

# **Australian Residential Energy Standard Assessment and Rating framework – A National response for 2010/2011 frameworks**

By

Timothy O'Leary, M. Arch. BSc. Surv. MRICS  
Institute of Sustainable Systems and Technologies(ISST)  
University of South Australia, North Terrace, Adelaide 5000  
Email: tim.oleary@unisa.edu.au

## **Abstract**

Keywords: energy efficiency, house ratings, carbon reduction

The National Strategy on Energy Efficiency(NSEE) is designed to substantially improve minimum standards for energy efficiency in both residential and commercial buildings and accelerate the introduction of new technologies through improving regulatory processes and addressing barriers to the uptake of new energy-efficient products.

This paper provides critical analysis of a national response to public discussion papers around the framework with a focus on residential class buildings. The core analysis covers in excess of 85 responses across a breadth of housing industry stakeholders published by the Senior Officials group on Energy Efficiency in 2010. Observations on housing energy performance issues together with technical and evidenced based housing energy efficiency data provide a common theme to the discussions in the paper under the headings of;

- The house energy rating schemes, metrics and tools, assessors, governance, training and accreditation issues.
- Overall sustainability, incorporating embodied energy, lifecycle of materials, water use and waste treatment.
- Accounting for climate variation, climate data and future climate change scenarios
- Economic evaluation, existing housing stock, consumer behaviour, appliance use, etc.

The analysis reveals a general support for the Building code of Australia (BCA) as the principle mechanism for implementation though with debate and disagreement on the various software tools and ratings systems currently in use. Also a recognition by stakeholders that the final outcome of the Framework may be that ratings and standards have broader coverage than just energy efficiency, particularly greenhouse gas emissions and that this deserves support not just because greenhouse gas emissions are connected to energy use (and other causes), but because climate change is a key issue of concern internationally and Australia must play its part in reducing its emissions.

## **Australian Residential Energy Standard Assessment and Rating framework – A National response for 2010/2011 frameworks**

### **1. Introduction**

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.

The current framework is set out in a public consultation paper released in March 2010 titled 'National Building Energy Standard-Setting, Assessment and Rating Framework by a body known as the Senior Officials Group on Energy Efficiency. This is the government appointed body tasked by COAG to oversee the implementation of the NSEE.

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;

- the enhancement and co-ordination of governance arrangements for building energy assessments, ratings and standard setting.

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.”*

Submissions were invited from across the spectrum of individuals, institutions and corporations with experience and active involvement in the residential and commercial building sector. Submissions became public documents unless marked confidential. Respondents could choose to remain anonymous (the vast majority did not) and all major formats were accepted as email, letters or separate papers. Some 89 responses were published by the Senior Officials group in July and these submissions provide a breadth and depth to the issues and current debate around setting Energy Efficiency targets and ratings framework for buildings in Australia. A breakdown by industry grouping and geographical base is provided in tables 1 and 2 below.

Group type	No of responses	% responses
University/Research groups	8	9
Trade and Industry Associations	16	18
Professional Bodies	12	13
Manufacturers/Suppliers	8	9
Developers/builders	3	3.5
Design Consultants/Energy Assessors	<b>26</b>	<b>29</b>
Local Associations (citizen and local government)	6	6.5
State Government bodies	2	2.5
National Green alliances/federal agencies	3	3.5
Energy retailers and Suppliers	3	3.5
Anonymous	2	2.5
<b>Total</b>	<b>89</b>	<b>100%</b>

Table 1: Respondents by group type

Location	No of responses	% responses
Australia Wide Body/ National Organisation	<b>47</b>	<b>53</b>
NSW	5	5.5
Queensland	4	4.5
Victoria	8	9
South Australia	6	6.5
Western Australia	6	6.5
Tasmania	6	6.5
ACT	2	2.5
NT	0	0
International/Global Organisation	3	3.5
Anonymous	2	2.5
<b>Total</b>	<b>89</b>	<b>100%</b>

Table 2: Respondents by location

The tables above reveal a breadth of responses across industry stakeholders though a somewhat marked lack of individual responses from developers and builders. One might assume that builders would expect a national co-ordinated response from their peak bodies i.e. the HIA and MBA which do indeed form submissions. The only state or territory which is not represented in a state only response is the Northern Territory which has a history of variance to the national building code due to remoteness and extreme climate concerns. More than half of responses were from National industry bodies and associations and in terms of groups most willing or able to provide a response it is building designers and energy assessors who make up almost one third of responses.

