Public Discussion Paper

National Building Energy Standard-Setting, Assessment and Rating Framework

March 2010

National Strategy on Energy Efficiency

Senior Officials Group on Energy Efficiency

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INVITATION TO COMMENT

Interested individuals and organisations are encouraged to engage in the consultation process for the development of the national building energy standard-setting, assessment and rating framework.

You are invited to make written submissions on this discussion paper. You are encouraged to comment on any matter related to the Framework and you do not need to limit your submissions to the issues and options raised in this paper, or to respond to all issues.

All forms and lengths of submissions will be accepted, including emails, letters or separate papers.

Submissions may be made available for public viewing, unless the author of the submission clearly indicates that all or part of the submission is confidential.

All submissions must be accompanied by a cover sheet which can be found at the back of this publication.

The closing date for submissions is close of business Friday 7 May 2010.

Submissions should be sent to:

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CONTENT

GLOSSARY

ABSA	Association of Building Sustainability Assessors
BASIX	Building Sustainability Index
BCA	Building Code of Australia
BERS	Building Energy Rating Scheme
COAG	Council of Australian Governments
CO_2-e	Carbon Dioxide equivalent
CPRS	Carbon Pollution Reduction Scheme
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DCCEE	Department of Climate Change and Energy Efficiency
DEWHA	Department of the Environment, Water, Heritage and the Arts
DTS	Deemed to Satisfy
GBCA	Green Building Council of Australia
GEMS	Greenhouse and Energy Minimum Standards
MEPS	Minimum Energy Performance Standards
NABERS	National Australian Built Environment Rating System
NatHERS	Nationwide House Energy Rating Scheme
NFEE	National Framework for Energy Efficiency
NSEE	National Strategy on Energy Efficiency
RIS	Regulatory Impact Statement
UNEP	United Nations Environment Programme
WELS	Water Efficiency Labelling Program

1. INTRODUCTION

1.1 Purpose of this paper

In July 2009 the Council of Australian Governments (COAG) agreed to the National Strategy on Energy Efficiency (NSEE). The NSEE is designed to substantially improve minimum standards for energy efficiency and accelerate the introduction of new technologies through improving regulatory processes and addressing barriers to the uptake of new energy-efficient products.

The NSEE measures are focused around four key themes:

- assisting households and businesses to transition to a low-carbon future through improving advice and education on energy efficiency and enhancing the skills capacity in industry;
- reducing impediments to the uptake of energy efficiency through reforms of energy markets and networks, and increased minimum energy performance standards for appliances and equipment;
- making commercial and residential buildings more energy efficient through a combination of measures addressing both new building design and construction and existing buildings; and
- governments working in partnership and leading the way through improving the performance of their own buildings and practices.

Measure 3.1.1 in the building chapter of the NSEE states that "All jurisdictions will work together to develop a consistent outcomes-based National Building Energy Standard Setting, Assessment and Rating Framework for driving significant improvement in the energy efficiency of Australia's building stock – to be implemented in 2011."

The Framework has the following key dimensions:

- development of a pathway for increasing the stringency of the energy efficiency standards for new buildings and major renovations over time;
- alignment of measurement and reporting metrics, and assessment and rating approaches to enable the consistent application of building ratings to new and existing buildings; and
- enhancement and co-ordination of governance arrangements for building energy assessments, ratings and standard setting.

The full description of the NSEE Framework measure is at Appendix A, and further discussion of the Framework outcomes is at Section 3.

This discussion paper has been prepared by the National Buildings Framework Subgroup for the Senior Officials Group on Energy Efficiency, which is tasked by COAG to oversee the implementation of the NSEE. The Subgroup contains representatives from all jurisdictions. The paper aims to facilitate consideration by stakeholders of the issues being addressed by the Framework measure and to seek input on the detailed development of the Framework.

The structure of this paper is to set out the need for the Framework (Chapter 2), then outline the outcomes and coverage of the Framework (Chapters 3 and 4), before moving onto a more detailed discussion of the issues relevant to both commercial and residential buildings, in particular the pathway for future stringency increases to building regulations (Chapter 5) and assessment and rating of buildings (Chapter 6). Governance of rating schemes and monitoring and evaluation issues for the Framework are then addressed (Chapters 7 and 8 respectively).

This discussion paper facilitates stakeholder consideration by:

- providing background on the key issues to be considered in the development of the Framework (and identifying areas which are beyond the scope of the Framework); and
- posing questions in relation to these issues, and where appropriate providing possible options to address these issues, for stakeholders to comment on.

The questions and options are included in this paper merely to focus stakeholder consideration. They are not intended to express a preference or be exhaustive. It is not required that stakeholders respond to all the questions and options in their comments on this paper. In relation to the options tables, note that not all options are mutually exclusive. When commenting on these, you may wish to indicate a combined option as an effective solution to specific issues.

1.2 Next steps

Any opinions or options expressed in this paper have not yet been considered or endorsed by governments. The National Buildings Framework Subgroup will consider all comments made on this discussion paper, and undertake further analysis as necessary, to develop a final Framework document for consideration by governments later in 2010.

The National Buildings Framework Subgroup may also initiate targeted stakeholder engagement to clarify comments made on the discussion paper, or to seek further information or feedback on options being considered.

1.3 Definitions

For the purpose of this document it is helpful to clearly define key terms that are used in the description of the measure in the NSEE.

This paper often refers to 'energy efficiency', 'energy efficiency ratings' or 'energy efficiency standards' simply for convenience, however the final outcome of the Framework may be that ratings and standards have broader coverage than just energy efficiency, particularly greenhouse gas emissions given its close links with energy use. The NSEE measure notes that the Framework should have the capacity for expansion to cover broader sustainability elements including water management over time.

The paper often uses the terms 'residential' and 'commercial' buildings for convenience, when it is acknowledged that there is a range of building classifications in the Building Code of Australia (BCA). Unless indicated otherwise, references to commercial buildings in the paper should be taken to mean all non-residential buildings.

'**Assessment'** is defined as the process through which the performance of a building is estimated or measured against specified criteria.

'Rating' is defined as the process of assigning a comparable value to the assessment against a common scale and communicating this value, for example as a star rating.

'Standard setting' is taken to mean the setting of minimum performance requirements and verification methods for new building work (for both new buildings and major renovations).

'Outcomes-based' is taken to mean a Framework designed to achieve identified and measurable policy objectives or outcomes.

2. NEED FOR A FRAMEWORK

Within Australia it is estimated that the building sector accounts for approximately 19 per cent of the country's total energy consumption and 23 per cent of greenhouse gas emissions.[1] This is split roughly equally between the residential and commercial building sectors. Energy demand and greenhouse gas emissions are increasing from both sectors at around one to two per cent per annum.

Minimum energy performance requirements began to be included in national building codes some years ago to achieve improved energy efficiency in new buildings. Alongside this move, the importance of energy rating schemes and tools has increased and there are a range of tools now available which have varying functions and metrics. Further details on buildings' contribution to energy use and greenhouse gas emissions, and building regulations and tools are provided in Appendix B.

A clear, co-ordinated and visionary approach to building energy efficiency assessments, ratings and future standards will help to improve outcomes and to address market failures in the building sector. The Framework is also critical to achieving the NSEE aims of:

- assisting households and businesses to transition to a low-carbon future;
- reducing impediments to the uptake of energy efficiency; and
- making buildings more energy efficient.

Addressing market failures

The market failures related to energy efficiency have been well documented in a range of national and international studies. Key market failures in the building sector include:

- information barriers – where information for consumers is not available, difficult to collect or hard to interpret;
- split incentives – where the costs and benefits (and therefore motivation) of undertaking energy efficiency actions are borne by different individuals; and
- bounded rationality – where decisions are complex (or perceived to be complex), individuals may make decisions that do not take into account all available information.[2]

Productivity & reducing regulatory burden

The productivity of the building industry, and hence the economy, will be improved if the systems and processes used to assess, rate and set standards for building energy efficiency performance are well designed, transparent, co-ordinated and clearly communicated to industry and the community. It is recognised that the current system surrounding building energy efficiency ratings and standards can be improved. Currently there are differing levels of stringency in new building standards across Australia and different assessment and rating processes applied. There is also no common system of communication of building ratings across different building types. Improvements on these fronts, linked back to established building assessment and rating systems, will be of benefit to building developers (in what they are designing and constructing), and building owners and renters (in purchasing decisions and how they use the building).[3]

Certainty and innovation

A forward plan regarding building energy efficiency will enhance the ability of industry and the community to plan for future stringency upgrades, which promotes innovation in the sector. The early identification of increases in stringency requirements through the Framework will provide industry with time to develop innovative, practical and cost effective solutions for application in residential and commercial buildings. Furthermore, advances in building products, technology and construction will assist buildings to meet future stringency levels for new buildings and grow Australia's green economy. With the certainty to plan and innovate, the costs of meeting future stringency provisions will be lowered for households and businesses.

1 ASBEC, *The Second Plank – Building a low carbon economy with energy efficient buildings*, 2008.
2 Australian Government, *Carbon Pollution Reduction Scheme*, *Green Paper*, July 2008, Department of Climate Change.
3 International Energy Agency, *Energy Efficiency Requirements in Building Codes*, *Energy Efficiency Policies For New Buildings*, March 2008.

The climate change challenge

Energy efficiency has been recognised by the Australian Government as the critical second plank in dealing with climate change, alongside the proposed Carbon Pollution Reduction Scheme (CPRS). In developing the CPRS, the Australian Government has recognised that some market failures will remain. Addressing these market failures through building energy efficiency measures is complementary to emission trading schemes, and is likely to reduce the overall carbon price, as energy efficiency is one of the most cost effective ways to reduce greenhouse gas emissions.

Improving building standards will also assist with adaptation to a changing climate. Building standards have the potential to help 'future proof' Australian buildings to take into account expected future climate conditions, such as more frequent periods of extreme hot weather and severe storms and flooding events.

Summary

The Framework therefore needs to be practical and appropriate and link with the range of other measures in the NSEE. It needs to be responsive to industry and consumer needs, increase certainty in the market place and community, reduce and simplify regulatory requirements, and facilitate greater industry innovation – while helping to develop a low-carbon economy to meet the challenge of addressing climate change. Finally, it needs to help increase industry and community understanding of the future direction of building sustainability requirements, of which energy efficiency is one element.

It should also be noted that the benefits of improving the energy efficiency and/or greenhouse performance of the building sector extend beyond economic cost saving. As noted in the International Energy Agency report on *Energy Efficiency Requirements in Building Codes, Energy Efficiency Policies for New Buildings*, 'the implications of such potential reduction [of energy consumption] should not be underestimated, as the scale of energy efficiency in buildings is large enough to influence [energy] security policy, climate preservation and public health on a national and global scale.'[4]

[4] International Energy Agency, *Energy Efficiency Requirements in Building Codes*, *Energy Efficiency Policies For New Buildings*, March 2008.

3. OUTCOMES OF THE FRAMEWORK

3.1 Description of the Framework

The buildings measures within the NSEE, *Making buildings more efficient*, set the foundation for a transformation of Australia's building stock. The transformation will be achieved through a combination of measures addressing both new building design and construction and existing building stock.

The Framework is listed as the key buildings measure in the NSEE and has linkages to many of the other measures. The core elements of the Framework, as described in the NSEE, can be grouped as follows.

In general, the Framework will:

- be outcomes-based;
- cover all classes of residential and commercial buildings;
- apply to new and existing buildings (including working with mandatory disclosure policies); and
- be capable of extension over time to cover broader sustainability elements – potentially including greenhouse gas emissions and water management.

In relation to setting building energy efficiency standards, the Framework will:

- set increasingly stringent minimum performance standards over time for new buildings and major renovations, with standards to be reviewed and increased periodically, for example, every 3 years (subject to regulatory impact analysis);
- use the BCA as the implementation mechanism for new building work;
- cover the building envelope and energy efficiency of key building services;
- allow innovation in meeting defined performance standards;
- consider how building performance can be maintained through commissioning, operation and maintenance; and
- facilitate effective monitoring and compliance.

