Sustainability

BLUESCOPE STEEL

Mandatory Sustainability Requirements for Residential Buildings in Australia

BlueScope Steel Ltd. (BlueScope Steel) has made a commitment to continually improve the company's environmental footprint and the sustainability of its products and services.

This is the fifth in a series of technical bulletins relating to sustainability issues that directly or indirectly impact the steel value chain. In writing these bulletins BlueScope Steel wishes to inform and educate the market, based on the latest available and verifiable information.

This technical bulletin briefly outlines the legislation that has been adopted by States and Territories across Australia in an effort to improve the sustainability of the residential housing stock.

While the Building Code of Australia (BCA) provides the basis for most of the energy and water efficiency requirements, States and Territories are also able to mandate additional performance criteria, as well as determine how and when to adopt the BCA standards.

BlueScope Steel products can be used in greener building design to improve energy efficiency, reduce energy and water demand, thereby helping developers and home owners meet mandatory provisions for resource efficiency and thermal comfort.

Other technical bulletins in this series related to mandatory sustainability requirements for residential buildings in Australia include:

3. Voluntary Green Building Ratings Tools in Australia;
7. Sustainable Building Solutions: Thermal Mass; and
8. Steel in Sustainable Buildings.

1. The Basis for Mandatory Sustainability Requirements

As climate change becomes an increasingly important issue, finding ways to reduce greenhouse gas (GHG) emissions and water and energy demand is now a priority of state and federal governments. The domestic housing sector has been targeted over the last decade as an area for no-regrets policies.

Including green building principals in the design of new and renovated buildings not only decreases energy demand (and GHG emissions) and reduces the pressure on scarce water resources, but also makes high quality, comfortable homes more affordable to live in.

New buildings and major renovations have become the focus for policy-makers because it is at the design phase that the greatest efficiency gains can be achieved. Efficiencies created by design are also independent of the choices that those occupying a building may make.

For example, there is no reliance on consumers making a choice to purchase energy efficient appliances. Mandatory standards currently focus on the use phase, rather than the full life cycle, of a building. Therefore, there is limited assessment of the amount of embodied energy in a building, the life span of a building (or its components) or the energy required to demolish a building at the end of its life.

Compliance of a building design with the legislated standards is usually assessed by a certified assessor and may involve the use of modelling tools. The design features become part of the plan submitted to council to gain building approval. Compliance is typically achieved by meeting a series of prescriptive rules. However non-prescriptive methods are also available, which allow designers and builders the flexibility to develop innovative methods to meet the standards.

2. Federal Level Initiatives

2.1 The Building Code of Australia

The Australian Building Codes Board (ABCB) has worked in conjunction with the Australian Greenhouse Office since 2000 to develop the energy efficiency provisions that are now part of the Building Code of Australia (BCA). The BCA forms the basis for energy efficiency policy throughout Australia.

Energy efficiency provisions for new residential buildings (Class 1 and 10 buildings) were first introduced into the BCA on 1 January 2003. The provisions vary depending on which climate zone a building is located. The provisions were developed to achieve energy efficiency equivalent to about a 3.5 to 4 star rating. The 2006 BCA increased energy efficiency measures to the equivalent of approximately a 5 star rating.

Star ratings are determined from modelling on the basis of the amount of energy a building is deemed to use for heating and cooling. There are various common modelling tools available. The ABCB Protocol for House Energy Rating Software defines the minimum set of information that must be used by all modelling tools accredited to rate homes. This ensures that ratings are consistent and repeatable, irrespective of the modelling tool selected or geographic location of the dwelling. Homes of good practice in each climatic zone should receive a similar rating.

The star rating system currently operates on a 10 star system. A rating of 0 stars would reflect that a building shell does practically nothing to reduce the discomfort of hot or cold weather. A 5 star rating indicates that a building has good thermal performance. A 10 star home would be unlikely to need any artificial cooling or heating.

In 2010, the BCA (Part 3.12 Energy Efficiency) was amended with provisions to achieve the equivalent of approximately a 6 star energy rating. The latest initiatives include energy efficiency requirements for hot water in new houses and lighting in new houses and apartments, with all proposals being subject to regulatory impact assessment. NSW, the Northern Territory, Tasmania, Victoria and Western Australia have not adopted the 2010 (6 star) provisions at this time.