Themes as are set out below that emerge from the responses are examined in this paper as are the views and general comments by respondents.

- The house energy rating schemes, metrics and tools, assessors, governance, training and accreditation issues.
- Overall sustainability , incorporating embodied energy, lifecycle of materials, water use and waste treatment.
- Accounting for climate variation, use of climate data and future climate change scenarios
- Economic cost/benefit evaluation , existing housing stock, consumer behaviour, appliance use, etc.

## 2. The Rating schemes, tools used for assessment, governance and training of assessors

Concern is expressed in responses that currently there exists little consistency between the tools used to rate buildings for energy efficiency. Fig1 (see below) provides an illustration of their variation in coverage. Some focus specifically on products (Ecospecifier), some on specific parts of a building, others on the building and its occupants (GreenStar). Some take a comprehensive life cycle assessment (LCA) focus e.g. (LCADesign). Others are restricted to the energy efficiency of heating and cooling during the operation of a building (NatHERS, FirstRate5, AccuRate, BERPro, ABGR) and a number take a broader approach incorporating a range of planning related issues (BASIX, VicBEST, STEP).

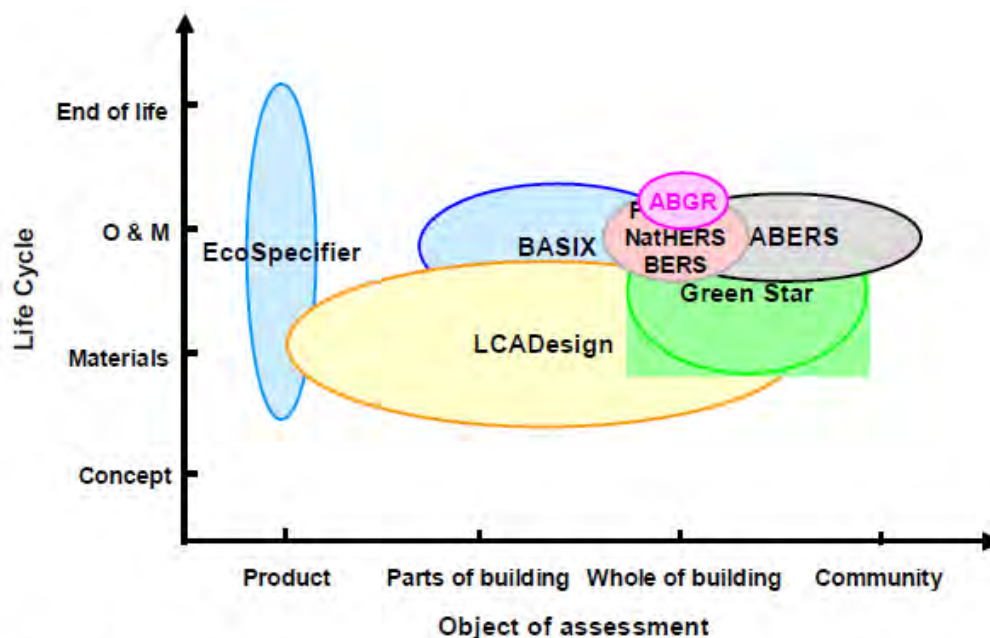


Figure 1 Classification of Australian tools and rating schemes for environmental assessment of buildings and related components

Source: FWPA 2005, "Technical Evaluation of Environment Assessment Rating Tools" Forest & Wood Products Australia

The different assessment tools tend to focus on different issues and metrics; some are single issue focus such as recycling, virtually all address energy in one form or another, but only a few include green house gas (GHG) measures or take a broader life cycle analysis(LCA) approach. Around a third of the tools available can be categorised as 'assessment' tools which provide quantitative performance indicators to help make decisions on design alternatives while the other two thirds are 'rating' tools which determine the performance level of a building against agreed (often subjective) standards.

