Current and planned BCA energy efficiency requirements for healthcare facilities.

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Abstract

The goal of the Building Code of Australia (BCA) is to enable the achievement of minimum necessary standards of relevant health, safety, amenity and sustainability objectives efficiently. The inclusion of energy efficiency measures in the BCA is part of a comprehensive strategy being undertaken by the Australian, State and Territory Governments to reduce greenhouse gas emissions. Since 2003 the BCA has included Performance Requirements, Deemed to Satisfy Provisions and Verification Methods with the objective of reducing greenhouse gas emissions by using energy efficiently.

Importantly with the current level of understanding of climate change, the philosophy of these provisions is reasonably straightforward. Benefits can be obtained by having a building envelope that has better thermal performance, reducing the size of any equipment needed for heating and cooling with the occupants less likely to feel the need to run the equipment. Improving the efficiency of the equipment itself means that it will consume less energy when it is used. This includes significant non-greenhouse benefits, being the dollar value of the energy reductions plus reductions in the size of air conditioning plant that needs to be installed in more efficient buildings and the overall health of the occupants.

This paper aims to identify the current minimum requirements of energy efficiency requirements and identify the future requirements for healthcare facilities through the use of the BCA.

Keywords: Building Code of Australia, Health Care Buildings, Energy Efficiency

Purpose

The purpose of this paper is to outline the basic requirement of the energy efficiency provisions of the Building Code of Australia 2007. Its current version was adopted on 1 May 2007 in Victoria and similarly in other states and territories, and it forms the basis of building codes in Australia. This paper is not about providing technical details or solutions nor does it set out to explain the engineering principles that make up the energy efficiency provisions, but its purpose is to merely highlight the minimum energy efficiency provisions and the possible future directions of building codes that may affect healthcare buildings. It is assumed that readers will have a level of knowledge of the BCA and have an understanding of its structure and use.

Introduction

The inclusion of energy efficiency measures in the BCA is part of a comprehensive strategy being undertaken by the Australian, State and Territory Governments to reduce Greenhouse Gas (GHG) emissions. The BCA has now been amended to include energy measures for all building classifications.

Climate change is an issue of major significance for all of us. Most of the world's leading scientists agree that climate change is occurring due to, in part, human activity. This presents a challenge to all of us in the way we live and work. It will require action from industry governments at all levels, the broader community and individuals.

On 20 November 1997, the Prime Minister released a statement *Safeguarding the future: Australia's response to climate change.* In this statement, a range of measures were announced to address global warming including the need to seek energy savings form the built environment. After a period of consultation with the building industry, the Australian government announced that the State and Territory Governments had agreed to introduce mandatory energy efficiency standards into the BCA in order to regulate GHG emissions attributable to the operation of the buildings.

The first stage was to introduce energy efficiency measures into the BCA for single dwellings on 1 January 2003 and the next stage was measures for multi residential building on 1 May 2005.The final stage included introducing measures for all other building classification on 1 May 2006

While the building sector is not the largest contributor to greenhouse gas emissions it is one the fastest growing sources. Energy used in buildings accounts for almost 27% of all energy related GHG emissions. By 2010 emissions from buildings due to energy consumption are estimated to increase by 48% above the 1990 levels . Improving the energy efficiency of buildings therefore represents one of the most cost effective ways to easily reduce GHG emissions in Australia.

BCA Philosophy

Since 2003 the BCA has included 'performance requirements', 'deemed-to-satisfy provisions' and 'verification methods' with the objective of reducing greenhouse gas emission by efficiently using energy. The deemed-to-satisfy provisions specify:

- Insulation to the building fabric;
- Measures to control unwanted heat gain or loss through glazing and roof lights;
- Measures to reduce air leakage around the edges of windows, doors and through other penetrations of the building fabrics;
- Measures to facilitate air movement for cooling;
- Minimum efficiency levels for equipment providing services within the building such as lighting or heating ventilation and air conditioning; and
- Insulation to hot water supply pipe work and the ducts, pipes and plant of central heating and cooling systems.

