Green Star and NABERS: Learning from the Australian experience with green building rating tools

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Abstract

Green building rating tools can assist in addressing the climate change issues facing cities today, by encouraging the development of more efficient buildings.

In Australia, two rating tools are in common use: the design rating tool Green Star, and the performance rating tool NABERS. These two tools are very different in what they measure, yet their ratings (both expressed in "stars") are often confused. There are increasing calls, including from government, for convergence or at least harmonisation of the tools. Full convergence of these tools may not be able to be achieved without sacrificing some valuable features of each tool, but there is potential for increased harmonisation, particularly in relation to the metrics for energy use and greenhouse emissions. Internationally there are also movements towards harmonisation of design rating tools.

Green rating tools will be best able to contribute to favourable environment and climate outcomes when they are in wide use, when they encourage building developers and operators to aim for ever higher performance, when they allow building users to easily compare buildings on environmental features and performance, and when they form part of a family of measures working together. Future developments of rating tools may realise their potential.

Introduction

As in other countries, the building sector is a significant source of greenhouse gas emissions in Australia, with an energy demand responsible for almost a quarter of Australia's total emissions (CIE 2007). There is also significant potential for cost-effective emission reductions in the building sector (Ürge-Vorsatz & Metz 2009; Warren Centre 2009; McKinsey 2008; CIE 2007) – but there are barriers to be overcome before this potential will

be realised. Appropriately designed green building rating tools can help to overcome these barriers, and can be an effective means of promoting energy efficiency and reducing emissions in the building sector.

Green rating tools use various methods to assess the potential, or performance, of a building in relation to specific sustainability criteria, usually including energy use as one of the central criteria. A building with a high green rating may use less than 70% of the energy used by an "average" building (Baines & Bowman 2008; ASBEC 2008) – a significant emissions (and cost) saving over the life of the building.

A building which has obtained a green rating can then advertise its rating to tenants or purchasers interested in sustainable buildings. This allows developers of sustainable buildings to capitalise on their investment (Nelson 2008), and increases the awareness of building performance in the property market – and hence the demand for high-performing buildings (Cole et al 2005; Campbell & Hood 2006; Hes 2007). Green rating tools have an advantage over mandatory building standards (though standards remain important) in that they give building developers and owners an incentive to build more efficient buildings.

Demand for green-rated buildings is growing exponentially (Nelson 2008), and tools are being rapidly developed and disseminated – leading to some competition, and confusion, between tools. Another important development is that although these tools were usually designed for voluntary use, governments and other agencies are, increasingly, requiring certain ratings for the buildings they occupy.

The effectiveness of these tools, in the context of cities and climate change, depends on several factors, including the way in which the tool is constructed, what it measures and how, the extent of acceptance and understanding of the tool in the building sector, the time and

cost needed to obtain a rating, and the drivers (eg government standards and community/ tenant expectations) to obtain a high rating (see for example the criteria set out by Hes 2008).

The two Australian green building rating tools discussed in this paper are the Green Star tool, a design rating tool similar to tools used in the UK, the US and elsewhere, and the National Australian Built Environment Rating System (NABERS), unique to Australia, which benchmarks actual building performance. These tools differ on many of the above points. They have quite different approaches and objectives, and yet the use of two tools in the relatively small Australian market has caused some confusion.

The experience of Australia with two different rating tools in common use may be of interest to others looking at ways to encourage efficiency and sustainability in buildings – particularly in light of the growing momentum, both within Australia and globally, towards harmonisation of green building rating tools, and the increasing use of such tools in mandatory measures.

Background on green building rating tools

Green building rating tools are commonly used to assess and market new or refurbished buildings (primarily office buildings) in many developed countries, including the following:

the United Kingdom (the primary tool being the Building Research Establishment Environmental Assessment Method or BREEAM, developed in 1990 and generally accepted as the world's first green building rating system);

the United States and Canada (Leadership in Energy & Design or LEED, Green Globes and the energy performance benchmarking tool, Energy Star);

Japan (Comprehensive Assessment System for Building Environmental Efficiency, or CASBEE);

Singapore (Green Mark);

Hong Kong (Building Environmental Assessment Method, or HK-BEAM).

Australia, New Zealand and South Africa also have green rating tools known as "Green Star", based in part upon BREEAM and LEED, and the Australian building sector also uses NABERS. While the BREEAM, HK-BEAM, LEED, Green Globes and Green Star tools share a common ancestry and have some similar features, CASBEE is somewhat different in approach, and NABERS and Energy Star are quite different as they are performance ratings rather than design ratings.