Some tools also utilise a 'predictive performance' approach, others a 'measured performance' approach.

The current residential software tools of the National Home Energy Rating Scheme (NatHERS)<sup>31</sup> : AccuRate, FirstRate5 and BERSPro utilise a predictive performance approach, modelling and rating the thermal performance of a home's building shell against agreed star bands; whilst NABERS Home assesses the actual operational environmental performance. NABERS Energy undertakes a similar operational assessment of existing commercial buildings. The most widely used commercial design-based tool at present is the Green Building Council's GreenStar tool, which focuses on 9 categories: indoor environment quality, energy, transport, water, materials, land use & ecology, emissions, management, and innovation.

While it is recognised that different tools are developed for different users and uses (concept design, pre-design, full-design) it is also clear that there is a need for the adoption of a consistent basis and methodology. The need for a benchmarking process is also important to ensure that the tools provide a consistent and unbiased assessment so that they cannot be misused to present market driven 'green-washed' positions. All tools should be able to accommodate and account for the variations in climate throughout Australia and allow for fair comparison of lightweight or mass construction and different usage and occupancy behaviour patterns.

In terms of measurement and evaluation metrics, green house gas (GHG) emissions are seen as critical as they relate to the overarching goals of the nation though some other targets such as low embodied energy or low peak load energy are also deemed important. Essentially a move away from measures of energy in mega joules and kilowatts to Carbon Output per building gross floor area or a similar carbon normalised measurement metric per unit of building function is proposed.

For code compliance, the star rating serves only to enable jurisdictions to signal the stringency that they wish to pursue in their regulation, but even for this purpose it is not effective. A 5-star rating varies 9-fold between climate zones for the energy performance that it enforces and 14-fold when converted to an approximate CO<sub>2</sub>-e basis. Although there is some correlation between the heating requirements and climate (expressed as heating degree days) there is no correlation for the cooling requirements (to cooling degree days). Moreover, the standard is relatively lenient in the harshest climates and relatively stringent in inherently more benign climates. If the same standard were enforced everywhere (for a particular building type) then the regulation would enforce higher performance in the climates where it is most needed.

The Building Environment Industry Innovation Council(BEIIC) in its submission supports the use of predictive / modelling based rating tools for new buildings. With regard to the measurement metrics, the BEIIC supports Option 1 a normalised measurement metric per floor area which aligns internationally with the proposed United Nations Framework Convention on Climate Changes(UNFCCC) common carbon metric and differentiates between residential and commercial buildings, and is suitable for both new and existing buildings.

In comments regarding the accreditation and training of assessors there is a view that state differences make for an inefficient rating scheme which inhibits assessors working across borders. Whilst there currently is one national umbrella organisation for home energy rating(HER) assessors, the software tools used and training in such is not distributed evenly across state borders and individual states have different assessor registration systems. Generally it is felt that at a national level a robust and effective administrative and governance system should also be implemented to oversee the design and use of rating tools based on an agreed standard or protocol.

### **3. Overall sustainability, incorporating embodied energy, lifecycle of materials, water use**

Comments support the evolution from a focus on energy efficiency to one that covers broader sustainability elements' and promotes holistic Life Cycle Assessment(LCA) of buildings . Expanding the framework to cover broader sustainability elements over time deserves support as the energy/greenhouse gas imperative diminishes and other issues increase in prominence. These include water resource management, but might also include the impacts of materials, products and services and their full range of impacts for human health, ecological impact and resource depletion.

Soil and water are important environmental issues and should be addressed as part of strategic and statutory planning and well as the BCA (these are still not energy standard matters) other issues should not be overlooked eco and human toxicity, photochemical oxidation...measure that assists in assessing all environmental impacts' of a building over its full life..

A few respondents mention the 'zero carbon' approaches of the Kingdom(UK) code for sustainable homes. It is noted by a number of respondents that a study by DEWHA (2007) into the measures for improving the environmental sustainability of building materials recommended 'life cycle assessment' as the *"most useful approach for the assessment of energy and materials flows impacts in whole building tools ."*

An evolution of the approach to building assessment is set out in figure 2 below.