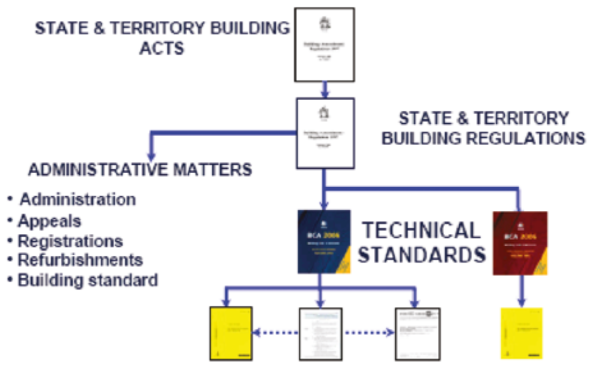
The philosophy underpinning these systems is quite straightforward. A number of benefits are obtained by having a building envelope that has a better thermal performance. It is likely to stay warmer in winter and cooler in summer. This can reduce the size of any equipment needed for heating and cooling and the occupants are less likely to feel the need to run the equipment. Improving the efficiency of the equipment itself means that it will consume less energy when it is used.

Occupant Comfort

The inclusion of energy efficiency measures to the BCA isn't directly about occupant comfort but is aimed at reducing energy demand and greenhouse gas emissions through the reduction in use of heating and cooling services. Occupant comfort is not specifically an objective of the BCA nor is it directly reflected in the performance requirements or deemed-to-satisfy provisions. Making buildings inherently comfortable is a by-product of the overall energy efficiency measures.

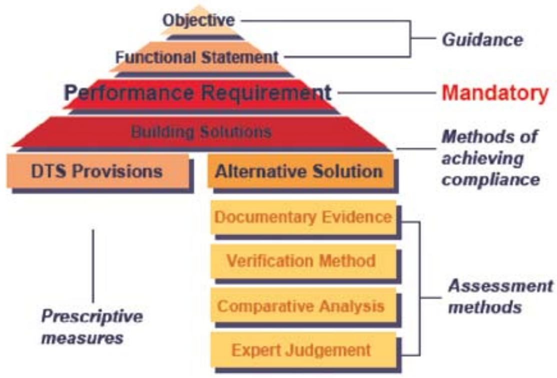
Regulatory Frame Work

The administration of the BCA is the responsibility of the State and Territory administrations. State and Territory administrations incorporate the BCA in their building legislation, which has the result of the BCA becoming part of the construction law. Typically the legal arrangement is such that the BCA contains the technical provisions, while the building administrative procedures are contained in an Act and associated regulations of that jurisdiction.



Performance Based BCA

The BCA was developed into a fully performance based document in 1996. This includes a performance based hierarchy consisting of objectives, functional statements and performance requirements as shown below:



A brief summary of each element is as follows:

- Objectives describe the community expectation for buildings;
- The functional statements describe how building achieves the objectives;
- The performance requirements outline the level of performance which must be met by building materials, components, design factors and construction methods in order for a building to meet the objectives and functional statements.

The performance requirements of the BCA are the only mandatory component of the BCA. Compliance with the performance requirements is achieved by:

- Compliance with the deemed-to-satisfy provisions;
- Use of an alternative solution justified by the appropriate assessment method; or
- Use of both deemed-to-satisfy and alternative solution.

Where an alternative solution is used, it must be proven that it meets the applicable performance requirements. In order to do this, the alternative solution must be assessed by at least one of the specified assessment methods. These are outlined in the BCA as follows:

- Evidence to support the use of material, form of construction;
- Verification methods such as those set out in the BCA or any other verification methods the building approval authority accepts;
- Comparison to the deemed-to-satisfy provisions; or
- Expert judgment.

Other rating systems

This paper does not consider other energy efficiency rating systems such as Australian Buildings Greenhouse Rating (ABGR) or Australia Greenhouse Office's Greenstar rating, although it is accepted that these ratings have a place as a 'best practice' solution. It should be noted that the BCA is a minimum community standard and as such should be used as a minimum level of compliance. The BCA does not prevent the use of these other rating systems. These rating systems can be used through the Alternative Solution process using the assessment methods via the performance requirements. Owners of healthcare buildings may wish to investigate the use of these, and should engage in appropriate qualified persons to provide advice.

Some important BCA terminology

Performance Requirements

Is a mandatory requirement which states the level of performance which a building solution must meet. A building solution will comply with the BCA if it satisfies the Performance Requirements.

Verification Method

Is a test, inspection, calculation or other method that determines whether a building solution complies with the relevant Performance Requirements. Verification methods can be those used in the BCA or such other verification methods as appropriate authority accepts for determining compliance with performance requirements.

Envelope

The term 'envelope' defines the area that either contains habitable rooms or areas that are conditioned and should be protected against unnecessary energy loss or gain.