The BCA for housing now includes energy efficiency provisions for:

- *building fabric*: includes provisions for installation of insulation and the use of light roofing colours;
- *external glazing and shading*: includes restricting maximum window sizes and/or using thermally improved glazing;
- *building sealing*: includes using seals around doors and windows.
- *air movement*: includes provisions for minimum opening areas and breeze paths to allow free cooling;
- *air conditioning and ventilation systems*: includes provisions for insulating and sealing ductwork; and
- *hot water supply*: includes provisions for the insulation of the unit and piping and for energy efficient hot water heaters (including solar, heat pump and gas systems).

2.1.1 Modelling Tools

Thermal modelling tools may be used as a verification method for achieving compliance with the BCA. There are currently three second-generation models that comply with the ABCB Protocol for House Energy Rating Software:

- AccuRATE (formerly NatHERS);
- FirstRate5 (formerly FirstRate); and
- BERS Professional (BERS Pro).

All three models are similar, as they rely on the same base simulation engine. However, the user interfaces differ, which affects the inputs required, output generated and the ease of use. All tools provide a star rating on a 0-10 star scale, and incorporate the full range of Australian climate zones.

2.2 NABERS Mandatory Disclosure

The National Australian Built Environment Rating System (NABERS) is a national initiative managed by the NSW Government (Department of Environment, Climate Change and Water). It is a performance-based rating system designed to assess the operational efficiency of existing residential, office (owners and occupiers), retail and hotel buildings. NABERS aims to measure the sustainability of buildings when in use, the assessment does not take the construction, maintenance or end-of-life phases of properties into account.

NABERS is currently comprised of four tools:

- NABERS Energy [formally the Australian Building Greenhouse Rating (ABGR)];
- NABERS Water;
- NABERS Waste; and
- NABERS Indoor Environment.

NABERS was developed as a voluntary assessment tool, but with the commencement of the *Building Energy Efficiency Disclosure Act 2010* (1 July 2010), disclosure of NABERS Energy ratings will become mandatory for most commercial office spaces (greater than 2000m^2) from 1 November 2010.

There is a transition period for the first year of the program, where disclosure of a valid NABERS Energy base or whole building rating, will be deemed to comply. However, from 1 November 2011 a full Building Energy Efficiency Certificate (BEEC) will need to be disclosed. BEECs are valid for 12-months, must be publicly accessible on the online Building Energy Efficiency Register, and include:

- The NABERS Energy rating for the building;
- An assessment of tenancy lighting (over the previous 12-months) in the area of the building that is being sold or leased; and
- Guidance on improving energy efficiency.

Table 1: Current mandatory requirements for new residential buildings, and some residential renovations, adopted in each jurisdiction to improve sustainability.

JURISDICTION	BCA 2009	BCA 2010	ADDITIONAL REQUIREMENTS							
				Energy Efficiency			Water Efficiency			
			Programme	Reduction Targets or Measures	Building Fabric	Water Heating	Reduction Targets or Measures	Fixtures & Fittings	Rainwater Collection	Greywater Reuse
NSW	√		BASIX	√	√		√			
VIC	√		5-Star Homes		√	√*		√	√*	√*
QLD		√					√			
SA		√			√	√			√	
WA	√					√		√		
NT	√									
ACT		√								
TAS	√									

NB: The prescriptive rules of BCA 2009 target an energy efficiency rating of approximately 5 stars, while BCA 2010 targets a 6 star energy efficiency rating.

* In Victoria, the requirement for new Class 1 buildings is to have either a rainwater tank connected to all sanitary flushing systems, or a solar water heater system installed in accordance with the Plumbing Regulations 2008.

The NABERS Energy star rating must also be included in any advertisement for the sale, lease or sublease of the office space.