In many cases these tools were developed by, or at the initiative of, the Green Building Councils in the relevant countries, members of the World Green Building Council. However, performance ratings (such as NABERS and Energy Star) are more commonly developed by government agencies.

Commencing with office building ratings, which remain the most commonly-rated building type, the tools have been expanded to include rating systems for other classes of buildings such as retail and education. In addition, separate tools are sometimes developed to rate different parts of a building, at different stages of its life. For example, a tenancy may be able to be rated independently of the building as a whole, and a project may be able to be rated at the design stage or after completion.

Although much of the structure and methodology of a green building rating tool can be borrowed from a tool developed in another country, each country using such a tool has found it necessary to tailor the tool to the particular circumstances of the country – its minimum building standards, climate and particular environmental concerns (eg water use) (Saunders 2008).

Several commentators (see eg Hes 2007 and Larsson 2004) have noted the different characteristics which can be used to describe building rating tools, and which often indicate the different purposes for which they were developed and are used. These characteristics

include whether a tool measures potential performance or actual performance, whether it is broad or focussed in scope, whether mandatory or voluntary. NABERS and Green Star can be seen to differ, to a greater or lesser extent, on each of these characteristics.

Green Star (Australia)

Green Star is a rating tool designed for voluntary use to assess several environmental factors relating to a building's design. If the relevant criteria are met, a "Green Star rating" for that building, up to six stars, may be awarded.

Background of the tool

The tool was first developed by Sinclair Knight Merz and the Building Research Establishment in 2003 (Saunders 2008: 27), and was then taken up and further adapted by the non-profit Green Building Council of Australia (GBCA), a member of the World Green Building Council. The GBCA currently operates the Green Star scheme.

Green Star was based on BREEAM, as well drawing on operational elements of the LEED system. It has however been tailored to Australian conditions, such as climatic conditions and local building standards and regulations.

Purpose of the tool

A Green Star rating is intended to assist in differentiating and marketing buildings with strong environmental credentials, rather than as a tool to apply to every building. The tool is intended for buildings in the top 25% of the Australian market (GBCA 2009). As part of this approach, certified Green Star ratings are only issued if four or more stars have been earned.

Green Star is largely a design rating, assessing the potential environmental performance of a new or refurbished building, or its attributes, rather than its actual performance or operation. This purpose is emphasised by the requirement that ratings be awarded within 24 months of completion of the building or the refurbishment. Parker notes that Green Star "assesses a

developer's achievement without interfering operational factors such as building management and occupation" (Parker 2008: 3.1).

These characteristics of Green Star are similar to those of the BREEAM, LEED and Green Globes tools.

Types of Green Star tools

As at April 2009, separate Green Star tools are available for the following categories:

Office Design – the most widely used tool in the portfolio. This tool assesses the environmental attributes of designs for office buildings in Australia.

Office As Built – similar to Office Design, but intended to assess the environmental attributes of newly built or refurbished office buildings in Australia, after completion of the project.

Office Interiors – designed to assess the environmental impact of an interior fitout.

Retail Centre – assesses the environmental attributes of new and refurbished retail centres in Australia. Ratings are assigned to the base building and its services, not to tenancy fitouts.

Education – assesses the environmental attributes of new and refurbished education facilities in Australia. Base building and fitout are rated together (unlike other Green Star tools which assess base building and fitout separately).

New versions of tools are developed over time through a process of feedback, comparison against international standards, and revision – among other things, to raise standards in line with new conceptions of "best practice". In addition, more categories of rating tools (including Office Existing Building, Industrial, Healthcare, Multi-Unit Residential and Mixed Use) are in the pilot phases of development. Of these, Office Existing Building has caused some discussion, as it would closely overlap with performance ratings such as NABERS.

Eligibility criteria

A Green Star rating can only be granted if certain initial criteria are met. These include (GBCA 2009a):

Spatial differentiation: The project being rated is a distinct building and not a component of a wider project.

Space use: If a building has multiples uses (that is, multiple classifications under the Building Code of Australia), the building use(s) being rated under Green Star, eg education, office or retail, must comprise at least 80% of the gross floor area of the building.

Tool-specific *conditional requirements*, for example that the building must not be sited on land of high ecological value or on prime agricultural land, or must not have greenhouse gas emissions greater than a specified level (eg 110 kg carbon dioxide per square metre per annum, for Office Design v3), estimated using modelling developed for NABERS Energy).

Timing of certification: As Green Star ratings relate to certain phases of a building's lifecycle, the building must be rated within a specified timeframe for particular ratings. For example, an application for an Office Design rating can be submitted before construction starts, whereas applications for As Built or Interior ratings can only be submitted after practical completion of the project. For both Design and As Built/ Interior tools, ratings will only be awarded within 24 months of practical completion of the project. (A project may be a new building or a refurbishment.)