The envelope of the building can include internal and external elements depending on the conditioned space or habitable room. A building envelope is not limited to a storey or sole occupancy unit and can extend through multiple floors of a building and non related tenancies.

Solar Heat Gain Co-efficient (SHGC)

The SHGC is a measure of how well glazing, including the glass and frame, resists heat flow as a result of the energy of sunlight. The SHGC is expressed as a fraction of incident solar radiation that is admitted through a window, both directly transmitted and absorbed and then released inward. SHGC is expressed as a number between 1 and 0. The lower the SHGC the less solar energy it transmits.

Total U-value

The BCA contains a definition for the total U-value which includes air films. In simple terms the U-value is the opposite of the R-value as an expression. A U-value addresses the ability of a material to conduct heat, while the R value measures the ability of a material to resist heat flow. The higher the U-value number, the greater that amount of heat that can pass through that material. A lower value is therefore a better insulator.

Conditioned space

Means a space within a building where the environment is likely by its intended use to be controlled by air conditioning. This excludes a space in a Class 7, 8, and 9 where the input power to an air conditioner system is not more than 15W/m2. This would generally exclude portable or spot heating or cooling.

Building classification

Although this paper has the purposes of identifying the healthcare requirements it is important to understand the classification structure of the BCA. The classifications of buildings are provided for the reader's information.

- Class 1 – Housing and small boarding houses
- Class 2 – Apartments
- Class 3 – Hotel, motel, hostel, guesthouse
- Class 4 – Single dwelling within commercial building
- Class 5 – Office
- Class 6 – Retail
- Class 7 – Car park, warehouse
- Class 8 – Factory
- Class 9 – Hospitals, cinema, stadium, hall, aged care
- Class 10 – Garage, carport, shed, fence, wall

Current BCA Requirements for Healthcare Buildings

Performance Requirements

The performance requirements specified in Part J of the BCA are as follows:

JP1

A building, including its services, must have features that facilitate the efficient use of energy appropriate to:

- Function and use of the building and service
- Internal environment
- Geographic location of the building
- Effects of nearby permanent features
- Solar radiation being utilised for heating and controlled to minimise energy for cooling
- Sealing of the building envelope against air leakage
- Utilisation of air movement to assist heating and cooling
- Energy source of the building

JP2

A building, including its services, must have features that facilitate the maintenance of systems and components appropriate to the function and use of the building.

Performance Requirement JP1 relates to the energy efficiency provisions to be installed in a building to facilitate the efficient use of energy. This performance requirement directly corresponds to the Deemed-to-Satisfy provisions J1 to J7.

Performance Requirement JP2 relates to the maintenance of such energy efficiency provisions. This performance requirement relates directly to the Deemed-to-Satisfy provisions J2 and J8.

Verification Methods

The scope of JV includes the following:

- JV1 is applicable to the sole occupancy units of a Class 2 and a Class 4 part of a building.
- JV2 is applicable to all Class 3, 5, and 9c aged care buildings and to certain Class 6, 8, 9a and 9b buildings; and
- JV3 like JV2 is applicable to all class 3, 5, and 9c buildings, aged care buildings and certain Class 6, 8, 9a and 9b buildings.

The intent of any verification method is to demonstrate that an alternative solution meets the performance requirements. They essentially provide flexibility where the prescriptive deemed-to-satisfy provisions are sometimes too rigid or do not work for certain building designs. The verification methods can allow for innovation and better use of a building's fabric and services in order to make the building more energy efficient.

The fundamental difference between JV1 and the other two Verification methods is that JV1 is about the annual energy load that needs to be met by the air conditioning plant while JV2 and JV3 are about the energy consumed by the building's air conditioning plant, lighting etc. JV1 does not include the efficiency of the air conditioning plant.

It should be noted that the verification methods are not mandatory and other verification methods outside of the BCA may be used. Their use and appropriateness is subject to the final approval by the relevant building approval authority.

Verification Method JV1 – verification using stated value for Class 2 and Class 4 part buildings

This is the only verification method for Class 2 buildings and Class 4 part building. Verification Method JV1 allows the use of house energy rating software programs . These computer software packages only assess the building fabric and envelope characteristics to determine the energy load and star rating. They do not assess the services within a building.

In relation to the deemed-to-satisfy provisions, Verification Method JV1 may be used to satisfy the following deemed-to-satisfy parts:

J1 – Building fabric

J2 – External glazing

J3 – Building sealing

J4 – Air movement

This verification method does not satisfy Parts J5, J6, and J7 and thus the building must either still comply with the deemed-to-satisfy provisions of these parts including maintenance provisions under Part J8 and J2, or use some other assessment method to demonstrate compliance.