In relation to the assessment and rating of buildings, the Framework will:

- work towards convergence of measurement based rating tools for existing buildings with predictive/modelling based rating tools for new buildings;
- include common measurement and reporting metrics to underpin standard setting and performance assessment;
- continue to communicate energy efficiency improvements via star ratings;
- include flexibility to account for climatic variation;
- accommodate mandatory disclosure of energy performance at time of sale or lease; and
- provide for the use of rating tools developed by the market, rather than necessarily having a single tool, provided they are accurate, transparent and user friendly.

3.2 An outcomes-based approach

3.2.1 What is an outcomes-based approach?

The NSEE states that the Framework will be formulated around an outcomes-based approach. This involves providing a clear goal about what is to be achieved and allowing flexibility as to how to achieve the goal, within clearly defined boundaries. An outcomes-based approach needs to be underpinned by adequate tools, monitoring, compliance mechanisms and support systems.

An outcomes-based approach lends itself to the setting of performance based standards and allowing innovation in meeting these standards, rather than setting prescriptive standards that specify how to achieve a goal. This helps the market to find the most cost-effective ways to achieve the outcomes, which increases overall productivity. Supporting flexibility within set limits allows for fit-for-purpose buildings that can still achieve desired environmental and other related goals.

For example, a goal could be set to reduce whole of building emissions or energy use, noting that this could be achieved from a range of elements within the building. The most cost effective way to achieve the goal may depend on location and market dynamics in that area.

In some cases minimum standards of performance for individual building elements may also be needed to adequately achieve the goal or related goals, for example peak load reduction strategies or the planned phase-out of greenhouse intensive hot water heaters.

A benefit of having an outcomes-based approach is that it can link the intended efficiency of a building at design stage with measurable results once the building is operational. This can inform industry and government about ongoing policy required to reach the desired environmental goals.

The issues of setting appropriate pathways for increasing the stringency of standards, and the extent to which flexibility will be allowed in achieving minimum levels of performance are dealt with in more detail later in this paper.

3.2.2 What outcomes should be pursued by the Framework?

The NSEE seeks to accelerate energy efficiency efforts, streamline roles and responsibilities across levels of governments, and help households and businesses prepare for the introduction of the CPRS.

The NSEE is designed to drive significant improvement in minimum energy efficiency standards to deliver substantial growth in the number of highly energy-efficient homes and commercial buildings – reflecting international best practice.

The outcomes for the Framework could therefore be regarded as, initially, achieving significant reductions in energy use and greenhouse gas emissions from buildings, through improved energy efficiency.

Current rating schemes have varying focuses on energy efficiency and greenhouse gas emissions. Achieving energy efficiency in individual buildings does not necessarily reduce greenhouse gas emissions, as this depends on the greenhouse intensity of the energy source and the total number and size of buildings being constructed in the future (however in general there is a positive correlation between improved efficiency and emission reductions). Conversely, a reduction in greenhouse gas emissions caused by buildings does not necessarily reduce total energy demand, ensure we use energy wisely or address other issues such as peak load demands on our energy networks.

The inter-relations between greenhouse gas emissions, energy use, peak demand, energy efficiency and human comfort in buildings are complex. The Framework will need to consider these complexities in establishing outcomes. Therefore, the Framework may need to incorporate several outcomes but will need to clearly fit these together as a practical and clearly communicated system.

The NSEE indicates the potential for the Framework to incorporate water management in buildings. At the present time other regulations cover water management. Most jurisdictions have plumbing regulations specifying to various degrees the need for rainwater tanks, grey water systems and/or minimum standards for fittings in new buildings. Further to this, the Water Efficiency Labelling Program (WELS) rates the water efficiency of a range of products. Although there may be scope to expand the Framework to cover water management at a later date, the difficulties with incorporating water into the Framework at inception are significant and have not been addressed in this paper.

It should be emphasised that there will be review points throughout the Framework and therefore a phased approach to including additional outcomes is possible. It may be that the initial focus is on greenhouse gas emissions and energy efficiency, while water, peak loads and embodied energy are considered at a later date. The table below outlines some options for the initial outcomes of the Framework.

Outcomes of the Framework – possible options

Options	Pros	Cons
1. Reduction in greenhouse gas emissions as the key outcome	• Sits well with international and community efforts to reduce greenhouse gas emissions • Fits with government policy objectives to reduce greenhouse gas emissions	• Does not necessarily mean energy efficiency will be increased • Measurement complications in that greenhouse intensity factors change annually and are not consistent across the country
2. Improvement in energy efficiency as the key outcome	• Cost-effective way to reduce greenhouse gas emissions • Has economic implications for consumers that could be easier to communicate and understand • Has the potential to help improve energy security and peak demand concerns	• Does not necessarily reduce total energy use or greenhouse gas emissions • Technical limitations to how energy efficient equipment and appliances can be, while significant greenhouse gas reduction potential might remain
3. Reduction in total energy used as the key outcome (possibly from network purchases only)	• Reduces load on energy networks and improves energy security • Defers costs of augmentation of energy networks	• Does not necessarily mean building energy efficiency will be increased • Encourages take-up of distributed generation systems that may not be most cost-effective option for reducing energy use
4. A combined outcome – for example, a reduction in greenhouse gas emissions to be achieved firstly through increased energy efficiency and secondly through increased use of low and zero emission energy	• Takes into account broad government policy objectives • Promotes a least cost approach to greenhouse gas emission reduction	• Combined outcomes may conflict in some situations, requiring trade-offs between outcomes • Communication of policy objectives and ratings could be more complex

What outcomes are preferred for the Framework?

Are there other key outcomes that could be considered for the Framework and how could these be practically included and in what timeframe (for example, a reduction in peak loads, water use, etc)?

4. COVERAGE OF THE FRAMEWORK

4.1 Coverage principles

The NSEE specifically states that the Framework will apply to new and existing building stock and to all classes of commercial and residential buildings. Further to this, increasingly stringent minimum energy performance standards are to be set over time and the Framework should be capable of extension over time to cover broader sustainability elements. These aspects relating to the coverage of the Framework are introduced in this chapter and discussed in more detail in relevant sections of the following chapters.

4.2 Coverage of different building classifications

The scale, construction styles, markets and occupancy profiles of different building classifications vary markedly. These variations will influence the way that the Framework and ratings scales can be applied to different buildings.

The BCA already has a clear distinction between detached and attached houses (Class 1 – BCA Volume 2) and other buildings (Volume 1). Residential buildings (Class 1, 2 and 4) have many similarities in occupancy but have different energy efficiency requirements in the BCA (for example, Class 2 buildings have an averaging of ratings across the units in the building). Multi-unit residential buildings (Class 2) can also range from two storey unit buildings that are similar to houses to high rise buildings, which share more similarity to office buildings in terms of construction.

Developing an approach to residential buildings for the Framework will need to consider whether different classes of residential buildings can be treated consistently.

The BCA also includes energy efficiency requirements for non-residential buildings, but does not currently make any reference to a rating scale. The NSEE states that the Framework will cover all classes of commercial buildings. This paper takes the view that 'commercial' in the context of the Framework refers to all non-residential buildings (including public buildings such as schools and hospitals). However, current commercial building rating schemes only address a subset of all non-residential buildings, that is offices, hotels, shopping centres, and education and healthcare facilities, and it may not be practical to develop rating schemes for all specialised building types.

Given the differences between buildings classifications noted above, it may be necessary to treat particular building classifications differently to others depending on the particular issue being addressed. It may also be preferable to give priority to the most common building types, for example, houses and office buildings, before others.

To what extent should different building classifications be treated uniformly in the Framework, or should different building classifications be treated separately, particularly the residential and commercial building classifications and specialised buildings, such as laboratories?

4.3 Coverage of new versus existing buildings

The NSEE is clear that the application of the Framework in relation to increasing energy efficiency standards only applies to new building work. The Framework does not address setting energy efficiency standards for existing buildings.

The Framework does however need to cover the assessment and rating of both new and existing buildings. Given the other NSEE measures relating to mandatory disclosure of building performance at time of sale or lease, there is a need to allow valid and consistent comparisons between all buildings on the market – from buildings just being built to ones built decades ago. It is also desirable to minimise the work and cost on building owners in getting required ratings for their building over its life – from design, building approval, construction, sale/lease, to potentially major renovations.

One option would be to have a standard rating scheme that can apply to all stages of the building's life that can be easily understood by the public. However, it is still critical that ratings made at different building lifecycle stages disclose information of relevance to these stages.

This raises the issue of what can be covered or included in a rating for new buildings compared to existing buildings. For example, in new houses not all fixtures to be installed in a building are known at the building approval stage under current arrangements, but these may have a significant impact on the performance of the building. Therefore the scope of information provided for building ratings at the building approval stage may need to be amended to be more detailed, or alternatively, the elements assessed and reported for new and existing buildings may potentially differ even if the method of assessing common elements remains the same.

When new commercial buildings are designed or existing buildings are substantially retrofitted they are modelled on a whole of building energy use basis, since determining the size of plant and equipment is an integral part of the building design process. While this means there is greater correspondence between modelled energy use and observed operational energy use, commercial building modelling still routinely underestimates energy use in operation. This introduces complications in having the same rating scale applying to both the modelled performance of the building design and the operational performance of the building post-construction, as it is likely that modelled ratings will be higher than those achieved in operation.

It should be noted that implementation of mandatory disclosure of building performance at time of sale or lease is being handled separately to the Framework and the details of the implementation process are not addressed in this paper. Cross-over issues that relate to the Framework are however taken up in the chapter regarding ratings and assessment of buildings.

4.4 Coverage of sustainability performance measures

As outlined in the NSEE, the Framework is initially focused on energy efficiency, but will be capable of expansion over time to other sustainability factors, such as greenhouse gas emissions and water performance. This paper focuses on consideration of energy efficiency and greenhouse gas emissions as these issues strongly interact and are considered more directly linked to current building regulations in many jurisdictions.

It is recognised that there are other important aspects that influence a building's overall sustainability performance, including water, indoor air quality and waste minimisation. However, it may not be practical to include these elements within the Framework initially. These additional sustainability elements could be considered for integration within the Framework over time, based on practicality, timing and decisions on the key priorities of the Framework.

Another issue of coverage relates to what stages of a building's lifecycle are to be included in performance measures. The energy efficiency or greenhouse gas performance of the production of building materials and building construction or deconstruction phases are an important component of the energy used over the lifecycle of a building, particularly as buildings become more energy efficient in their operation.[5] At this point in time, embodied energy and emissions are difficult to measure across all building materials relative to operational energy use and could overly complicate the development of the Framework. As such, it may be preferable for the Framework to be targeted initially at the operational aspects of the building. Inclusion of embodied energy and emissions in the Framework could be a long term aim, and be considered as part of future reviews of the Framework.

It should also be noted that there is a lack of consistency internationally in regard to the criteria used to rate the environmental performance of materials and equipment. The trade implications will need to be considered before this could be incorporated into the Framework.[6]

If the Framework were to be expanded to include water and other sustainability elements such as embodied energy/emissions or indoor air quality, how could this be done and in what timeframe?

4.5 Incorporating built-in appliances

If the Framework is to consider 'whole-of-building' approaches, particularly for residential buildings, then it will need to take into account the energy use of built-in equipment and appliances, that is hot water, heating, cooling and ventilation systems, and lighting.[7] Many of these are also currently regulated through Minimum Energy Performance Standards (MEPS).

A possible expansion of the scope of building rating and standards systems to include 'whole-of-building' approaches would need to not only consider the advantages and disadvantages of the expansion but also the links between appliance and equipment MEPS and labelling initiatives or other initiatives.[8]

These regulatory approaches can operate in a co-operative way – with MEPS preventing the sale of the most inefficient or greenhouse gas intensive equipment to the entire market, building standards driving the use of higher efficiency design and equipment in new building work, and ratings schemes facilitating consumer information and encouraging voluntary action to purchase the most efficient equipment and appliances beyond minimum requirements.