3. State Level Initiatives

Each state and territory has a degree of flexibility on when and how BCA standards are implemented. Some jurisdictions have additional mandatory requirements that are above those dictated by the national provisions, while some have amended the provisions to account for their geographic location or current building practices. For example, because of current building practices, heavy weight concrete block walls are not required to have additional insulation in climate zones 1 & 2 (the hot, humid areas in the far north of Australia). Further, the Northern Territory has yet to implement some of the 2009 BCA standards because of concerns about the modelling tools and the assessment of homes in tropical and hot, arid climates, in particular, how they account for natural ventilation.

Each state or territory applies similar energy efficiency requirements for alterations or additions to buildings as they do for new developments. In some instances, this may require bringing the entire home up to the acceptable standard.

The table above (*Table 1*) summarises the legislation currently enacted in each jurisdiction.

3.1 Beyond The BCA

Several jurisdictions have implemented standards that are additional or different to the national provisions of the BCA – typically referred to as state variations. Some of these variations include different mandatory provisions regarding water and energy efficiency (*Table 1*).

3.1.1 NSW BASIX

NSW BASIX covers the bulk of the national BCA energy efficiency provisions. The specific aims of BASIX are to ensure that homes are designed to use less potable water and be responsible for fewer GHG emissions. This is achieved by setting water and energy reduction targets, as well as targets for thermal comfort. Currently the targets are a reduction of up to 40 per cent of the potable water use and GHG emissions of the average home. Energy targets vary according to building type and location: water targets incorporate regional variations such as soil type, climate, rainfall and evaporation rates. Thermal comfort assesses the home's efficiency at staying warm in winter and cool in summer. The thermal comfort measures required under BASIX are similar to the national BCA requirements.

While BASIX is generally non-prescriptive (i.e. any of the range of design and fittings strategies that reduce energy and water use can be used to meet the targets), building fabric measures are more prescriptive to meet thermal comfort targets.

3.1.2 Victoria 5 Star Homes

As well as a 5 star building fabric rating (achieved via the national BCA provisions (2009) or prescriptive measures), all new homes – and significant alterations – require water saving fixtures and

the installation of either a rainwater tank connected to all sanitary flushing systems or a solar hot water system[1,2].

3.1.3 Queensland

All new residential buildings, including detached houses, townhouses, terrace houses and villas, must meet mandatory water savings targets[3,4], which can be achieved through a number of options including:

- household rainwater tanks;
- dual reticulation;
- communal rainwater tanks;
- stormwater reuse; and
- an approved greywater treatment plant.

3.1.4 South Australia

In SA, new homes and extensions to existing homes (where the extension incorporates a water closet, water heater or laundry cold water outlet), where the roof catchment area is greater than 50m^2, must be designed to collect and

store rainwater in a tank with a 1000 litre capacity. The tanks must be plumbed to at least a water closet, a water heater or all laundry cold water outlets. Where the roof catchment area of the building is less than 50m^2, all the surface water runoff from the roof catchment area must be collected, stored and plumbed as above. However there is currently no specification on the size of the storage tank.

There are also additional energy efficiency requirements for hot water heating systems in new homes and alterations and/or additions that involve the augmentation of the water heating system.

3.1.5 Western Australia

To increase energy efficiency, new homes in WA must have energy efficient hot water systems: either a solar system; a gas system with at least a 5 star energy rating; or a heat pump must be installed to achieve a minimum energy saving of 60 per cent (given hot water demand of 38MJ per day for Climate Zone 3).

There is also a performance requirement that buildings be capable of using potable water efficiently, and excessive loss of potable water should be prevented. There are specifications for efficient tap and showerhead fittings and sanitary flushing systems to achieve these performance requirements. Outdoor private swimming or spa pools must also have a cover or blanket to reduce water evaporation.

4. Meeting the Standards

There are numerous ways the Standards can be met. Design features that improve energy efficiency include:

- using light coloured roofing materials to reduce heat gain in summer;
- insulating walls, ceilings, roofs and suspended floors;
- using energy efficient lighting;
- using a solar, high efficiency gas or electric heat-pump hot water system;
- orientating the building and providing exterior shading to control solar heating and wind flow;
- creating a tight building envelope, improving seals and draught-proofing;
- using high performance glazing; and
- allowing for air movement.