Verification Method JV2 – verification using stated value

The verification method JV2 is based on calculating the annual energy consumption and then comparing the calculated annual energy consumption with a stated value specified in the BCA.

Annual energy consumption means the theoretical amount of energy used annually by the building services. It is calculated using a software package that is capable of assessing the contribution of the building fabric, air infiltration, outside air ventilation, internal heat sources and services such as air conditioning systems and artificial lighting all specifically for the building use and location.

Two scenarios must be considered for the solution to comply with JV2. These are:

- The annual energy consumption of the proposed building with the proposed services is not more that the annual energy consumption stated value allowance specified in Table JV2 ; and
- The annual energy consumption of the proposed building with its services modelled at the minimum standard specified in the deemed-to-satisfy provisions. The annual energy consumption must not be more than the annual energy consumption stated value allowance specified in Table JV2. However, the scenario is also modelled to prevent the envelope from being downgraded for enhanced building services.

Verification Method JV3 – verification using a reference building.

Verification method JV3 can only be used for certain classes of buildings, being 3, 5, 6, 8 and 9 buildings, and it applies to both the building envelope and its services. Like JV2, the basic method is that two scenarios are assessed:

- The annual energy consumption of the proposed building with the proposed services is not more that the annual energy consumption allowance of the complying deemed-to-satisfy reference building with complying deemed-to-satisfy services.
- The annual energy consumption of the proposed building is not more than the energy consumption allowance of a reference building using the same complying deemed-to-satisfy services in both cases.

The annual energy consumption is calculated using an energy analysis software package . This verification method is similar to JV2 except rather than using a stated energy allowance the use calculates their own allowance using a reference building. This establishes the theoretical annual energy consumption that would have been achieved had the building been built with the deemed- to-satisfy provisions.

This method requires three computer modelling runs:

1 proposed building with proposed services

2 proposed building with deemed-to-satisfy services

3 reference building with deemed-to-satisfy fabric and deemed-to-satisfy service

Deemed-to-Satisfy Provisions

Building fabric – Part J1

The intent of J1 is to ensure that the construction around the air conditioned space has sufficient levels of thermal performance to ensure that energy is not used unnecessarily due to the influence of the external environment and the controlled environment within. The measures in Part J1 achieve an outcome by requiring certain elements to have minimum levels of insulation either through adding insulation, such as batts or membranes throughout, or the inherent thermal qualities of the building fabric, for instance the thermal mass of a masonry wall.

The fabric requirements are based on recognition of the predominant annual external climactic conditions. For instance in Melbourne the predominant annual energy usage is for heating due to the long cooler months and night time use. Accordingly the BCA provisions are designed to ensure the building uses the least amount of energy to heat the occupied areas.

The building fabric provisions of the BCA address the following elements of a building and can be summarised as:

- Roof and ceiling construction, including both internal elements between conditioned or potentially conditioned spaces and non conditioned spaces, and external elements. Ceilings are not limited to the area immediately below the roof and now include the ceiling between conditioned space and non conditioned space such as a plant room.
- Roof lights installed at an angle of between 0 and 70 degrees measured from the horizontal plane. Roof lights that fall outside of this parameter are considered to be windows and are addressed within the glazing provisions (Part J2).
- Walls both external and some internal walls that separate conditioned and non conditioned space.
- Floors – similarly this includes elements that separate conditioned and non conditioned spaces. The provisions address all such floors depending on construction type and not those immediately above or below ground level.
- Achieve Total R-Value listed in BCA Tables.
- Options for compliance in BCA Specifications.
- Other solutions can be used providing they have been tested and meet nominated Total R-Value.
- Thermal break requirements where metal frame member connects roof cladding and inner lining and must be not less than R0.2.

Glazing – Part J2

The most important measures in reducing the energy consumption of a freestanding building is the treatment of glazing and the insulation of the walls, floors, roofs and ceilings. Where the roof and walls may influence only a small proportion of the building's overall performance of heating and cooling needs, treatment of the glazing is likely to be the most important part.

Many factors contribute to heat loss or gain through glazing on a building including:

- The location of the building;
- The total area of the glazing;
- The types of glass and frame used; and
- The likelihood of the building being air conditioned for long periods.

The BCA deemed-to-satisfy provisions consider two major thermodynamic effects on glazing:

- Heat conduction through the glass and frame by virtue of temperature difference between inside and outside; and
- Solar radiation through the glass into the building.

