of delivering very high illumination levels when the sky is clear.
- Direct sun should be excluded from task areas (particularly polished surfaces including kitchen benches and desktops) because of the high potential for glare and discomfort.
- Internal sun penetration can be controlled with the least impact on an external view by vertical blinds on predominantly east and west oriented windows and horizontal blinds for predominantly northern (and southern, for north of the tropic of Capricorn) oriented windows.

Passive daylighting tips

To light task areas effectively, direct natural lighting from windows, skylights or light tubes (see Skylights) must be close to the task area. Windows should be part of the perimeter wall of the room being lit and skylights should be located in the roof directly above the task area to be lit.
**Light tubes** can be purchased for as little as $100 and installed easily by a tradesperson or capable DIY owner. They can replace a 60W light running for up to eight hours a day in a poorly lit room, saving as much as $30 per year. They can thus pay for themselves in less than five years (varies according to length of use and combined wattage of lights on switch circuit).

![Light tubes](image)

Light tubes can replace a 60W light running for up to eight hours a day in a poorly lit room.

**Light shelves** reflect daylight to penetrate deep into a building. They are suitable for north and south elevations but not the flat sun angles of east and west. A horizontal overhang with a high reflectance upper surface is placed above eye-level to reflect daylight onto a light coloured ceiling and deeper into a space.

By varying the height, angle and internal or external projection of a light shelf, you can control the pattern, intensity and depth of penetration of natural light (including sunlight) within a space. Light shelves should be light in colour and require frequent cleaning.

Not only do light shelves allow light to penetrate deeper into the room, they can shade near the windows to reduce window glare or create a sun patch. Exterior shelves generally provide more effective shade while interior shelves provide deeper reflected light. A combination of exterior and interior shelves works best to give an even illumination gradient.

Glass bricks are a useful source of daylight in walls that are close to boundaries or need privacy. Glass brick panels let in diffuse daylight while maintaining sound and visual privacy, and fire ratings.

*Glass bricks let in diffuse daylight while maintaining sound and visual privacy in walls that are close to boundaries or face the street.*

Light shelves reflect light deeper into rooms.

**Electric lighting design aspects**

Use of electric lighting in the home has two aspects: specific task lighting and creating a night-time ambience for a room or space.

Human vision has a very high dynamic range but perception of brightness shifts with the overall brightness of the entire space. The eyes adapt to low light levels at night and it is unnecessary to try to duplicate the high level of illumination available from daylight.

When considering lighting a space, work on points of interest within. The human eye is attracted to bright
Energy

Lighting

objects and accordingly should be rewarded with something of interest. By contrast, dark areas are of limited attraction but serve to accentuate (by contrast) the brighter objects of interest. Use highlights (about 10 times the ambient light level) to draw attention to key objects or spaces in a room, or for lighting specific tasks. Carefully select features to highlight (e.g. artwork, sculptures, and furniture items) and use the minimum effective highlight level so you don’t waste energy.

Reading lamps or table lamps are an effective, flexible and efficient means of giving higher task lighting rather than increasing general lighting of the entire space. They can also be part of the accent lighting for mood setting (e.g. table lamp on side table in lounge room).

Applications for electric lighting

Plan your lighting to complement your lifestyle. Consider the activities that occur in each room, the atmosphere you want to create and the decorative elements you want to highlight.

Consider in particular the areas that serve more than one purpose and require more than one style of lighting (e.g. relaxed entertaining, media viewing, reading/writing, general activity). Use separate lighting solutions and circuits for each function rather than integrating them into a single circuit. Lights may need to be on separate switches, and/or dimmers used to create the lighting desired.

Each lamp type has advantages and disadvantages and good design uses an appropriate type for each application.

Remember:

- Light is heavily absorbed (wasted) in dark-coloured rooms.
- Light can be indirectly reflected (i.e. cove and pelmet lighting) to create very subtle background illumination but only in light-coloured rooms/surfaces.

There is no ‘best’ lamp for all applications. Of the many alternatives, each has advantages and disadvantages: good design uses an appropriate lamp/light fixture for each application.

The various lamp technologies generate light differently. Choose lamps best suited to producing desired lighting effects such as light distribution, switch-on time and dimmability.

For example, some compact fluorescent lamps (CFL) take a few seconds to strike and ‘warm up’, and are thus unsuitable where use may only be for a few seconds (e.g. kitchen pantry) or where lights are switched on and off quickly. CFL lamps, although efficient, are an inferior choice in these rooms to tungsten halogen or even LEDs, although LEDs may not have the cost benefit for such short uses.