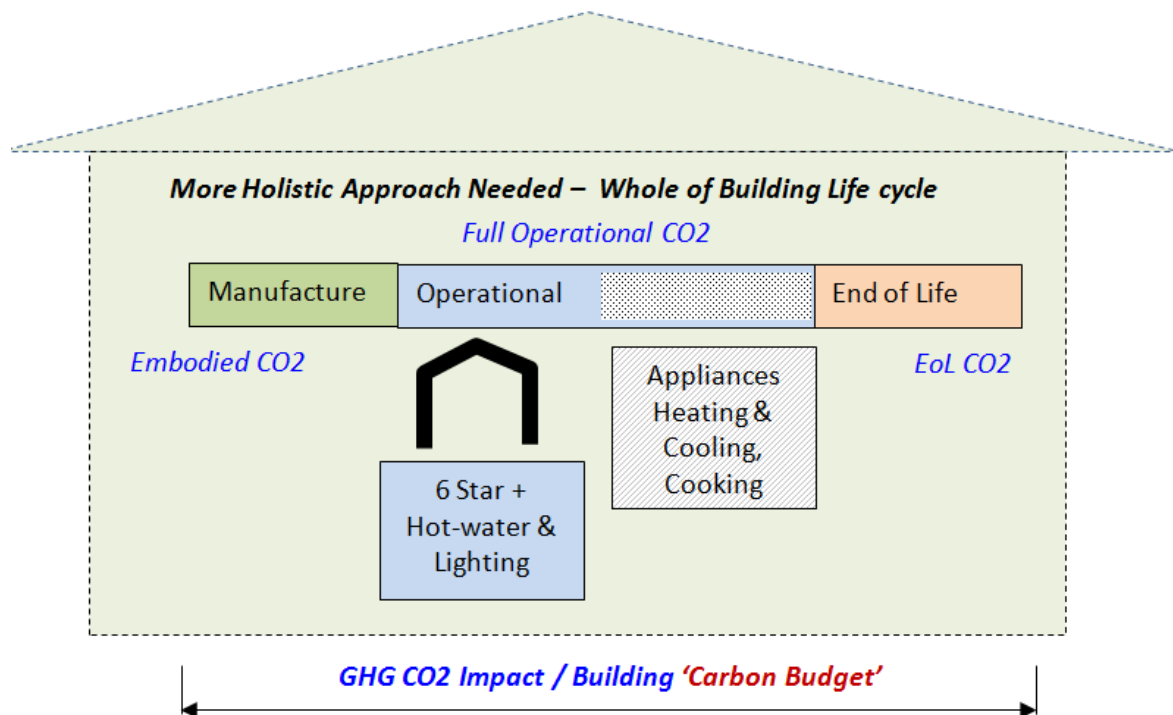


Figure 2: Evolution of the approach to building assessment Source: A3P – Australian Plantation Products Public Discussion Paper Submission, May 2010

Not all agree on the need for wider environmental or LCA assessments, such as one peak building organisation contends that it is far too difficult to include water management in the framework. Instead it recommends the continued use and expansion of Australia’s water efficiency labelling scheme (WELS) which allows consumers to compare the water efficiency of different products in the home. Others believe that the BCA is not the appropriate vehicle for regulating water consumption; and specific state-based water regulations, unrelated to the building process, would be more effective. Notwithstanding, in the longer term some would not oppose the regulation of water consumption by a National Construction Code, in a manner similar to the NSW BASIX approach, if there were strong community and industry support for this approach. One argument put forward is that, although the BCA is an appropriate vehicle for regulating energy use and greenhouse emissions in buildings, it is not an appropriate vehicle for regulating the other environmental considerations as listed below:

- Air quality, air changes, VOCs, airborne toxins etc. – These are best dealt with by national health regulations.
- Water quality, eutrophication, waterborne toxins etc. – These are best dealt with by national water quality regulations, with regional and/or catchment qualifications



- Land use, waste disposal, recycling etc. – These are best dealt with by regional planning regulations.