It is not intended that the Framework address standards for plug-in portable appliances used in buildings, given that these are difficult to regulate through the BCA, are easily changed depending on the building occupant, and their efficiency can be addressed through other complementary approaches. These items could however be included for some aspects of the Framework, for example, the collection of data on energy use in occupied buildings to help understand their actual energy performance.

5 The Building Products Innovation Council (BPIC), with funding assistance from the Department of Innovation, Industry, Science and Research, is currently developing a materials rating scheme.

6 U.S. Department of Energy and the Asia-Pacific Partnership on Clean Development and Climate, *Shaping the Energy Efficiency in New Buildings: A Comparison of Building Energy Codes in the Asia-Pacific Region*, September 2009.

7 It should be noted that the BCA already includes standards for a range of appliances and equipment in non-residential buildings.

8 The National Strategy on Energy Efficiency has indicated the establishment of national legislation for MEPS and labelling that will, over time, move to add Greenhouse and Energy Minimum Standards (GEMS). GEMS legislation is expected to cover non-electrical appliances and system components that affect the energy efficiency of appliances.

4.6 Interaction with building lot layouts

Achievement of the full potential of passive solar building design and access to solar energy to reduce net building energy use is dependent on external factors, such as lot layouts that promote northern orientation of buildings, planning rules that minimise overshadowing of one building by another, and location of trees. These issues can generally be addressed through planning systems. The NSEE has taken this issue into account through a separate measure (3.3.5) which addresses the opportunities to support solar access to buildings through building lot or precinct level layout. This is being implemented by jurisdictions through the Local Government and Planning Ministers Council. Links between measure 3.3.5 and the Framework will be made wherever practical and effective.

5. SETTING A PATHWAY

5.1 Introduction

The NSEE states that the Framework will over time set increasingly stringent minimum performance standards for new buildings and major renovations. This will give industry greater confidence to innovate and develop affordable solutions to improve building energy efficiency. The NSEE states that standards would be reviewed periodically, for example every 3 years, and the NSEE as a whole is to continue till 2020.

To achieve this intention, it may be beneficial for the Framework to set out a vision for building energy performance by 2020 and then to consider what pathway is needed to achieve this vision and the assessment and rating systems necessary to facilitate this pathway.

5.2 International examples

The NSEE states that the process for developing future standards will be informed by an examination of international best practice.

Several international jurisdictions, such as the United Kingdom (UK) and California, have set longer term goals for buildings, including 'net zero energy' or 'net zero emission' goals.[9] For example, the UK has set a goal that new houses should be net zero emission by 2016, and has determined two step changes in house energy standards in 2010 and 2013 to work towards this target. In 2008 the UK Government announced its ambition that all new non-domestic buildings should be zero emission from 2019.

Responsibility for building regulation in the United States of America (USA) largely resides at a state level. The Department of Energy's Building Technology Program funds research and technology development with the goal that it will lead to marketable zero net energy homes by 2020 and marketable zero net energy commercial buildings by 2025.[10] California has set its own net zero energy regulatory goal, as described in the table below.

	Short term	Medium term	Long term
UK (Zero Carbon Homes)	2010: 25% improvement relative to 2006 requirements for emissions associated with energy use	2013: 44% improvement	2016: new homes to be zero carbon (to be phased in over the following years)
California (Zero Net Energy Homes)	2011: 50% of new homes will surpass the 2005 Title 24 energy efficiency standards by 35% and 10% will surpass the standards by 55%	2015: 90% will surpass the 2005 standards by 35% and 40% will surpass the standards by 55%	2020: 100% will surpass the 2005 standards by 35% and 90% will surpass the standards by 55%, and homes to be Zero Net Energy[11]

In the European Union (EU), the Directive on energy performance of buildings is the main legislative instrument at EU level to achieve energy performance in buildings. The EU is currently considering proposals to amend the Directive, including a requirement for member countries to draw up national plans for increasing the number of buildings for which both carbon dioxide emissions and primary energy consumption are low or equal to zero. Several member states have already set up long-term strategies and targets for achieving low energy standards for new houses, as described below.

9 Note: there is no global definition of zero emission buildings. Terms and calculation methodologies differ between countries.

10 http://www1.eere.energy.gov/buildings/

11 This means that houses will need to be energy efficient and have sufficient onsite energy generation to balance the energy used by the building per annum.

Selected EU targets for low energy residential buildings[12]

Country	Low energy target
Austria	Planned: social housing subsidies only for passive buildings as of 2015
Denmark	By 2020 all new buildings use 75 % less energy than currently enshrined in code for new buildings. Interim steps: 50 % less by 2015 , 25 % less by 2010 (base year 2006)
Finland	30 – 40 % less by 2010; passive house standards by 2015
France	By 2012 all new buildings are low energy buildings (Effinergie standard), by 2020 new buildings are energy-positive
Germany	By 2020 buildings should be operating without fossil fuel
Hungary	New buildings to be zero emission buildings by 2020
Ireland	60 % less by 2010, net zero energy buildings by 2013
Netherlands	50 % reduction by 2015, 25 % reduction by 2010 both compared to current code plans to build energy-neutral by 2020
Sweden	Total energy use / heated square metre in dwellings and non residential buildings should decrease. The decrease should amount to 20 per cent until 2020 and 50 per cent until 2050, compared to the corresponding use of energy in 1995

It should be noted that other countries may have different policy drivers to Australia for setting their building energy efficiency standards, thus making it difficult to directly compare the stringency of standards, for example:

- buildings may be a higher proportion of their national greenhouse emissions/energy use;
- their buildings may have to cope with more extreme climates; and
- they may have different concerns about security of energy supplies.

5.3 Possible goals for increasing stringency of standards

Achieving a transformation of Australia's building stock will potentially require a significant shift from current practice. However, many of the technologies and construction techniques are already known, and the leading work being implemented now in building design and construction could become common practice in future as experience with these new approaches is diffused throughout the sector. In the longer term it would be expected that market innovation would enable even better results to be achieved.

To give some certainty to industry and the public, and consistent with the outcomes-focus of the Framework, it may be desirable for the Framework to set an indicative goal to be achieved by the end of the ten year timeframe of the NSEE, for example, in 2020. A long term goal will also encourage the innovators in industry to invest ahead of current standards.

Such a goal would have to be indicative as the actual energy efficiency requirements to be used for regulatory purposes are set in the BCA through its normal amendment process. However the goal, and the pathway to that goal, could guide the development of the details of energy efficiency upgrades to be included in the BCA in any particular year. The final form of BCA amendments would still be subject to regulatory impact analysis and remain a decision of governments at that time. The longer term goal could itself also be modified by governments over time.

12 http://ec.europa.eu/energy/efficiency/doc/buildings/info_note.pdf

It should be noted that the NSEE was designed to complement the CPRS, which will set an overall national greenhouse gas emissions cap. A key aim of the CPRS is to encourage the least cost abatement wherever it can be found in the economic sectors covered by the CPRS. If a reduction in greenhouse gas emissions is a key outcome of the Framework, then setting an indicative 2020 goal for greenhouse gas emission reductions from new buildings would need to complement the target under the CPRS: that is, the NSEE would help Australia meet its 2020 target.

Setting goals out to 2020 will be a difficult task given the changes that could occur over that time. Impact analysis of goal options would need to take into account the goal's feasibility from a technological, social, environmental and economic perspective to ensure the proposed goal was achievable and appropriate. Considerations could include future technological advancements in the energy efficiency of building materials, built-in equipment and appliances and renewable energy technologies, the availability of low-cost solutions from overseas, and reduced costs as market take-up of such products increases.

Setting a goal for 2020 – possible options

Options	Pros	Cons
1. No goal specified in the Framework, but a number of review points (for example, every three years) could be set at which the BCA would consider increasing the stringency of standards	• Allows stringency upgrades to be assessed based on the latest information available at the review point • Gives industry certainty that stringency levels will not be changed until the next review	• Does not give industry any certainty about future stringency levels over the longer term • Does not encourage early-movement and innovation in the industry towards higher standards
2. No goal for 2020 is specified in the Framework, but a rolling goal could be set at each review point (for example, for the next three years)	• Gives three years notice of future stringency upgrades to allow industry greater time to prepare • The Regulatory Impact Statement (RIS) would not be based on long-term projections that may prove to be inaccurate	• Does not give an indication of where the standards may end up in 2020 • Does not facilitate industry planning beyond a three year time frame
3. An indicative goal is set for 2020, but leaves the setting of intermediate standards to be considered at specified review points	• Gives industry certainty about governments' long-term objectives for building energy efficiency • Encourages early innovation in the industry to achieve the goal	• Difficult to determine at this stage the impacts of particular goal options in 2020 • Does not give industry any certainty about future standards until proposals for BCA changes in a particular year are announced
4. The Framework sets an indicative goal for 2020, as well as intermediate standards or 'gateways' for particular years that step down to the 2020 goal	• Gives industry a clear indication of a timetable for future increases in stringency • Indicative steps would still be subject to RIS processes closer to the time of the step change and could be adjusted	• Difficult to determine at this stage the impacts of particular goal and step change options

If an indicative goal is to be considered for 2020, the next question that arises is: at what level should it be set? Since any 2020 goal would be indicative rather than regulatory it could only flag a future pathway for increasing the stringency of standards for new buildings, and would need to be re-evaluated as 2020 approaches.

The rigorous impact analysis required for governments to make informed decisions as to an appropriate longer term indicative goal for 2020, if one was to be set, has not been completed to date. However, possible ranges for such an indicative goal could be considered in the context of current stringency requirements, best practice examples and also international trends.

New building regulations related to energy efficiency result in building operational performance well above the average for the existing stock, using currently available and practical technologies. For example, within NSW the Building Sustainability Index (BASIX) system requires new homes to be approximately 40 per cent less greenhouse gas intensive than a historical baseline.

There is also a depth of best practice examples of buildings being constructed to well above the current minimum requirements, for example houses rated seven to nine stars under the Nationwide House Energy Rating Scheme (NatHERS), and office buildings rated five stars under National Australian Built Environment Rating Scheme (NABERS). This shows that high performing buildings built with current technologies are technically and often economically, possible to achieve.

As mentioned above, many other countries are setting longer term goals regarding the sustainability of their new buildings. Some countries are setting zero emission or zero energy targets for their buildings and some are seeking to achieve these goals before 2020. Such goals may provide a 'stretch' goal for the industry and the community.

These examples of current minimum standards, Australian best practice and international goals provide the context within which any indicative longer term goal could be considered for Australia. The final consideration of whether an indicative longer term goal should be adopted and the level at which the goal could be set will require careful consideration and rigorous analysis.

Should a 2020 or longer-term goal for improving the energy/greenhouse performance of new buildings be included in the Framework, and if so, what goal is preferred?

5.4 Pathway steps

Regardless of whether there is a 2020 goal, setting clear timing steps for changes to building regulations out to 2020 would provide the building industry with considerable certainty.

A pathway could either have a smaller number of large steps or a larger number of small steps. Small steps allow for transition to new regulatory requirements to be made in increments, providing for adaptation and learning over time by stakeholders. However a disadvantage of this approach is that it entails nearly constant change. The advantage of a smaller number of larger steps is that it provides certainty several years out, but when steps do occur they could require significant changes to the industry in a short space of time.

The NSEE uses by way of an example reviews and upgrades every three years, but the type of review undertaken may affect the timing of when a further stringency upgrade could be applied. For example, reviews could take 3-5 years if comprehensive actual energy use data was to be collected, evaluated and consulted upon for larger commercial buildings. This type of review would limit the progress of sustainability improvements that could be practically made before 2020 if no further steps could be taken until the review is complete. Issues around monitoring and evaluation are discussed in more detail later in the paper.