Water reduction targets (where applicable) can be met by:

- installing, or expanding, rainwater, greywater and/or stormwater collection systems;
- increasing the roof area diverted to water collection tanks; and
- installing water efficient fittings.

4.1 How BlueScope Steel Can Help

BlueScope Steel products can be used in greener building design to improve energy efficiency, reduce energy and water demand and help developers and home owners meet mandatory provisions for thermal comfort.

The high strength-to-weight ratio of steel allows for wider spans, creating large open spaces that can be redefined over the life of the building. The multi award-winning TT Architecture designed home in Canberra is just one of many examples of the spans that can be achieved using steel[5,6]. The roofline was achieved through the design flexibility that steel roofing panels allow, especially the minimal structural support they require. The roof encloses a large central space, and with glass installed up to the roofline, the sun can penetrate the family rooms during colder months[6], reducing energy demand. The large internal volume also allows for a *one-room-thick* design philosophy[6], which – with doors and windows on both sides of the room – creates good cross ventilation, which helps maintain thermal comfort throughout the year.

Above: The multi-award winning TT Architecture designed home, Canberra.

Draughts account for up to 25 per cent of air loss from Australian homes[7]; so weather-proofing and draught sealing can potentially make a big difference to energy use. Because steel building components are produced with consistency, and tight tolerances that are maintained over the life of the building, they can be used to create extremely airtight *building envelopes*. A steel envelope can therefore help limit air loss and reduce energy demand.

The range of colour finishes produced in steel can also aid passive solar design. In warmer climates, roofing and walling made from light coloured standard COLORBOND® steel with Thermatech® solar reflectance technology; light coloured COLORBOND® Metallic steel; ZINCALUME® steel or COLORBOND® Coolmax® steel will help reflect energy away from buildings, thereby contributing to reduced energy demand for internal cooling.

Meeting peak summer electrical loads is an increasing problem for most of Australia's electricity supply grids. COLORBOND® steel's low thermal mass and high thermal emittance can contribute to reducing energy demand for cooling at peak-times as any energy that is absorbed into the roof is quickly re-radiated from the building.

In the cooler Australian climates, where there is minimal need for summertime cooling, dark roofs and walls can be used to absorb solar energy, thereby reducing annual energy demand for heating.

The BCA classifies roof and wall materials based on solar absorptance – the opposite of solar reflectance – expressed as a value between 0 and 1. Solar absorptance values are based on as-new/unweathered product. A value of 0 indicates that a roof absorbs none of the incoming solar radiation, whereas a value of 1 would mean that a roof is absorbing 100 per cent of the incoming radiation. For residential (Class 1 and 10) buildings, three classes have been established: solar absorptance of less than 0.4; solar absorptance of between 0.4-0.6; and solar absorptance of more than 0.6 (referred to herein as *very light*, *light* and *dark* respectively). There are nine standard COLORBOND® steel colours, five COLORBOND® Metallic steel colours, COLORBOND® Coolmax® steel and ZINCALUME® steel, which have solar absorbance of less than 0.6, and may qualify for an insulation concession in warm climates under the deemed-to-satisfy provisions (*Table 2 on following page*). For most Australian climates, the use of these products may also improve the energy performance of a modelled design – when modelling tools are used to demonstrate compliance.

Table 2: BlueScope Steel products in BCA low solar absorptance – light colour – categories for residential (Class 1 and 10) buildings.

PRODUCT	VERY LIGHT Solar Absorptance ≤0.4	LIGHT Solar Absorptance ≤0.6
Standard COLORBOND® steel	Classic Cream™	Paperbark®
	Surfmist®	Evening Haze®
		Shale Grey™
		Sandbank®
		Dune®
		Windspray®
		Pale Eucalypt®
COLORBOND® Metallic steel		Citi®
		Axis®
		Conservatory®
		Skybridge®
		Cortex®
COLORBOND® Coolmax® steel	Whitehaven™	
Metallic coated steel	ZINCALUME®	