Noted by one respondent that the Australian Greenhouse Office(AGO) in their initial assessment of the introduction of energy efficiency measures in 1999 recommended the use of an 'adjustment factor' for residential building energy ratings to account for embodied energy

*“In policy terms, embodied energy may be addressed by **building in some factor** into say a HERS scheme, if implemented. For example, **a four star house (operational energy) using low embodied energy materials (for example, timber)** may rate as **equivalent to a five star house (operational energy) using higher embodied energy materials (for example, concrete and clay brick).**”*

#### **4. Accounting for climate variation, climate data, future climate change**

For residential buildings (DEWHA 2008) states the performance requirement for the energy efficiency of the building shell is expressed in terms of a single star rating under the NatHERS scheme. The framework document presents 3 possible options as per below, where option 1 represents the current scheme.

1. Adjust the rating scale according to climate zone
2. A rating scale that is consistent across the country
3. A consistent rating scale (as per 2) but different standards for different climate zones

Option 1 has general support where the underlying star banding figures ( i.e. MJ/m<sup>2</sup> per annum) in NatHERS vary by climate zone, so for example a six star house in Darwin has quite a different predicted thermal performance to a six star house in Hobart. Option 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) is less well supported by those who feel that any political difficulties in dealing with more challenging climates should be dealt with separately to the rating schemes and are of the view that the current situation of variations is not well understood.

Option 3 has limited support whereby any scheme might vary the stringency depending not only on major climate zone but based on building use, occupancy, and whether new build or renovation. This is seen as enabling regulators to tailor the requirements to suit the circumstances, without interfering with any simulation software used in the rating

assessment. One comment was made that the number of climate zones to be used in any revised scheme must be reasonable and rational( there are currently 8 major climate zones in the BCA) and any database used in determining zones for the scheme must be consistent among all programs for home energy ratings software.

The issue of climate zone variability and proper representation is seen as extremely important in a number of respondents where questions are being asked as to the appropriateness of current modelling for homes in warm-to-hot climates (Qld, NSW (northern), NT, WA). Stakeholders from these states believe that the current protocols do not adequately address the way people live in these areas and that more appropriate user behaviour patterns need to be developed. There are some concerns that the current NatHERS Star Bands and occupant behaviour patterns do not accurately represent warm-hot climate areas and concerns with the accuracy of weather data which have been separately raised in a recent article (The Australian, 2010) quoting leading technical experts and academics in the field.

On the issue of taking account of future climate change some respondents feel that not adjusting data used in models to account for future climate conditions may limit the benefits of the framework in future years. It is felt that adjusting the data for future climate conditions based on the highest probability trajectory within the timeframe of this scheme would allow industry to begin to develop innovative solutions and potentially 'future proof' long term building investments. A minority feel that accounting for future climate change is unreasonable and finding a point to draw the line in this regard appears very difficult. That there is considerable uncertainty in the forecast effects of climate change over the timescales for review of measures under this Framework, so the preferred approach would be to adjust existing climate data to favour more recent, hotter years. One options suggested is not to include now but to establish a framework that allows adjustments to targets if this proves to be an issue in the future. Where it is the quantification of future climate change effects that would be unreasonable, designers can still be mindful of future impacts of climate change so design housing to be efficient and sustainable now.

#### **5 . Economic benefits, existing housing stock, consumer behaviour, appliance use etc..**

The importance that the framework promotes an affordable cost outcome is recognised throughout the responses though there is a wide disparity of views on the question of the measure of costs and benefits. Representatives of the home building and property development industry and are far more critical of the costs involved in increasing stringency measures. Some industry bodies are scathing of the current economic modelling around the Regulatory Impact Statement(RIS) on increasing energy efficiency standards in the BCA.