It would also be valuable to identify how far in advance decisions could be made on future stringency levels. Currently, changes to the BCA are subject to a standard regulatory impact assessment process generally undertaken the year before implementation. While setting out a pathway now of stringency upgrades over a number of years would give industry more certainty than at present, this certainty could be clouded if there was the potential for the pathway steps to be changed through RIS processes undertaken closer to the time.

If certainty was to be provided by standards being announced several years in advance and not changed closer to the time, this would require undertaking a RIS on projected market costs and benefits say 3-5 years into the future – which are difficult to predict accurately. One option to address this conflict is to announce standards several years in advance and also any conditions that would result in the standard being reconsidered – that is any market circumstances that might mean an additional RIS would be undertaken closer to the time of implementation.

What are the key factors that should be taken into account in setting future stringency levels for building energy efficiency in the BCA?

How often should major upgrades to the BCA occur, taking into account industry preparation times and review cycles?

How can certainty on future stringency levels be improved, but in a way that allows scope for refinement at the time of specific changes to the BCA?

5.5 Pathways for different building types

Assuming that a pathway with an indicative goal is set, there are several options for applying possible pathways to different building classes. These include an identical pathway for all building classes, different pathways for commercial and residential buildings, or setting specific pathways for each building class. The advantages and disadvantages of these options are considered in the following table.

Pathways for different building classes – possible options

Options	Pros	Cons
1. The same pathway can be set for all building classes. For example, this could be based on a percentage reduction of greenhouse gas emissions or energy use (depending on the key goal of the pathway) from a base figure	• Consistency across whole sector • Easy to communicate • Could take into account current building class variations by improving all buildings at the same rate regardless of starting point	• Not all building classes currently have energy rating tools • The same scale of improvements may not be appropriate for different building classes

Options	Pros	Cons
2. Two pathways are set for commercial and residential buildings to reflect the different markets for these buildings	• Consistency in each sector • Easy to communicate to the different audiences for residential and commercial buildings	• Separate communication strategies needed for residential and commercial buildings • A consistent approach will be needed across similar residential and commercial building types (for example, multi-unit residential) • No tool currently available to assess all commercial building classes
3. Different pathways set for residential (that is Classes 1 and 2), and distinct commercial building classes	• Would allow for differences in commercial buildings to be reflected in their pathways • Would allow for different rates of improvement depending on the building class	• More complex to communicate • Building classes for which there is no rating tool will be difficult to include in the pathway • Different standards for different buildings may be perceived as unfair

6. ASSESSMENT AND RATING OF BUILDINGS

6.1 Introduction

In developing the Framework it will be important to consider the similarities and differences in the assessment and rating of residential and commercial buildings. The Framework should also recognise the different assessment and rating processes used in predictive modelling versus measurement-based tools. The Framework should seek alignment between these aspects only where feasible and desirable to the extent that confusion is minimised and efficiencies are gained.

Considerations include:

- specifying consistent but not necessarily identical approaches to assessing the energy performance of different building classifications;
- as far as practicable, aligning rating scales and benchmarking processes;
- accounting for variations in climate and emissions factors in different regions of Australia;
- developing appropriately robust administration and governance systems for rating tools and assessors; and
- accommodating mandatory disclosure at time of sale or lease.

Over the last decade or so, a number of tools have become available for assessing the energy performance of residential and commercial buildings. These have been developed for varying purposes and to take account of the different uses, scale and construction of residential and commercial buildings. Broadly, these tend to be either tools that predict performance or report on measured operational performance.

The residential energy efficiency rating tools that have been developed to date (such as those within NatHERS) have been primarily focussed on modelling and assessing the thermal efficiency of the building shell and in some cases (such as BASIX) including the energy efficiency of built-in appliances (heating, cooling, hot water and lighting). These tools are not typically used to measure and benchmark the operational energy efficiency of the house post-construction – although some have this capability. Other tools, such as NABERS Home, focus on operational assessments of existing homes and hence account for the wide variability in actual user behaviour and size of households.

For the commercial sector, both predictive and operational tools are well developed, with a number of predictive tools available to be used to demonstrate compliance with the energy requirements of the BCA.

NABERS Energy, the commercial sector energy efficiency rating system with greatest market coverage, is an operational performance tool that benchmarks on a normalised basis the operational energy use of buildings after construction. Whilst it does not have a built-in predictive or modelling capacity, developers are able to simulate the predicted NABERS Energy performance of new office buildings through the 'Commitment Agreement' process. Modelling of new commercial building performance can be undertaken using a variety of commercially available software programs, the results of which can then be plugged into a ratings calculator like NABERS.

6.2 Approaches to assessing building energy performance

6.2.1 Measurement metrics

The metrics used to assess energy efficiency must be carefully considered and align with the overall outcomes of the Framework. A number of energy sources are used within buildings. A comparison of the end-use efficiency of the building in terms of raw energy use may not adequately take into account 'upstream' energy conversion losses for different energy sources or their greenhouse gas emission intensities.

For NABERS Energy, buildings are rated on the basis of the normalised greenhouse gas emissions from their overall energy use.[13] This ensures that the full fuel cycle impact of different fuels is assessed fairly. However, it also means that the rating is not a pure energy efficiency metric.

NatHERS tools currently assess the thermal performance of the building shell only, normalised to floor area, but this is not directly related to predicted actual operational energy use for heating or cooling or the house overall.

For the measurement metric to make sense, it needs to allow for fair comparison between similar buildings, possibly through 'normalising' the metric to a common base. The basis for this comparison differs in current rating systems. For example, NatHERS results are presented per unit of floor area. NABERS ratings are presented per unit of 'function' or primary purpose of that building. For example, NABERS ratings for houses are based upon the number of occupants, for hotels the number of rooms, and for office buildings the lettable floor area.

The different approaches result in different measures of efficiency. For example, a large house with a high NatHERS energy efficiency rating per square metre could still be using more energy in total than a lower rated but smaller house containing the same number of occupants. The same building may rate poorly under NABERS due to a high energy use in comparison to other buildings with the same number of occupants.

Measurement metrics – possible options

Options	Pros	Cons
Residential and commercial buildings		
1. Common metric for residential and commercial buildings, for example, annual greenhouse gas emissions/energy use per floor area	• Consistency across sector • Direct link to outcomes of Framework • Easy to communicate • Easier to understand for building types that overlap residential and commercial classifications	• Different normalisation factors may be more appropriate for residential and commercial buildings • Doesn't give an indication of the emissions/energy use of the whole building
2. Separate metrics for residential and commercial buildings, for example, annual greenhouse gas emissions per floor area (commercial) and per occupant (residential)	• Acknowledges differences in structures and uses of residential and commercial buildings • May provide more relevant and useful information to the different building markets	• Harder to compare energy efficiency of buildings across different building classifications
New and existing buildings		
1. Common metric for new and existing buildings	• Consistency across sector • Easy to communicate • Allows for comparison between buildings regardless of age	• Need to account for issue that predicted performance of buildings when being designed is often different from actual performance after construction due to occupant behaviour
2. A 'dashboard' approach of a number of metrics that may apply differently to new and existing buildings	• The rating of the building as-designed could carry over to the rating of the building post-occupancy for consistency, but potentially other indicators/metrics could be added at a later stage	• More complicated to communicate to the public

13 kWh is used as the basis for NABERS ratings in Tasmania.

Options	Pros	Cons
Normalised measurement metrics		
1. Normalised measurement metric per floor area	• Easy to calculate from building plans • Already used in a number of rating tools • Aligns with the proposed United Nations Environment Programme (UNEP) Common Carbon Metric • Provides a simple measure of relative performance	• May not take into account the additional energy used in larger buildings • Floor area may not be an accurate measure of how efficiently the building performs its designated function
2. Normalised measurement metric per unit of building function, for example, house occupants or hotel rooms	• Provides an accurate measure of how efficiently a building performs its function • UNEP Common Carbon Metric also recommends this option where available	• Need agreed methods of calculating the assumed functional use of the building, as in practice this would vary over time
3. Absolute measurement metric (that is, per building)	• Shows total energy use/ greenhouse gas emissions of particular buildings • Smaller buildings get positive recognition	• No obvious correlation to occupancy levels • Hard to compare efficiency of buildings of a different size

What measurement metrics and normalisation approaches are most appropriate?

Are different approaches needed for different classes of buildings?

6.2.2 Allowing flexibility in achieving better performance

COAG has agreed to include water heating and lighting for residential buildings in the BCA, but the water heating and lighting standards are not integrated with the existing thermal performance standards under a single rating scale. This requires each component to achieve its own standard. For non-residential buildings, there is already significant flexibility within the BCA compliance mechanisms to trade-off different features of building design in order to meet the required standard.

A more comprehensive measure of a residential building's energy performance could be to assess the total energy use of *all* built-in equipment and appliances, as it is the total energy use of a building that impacts on energy supply networks and greenhouse gas emissions. This could include lighting, water heating, space heating and cooling, and possibly other common building services.

This is the approach adopted by BASIX in NSW, although it includes a minimum standard for thermal efficiency of the building envelope. For the thermal comfort component, BASIX allows input from NatHERS tools (currently around 75% of assessments) or its own do-it-yourself tool based on the BCA deemed to satisfy provisions (currently around 25% of assessments). NABERS Energy also assesses the overall performance of building services using operational energy use.

If there was a move to a 'whole-of-building' rating then there would still need to be an assessment of the thermal efficiency of the building shell (which determines heating and cooling loads on the building) and an additional standard set of assumptions about how the building is used in order to predict the energy used by the built-in equipment and appliances, for example, the amount of hot water used, how often lights are turned on, temperature settings and operational hours of heating and cooling systems, etc.

At present NatHERS tools assess the thermal load due to the building shell only. There has been significant work done over recent years on the NatHERS benchmark tool, Chenath and AccuRate, to prepare for such a possible expansion of scope to built-in equipment and appliances.

The inclusion of built-in equipment and appliances with thermal shell performance in a building rating can give greater flexibility in terms of climatic variations to achieve the most cost-effective outcome. For example, in one climate zone increasing energy performance standards for the thermal shell may be the most cost-effective way to improve energy efficiency whilst in another climate zone it may be through improving the energy efficiency of water heating.

Although allowing flexibility in how a particular BCA performance requirement is achieved is a desirable principle, some boundaries or limits may be justified. For example, it may not be desirable that a poor rating of the thermal efficiency of the building shell, which has a long life and can be expensive to modify in future, should be able to be completely traded-off against the installation of solar panels or highly efficient appliances which have shorter life-spans and are more subject to occupant management and behaviour. It may also be desirable that current standards be retained (that is, they are not 'rolled back' to facilitate flexibility). Furthermore, the design of the building may need to meet multiple objectives, for example, human comfort, hence limits on the flexibility of particular building elements may still be needed to ensure that commonly accepted standards of housing quality are maintained.

Flexibility in new building standards – possible options

Options	Pros	Cons
1. Complete flexibility	• Allows for least-cost approach to comply with building standards • Allows innovative approaches to building efficiency by designers and builders	• Lack of minimum standards means that all building policy objectives may not be achieved • Different building components have different life spans – complete flexibility would not take this into account
2. Flexibility with minima for specific components, particularly the thermal efficiency of the building shell	• Current standards maintained (for example, thermal performance) • Able to take into account the life spans of different building components	• Places limits on design flexibility
3. No flexibility – separate standards for each component	• Provides tighter control over building performance to achieve set objectives • Allows setting of "Deemed to Satisfy" (DTS) standards	• Building regulations will need to be very detailed • Significantly limits design flexibility • Costs of achieving an overall performance outcome would be higher than the flexible options

6.2.3 Including on-site energy generation systems

There is growing interest internationally in increasing the use of renewable energy as a means of reducing greenhouse gas emissions. Buildings with their own energy supply could also reduce peak load demands on energy networks, although they do not necessarily improve the efficiency with which the energy is used in the building. Governments are now providing financial incentives for the installation of renewable energy systems on buildings, such as photovoltaic panels, and net zero energy or emission buildings are becoming technically and economically feasible. It needs to be considered whether on-site energy generation systems that are a fixed component of the building should be included as part of the building rating and taken into account in achieving building greenhouse gas emission and energy use reduction outcomes.