Most rooms need two types of lighting: general lighting and task/accent lighting. Use different lamps and light fittings for each purpose.

General/ambient lighting

Ambient lighting provides overall, general lighting that radiates a comfortable level of brightness. A central source of ambient light in all rooms is fundamental to a good lighting plan.

- Use omni-directional (light in all directions) lamps in pendants, chandeliers, ceiling or wall-mounted fixtures.
- Avoid using downlights for general illumination. They make bright ‘pools’ of light on the floor (most floor surfaces absorb as much as 80% of the light) while making the ceiling cavity appear dark, which creates a ‘gloomy’ ambience. Downlights are better suited to task lighting over work spaces. Up to six downlights can be needed to light the same area as one pendant light. Think about other ways of lighting with fluorescent omni-directional lamps before installing downlights or if used, fit lower wattage and more efficient bulbs.
- Choose light fittings and lamp shades that allow most of the light through so a lower wattage lamp can be used. Some light fittings can block or absorb 50% or more of light.

Task/accent lighting

Task lighting is used to illuminate specific tasks such as reading, sewing, cooking, homework, games or hobbies. Accent lighting adds drama to a room by creating visual interest. It can emphasise paintings, house plants and collectables, or highlight the texture of a wall, drapery or outdoor landscaping.

- Directional lamps or downlights, such as LED or halogen reflector lamps, are best employed for this purpose.
- Use desk/table/floor lamps in areas where the activity or furniture is likely to change positions (lounge, dining, bedrooms)
Where illuminated task surfaces will not change (e.g. over kitchen benches), use fixed directional lighting.

Make sure task lighting is free of distracting glare and shadows but bright enough to prevent eye strain.

Key points for selecting the appropriate beam angle for directional lamps:

- Beam angle is the angle at which light intensity drops to 50% of centre beam intensity. Virtually all (around 90%) light from a directional lamp is in the beam and very little light reaches other surfaces outside the path of the beam.
- Basic rule: for the same wattage lamp, the smaller the beam angle the brighter the surface illuminated but the smaller the area illuminated.
- Select the appropriate beam angle by determining the largest dimension of the feature to be lit and the distance from it. The packaging of most directional lamps generally shows a simple graphic to help select the appropriate beam angle.

### Choosing lamps

#### Colour of light

Two ratings are used to describe the colour of white light sources:

- correlated colour temperature (CCT)
- colour rendering index (CRI).

**CCT**, measured on the Kelvin (K) temperature scale, describes the ‘shade’ of white light emitted.

<table>
<thead>
<tr>
<th>CCT (K)</th>
<th>Colour designation</th>
<th>Appearance</th>
<th>Typical uses</th>
</tr>
</thead>
<tbody>
<tr>
<td>2,700–3,200</td>
<td>Warm white</td>
<td>Similar to incandescent</td>
<td>Household rooms</td>
</tr>
<tr>
<td>4100</td>
<td>Cool white</td>
<td>Neutral light</td>
<td>Offices, garages, workshops</td>
</tr>
<tr>
<td>5,500–6,500</td>
<td>Daylight</td>
<td>Cold, harsh, unrelaxed light</td>
<td>Bathrooms, laundries</td>
</tr>
</tbody>
</table>

The material and colour of your furniture can play a role in your decision to use warm or cool lights, since the variation of lighting colour can make room colours appear very vibrant or quite dull.

**Correlated colour temperature**

**Unit:** Kelvin

**Role:** scale to describe how ‘warm’ or ‘cool’ the light source appears

**Origin:** in theory, as an object (e.g. piece of metal) is heated, it glows, changing colour from a red to orange to yellow to white to bluish-white as the temperature increases.

**CCT of typical residential lamps:**

- Incandescent lamps: operate by heating the filament to 2,700K and by definition, have a colour temperature of 2,700K
- Fluorescent, CFL and LED lights: available in a wide range of colour temperatures.

Cool white (left) and warm white (right) colour temperature lamps give rooms a different appearance.
Match the lamp’s colour temperature to the tones of your room. Warm colour temperatures render warm colours like reds, yellows and browns well; cool colour temperatures render cool colours like greys, greens and blues better. In rooms following these general rules, furnishings appear more vibrant. If you have a mix of furnishings, use lamps that produce light in approximately the 3,500K range.

No matter what colour temperature light you choose, if it has a low colour rendering index, nothing will look good under it.