BASIX also classifies roof colours into three groups based on the solar absorptance of new product: *light* (solar absorptance of less than 0.475); *medium* (solar absorptance of between 0.475 and 0.70); and *dark* (solar absorptance of more than 0.70). Because of the incorporation of Thermatech® solar reflectance technology into all standard COLORBOND® steel colours, and the introduction of COLORBOND® Coolmax® steel, the range of colours that have low solar absorptance has increased. There are now nine products in the *light* colour category, and twelve colours that are classed as *medium* (*Table 3*). Light colours may qualify for a deemed-to-comply insulation concession, and both light and medium colours can be used to lower the demand for cooling in the building, thus helping to meet energy reduction and thermal comfort targets. The light colour concessions recognise the benefit of lower annual heating and cooling energy demand and reduced peak summertime loads.

Table 3: BlueScope Steel products in BASIX low solar absorptance – light colour – categories.

PRODUCT	VERY LIGHT Solar Absorptance ≤0.475	LIGHT Solar Absorptance >0.475 ≤0.70
Standard COLORBOND® steel	Classic Cream™	Windspray®
	Surfmist®	Pale Eucalypt®
	Paperbark®	Bushland®
	Evening Haze®	Headland®
	Shale Grey™	Wilderness®
	Sandbank®	Jasper®
	Dune®	Manor Red®
COLORBOND® Metallic steel		Citi®
		Axis®
		Conservatory®
		Skybridge®
		Cortex®
COLORBOND® Coolmax® steel	Whitehaven™	
Metallic coated steel	ZINCALUME®	

Lightweight – low thermal mass – steel construction also responds quickly to changes in thermal conditions, which is particularly beneficial for homes that are occupied intermittently. The home can be heated or cooled quickly, without having to expend a lot of energy to heat or cool the structure.

Billed as the Gold Coast's most sustainable house, Innovation House 3 at the Currumbin Ecovillage, was constructed using BlueScope Steel products[8]. Stratco corrugated roofing made from COLORBOND® steel is one of the featured wall cladding materials and Ritek® custom roof panels incorporate steel for the lining of the roof and ceiling[8]. The layers are bonded together, including an insulative inner section of thermally efficient polystyrene, to create a roof system that significantly reduces the amount of heat radiated into the home. The external layer of COLORBOND® steel in the colour Dune® helps reflect the hot Queensland sun. The house is also fully water self-sufficient: a 17,000 litre BlueScope Waterpoint Classic® rural water tank is connected to the home.

Literature Cited

1. **Building Commission Victoria (2008)** What you need to know about 5 Star for new houses, home renovations and relocations. Building Commission, Victoria, Melbourne. 8pp.
2. **Building Commission Victoria (2008b) Practice Notes: Residential sustainability measures. Building Commission, V., 14 pp.** http://www.sustainability.vic.gov.au/resources/documents/BC_PracticeNotes2008-551.pdf **(2008)** Practice Notes: Residential sustainability measures. Building Commission, Victoria, Melbourne. 14pp.
3. **Office of the Queensland Parliamentary Counsel (2008)** Building Regulations 2006, Reprinted as in force on 18 July 2008, Reprint No. 2E. Office of the Queensland Parliamentary Council, Brisbane. 56pp.
4. **Department of Infrastructure and Planning (2008)** *Water Savings Targets*. Queensland Government. Last Accessed August 15 2008. http://www.dip.qld.gov.au/sustainable-living/water-savings-targets.html
5. **TT Architecture (2008)** *Rischbieth Houses*. Last Modified 2008, Accessed August 2008. http://ttarchitecture.com.au/portfolio/47/rischbieth-houses
6. **BlueScope Steel Limited (2008)** *Double Act Steels Awards*. Last Modified 10 April 2008, Accessed August 2008. http://bluescopesteel.com.au/go/case-study/double-act-steels-awards
7. **McGee, C., Mosher, M. and Clarke, D. (2008)** Passive Design: 4.7-Insulation. In, *Your Home Technical Manual. 4th ed*. Department of the Environment, Water, Heritage and the Arts, pp 101-107.
8. **BlueScope Steel Limited (2008)** *Sustainable Innovation*. Last Modified 10 April 2008, Accessed August 2008. http://bluescopesteel.com.au/go/case-study/sustainable-innovation

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