NABERS Energy already recognises on-site energy generation as its calculations are based on utility bill data (that is, energy sourced from external sources only). NABERS also allows purchased GreenPower to count towards a NABERS Energy rating, although for the commitment agreement process and mandatory disclosure GreenPower is excluded from NABERS Energy ratings. BASIX also takes into account on-site renewable energy generation, that is energy included in the house construction but not GreenPower purchases.

The extent to which on-site energy generation can be used to offset the energy used by the building will need to be addressed as part of the discussion on flexibility in building standards outlined above.

Building occupants may also choose to purchase accredited GreenPower electricity as a means of supporting renewable energy, but this does not involve on-site generation and is difficult to assess as part of any regulatory process especially as its purchase can be changed or discontinued at any time.

To what extent should rating schemes and building standards allow energy/ emission offsets from on-site renewable energy generation?

6.3 Rating scales

NSEE states that building energy efficiency performance ratings will continue to be communicated by star ratings. However, there are currently a number of star rating systems used for comparing products that have different underlying metrics and can mean different things to consumers. Some examples follow.

The minimum standard for new houses in the BCA is currently five stars (and will be increasing to six in the 2010 BCA) but houses can be rated up to 10 stars in NatHERS. NatHERS uses a logarithmic scale which increases exponentially, meaning it is harder to move from seven to eight stars than it is from two to three stars. This helps to avoid bunching at the bottom end of the scale, an issue that has arisen in the UK rating scales. The BASIX scheme does not give star ratings but its rating is based on a percentage reduction from a NSW historical baseline.

The appliance rating scheme rates appliances from one to six stars, with the most efficient appliances currently on the market getting around four to five stars. There are moves to extend the star bands to 10 stars (air conditioners and refrigerators already use 10 stars) – which will coincidentally align the number of stars with that of NatHERS. It should be noted however that a 10 star NatHERS rating is based on a theoretical limit (that is no energy required for heating and cooling), whereas appliance ratings are based on incremental improvements in efficiency over the worst performing products on the market.

In Europe, energy efficiency labelling for appliances, cars and residential buildings uses an alphabetic 'A'-'G' rating, with 'A' the most efficient. There is now a move to add A+ and A++ ratings at the top of the scale to accommodate increasing energy efficiency improvements in new products without having to rescale existing products downward.

Commercial buildings also have a number of star rating systems. NABERS ranks building performance against a five star scale, with five representing market best practice. NABERS is a linear scale, which theoretically would place zero-carbon buildings at seven stars. The scale would need to be recalibrated if it was extended to a 10 star scale.

The Green Building Council of Australia (GBCA) green star rating is based on a number of categories including energy and greenhouse. The category scores are weighted and added together to give an overall score which is ranked against a six star scale. The GBCA only accredits buildings that are rated four star ('best practice'), five star ('Australian excellence') and six star ('world leader').

One challenge that may emerge in using a single rating for new and existing buildings is the potential for bunching of ratings. The ratings for new buildings may bunch just above the minimum standard for building approval, whilst those for existing buildings may bunch at the lower ends. A problem of such bunching is that it limits the ability to discern the difference in performance of buildings within the bunch.

It may also be desirable to structure the rating scale so that the ratings of buildings which are not altered over time do not need to be recalibrated downward as more efficient buildings come onto market.

Rating scales – possible options

Options	Pros	Cons
One or multiple rating scales – to cover different sustainability elements		
1. Multiple rating scales to cover different sustainability elements of buildings	• More information for consumers • Easier identification of potential areas of building improvement • No need to aggregate or weight ratings of different elements • Ability to easily add or remove elements in the future	• Potentially more complex to communicate • More complicated comparison between buildings
2. Combined rating scale that encompasses all sustainability elements	• Simple communication message • Rapid comparison between buildings	• Requires ratings of different elements to be weighted and aggregated • Reduced transparency on the performance of different building elements
3. One headline star rating for communication purposes and information on more detailed sustainability aspects provided in a report	• Allows for simple communication and more detail for those consumers who want it • Allows relatively easy comparison • Minimal aggregation of data • Ability to easily add or remove elements	• The headline rating may not align with what is most important factor for all consumers
Linear or logarithmic scale		
1. Linear rating scale	• An evenly spaced rating scale is easy to understand • Rating increases relate directly to a specified improvement in building performance across the scale	• Existing buildings may be bunched at the lower end of the scale • Does not reflect that the cost-effectiveness of improving a particular star rating to the next level is not the same across the scale

Options	Pros	Cons
2. Logarithmic rating scale	• Can adjust the scale to recognise the effort of achieving different rating points on the scale	• More complicated to communicate • Improvements between ratings cannot be directly compared as rating points are not evenly spaced on the scale • Requires a transparent, reliable method for adjusting scale to avoid "black box" results
Star Scale		
1. 10 star scale (with 10 representing best technically possible, for example, zero energy/emissions)	• Simple to communicate • Consistency across the sector • Could easily be matched with a greenhouse gas emissions or energy metric • System currently used for NatHERS	• Need additional information for industry professionals – stars are primarily for the consumer • Changes to the NABERS rating scale would be required
2. Five or six star scale	• Simple to communicate • System currently used for NABERS	• Limited range to discriminate between buildings of different performance

6.4 Accounting for climate variation

Australia has a wide variety of climates. The Framework should aim to enable households or businesses evaluating a property in any particular city to understand the energy efficiency of that property relative to the climate of that location.

6.4.1 Accounting for climate variation in building standards

For residential buildings, the BCA performance requirement for the energy efficiency of the building shell is expressed in terms of a single star rating under NatHERS. However the underlying star banding in NatHERS varies by climate zone, so for example a five star house in Brisbane has quite a different predicted thermal performance to a five star house in Hobart. This is due to there being practical limits on thermal performance in different climate zones and varying benefit/cost ratios in these zones in achieving particular standards.

If climate zone variability were not included in the BCA, then the cost of compliance with building standards and the benefit/cost ratio would not be consistent across climate zones. The question arises then of how to determine the extent of variability allowed while still seeking national consistency in standards and the equitable sharing of the costs of reducing emissions or energy use.

It may be more simple and transparent if star bands were set independently of climate zones and instead linked to reduction in energy use or greenhouse gas emissions, with buildings in more extreme climates being able to offset high heating or cooling energy use by higher performance in other building components. The benefit/cost implications of this approach would need to be considered in detail.

If the Framework were to include an overall national goal, it would also need to consider how this goal was applied in different climate zones. For example, the approach of setting an overall reduction goal relative to a baseline could be modified so that rather than setting a single national baseline, baselines could be calculated based on the average of the climate region/state where the building is located. The percentage reduction goal could therefore be common across Australia but the starting points would be different, depending on region.

Accounting for climatic variation – possible options

Options	Pros	Cons
1. Adjust the rating scale according to climate zone (that is, an X star building in Melbourne will have a different performance requirement to an X star building in Brisbane)	• Communication to the consumer is easier – the same star standard everywhere • Does not penalise buildings situated in harsh climatic conditions	• Need consistent, technically valid and transparent means of setting star bands in different climate zones • Industry confusion as to what the star rating means – perceived lack of national consistency • Does not make transparent that buildings in harsh climatic conditions are likely to have greater energy use
2. A rating scale that is consistent across the country (that is, an X star building has the same performance requirements no matter where it is located)	• National consistency in describing building performance – increased understanding and ease of communication	• Penalises buildings situated in harsh climatic conditions
3. A consistent rating scale across the country but different standards set for different climate zones, for example, depending on benefit/cost ratio, or as a percentage reduction goal relative to that zone's baseline (that is, the standard in Melbourne may be X star and the standard in Darwin may be (X-1) star)	• Treats buildings in all climate zones fairly in terms of effort required to achieve the standard • Performance requirements for buildings in different climate zones more transparent	• May be confusing for industry stakeholders who work across more than one climate zone

6.4.2 Taking account of future climate change

Heating and cooling loads are determined in building energy modeling tools relative to historical weather data. However, with projected climate change it may be the case that a building constructed now will face noticeably different climate conditions by the end of its life. This raises the issue of whether rating schemes should take account of how adaptable or resilient buildings are to future climate conditions.

Taking account of future climate change – possible options

Options	Pros	Cons
1. Adjust existing climate data to favour more recent, hotter years	• Still based on recent climate data • Not reliant on projections	• May give a result that is less than actual future climate conditions
2. Adjust existing climate data to projected future climate conditions	• Takes into account projected temperature variations due to climate change which may significantly affect the overall performance of the house subsequent energy use • Helps focus on adaptation of buildings to more extreme weather	• Climate predictions may prove to be inaccurate

6.5 Incorporating ratings in the building code

There are some specific issues regarding how energy ratings are incorporated in the BCA and implications for other aspects of the BCA, which are outlined below.

6.5.1 Continuation of DTS provisions for residential buildings

In relation to residential buildings (Class 1 and 2) the BCA currently includes prescriptive (commonly called 'Deemed to Satisfy' (DTS)) and simulation/modelled options for complying with its performance requirements in relation to the thermal efficiency of the building shell. It is likely that as the standards increase in stringency and potentially become integrated across building components, it will be cheaper for builders to follow the simulation/modelled route as greater design flexibility is allowed. It may also be simpler for regulators to rely on modelled approaches as the complexity of the building increases and it becomes more difficult to determine DTS provisions that adequately cover all circumstances. For these reasons the prescriptive DTS provisions for multi-unit residential buildings are being removed from the 2010 BCA but DTS remains for houses.

Minimum standards for certain building components, especially the thermal shell of the building, may still be desired but a modelling approach will allow designers to trade-off more easily between different components beyond any minimum standards.

Provisions in the BCA for prescriptive or modelled approaches – possible options

Options	Pros	Cons
1. Remove DTS from Class 1 of the BCA leaving only the simulation/modelled option	• Encourages greater flexibility in meeting standards and hence has the potential to promote innovation in the sector	• Smaller or more traditional builders may need to transition to the new system from using a DTS approach
2. Leave DTS in the BCA alongside simulation/modelled option	• Flexibility through modelled option is still available • Allows smaller or more traditional builders the option of using a DTS approach	• DTS could become much more expensive than modelled option – disadvantages those choosing to use this option

6.5.2 Number of climate zones in the BCA

The BCA DTS provisions are specified for eight climate zones across Australia. However, NatHERS accommodates 69 climate zones, with possible expansion already flagged to move to 80 zones.

The design of buildings for dealing with mild versus extreme hot or cold climates can vary, for example, Queensland already provides an optional credit for outdoor living areas in its housing regulations due to greater household use of such areas in hot climates.

How can the number of climate zones recognised in the BCA for DTS be better aligned with the greater number of zones used in rating tools?

6.5.3 Incorporating star ratings for commercial buildings in the BCA

Energy efficiency requirements for commercial buildings are contained in Section J of the BCA (Class 3 and 5 to 9 buildings). Requirements apply to building fabric, glazing, mechanical services and artificial lighting. The extent of the requirements and the manner of application depends on the building classification and the climate zone in which it falls.

Currently there are two methods of compliance with the BCA requirements: DTS, which involves using set prescriptions that meet the energy efficiency requirement; or a verification method, which involves modelling performance under various scenarios, and allows for flexibility in meeting the prescribed standards. Any software can be used for modelling as a verification method, as long as it is able to calculate the heating and cooling loads in accordance with the methodology prescribed in the BCA.

There is currently no relationship between the BCA requirements and any building rating system, including NABERS. Current rating systems also do not always neatly align with BCA building classifications, and there are no existing tools for several classifications. Consequently, it can be difficult to communicate increases in the stringency of the commercial building requirements. Developing or utilising existing star rating scales for commercial BCA classifications would assist with communicating stringency standards to a non-technical audience.