CRI rates the ability of the light to accurately portray colours of objects in the space being lit.

- **Colour rendering index**

  - **Unit**: none
  - **Role**: scale between 100 and below 0 where 100 represents true natural colour reproduction for that particular colour temperature
  - **Origin**: a reference source such as sunlight is defined as having a CRI of 100; incandescent lamps radiate a similar spectrum of light to the sun

  - **CCT of typical residential lamps**:
    - Incandescent lamps: 100
    - Fluorescent, CFL lamps: 60–95
    - LED lamps: 80–90

  - **CRI**: 50–70
    - **Fair**
  - **CRI**: 70–80
    - **Good**
  - **CRI**: 80–90
    - **Excellent**

A CRI of higher than 80 is usually adequate but for specialised tasks where colour is important (food preparation, applying makeup, painting) it is advisable to choose lamps with a CRI above 90.

Lamps of the same colour temperature can vary in their ability to render colours correctly.

**Expand your definition of cost**

Buyer decisions are often driven by the price tag on an item, without regard for lifetime costs. Lamp technologies differ fundamentally in their lifetime and power consumption, and both have a significant impact on the true cost of providing light over an extended period. For example, at present the initial price of a halogen lamp is significantly lower than the price of an equivalent LED lamp but an LED lasts five to ten times longer and consumes one-fifth the energy. The true dollar cost thus favours LED. The graph analysis for replacement lamp alternatives to a 75W tungsten filament incandescent lamp (no longer available) shows a starting cost of the price of a lamp, each step representing the replacement cost for another lamp, and the rising continuous line indicating the electricity costs of running the lamp.

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The colour rendering index rates the portrayal of colour.

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Note: All lamps have equivalent light output. Banned 75W incandescent for reference only.

Operating and replacements costs for lamp technologies, based on lifetime and price of 25,000 hours and $50 for LED, 8,000 hours and $6 for CFL, 2,000 hours and $4 for halogen, and 1,000 hours and $1 for incandescent lamps; and electricity rate of 22.759¢ per kWh.

The lamp use of five hours per day as the basis for the graph is typical for commonly used areas such as kitchens and lounge rooms (based on 2012 Residential Energy Monitoring Program, Lighting data collection and analysis study). In rooms with fewer hours of use, the cost shown on the graph will decrease by the same proportion (e.g. half the hours of use per day: half the cost at each point in time).
This type of analysis can be extended to look at the cost for particular lighting arrangements for each room. The table compares three lighting designs for a 5 x 5m living room with four feature items that could be highlighted, for five hours operation a day.

<table>
<thead>
<tr>
<th>Design</th>
<th>Ambient lighting</th>
<th>Accent lighting</th>
<th>Total wattage</th>
<th>Initial lamp cost</th>
<th>Annual running cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>9 x 50W MR16 halogen</td>
<td>nil</td>
<td>~450W</td>
<td>Under $50</td>
<td>~$200</td>
</tr>
<tr>
<td>B</td>
<td>1 x 72W halogen</td>
<td>4 x 20W MR16 halogen</td>
<td>~150W</td>
<td>Under $50</td>
<td>~$70</td>
</tr>
<tr>
<td>C</td>
<td>1 x 23W CFL</td>
<td>4 x 6W MR16 LED</td>
<td>~50W</td>
<td>$200</td>
<td>~$25</td>
</tr>
</tbody>
</table>

Switches and controls

Time of use, hours of use, and occupancy of and traffic through spaces vary in the home. Switches and controls can be a very effective method of providing lighting only when and where it is required.

Some basic principles:

- Provide multiple switches to control different lighting elements (ambient, accent or task) in a room where all may not be required all the time. One switch to turn on all lights in a large room is very inefficient. When choosing switching groups always begin with lighting that is needed most, such as that over the kitchen benches, then work backward. Place switches at exits from rooms and use two-way switching (for long hallways or stairwells) to encourage lights to be turned off when leaving the space.

- ‘Smart’ light switches and fittings use movement sensors to turn lights on and off automatically. These are useful in rooms used infrequently where lights may be left on (for very long times) by mistake, or for children, the elderly and people with disabilities. Built-in daylight sensors make sure the light doesn’t turn on unnecessarily during daylight hours.

- Use timers, daylight controls and motion sensors to switch outdoor security lights on and off automatically. Similar controls are particularly useful for common areas, such as hallways, corridors and stairwells, in multi-unit housing. Some controls are not compatible with particular lamp types so seek advice.

- Consider using solar powered lighting for garden and sensor security lights.