The BCA provides two assessment methods which apply to buildings of different classification and sizes. The first method (Glazing Method 1) is for residential type building and small Class 6 (retail) building and the second method (Glazing Method 2) is for Class 5-9 buildings.

The equations in both methods take into account area and thermal performance of the glazing unit , its solar orientation and external shading projections or shading devices. The methods differ in terms of what is calculated. Glazing Method 1 considers heat flows in buildings that will not necessarily be air conditioned and Glazing Method 2 accounts for the impact of air conditioning energy use in the building where it is likely to be air conditioned for long periods of time.

Calculation can be done long hand or be automated using spreadsheet software discussed later in this paper.

Glazing method 1

The basic requirements of glazing method 1 are to:

- Separately assess the conductance and solar heat gain of the glazing in each sole occupancy unit, public space or other occupied space and to do those two assessments for each storey of each sole occupancy unit or space;
- Calculate the allowable conductance and allowable solar heat gain through the glazing on each storey of each sole occupancy unit public space or other occupied space; and
- Calculate the aggregate conductance and aggregate solar heat gain though the glazing on each storey of each sole occupancy unit or space, using the method specified in the BCA and confirm that they do not exceed the allowable conductance and the allowable solar heat gain calculated above.

In summary glazing method 1 requires the following:

- Calculate for each storey of a sole-occupancy unit;
- Aggregate conductance ≤ area of floor x constant for conductance (CU);
- Aggregate solar heat gain ≤ area of floor x constant for SHGC (SHGC);

A summary of the Glazing Method 1 formula is shown below:

Aggregate conductance = (A1 x U1) + (A2 x U2) + …….

- A1 is the area of glazing element 1
- U1 is the conductance of glazing element 1

Aggregate solar heat gain coefficient
= (A1 x SHGC1 x E1) + ……

- A1 is the area of glazing element 1
- SHGC1 is the solar heat gain coefficient of glazing element 1
- E1 is the solar exposure factor of glazing element 1

A note of caution: U-value and SHGC can be found on manufacturer's literature. Be careful as the SHGC and U values may only be listed for the glass and may not include the frame details.

Glazing method 2

Glazing method 2 is based on annual dynamic energy consumption. As previously identified, it is intended for buildings which are fully air conditioned and have high daytime use such as healthcare buildings. The main difference is about controlling the annual energy consumption rather than reducing the seasonal peak heating and cooling loads.

Similarly with Method 1, the calculation lends itself to being expressed in a spreadsheet; however it is a single formula that covers the total air conditioning energy consumption for a full year. The formula must be applied to each façade on each storey of the building.

The basic requirements are:

- Separately assess the glazing facing each orientation and in each storey;
- Determine the individual allowances for each façade by multiplying the façade areas by energy index taking into account the level of insulation in the opaque portions of the façade; and
- Calculate the aggregate air conditioning energy value of the glazing facing each orientation on each storey.

In summary the glazing method 2 formula is as follows:

Aggregate A/C value =

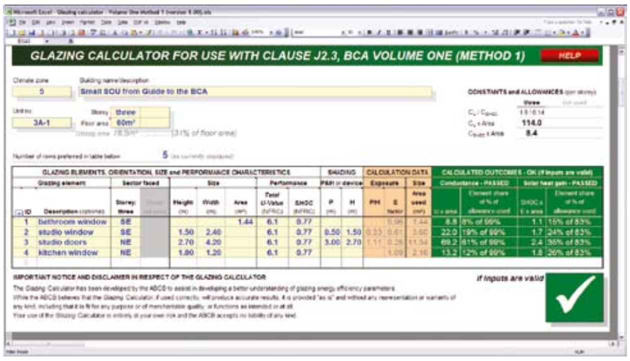
A1[SHGC1(CAxSH1+CBxSC1)+CCxU1] x
A2[SHGC2(CAxSH2+CBxSC2)+CCxU2] + ………

Where: A is the area of the glazing element

- SHGC is the solar heat gain coefficient of the glazing element
- CA, B & C are the constants for the orientation (BCA Table J2.4b)
- SH is the heating shading multiplier (BCA Table J2.4c)
- SC is the cooling shading multiplier (BCA Table J2.4d)
- U is the Total U-Value of each glazing element

Glazing calculators

Separate glazing calculators have been developed by the ABCB to assist with the calculation required under the 2 methods. Both calculators are based on Microsoft Excel and can be downloaded from the ABCB website . A designer only needs to input the data into the spreadsheets and the calculations will be carried out to determine the allowance and compare them with the aggregate performance of the proposed glazing.