There will be some commercial building types for which it is not practical to develop star based benchmarking scales due to their specialised nature. In these cases, it is likely that DTS provisions will need to be retained.

Another alternative to prescribing star ratings in the BCA would be to prescribe energy use limits in megajoules per square metre or greenhouse gas emission limits in kilograms CO_2-e per square metre.

Should star ratings be used as the means for setting standards for commercial buildings in the BCA?

There are no existing rating scales for several classifications. To what extent this is an issue? Should DTS provisions be retained where it is not practical to develop a rating scale for particular types of buildings?

6.5.4 Alignment of modelling protocols

The modelling software used for the NABERS Commitment Agreement process for office buildings is also suitable for modelling BCA compliance for Class 5 buildings. However, there are currently different modelling protocols for using the software for these processes, meaning that developers entering into a NABERS Commitment Agreement need to model their office building's performance twice to achieve BCA compliance.

The Department of Climate Change and Energy Efficiency (DCCEE) is investigating options for aligning NABERS modelled ratings and BCA verification methods. Aligning the modelling protocols could potentially enable the energy efficiency requirements for commercial buildings to reference a particular NABERS Energy star rating as the minimum performance requirement for new building work under the BCA. It would also allow developers to use a single building model for both processes.

One issue with modelled ratings, however, is that they rely upon the simulation of the building to accurately predict the likely future energy use. Many factors influence the accuracy of this prediction, including imperfect construction, commissioning, control and operation of buildings, the ability of the person who undertook the simulation, and the constraints of the modelling software itself. Consequently, a building that is designed to a five star standard may only perform at three or four stars in operation. The NABERS Commitment Agreement process militates against this to a degree, as developers need to achieve the modelled performance in operation and thus tend to employ more conservative assumptions.

Should the modelling protocols for commercial buildings BCA compliance and NABERS Energy Commitment Agreements be aligned?

How can Government support improved modelling standards to more accurately predict future building performance?

Should modelled ratings include a correction factor to account for imperfect commissioning?

7. GOVERNANCE OF RATING SCHEMES

The governance arrangements for rating schemes and management of tools need to be rigorous and well maintained in order to ensure the credibility of any standards set and the system overall. The potential inclusion in rating tools of energy used by equipment and appliances adds another layer of complexity.

7.1 Rating tools

NABERS Energy is the generally accepted rating tool for assessing the environmental performance of existing commercial buildings. Modelling of new commercial building performance can be undertaken using a variety of commercially available software programs, the results of which can then be plugged into NABERS.

The governance of tools in the residential sector is more complicated. NatHERS allows market competition in tool development through the accreditation of any tool which meets set performance benchmarks, as defined relative to the Commonwealth Scientific and Industrial Research Organisation (CSIRO) benchmark calculation engine. NatHERS tools are currently: AccuRate (the NatHERS benchmark tool); and the provisionally accredited FirstRate5 (a Victorian Government tool) and BERS Pro (a privately developed tool).

The BCA only recognises the use of NatHERS software for determining compliance with the thermal performance standard, but NSW has a variation to the BCA that requires the use of its BASIX tool in NSW (which incorporates NatHERS results). Greater consistency between states is desirable, particularly for companies that operate in multiple jurisdictions.

The question needs to be asked as to whether it may be desirable to have a single rating tool that covers both residential and commercial building classifications for national consistency and efficiency in governance.

Coverage of different building classifications – possible options

Options	Pros	Cons
1. Develop one rating tool for all building classifications	• Would be nationally consistent • Simplifies training of assessors and management of the tool	• May not deal adequately with the differences in the markets and construction of different building types • A new rating tool would need to be developed
2. Different rating tools for different building classifications	• Allows for complexities of different building classifications to be built into tools	• More tools to be developed and maintained for those without tools currently

If there is a continuation of the current distinction between residential and commercial rating tools then there are some specific issues relating to the market for residential rating tools that will need to be addressed.

Market for residential rating tools – possible options

Options	Pros	Cons
1. Governments to facilitate the evolution of a single new national tool from existing NatHERS and BASIX tools	• Could contribute to consistency of assessment results • Could take the best parts of existing tools and combine them • Scientific validity of the tool would be maintained by governments • Eliminates need for a tool accreditation scheme	• Intellectual property issues will need to be resolved for building on current software • High costs associated with development of new tools • Limits market development of other tools • Potential for a lack of innovation in rating tools
2. A national accreditation scheme for rating tools, with multiple 'front end' tools developed by the market, but relying on a single calculation engine developed and managed by governments (as per option 1)	• Allows some competition in the market while giving consistency in results • Licensing of use of the engine could generate funding for further development	• Governments still need to develop and maintain a benchmark tool • Potential for ratings to vary depending on which tool is used • Assessment of tools against benchmarking standards will be needed for quality assurance
3. Development of a national protocol/specification for a rating tool that any private tool developer could attempt to comply with	• Encourages market innovation and competition in all aspects of the tool, including the thermal calculation engine	• Increases potential for ratings to vary between tools • Government would still need to ensure consistency of inputs and outputs through accreditation of tools • Quality assurance standards for the tools will need to be developed and enforced (without a benchmark tool these may be difficult to define) • Private sector tool providers may fail to come up with an acceptable tool or sufficiently invest in tool upgrades

7.2 Assessors

The quality of building assessments and ratings is dependent not just on ratings tools, but also on the quality of the data input to those tools. The inputs to tools are conditional on the people undertaking building assessments being able to correctly interpret building plans and specifications and correctly use the features of the tools. Therefore, ensuring the quality of assessors is critical to ensuring the quality of the overall system.

NatHERS includes arrangements for the training and accreditation of assessors to undertake ratings using NatHERS tools. At present there is only one organisation that has accreditation to accredit assessors (the Association of Building Sustainability Assessors (ABSA)), and not all jurisdictions require this training and accreditation for compliance with the building code provisions.

For straightforward detached houses, BASIX allows the public to undertake assessments of home sustainability through its website without prior training or accreditation in the BASIX tool. Specific training is not required as compliance checking is then carried out by local government or private certifiers as part of building certification. For complex projects and multi-unit construction, the thermal comfort component must be completed by an accredited ABSA assessor. This accounts for approximately 75% of all assessments.

Only NABERS accredited assessors are able to perform accredited NABERS performance ratings of commercial buildings, although the NABERS website does provide a calculator for self-assessments.

Assessor accreditation – possible options

Options	Pros	Cons
Assessor accreditation		
1. All users of rating tools for regulatory purposes to be accredited	• Brings rating industry in line with other industry accreditation schemes • Skill development can be implemented more effectively through accrediting organisations • Auditing can result in the loss of accreditation • Increased accountability in the profession	• Accreditation process will need to be managed and funded • Costs of getting a rating could increase, which adds to building costs • Numbers of assessors will need to be monitored to ensure demand for ratings is met
2. Rating software is designed with sufficient built-in checks that assessors do not need to be accredited	• Less financial burden on assessors and hence the consumer	• Potential to limit flexibility of design through more prescriptive software • May need to be more auditing of ratings to lessen risks of errors
Accreditation process		
1. Assessors accredited and audited by professional bodies	• Could help to facilitate strong links between accreditation and professional development • Reduced government involvement and expense	• Potential conflict of interest in auditing and disciplinary measures if the result is a loss of membership of professional body
2. Assessors accredited and audited by an independent national agency	• Would help to make the process independent and transparent • National consistency in accreditation • No interstate work barriers for assessors	• Would need to ensure industry representation within the structure • National agency would need to be set up and would require ongoing funding
3. Assessors accredited and audited by state and territory governments	• More localised management of assessors	• May not be national consistency in assessor standards • Limitations for assessors wanting to work across more than one jurisdiction, unless there was a scheme for mutual recognition of state accreditations

7.3 Funding

The ongoing management and development of tools (and underlying calculation engines) and the schemes surrounding them are complex, costly and resource intensive. Rating tools need to be backed by scientific research on the thermal performance of building materials and their interactions, and need to be dynamic to potentially accommodate the introduction of new materials and construction techniques.

In general, the management and development of government-owned tools is currently mostly funded by the jurisdictions involved through the normal budget process, with some partial self-funding coming through user fees. The reliance on government funding has led to the amount and timing of funding being subject to budget cycles and other funding pressures on government.

Detailed costing of the implementation of the Framework has not yet been undertaken as this is dependent on what options governments choose to pursue, but is likely to be significant. It would be desirable to establish a sustainable funding model, be this through governments or other self-funding means, for the management and development of tools and assessor components that can help towards meeting the outcomes agreed as part of the Framework into the future.

Funding – possible options

Options	Pros	Cons
1. Government funding	• Direct costs to software providers and assessors minimised	• Dependent on budget cycles • Costs covered through general tax revenue rather than targeted to direct users
2. Self-funding mechanism (for example, fees for use of rating tools, licencing of government software to private tool developers, accreditation fees on assessors etc)	• More independence from government budget cycles • User pays system installed	• Ensuring that fees cover all required funding may be difficult • Devising an equitable way of allocating costs across all users would be required

8. MONITORING AND EVALUATION

8.1 Evaluation of the Framework

Governance of the National Building Framework will need to be developed in line with the Framework itself.

The monitoring and evaluation of the Framework will be essential to ensure it remains relevant and effective over the next decade. This involves the establishment of longer-term oversight arrangements for the Framework by jurisdictions, developing a mechanism for future industry input and establishing monitoring and review mechanisms which are transparent.

It may be beneficial to flag major review points for the Framework. This would be an opportunity to assess the benefits of the Framework, the progress made in the sector and the possibility and need to extend the Framework beyond the initial 10 year span. A possible Framework evaluation point could be mid-way to 2020, that is 2015, which would allow for future upgrades to the BCA to be implemented as well as enough time to re-evaluate any 2020 goal if required.

What is an appropriate timeframe for a full evaluation of the National Buildings Framework measure?

8.2 Building code evaluation methodologies

All future increases in stringency of standards agreed to in the Framework should be based on rigorous analysis of the economic, social and environmental impacts of each increase. There are several approaches to this, including but not limited to actual data collection and analysis from established buildings under each new code change.

To date, there has been limited national ex-post evaluation completed to review the benefit/cost ratios of previous energy efficiency upgrades to the BCA. Several smaller studies have been conducted, including monitoring of a small sample of real buildings. These studies have led to improvements in the NatHERS benchmark calculation engine. There have also been multiple scientific studies into the accuracy of building energy modelling software used for building code compliance. Some jurisdictions have also done reviews of the impacts of their building energy efficiency regulations.

One way to evaluate building code upgrades is to collect actual energy use data of real buildings. The collection of actual data on building energy use from a statistically relevant sample of buildings is a high cost exercise – a range of climate zones would need to be adequately represented, multiple building classes may need to be covered, data may need to be collected across several seasons, and variations in occupant use of the buildings would need to be considered. It is also time consuming as there will need to be sufficient time to allow the last step changes to the BCA to be reflected in new buildings being constructed and occupied, allow a period of monitoring of the operational performance of these buildings, and then analysis of this data to feed into the development of the next step change.

An alternative to collecting actual data could be to use a modelling approach that estimates updated costs and benefits after the market has been designing and building to these standards for a period of time. It is generally assumed that costs for new building techniques and materials decrease over time as the market penetration increases hence affecting the benefit/cost ratios. Such an approach could include the establishment of expert advisory committees and allow for regular surveys of the building industry and consumers. This approach may allow a robust assessment of the latest BCA changes to be undertaken in a timeframe which allows the energy efficiency performance standards to be improved progressively over the period to 2020.