They have noted that previous RISs in this area have indicated that significant cost-effectiveness of building fabric improvements are difficult to justify, with a contention that should there be no change in occupant behaviour, then there is no benefit. As the submission from the Property Council states;

*“In respect of the proposed (and subsequently agreed) 2010 changes to the BCA, we note that ABCB RIS 2009-3 (housing) indicated a variable benefit/cost ratio of the BCA initiatives, and in many cases less than one (i.e. the cost is greater than the benefit). From ABCB RIS 2009-4 (other buildings), we note that the benefit/cost ratio was on average only 2.05. This indicates that the often-stated assumption, of “significant savings in greenhouse emissions in building, at relatively little cost”, is erroneous. Although there are reductions to be made, they will be won at real and significant cost; and even then, only when there is significant change in occupancy behaviour.”*

Some respondents allude to the difficulties of establishing the true costs of EE measures as it is felt that builders will not disclose ‘additional cost’ of EE measures and that this cost could erode their margins. That individual site specific ( i.e. non volume) solar passive design is not cost effective for the builder/developer. The Association of Sustainability Assessors(ABSA) contends that achieving the current 6 star standard can be built with little or no impact on cost if well designed and orientated. These ‘lower order’ costs to build to increased levels of efficiency having been addressed in the recent findings of research by Constructive Concepts (2009) and Belusko and O’Leary (2010). In one submission the air-conditioning industry not provided with the raw data modelled supporting the benefit to cost ratio to the community and that the RIS did not model the existing building stock. Further criticism of the RIS has come from the property industry (Verwer 2010) citing that a key failure of the RIS is not only to account for behaviour of building occupants but that a key element has been overlooked, in the timing gap between capital investment required and the return received by investors, particularly in relation to the refurbishment of existing stock.

Notwithstanding these comments many respondents agree that the improvement in stringency is worth the cost however with some reservations as it is felt that there is limited market ROI (Return on Investment), therefore the federal or state governments will have to make available significant incentives and other funding mechanisms. An independent housing sustainability assessor makes the point from his experience that there is an upper limit to what people will pay for a home and that individual site specific ( i.e. non volume) solar passive design is not cost effective for the builder/developer.

One respondent a Real Estate professor observes that whilst cost is mentioned several times in the framework discussion paper, there is no mention of ‘value’. Also, a perceived problem

to be addressed by the framework is that of poor information dissemination on the benefits of sustainability. That this might be solved by embedding this in the teaching of property professionals where sustainability should be seen as adding capital value as the prime motivator in property development including housing provision is financial.

Some respondents make the point about an existing building stock making up the bulk of buildings whereas the energy efficiency provisions of buildings codes e.g. the 6 star standard deals only with new construction. Most respondents agree that the future framework needs to cover the assessment and rating of both new and existing residential buildings however are less clear as to what actions are required for a future 'mandatory disclosure of building performance at sale' type system bringing the existing housing stock into the equation. A question is raised as to the reason for any regulated minimum acceptable performance needed to be harmonised with Mandatory Disclosure because they are seen as performing different functions as instruments of change. However, since homebuyers and tenants may be choosing between new and existing homes to invest in or occupy, there may well be a need for an equivalent prediction of the performance of new buildings to that for existing buildings under Mandatory Disclosure. A clear message from the responses is that a consistent comparison approach is needed for all buildings throughout Australia (new and existing) and that the base metric should be GHG reduction.

This could be generated as an extension to the existing tools for code compliance of new buildings by making assumptions about typical equipment loads, occupancy and use of the buildings. This aspect may require significant research (similar to the HEEP research conducted in New Zealand or the Energy Efficiency Best Practice programme in the early 90's in the UK.) Some further suggestions by sustainability assessors ABSA are that;

- *Improvements can be "hard-wired" by not allowing a house to be sold at a lower star rating than it was purchased or built.*
- *If the NatHERS tool is used for star ratings in the first instance, then when CSIRO produces their proposed sustainability tool, to be based on the AccuRate engine, this can be seamlessly introduced as one common tool for new and existing house ratings.*
- *This would essentially mean a **Dual Star Rating** i.e. one for the building itself and one for fixed appliances. This approach may also help to drive change in the manufacture, installation and sale of fixed appliances as the energy efficiency of their products become more transparent and subject to substitution etc. This may also assist to drive rapid innovation in this area which in turn has export potential.*

Whilst it is also recognised that plug-in appliances are a significant contributor to residential GHG emissions (35-49%) a number of submissions support the position that they not be a focus of the future framework given that they are difficult to regulate through the BCA, their

usage is highly variable, they are easily changed depending on the building occupant, and their efficiency can be addressed through other complementary approaches e.g. MEPS.