- Modern dimmer controls save energy and also increase lamp life. However, reducing light output to 50% saves only about 25% of the energy (for a halogen lamp). If you dim some lights most of the time, consider replacing them with lower wattage lamps.

- Most standard fluorescent and LED lamps cannot be dimmed (although this is improving), but special dimmers and lamps are available (check packaging or manufacturer’s website for information). When installing new light fittings and controls, check on compatibility.


Switch with passive infrared sensor.
**Non-directional lamps**

<table>
<thead>
<tr>
<th>Bulb Type</th>
<th>Performance range</th>
<th>Quality</th>
<th>Price</th>
<th>Efficacy (lumens/W)</th>
<th>Quantity of light (lumens)</th>
<th>Light distribution</th>
<th>Lifetime (hours)</th>
<th>Colour rendering</th>
<th>Dimmable</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>LED</strong></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>$5–20</td>
<td>&gt; $20</td>
<td>20–40</td>
<td>med</td>
<td>varies</td>
<td></td>
<td>&gt; 20k</td>
<td>excellent</td>
<td>many dim</td>
</tr>
<tr>
<td></td>
<td>$5–20</td>
<td>&gt; $20</td>
<td>20–40</td>
<td>med</td>
<td>varies</td>
<td></td>
<td>&gt; 20k</td>
<td>excellent</td>
<td>many dim</td>
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<td>&gt; $20</td>
<td>&gt; $20</td>
<td>20–40</td>
<td>med</td>
<td>varies</td>
<td></td>
<td>&gt; 20k</td>
<td>excellent</td>
<td>many dim</td>
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<tr>
<td><strong>CFL</strong></td>
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<td></td>
<td>$5–20</td>
<td>&gt; $20</td>
<td>20–40</td>
<td>med</td>
<td>varies</td>
<td></td>
<td>&gt; 20k</td>
<td>excellent</td>
<td>few dim</td>
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<tr>
<td><strong>CCFL</strong></td>
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<tr>
<td></td>
<td>$5–20</td>
<td>&gt; $20</td>
<td>20–40</td>
<td>med</td>
<td>varies</td>
<td></td>
<td>&gt; 20k</td>
<td>excellent</td>
<td>many dim</td>
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<tr>
<td><strong>Linear &amp; circular fluoro</strong></td>
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<td>$5–20</td>
<td>&gt; $20</td>
<td>20–40</td>
<td>med</td>
<td>varies</td>
<td></td>
<td>&gt; 20k</td>
<td>excellent</td>
<td>few dim</td>
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<tr>
<td><strong>Induction</strong></td>
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<tr>
<td></td>
<td>$5–20</td>
<td>&gt; $20</td>
<td>20–40</td>
<td>med</td>
<td>varies</td>
<td></td>
<td>&gt; 20k</td>
<td>excellent</td>
<td>few dim</td>
</tr>
<tr>
<td><strong>Halogen</strong></td>
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<tr>
<td></td>
<td>$5–20</td>
<td>&gt; $20</td>
<td>20–40</td>
<td>med</td>
<td>varies</td>
<td></td>
<td>&gt; 20k</td>
<td>excellent</td>
<td>all dim</td>
</tr>
</tbody>
</table>

LED is a rapidly developing technology; prices are decreasing while performance is improving. CCFL: cold cathode fluorescent lamp.
LED is a rapidly developing technology; prices are decreasing while performance is improving; CCFL: cold cathode fluorescent lamp.

### Directional lamps

<table>
<thead>
<tr>
<th>Bulb type</th>
<th>Lamp colour range</th>
<th>Performance range</th>
<th>Quality</th>
<th>Price</th>
<th>Efficacy (lumens/W)</th>
<th>Available light output</th>
<th>Beam control &amp; range of beam angles</th>
<th>Lifetime</th>
<th>Colour rendering</th>
<th>Dimmable</th>
</tr>
</thead>
<tbody>
<tr>
<td>LED</td>
<td>7000K, 5700K, 4000K, 3500K, 3000K, 2700K</td>
<td>&gt; $20, 20–40</td>
<td>med</td>
<td>&gt; 40</td>
<td>high</td>
<td>good</td>
<td>&gt; 20k</td>
<td>&gt; 80 excellent</td>
<td>all dim</td>
<td></td>
</tr>
<tr>
<td>CFL</td>
<td>7000K, 5700K, 4000K, 3500K, 3000K, 2700K</td>
<td>$5–20, 20–40</td>
<td>med</td>
<td>&lt; 40</td>
<td>low</td>
<td>poor</td>
<td>5–20k</td>
<td>70–80 good</td>
<td>many dim</td>
<td></td>
</tr>
<tr>
<td>CFL</td>
<td>7000K, 5700K, 4000K, 3500K, 3000K, 2700K</td>
<td>$5–20, 20–40</td>
<td>low</td>
<td>&lt; 20</td>
<td>poor</td>
<td>&lt; 5k</td>
<td>&lt; 5k</td>
<td>excellent</td>
<td>few dim</td>
<td></td>
</tr>
<tr>
<td>Halogen</td>
<td>7000K</td>
<td>&lt; $5, 20–40</td>
<td>high</td>
<td>&lt; 20</td>
<td>good</td>
<td>&lt; 5k</td>
<td>&lt; 5k</td>
<td>excellent</td>
<td>all dim</td>
<td></td>
</tr>
</tbody>
</table>