Evaluation of stringency increases – possible options

Options	Pros	Cons
1. Evaluation of actual building operational energy use data	• Provides a more comprehensive picture of what is actually happening on the ground • Limits need for assumptions to be built into the analysis • Could build off data collected through mandatory disclosure and other energy assessments	• Potentially expensive and time consuming to collect the amount of data needed for a statistically significant evaluation
2. Review/remodelling of RIS calculations after BCA changes introduced, based on latest available data and ongoing review of software validity	• More cost effective and faster approach to evaluating stringency increases and software supporting the BCA	• Only gives an estimate of actual data

8.3 Data collection

An important aspect of the Framework is its capacity to assist in improving the level and quality of information available to industry, consumers and governments on building performance. This will assist decision makers within government and industry to develop future policy on building energy efficiency standards and programs.

A substantial data set will be required to facilitate effective monitoring and evaluation of building performance and to monitor and report on whether the outcomes of the Framework are being achieved. To achieve this, the Framework could include a mechanism to collect and disseminate building rating data on a consistent national basis. Data could potentially be collected on new and existing buildings from mandatory disclosure and building approval processes and other related government programs, for example, home sustainability assessments.

As NABERS (and the Australian Building Greenhouse Rating before it) has been collecting operational energy data for over 10 years, it has built up a substantial data set on office building performance. ABSA also has data on the home energy ratings done by its members, and BASIX has data on its ratings. The logistics of collecting and analysing data from a number of sources and rating schemes with different data fields will need to be considered in developing the Framework, and be coordinated with the NSEE Measure 1.4.1, the Energy Efficiency Data Project.

Decisions relating to the governance of assessment and rating schemes and the tools used should therefore take into account the need for data collection. For example, it may be easier to collect data if the rating tools and data entry points are online and connected to data 'warehouses'.

Not only would data collection provide valuable input for monitoring and assessing current programs and the policy design of future programs, greater availability of data on individual buildings would facilitate cheaper and quicker assessments for mandatory disclosure purposes. A centralised database of all building assessments would lead over a period of time to every building in the country being included and assessments becoming a process of updating the information available rather than completing an entire assessment.

Data collection – possible options

Options	Pros	Cons
1. Establish a National Building Database	• All buildings data in a central location • Data available for evaluation and policy development • Data accessible to all levels of government	• Adequate information sharing protocols would need to be established • May split energy data from other data for buildings required or captured by jurisdictions • Potential limitations to capacity and responsiveness of a centralised system
2. Data collection on a jurisdictional level	• Data directly available to help inform policy at a jurisdictional level • Potential to build on existing jurisdictional resources for other building and planning information	• Extra step involved to get a national picture of the building sector • Duplication of database software and maintenance across jurisdictions
3. Data collection split according to building classification	• Could build on existing NABERS database for the commercial sector and data collected under NatHERS for residential sector • Data available for evaluation and policy development	• Duplication of database software and maintenance • Extra step involved to get a national picture of the building sector

8.4 Capacity Building for Framework Implementation

8.4.1 Enhancement of building industry skills

In developing the Framework broader issues such as industry skills, capacity to undertake building ratings and the adoption of new building materials and construction techniques will need to be considered as there can be long lead times involved. These issues will be addressed in more detail as the Framework develops, but are considered briefly below.

The capacity and skills necessary for industry to meet increasing levels of stringency over time will need to not only be considered in initially setting intended stringency levels but also will be essential to lowering the cost of achieving any new standards. The promotion of best practice buildings and market-leading voluntary rating and assessment tools are important complements to the Framework as they stimulate demand, build skill capacity, build economies of scale and thereby reduce costs of regulation.

There are several industry skills initiatives which relate to the energy efficiency and sustainability agenda, including measure 1.2.1 of the NSEE – the development of a National Energy Efficiency Skills Initiative. Such linkages will be considered during the Framework's development and implementation.

8.4.2 Training of assessors

NSEE Measure 1.2.2 is to 'Strengthen national capability in energy auditing and assessment.' The key elements of this measure are to:

- rationalise existing energy efficiency audit and assessment processes with the aim of achieving nationally consistent approaches and requirements;
- align building assessment metrics with outcomes from the National Building Energy Efficiency Rating and Assessment Framework;
- review the need for additional training in energy auditing; and
- review Australian and New Zealand standard AS/NZS 3598:2000.

It is clear that there are substantial links between this measure and the Framework measure, in terms of the assessment metrics as well as strengthening energy efficiency audit and assessment processes.

APPENDIX A

NSEE Measure 3.1.1

http://www.coag.gov.au/coag_meeting_outcomes/2009-07-02/docs/Energy_efficiency_measures_table.pdf

3. Making buildings more efficient

Historically, our buildings have not been built with energy efficiency as a key concern, although voluntary industry action, government policy requirements and building efficiency standards instituted over the past decade have begun to transform our built environment. Energy consumption in buildings accounts for approximately 20 per cent of Australia's greenhouse gas emissions – split equally between commercial and residential buildings.

This Strategy sets the foundation for a transformation of Australia's building stock. The Strategy is designed to drive significant improvement in minimum energy efficiency standards to deliver substantial growth in the number of highly energy efficient homes and commercial buildings, reflecting international best practice. The transformation will be achieved through a combination of measures addressing both new building design and construction and existing building stock.

New buildings will be designed and constructed according to increasingly stringent energy efficiency standards that will lead to a reduction in energy consumption. These standards will account for climatic variation. Major renovations will be subject to the same standards.

This Strategy also includes measures to help raise the energy efficiency of existing building stock through cost-effective voluntary action in response to better information about building energy use. In particular, people seeking to buy or lease properties will be provided with information about the energy efficiency of the buildings through proposed new mandatory disclosure provisions. Armed with this information, consumers and businesses will be able to make informed choices about the energy efficiency of the buildings they buy and lease – and builders and building owners will respond to those market signals by investing in energy efficiency.

This Strategy encompasses early action in the commercial and residential sectors to significantly improve the energy efficiency of new buildings and also to phase-in mandatory disclosure, both commencing in 2010. This early action will be followed by major reforms to the building standard setting and rating system in 2011 to deliver national consistency in the way minimum standards for building energy efficiency are set and how performance outcomes and design are assessed and rated.

Governments will set out a clear process and timetable for periodic review (for example, every three years starting in 2012) of energy efficiency standards so that over the life of this strategy energy efficiency requirements will be progressively increased. This will give industry greater confidence to innovate and develop affordable solutions to improve building energy efficiency. For example, six, seven and eight star buildings, or equivalent, will become the norm in Australia, not the exception.

3.1 Consistency in standard setting and performance assessment frameworks

Measure	Key elements	Indicative pathway	Implementation responsibility
3.1.1 All jurisdictions will work together to develop a consistent outcomes-based national building energy standard setting, assessment and rating framework for driving significant improvement in the energy efficiency of Australia's building stock. To be implemented in 2011.	a. This measure will be used to increase the energy efficiency of new residential and commercial buildings and major renovations, with minimum standards to be reviewed and increased periodically, for example every three years. b. Energy efficiency improvements will continue to be communicated via star ratings, underpinned from 2011 by new national measurement and reporting metrics relevant to both new and existing buildings, under the national framework.	This measure will lead to the development of an integrated national outcomes-based framework. The Australian Government Department of the Environment, Water, Heritage and the Arts (DEWHA) will chair a group of jurisdictional representatives, drawing on external expert advice as required, to lead development of the national framework and consult with building industry stakeholders.	Australian, state and territory governments. All jurisdictions via a specific purpose committee and including the NFEE Buildings Committee.
	c. This framework will: • apply to new and existing building stock; • cover all classes of commercial and residential buildings; • over time set increasingly stringent minimum performance standards for new buildings and major renovations (subject to regulatory impact analysis); • include common metric(s) to underpin standard setting and performance assessment; • include flexibility to account for climatic variation; • accommodate mandatory disclosure of energy performance at time of sale or lease; • work towards convergence of existing, measurement-based rating tools (such as the National Australian Built Environment Rating System – NABERS Energy) for existing buildings with predictive or modelling-based tools used for rating new buildings; and • be capable of extension over time to cover broader sustainability elements, including water management and greenhouse gas emissions and the maintenance of energy efficiency performance through commissioning, operation and maintenance of buildings.	The Building Code of Australia (BCA) will be the instrument by which the framework is implemented for both new building work and major renovation of existing buildings. The revised code will: • increase the performance standard for all new buildings and transition to a nationally consistent performance based assessment system by the end of 2011; • cover the building envelope and energy efficiency of key building services; • allow innovation in meeting defined performance standards; • provide for the use of rating tools developed by the market which provide an accurate assessment of a building's performance, and that such tools be transparent and user friendly; and • facilitate effective monitoring and compliance. A draft framework and implementation agreement will be developed by the end of 2009. Jurisdictionally agreed framework and implementation agreement to be agreed by the end of 2010, with implementation by the end of 2011 through the BCA.	
	d. Enhancement of the national governance framework of NABERS Energy as a part of the development of a unified national framework.	Australian Government will chair the NABERS National Steering Committee with representation from all jurisdictions. NSW will provide national administration of NABERS and manage the development and delivery of the scheme, under the direction of the National Steering Committee.	

APPENDIX B

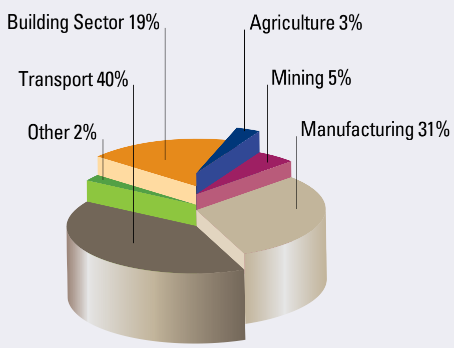
Background information on building energy use, regulations and tools

B.1 Buildings' contribution to energy use and greenhouse gas emissions

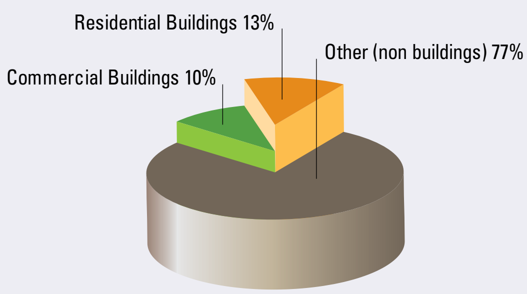
Globally, the building sector is accountable for approximately '40 [per cent] of the world's energy consumption and…[one third] of global greenhouse gas emissions.'[14] The total energy use and greenhouse gas emissions from the sector is predicted to increase, with the Intergovernmental Panel on Climate Change's 4th Assessment Report (IPCC AR-4) estimat[ing] that building-related greenhouse gas emissions reached 8.6 billion metric tons (t) CO_2 equivalent (e) in 2004, and could nearly double by 2030, reaching 15.6 billion tCO_2e under their high growth scenario.[15]

Within Australia it is estimated that the building sector accounts for approximately 19 per cent of the country's total energy consumption and 23 per cent of greenhouse gas emissions.[16]

Australian Energy Consumption



Australian Greenhouse Gas Emissions



The Second Plank – Building a low carbon economy with energy efficient buildings, ASBEC, 2008.

In 2007 the residential sector accounted for 451 PJ or 12 per cent of Australia's total energy consumption.[17] Heating, cooling and water heating are significant contributors to household energy use and greenhouse gas emissions along with plug-in appliances, although the proportions vary depending on climate zone. It is predicted that energy demand and greenhouse gas emissions will increase in the residential sector, with greenhouse gas emissions increasing at a rate of 1.3 per cent per annum largely due to the growth in building stock.[18]

14 UNEP Sustainable Buildings and Climate Initiative, *Common Carbon Metric for measuring Energy Use & Reporting Greenhouse Gas Emissions from Building Operations*, 2010.