Sample screen shot of the glazing calculator for glazing method 1.

Building sealing – Part J3

Building sealing provisions have been developed to control unwarranted air movement through a building. The building sealing provisions address the following elements of a building:

- Chimneys and flues;
- Roof lights;
- External windows
- Exhaust fans
- Construction of roofs, walls and floors; and
- Evaporative coolers.

The provisions have been developed to address conditions most likely to be experienced in the eight climate zones adopted by the BCA.

The intent of Part J3 is to introduce sealing measures that restrict the air flow of unwarranted outdoor air into and out of a building. Drafts associated with air movement through poorly sealed external openings and construction gaps can influence the behaviour of the building's occupants. The air flow through these openings has the potential to reduce the comfort level within the building which in turn will cause an increase in the use of the heating and cooling systems to overcome this discomfort.

A summary of this part is outlined below:

Application - Class 2 – 9 other than:

- – Class 6, 7, 8 or 9b without conditioned spaces
- – Permanent ventilation opening for the safe operation of gas
- – Building or space where Part F4 ventilation provides pressurisation to prevent infiltration
- – Atrium or solarium that is not conditioned and separated from remainder of building

Chimneys and flues

- – Open solid fuel burning appliances to be provided with damper or flap

Roof lights

- – Roof lights to be sealed to prevent leakage

External windows and doors

- – Seals to be provided to openable windows and external doors
- – Exceptions
  - AS 2047 windows
  - External louvre door, louvre window
  - Fire door

Main entry point leading to a conditioned space more than 50 m², either:

- – Airlock
- – Self-closing door
- – Revolving door

Does not apply for shop/café where there is a 3 m unconditioned zone at the front

Exhaust fans

- – Be provided with self-closing damper, filter or the like

Construction of roofs, walls and floors

- – Need to be sealed to prevent air leakage
- – Caulking, skirting, architraves, cornices or the like are suitable

Evaporative cooler to be provided with self-closing damper

Air movement – Part J4

The intent of Part J4 is to reduce the use of air conditioning systems by taking into account the natural cooling effect provided by air movement. Ventilation openings are required to be deigned to allow the interior of a Class 2 building or Class 4 building to take full advantage of any natural breeze. Facilitating the design of a building to enable cross flow ventilation may reduce the frequency of cooling services being used in a building.

In summary Part J4:

- Applies only to a habitable room in a sole occupancy unit of a Class 2 or class 4 part of a building; and
- Does not apply to Class 3, or 5 – 9.

Note: The Victorian variation only applies to Class 4 in climate zone 4

Air conditioning and ventilation systems – Part J5

Efficient design of air conditioning systems and ventilation systems is essential for the building's environmental management. As people's expectation for higher internal comfort levels increases, there is a corresponding demand on systems to provide comfort.

Research detail in the Australian Greenhouse Office final report into greenhouse gas emissions indicates that heating and ventilation systems are expected to produce up to 13 percent of the greenhouse gas emissions in the year 2010 if current energy usage patterns continue.

The provisions of Part J5 relate to the mechanical systems that actively heat or cool a space and include provision for:

- Ductwork insulation
- De-activating room conditioners when the room is not occupied
- Thermostatic temperature controls
- Outside air cycles
- Car park ventilation control
- Energy consumption of fans and pumps
- Not mixing hot and cold air to provide temperature control.
- Time switches
- To ensure that air conditioning and ventilation systems are only activated when a building's areas are occupied or likely to be occupied
- Insulation of holding tanks
- Water circulation for pump power
- Energy efficiency ratios for packaged air conditioners
- Energy efficiency ratios for refrigerant chillers
- Thermal efficiency requirements for gas and oil fired boilers
- Operational controls for exhaust systems.

Application of this provision is likely to require specialist input in conjunction with manufacturer's data validating the performance of the conditioning system in order to enable the approval authority to assess the proposal against the requirements of the BCA. Appropriately qualified mechanical engineers should ideally be specialists in air conditioning. It may be necessary to validate their experience before accepting their documentation.