The idea proposed in the discussion paper whereby data is collected on appliance use and efficiency is generally supported. One proposal being that at construction, sale or lease, to record brand and model number of fixed gas and electrical appliances currently in the property using an "Appliance schedule". Include items such as heating and cooling, hot water heaters, lighting, pool pumps and filters, central controllers, PVs and solar systems. Then using a Green Loans style calculator and data from the national appliance energy rating system (<http://www.energyrating.gov.au/appsearch/default.asp>) to provide an appliance potential energy use rating to the property.

## **6. Conclusion**

The broader aspects of sustainability beyond building shell energy performance are recognised in many submissions that cover aspects of life cycle analysis, embodied energy, water use and waste treatment. Dealing with climate change, climate variability and future scenarios is seen as problematic, however whilst some debate on the science of the data is evident the main concern is for any future scheme to be flexible enough to account for the regional variations in climate across Australia when rating houses for energy efficiency.

The analysis reveals a general support for the Building code of Australia (BCA) as the principle mechanism for implementation of building energy efficiency, though with debate and disagreement on the various software tools and ratings systems currently in use. It was generally held that any new assessment and rating tools must be flexible enough to accommodate both new and existing buildings, innovative materials and systems development, and should be able to provide assessment details for buildings under the requirements of the government's proposed future Mandatory Disclosure Initiative.

There is a recognition by stakeholders that the final outcome of the Framework may be that ratings and standards have broader coverage than just energy efficiency, particularly greenhouse gas emissions and that this deserves support not just because greenhouse gas emissions are connected to energy use (and other causes), but because climate change is a key issue of concern internationally and Australia must play its part in reducing its emissions. Measures that assist in assessing all environmental impacts of a building over its full life are seen as key planks in any future expansion or revision to the current framework.

## 7. Acknowledgements

The author would like to express his gratitude to the Forest & Woods Products of Australia and the Australian Plantation Products group for permission of use of their figures in this paper.

## 8. References

Australian Greenhouse Office(AGO) 1999, "Australian Residential Building Sector Greenhouse Gas Emissions 1990-2010", a project for the Australian Greenhouse Office undertaken by Energy Efficient Strategies

Belusko, M. O'Leary T. (2010) "Cost analyses of measures to improve residential energy ratings to 6 stars – Playford North Development, South Australia", Australasian Journal of Construction Economics and Building (AJCEB) UTSe Press Journals Volume 10 no. 1/2 2010

Constructive Concepts (2009), "Building Improvements to raise house energy ratings from 5.0 stars", report for Australian Building Codes Board, Canberra, ACT, June 2009

COAG, (2009) ,Council of Australian Governments, 'National Partnership Agreement on Energy Efficiency, Canberra ACT July 2009

Department of Climate Change and Energy Efficiency, (2010) Public discussion Paper national building Energy Standard-Setting, Assessment and rating framework, March 2010, Senior Officials Group on Energy Efficiency, Commonwealth of Australia 2010

DEWHA, (2008) [online] "*Nationwide House Energy Rating Scheme*" (Last modified 10<sup>th</sup> Jan 2010) Available at: [www.nathers.gov.au/eer/index.html](http://www.nathers.gov.au/eer/index.html) [accessed 24 Jan 2010], Department of Water, Heritage & Arts, Commonwealth of Australia

FWPA 2005, "Technical Evaluation of Environment Assessment Rating Tools" Forest & Wood Products Australia

The Australian, (2010) "Energy-efficiency weather data 30 years old" by Hedley Thomas, published in the Australian newspaper, October 08, 2010

Verwer, P. (2010) "Pulping the RIS fictions", The Property Council of Australia (PCA). online accessed 7/6/2010, available at <http://propertyoz.com.au/Blog/archive/2010/04/01>