In Australia, only incandescent, CFL and linear fluorescent lamps are regulated for energy efficiency and light quality. Other lamp technologies can vary greatly in quality. Read packaging information and technical specifications carefully to ensure the product is suitable for your intended use.

**Regulations**

Lighting energy efficiency requirements are regulated through Minimum Energy Performance Standards (MEPS) for specific lighting products. Lighting installations in new homes must comply with the requirements of the Building Code of Australia (BCA). Important safety aspects of electric lighting are also covered by Australian Standards.

**Minimum Energy Performance Standards**

In Australia, for most residential lamp technologies (incandescent, CFL and linear fluorescent lamps) inefficient lamps have been phased out and MEPS are in place, which cover aspects of energy efficiency and light quality. For more information see the E3 Equipment Energy Efficiency website: www.energyrating.gov.au.
Energy

Building Code of Australia

The BCA addresses lighting on: the installed power density of artificial lighting and associated controls; heat gains and losses from reduced coverage of ceiling insulation due to downlight and skylight installations; and access to daylight through windows.

Since May 2011, any new home or significant renovation of an existing home must have an aggregate lamp power density of hard-wired electric lighting that does not exceed specified values, which may be reviewed from year to year. Concessions to this rule exist for certain lighting controls depending on their application (BCA Vol 2, Part 3.12.5.5).

For effective minimisation of heat gains and losses in homes, ceiling insulation should ideally form a continuous thermal barrier between the interior spaces of the house and the exterior (see Insulation installation). Each skylight and recessed light fitting, such as a downlight, introduced into the ceiling space creates a ‘hole’ in the insulation barrier. The high operating temperatures of many lamps also demand a fire safety requirement for an additional space between each light fitting and the edge of the insulation to prevent risk of fire (AS/NZS3000:2007, Electrical installations).

Thermal losses through these breaks in a home’s insulation will ultimately increase energy costs for household heating and cooling. The BCA includes a requirement that the minimum thermal resistance of the chosen insulation material be increased to help combat these losses, depending on the percentage of ceiling area that is uninsulated (BCA Vol 2, Part 3.12.1.1b). Also to be considered are:

- provision of light to habitable rooms including minimum area for windows and skylights (BCA Vol 2, Part 3.8.4)

Top ten steps to lighting

1. Design a house to not need lights turned on during daylight hours.
2. Consider the orientation and layout of rooms to best use available daylight.
3. Use surface reflectance of light coloured surfaces, and well positioned pendant and wall lights, for good light distribution in a room.
4. Decide the type or types (e.g. general lighting, mood/background lighting, task lighting) of ambience you wish to create in each room during night-time use.
5. For more than one type of ambience, adjust light levels (dim lights) or turn different lights on or off through different switching circuits.
6. Create task or accent lighting with directional lighting.
7. Create general lighting with non-directional lighting.
8. Use warm coloured lamps for the home, except possibly for bathrooms and laundries where the cooler coloured lamps present an appearance of a clean, sterile space.
9. Before selecting a lamp, identify relevant attributes for illuminating each room (e.g. quick start-up, long life lamp, dimmable, multi-way switching).
10. For getting the ‘right amount of light’ to create the ambience you want, think about lumens, which measure of the total amount of visible light emitted by a source, not wattage (power).

References and additional reading


Energy Rating product list. www.energyrating.gov.au

Illuminating and Engineering Society of Australia and New Zealand (IESANZ). www.iesanz.org


Living Greener. www.livinggreener.gov.au

NZ RightLight. www.rightlight.govt.nz


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