Part J5 can be summarised as follows:

- Air conditioning systems:
  - Capable of being inactivated when sole-occupancy unit (SOU), building or part not occupied
  - Ductwork insulated in accordance with Specification J5.2
  - When serving more than one SOU or zone which have differing needs, have thermostatic controls in each SOU or zone
  - Systems of more than 50 kWr, have an outside air cycle
- Similar requirements for mechanical ventilating systems
- Exceptions
  - Smoke hazard management
  - Essential ventilation such as garbage room, lift motor room, etc.
- Time switches
  - Time switches to be provided on power supply for:
- Air conditioning system (> 10 kWr)
- Ventilation system (> 1000 L/s)
- Heating system (> 10 kWheating)
- Time switch must comply with BCA Specification J6
- Heater and chiller units
  - Systems providing heating or chilling for air conditioning must:
- Have piping, vessels and tanks insulated to Spec. J5.4
- Where water circulated is greater than 2 L/s:
- Comply with maximum motor shaft power requirements
- Have variable speed when operating more than 3,500 hours per year or more than 11 kW of motor shaft power
- Efficiency requirements for boilers, package air conditioning plant, refrigerant chillers, air-cooled condensers and cooling tower fans

Artificial lighting and power – Part J6

The BCA measures for artificial lighting and power are designed to curb unreasonable energy use in the lighting systems in all buildings except the sole occupancy unit of Class 2 buildings and Class 4 buildings.

The main concerns of this part are that lighting is often installed in excess of the lighting required for the task, and that inefficient fittings are used. For instance, ambient lighting installed for aesthetic or mood purposes is not generally required for safety or operational purposes and there are opportunities to save power by restricting excessive usage.

The requirement of Part J6 addresses the following elements:

- Artificial lighting controls for the amount of energy used in light fittings by specifying the maximum lamp power density in defined locations and the maximum illumination power density
- Control switching arrangements which include the use of motion detectors or key holders
- Control of interior lighting and power
- Artificial lighting around a building
- Decorative and display lighting
- Boiling water and chilled water storage units.

This part also provides specifications and further information on appropriate design requirements for corridor lighting, time switches, motion detectors and daylight sensors and dynamic lighting control devices.

Hot Water Supply – Part J7

The hot water supply provisions have been developed to minimise the amount of energy used in providing sanitary hot water to the building, specifically to control the loss of heat from hot water systems and storage water heaters that heat and supply water.

Storage water heaters operate by maintaining stored water at a specified temperature irrespective of when the water is to be used. Maintaining water at a temperature above ambient will incur energy loss. Accordingly measures have been put in place to reduce the amount of heat loss from these units which in turn will provide tangible reductions in greenhouse gas emissions.

The other aspect of this provision is the requirement to insulate hot water supply pipes irrespective of whether the pipes are fitted to a storage hot water unit or an instantaneous hot water unit. Once again the requirements are intended to prevent the loss of heat from hot water within piping and reduce the amount of energy required to heat the water.

The main detailed requirements are contained within AS3500.4, Plumbing and Drainage, heater water services. People need to be aware that when using the BCA provisions, state and territory plumbing legislation may already require compliance with the Standard irrespective of the BCA requirements, such as are already in place in Victoria. Part J7 does not apply in Victoria .

Access for Maintenance – Part J8

Building owners and designers should appreciate that effective design is not only concerned with the needs of the building's occupants but also to ensure that the building infrastructure, including services, can be maintained. Considered design will ensure that the building functions as intended and the internal environment retains its appeal for the occupants, while reducing long term building running costs and possible health implications.

Requiring the building to be designed with room to reach the equipment to conduct the appropriate maintenance work should be considered. Such work may be able to be conducted from portable facilities, however consideration may need to be given to more long term fixtures such as working platforms. The BCA introduced maintenance access provisions to ensure that this important function is integral to the building design prior to being approved for construction.

Features that require on-going maintenance must be accessible for maintenance:

- Adjustable or motorised shading devices
- Time switches, motion detectors and push button timers
- Room temperature thermostats
- Plant thermostats such as on boilers or refrigeration units
- Motorised air dampers and control valves
- Reflectors, lenses and diffusers of light fittings
- Heat transfer equipment.

Future Directions

The introduction of energy efficiency within the BCA and the effect of these provisions on new buildings is well documented. The future challenge for all state and territory regulators is how these provisions will be enhanced to drive innovation and encourage best practice in the areas of energy efficiency and sustainability.