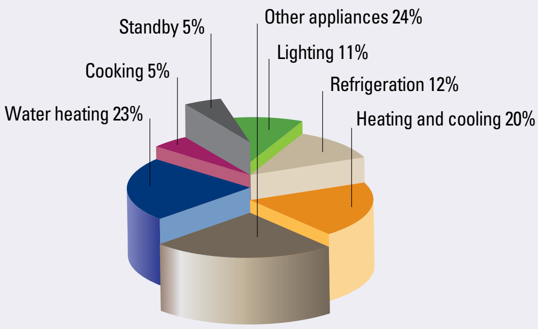
15 Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, 2007.

16 ASBEC, *The Second Plank – Building a low carbon economy with energy efficient buildings*, 2008.

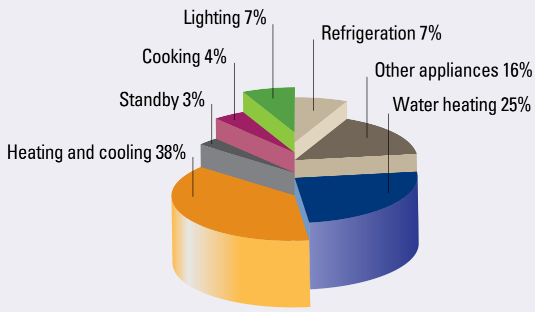
17 Australian Government, *Energy Use in the Australian Residential Sector 1986-2020*, DEWHA, 2008.

18 ASBEC, *The Second Plank*, 2008.

Greenhouse Gas Emissions from home energy use 2008



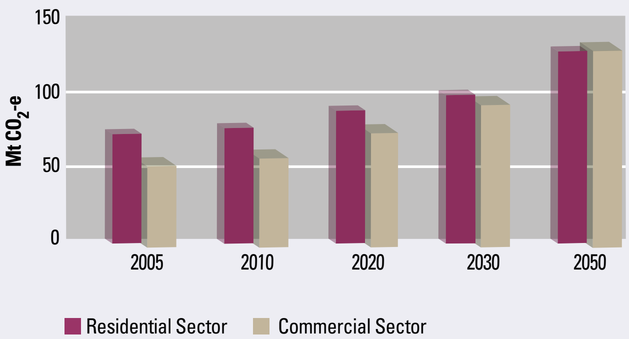
Home energy use 2008



Your Home Design for Lifestyle and the Future: Technical Manual, DEWHA, 2008[19].

As illustrated in the graph below, it has been predicted that energy demand in the commercial sector will increase more dramatically than in the residential sector, again largely due to growth in building stock. Between 1990 and 2006, emissions in the commercial sector increased from 32 Mt CO_2-e to 60 Mt CO_2-e an 87 per cent increase in just 15 years. On a business as usual scenario, emissions from the commercial sector are projected to continue to increase by 2.1 per cent per annum, reaching 140 Mt CO_2-e by 2050.[20]

Building Sector Emission Projections



Based on ASBEC, 2008.

It has been estimated that electricity was responsible for 65 per cent of energy use and 89 per cent of emissions from the commercial sector. Space cooling, ventilation and lighting were found to be the most significant causes of greenhouse gas emissions at approximately 71 per cent of total emissions.[21]

[19] Note: these figures are averaged across Australia and the proportions would vary in different climate zones.

[20] *Mandatory Disclosure of Commercial Office Building Energy Efficiency – Regulation Document*, DEWHA, 2009.

[21] *Australian Commercial Building Sector Greenhouse Gas Emissions 1990-2010*, DEWHA, 1999.

B.2 Government regulation of building energy efficiency

Including minimum energy performance requirements in national building codes has been used as one of the most cost effective methods of achieving improved building energy efficiency.

The life-span of a typical building is generally 30-80 years. Decisions made during a building's design project phase for both new buildings and major renovations can significantly influence energy consumption over much, if not all, of a building's lifetime. Further, the cost of upgrading an existing building's performance is typically much higher than building in those features during initial construction.

The importance of energy efficiency standards for buildings is not a new concept. In 1961, for example, Denmark introduced energy standards for buildings with positive results. The United States adopted residential and commercial building codes with energy components in 1975.[22]

Various energy efficiency regulations began to be introduced in different Australian jurisdictions in the 1990s. For example, in 1991 Victoria introduced insulation regulations for domestic dwellings, followed by the ACT in the mid 1990s. NSW began its 'Energy Smart Homes' policy in 1997 and has since established BASIX to assess energy and water efficiency and thermal performance of residential buildings.

National energy efficiency provisions for housing in Australia (that is Class 1 and Class 10 buildings) were first introduced into the BCA on 1 January 2003.[23] The provisions varied depending upon the climate zone in which the building was located. To ease adoption, the provisions were initially kept relatively simple and were developed to achieve a nominal level of energy efficiency equivalent to a 3.5 to 4 star rating under NatHERS.

Energy efficiency provisions in the BCA have progressively increased since 2003. In 2005, provisions were introduced for Class 2-4 dwellings (apartments, boarding houses, etc.) for a minimum of 3 stars for all units, an average of 4 stars for units within one building in cool/temperate climates, and an average of 3.5 stars for units within one building for warmer climates.

In 2006 the provisions for Class 1 buildings were upgraded to a minimum of 5 stars, and energy efficiency standards were introduced for commercial buildings for the first time. The commercial building requirements represented an important first step for new commercial building work, affecting the thermal performance of external walls and glazing, the efficiency of artificial lighting and the appropriate installation of heating, ventilation and air-conditioning systems. It was recognised at the time of adoption that the stringency of the commercial building requirements could be increased significantly in the future.

On 2 July 2009 as part of the NSEE the COAG agreed to investigate an increase in the stringency of the energy efficiency requirements for residential buildings from 5 to 6 stars, or equivalent, nationally in the 2010 update of the Building Code of Australia to be implemented by May 2011, and including new efficiency requirements for hot water systems and lighting. The energy efficiency standards for all classes of commercial buildings were also to be increased in the 2010 BCA. Following regulatory impact assessment, the Building Ministers Forum confirmed on 22 January 2010 that these measures are to be incorporated in the 2010 version of the BCA.

The BCA is a national code but states and territories implement the code through their own legislation. Jurisdictional variations to the national code are recorded in the appendices of the BCA. For example, in NSW the Building Sustainability Index (BASIX) replaces the energy efficiency provisions of the BCA for residential buildings, and in northern climates (zones 1 & 2) credit will be given for appropriate outdoor living spaces in the 2010 BCA update.

[22] U.S. Department of Energy and the Asia-Pacific Partnership on Clean Development and Climate, *Shaping the Energy Efficiency in New Buildings: A Comparison of Building Energy Codes in the Asia-Pacific Region*, September 2009.

[23] The BCA contains the technical standards for the construction of new buildings and major renovations to existing buildings throughout Australia.

Improvements to existing buildings are currently addressed through incentive programs targeting specific elements of a building, such as insulation and hot water heaters. Australian governments have also committed to introducing mandatory disclosure of the energy efficiency of commercial and residential buildings from 2010 and 2011 respectively. These schemes aim to improve energy efficiency of existing buildings through publicly disclosing information relating to the energy efficiency of the building.

Appliances sold in Australia, including electric storage water heaters, single phase and three phase air conditioning units and commercial refrigeration, are currently regulated through Minimum Energy Performance Standards (MEPS). Many products also have energy performance labels to help customers choose the most efficient models.

B.3 Building rating schemes

The importance of rating schemes and tools has increased with the introduction of energy efficiency standards in the BCA and increasing public interest in the environmental performance of buildings. There are now a range of tools available which have varying functions and metrics.

The table below summarises the most widely used rating schemes. Other tools are currently being developed within individual jurisdictions and to cater for specific programs, and others are available overseas, but these have not yet gained substantial market traction in Australia.

Nationwide House Energy Rating Scheme (NatHERS)	The Nationwide House Energy Rating Scheme (NatHERS) started in 1993 and is now part of the National Framework for Energy Efficiency (NFEE). The Scheme is administered by the Commonwealth in partnership with jurisdictions. NatHERS accredits software tools that rate, using a 10 star band, the potential energy efficiency of the building shell of a home in terms of the heating and cooling energy required per square metre to keep the home at a reasonable level of human comfort. The more stars, the less likely the occupants need to use cooling or heating systems to stay comfortable. The rating takes into account how well the components of the home are suited to the local climate, for example: • the layout of the home; • the construction of its roof, walls, windows and floor; and • the orientation of windows and shading to the sun's path and local breezes. Current 'second generation' software accredited under NatHERS are AccuRate, FirstRate (provisional) and BERSPro (provisional).
Building Sustainability Index (BASIX)	BASIX was launched by the NSW government in 2004 to reduce greenhouse gas emissions and water use in the residential sector. Energy, thermal comfort (building shell efficiency) and water reduction targets need to be met for all new dwellings in NSW. A BASIX certificate, which is a requirement for building approval, will only be issued if these targets are met. BASIX uses information such as site location, house size, type of building materials and fittings for hot water, cooling and heating. BASIX is not a "one-size-fits-all" approach: it incorporates regional variations such as soil type, climate, rainfall and evaporation rates. These targets vary according to building type and location.[24] BASIX rates buildings by estimating their total household energy and water use as a percentage of a NSW average. BASIX uses a percentage reduction target and reports the results in standard metrics (tonnes of greenhouse gas emissions avoided and gigalitres of water saved).

[24] http://www.basix.nsw.gov.au/information/common/pdf/basix_fact_sheet.pdf

National Australian Built Environment Rating System (NABERS)	NABERS is a national voluntary environmental rating system for existing commercial and residential buildings administered by the NSW government and governed by a National Steering Committee comprising representatives from the Commonwealth, state and territory governments and chaired by the Commonwealth. Its energy component incorporates the former Australian Building Greenhouse Rating Scheme. NABERS Energy has been announced to form the basis of the Commercial Building Mandatory Disclosure program beginning in 2010. NABERS ratings are based on greenhouse gas emissions associated with actual annual operational energy use data for the building per unit of function, such as floor area, number of occupants or number of rooms. NABERS ratings are communicated using a 5 star-rating band, with 5 set at leading practice and 2.5 at market average. For new buildings, NABERS incorporates a 'commitment agreement' whereby a building is designed to perform at a 4.5 or 5 star NABERS Energy standard and then the building developer (or its subsequent owner) needs to demonstrate that the building meets the claimed energy performance after being occupied.
Green Star	Green Star is a national voluntary environmental rating scheme run by the building industry through the Green Building Council of Australia. It evaluates the environmental design of new commercial offices, health care buildings, education facilities, and multi-residential unit buildings by determining an overall score across a number of weighted categories. Green Star communicates this score using a star band between 4 and 6 stars, with 6 being international best practice. NABERS Energy is embedded in the "energy" category of the Green Star rating tool for offices.

COVER SHEET FOR PUBLIC SUBMISSIONS

National Building Energy Standard-Setting, Assessment and Rating Framework – Public Discussion Paper

A cover sheet is required for every submission*. Please include contact details so we can confirm receipt of your submission or contact you if we have any questions about your submission.* (Please see *Confidentiality statement* below for information on keeping your name or submission confidential.)

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CONFIDENTIALITY STATEMENT

All submissions will be treated as public documents, unless the author of the submission clearly indicates the contrary by marking all or part of the submission as 'confidential'.

Do you want to keep the entire **submission confidential**?

☐ Yes, keep all the contents of my submission confidential.

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Unless you request otherwise, your submission will be published on the relevant Commonwealth government website in full and extracts from submissions may also be reproduced in public documents. The submission will be published including your name and your state/territory, but your other personal information (e.g. phone number, email address, postal address) will be kept confidential. If you would like your name to be confidential also, please let us know below.

Do you want to keep your **name confidential**?

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☐ No, publish my name or organisation, and my state/territory with my submission, for example 'J. Smith, WA' or 'The Native Vegetation Association, NT'.

If your submission contains the personal information of any third party individuals, please indicate below if they have not consented to the publication of their information. A request made under the *Freedom of Information Act 1982* for access to a submission marked confidential will be determined in accordance with that Act.

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☐ consent/s to the publication of their information.

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