These will include:

- Maintenance of the current Part J energy efficiency provisions to ensure that they will meet the communities' minimum expectation on efficiency and sustainability
- Adoption of second generation '5 Star' requirements, with greater emphasis on appliances and fixtures in buildings
- Further work to provide a consistent approach to alterations and additions to existing building stocks including the removal of state variations to the BCA
- Improving the environmental sustainability of building materials which may include:

Options to reduce greenhouse gas and other impacts like:

- Reducing the size and material intensity of buildings by optimising design processes for both operational and embodied impacts (including at refit and renovation)
- Further improving the efficiency of materials use, and reducing waste, through design, construction, and demolition stages
- Optimising the environmental performance of materials individually through process, manufacturing and supply-chain innovation, including in product durability
- Optimising the performance of materials in use through specification for best cradle-to-cradle performance within given assemblies
- Designing for the life of buildings – alterations, 'churn' and design for disassembly (design for disassembly in non-residential buildings has the potential to deliver significant savings in total materials flows, with economic benefits to building owners, facility managers and tenants over the building life).

Design principles to make buildings more adaptable like:

- Using an open building system – this will allow alterations in the building layout through the relocation of components without significant construction work
- Using assembly technologies that are compatible with standard building practice
- Separating the structure from the cladding
- Providing access to all parts of the building and all components
- Using components that are sized to suit the intended means of handling
- Providing a means of handling components during disassembly
- Providing realistic tolerances to allow for movement during disassembly
- Using a minimum number of different types of connectors
- Using a hierarchy of disassembly related to expected life span of components
- Providing a permanent identification of component types.

In the same way that energy efficiency measures in buildings have benefited from taking a national approach through the BCA there is a need for water use in buildings to be the focus of a nationally consistent approach now with the inclusion of sustainability in the mandate of the ABCB.

Improving the water efficiency in Australia will require a range of measures which need to have flexibility to encourage best practice and innovation, whilst eliminating poor practices. A scoping study to investigate water efficiency in buildings, prepared for the Australian Greenhouse Office, outlined possible future directions and could include:

- Develop specific water efficiency requirements for new buildings and major renovations. The performance measures could be similar to the energy efficiency provisions within the BCA. They would need to be flexible to take into account the different climatic conditions across Australia.
- Require the use of minimum performance standards for fixtures and appliances in new buildings and alterations. This could be based on the Water Efficiency Labelling and Standards (WELS) scheme.
- Build a nationally consistent approach for the inclusion of rainwater harvesting in new buildings and major alterations and setting the appropriate range for use of rainwater in buildings.
- Require the plumbing in new buildings and renovations to facilitate the ease of future rainwater tank installations, third pipe and grey water systems.
- Develop new and review existing standards for the performance, safety and water efficiency of products including rainwater tanks, grey water systems, cooling towers and evaporative coolers
- Review current Australian standards such as AS1851 testing of fire safety systems, to reduce the use of potable water in testing these systems
- Provide performance standards in the BCA on water use in cooling towers and other hydraulic systems used in commercial (Class 5-9) buildings.
- Align planning and building controls to ensure that new buildings meet performance targets prior to planning and building approvals.

There also needs to be consideration of existing building stock when developing new building regulation. Improving existing building might include the following:

- Development of national benchmarks for measuring water efficiency – particularly in the use of water rating tools, notably for public buildings.
- Review systemic water pressure levels and install main pressure or flow reduction devices where necessary. It is noted that water authorities in Melbourne have already started to undertake this work.
- Require building to be upgraded to meet water use efficiency requirements within the building and plumbing codes upon the sale of the building or within a specific time frame.
- Require that replacement fittings/appliances must meet certain minimum standards.

Conclusions

The goal of the Building Code of Australia (BCA) is to enable the achievement of minimum necessary standards of relevant health, safety, amenity and sustainability objectives efficiently. The inclusion of energy efficiency measures in the BCA is part of a comprehensive strategy being undertaken by the Australian, State and Territory Governments to reduce greenhouse gas emissions. Importantly with the current level of understanding of climate change, the philosophy of these provisions is reasonably straightforward.

It is important to identify the current minimum requirements of energy efficiency requirements and identify the future requirements for healthcare facilities through the use of the BCA to ensure that all healthcare buildings provide a minimum level of energy efficiency in which healthcare providers can contribute to the abatement of Australian Greenhouse Gas emissions and deliver economic, as well as social and environmental, benefits to the community.

Future direction must include a greater emphasis on sustainability and a national approach through the Building Code of Australia including water use in buildings. Improving the water efficiency in Australia will require a range of measures which need to have flexibility to encourage best practice and innovation.

Further information

www.greenhouse.gov.au/buildings

www.buildingcommission.com.au

www.abcb.gov.au