While these criteria are designed to ensure certain minimum standards and to further Green Star's aim of differentiating high-performing buildings, they do preclude Green Star ratings being used to compare all types of buildings.

Categories assessed

If the eligibility criteria are met and the rating can proceed, points towards a rating can be scored in the following categories:

energy

transport

water

indoor environment quality

emissions

materials

land use and ecology

management

innovation.

In each category, there are a series of criteria that, if complied with, would reduce the environmental impact of a building in that category (Saunders 2008). For example, points in the "Energy" category can be earned for reducing emissions below the conditional requirement mentioned above, for sub-metering, for peak energy demand reduction, and for separate light switches for each zone, among other things (Green Star Office Design v3).

Innovation points are to encourage and recognise pioneering initiatives in sustainable strategies and technologies, for exceeding Green Star benchmarks, or for beneficial environmental design initiatives currently outside the scope of the Green Star rating tool. The inclusion of an 'innovation' category has been praised by commentators and is being adopted in other design tools such as BREEAM (Saunders 2008).

How a rating is calculated

In each of the above categories other than Innovation, a percentage rating of "points achieved" as against "points available" is calculated to give a category score. Then a State-specific weighting is applied to each category score to reflect the relative importance of each category. For example, in New South Wales, Energy and Indoor Environment Quality receive the highest weightings, at 25% and 20% respectively (across the eight categories, the sum of the weightings is 100%) (GBCA 2009). The weighting differs between States to reflect the differing importance of some issues across Australia, as a large and climatically diverse

country. As one example, in the low-rainfall States, water conservation initiatives would receive a higher weighting.

After the category score is multiplied by the weighting for the relevant State, the weighted scores are totalled and any Innovation credits (which are not weighted) are added, giving a total score. (As the Innovation credits are added to the existing scores which themselves can total 100, a score of over 100 is theoretically possible – but virtually impossible in practice.)

Star ratings are awarded to certain ranges of point scores as set out in the following table.

Table 1: Green Star ratings

Star rating	Minimum assessment score	Comments
One Star	10	Minimum practice
Two Stars	20	Average practice
Three Stars	30	Good practice
Four Stars	45	Best practice
Five Stars	60	Australian excellence
Six Stars	75	World leadership

Source: GBCA 2009

In one study comparing building rating tools, Green Star was assessed to be comprehensive and rigorous (Campbell & Hood 2006). However, according to another comparative study, a building built to achieve the highest Green Star rating of six stars may, if located in the United Kingdom, only achieve a “Good” or “Very Good” rating under BREEAM, rather than the top BREEAM ratings of "Excellent" or "Outstanding" (Saunders 2008: 42). This may be due in part to differing minimum requirements set out in building codes, as Green Star awards points for performance better than Australian building code requirements, which may in turn be less stringent than their UK counterparts.

Independent assessment or certification

A Green Star technical assessment manual is prepared for each tool mentioned above, describing each available credit and the compliance requirements to achieve the credit, and providing further guidance and background information. These manuals are available for purchase from the GBCA, generally at a cost of AU$500 for GBCA members and AU$600 for non-members. Any person with access to sufficient information about a building may, using the manual, calculate the building's score under the Green Star system. However, to be able to publicise a Green Star rating and use the Green Star brand, the rating assessment must be certified. (Certain rights are also given to project proponents who have registered with the GBCA for certification once their project has reached a stage when it can be certified.)

Certification requires an independent panel, commissioned by the GBCA, to review the self-assessed rating and recommend (or oppose) the award of a particular Green Star certified rating. An assessment fee is also payable to the GBCA, which varies depending on the size of the project being rated and whether the applicant organisation is a member of the GBCA (ranging from a member fee of AU$5,200 for a project with a gross floor area of less than 2,000 square metres, to a AU$30,600 non-member fee for a project with a gross floor area of greater than 100,000 square metres, according to the GBCA website). This is in addition to the costs to the entity seeking certification in gathering the relevant information and preparing the application – work which may cost AU$20,000 to AU$70,000 (Hes 2007).

Only ratings of four stars or more will be awarded a certification. Thus, while any building that fulfils the preconditions can assess its own Green Star rating, the Green Star brand is only able to be used in relation to relatively highly-performing buildings. This restriction helps to fulfil one of the functions of the Green Star rating – a tool to market "green" buildings.

Prevalence of Green Star ratings

Data on the GBCA website indicates that as of early May 2009, a total of 146 projects have received Green Star certified ratings. The majority of ratings were for Office Design (118 projects), with 12 ratings for Office Interiors, 10 for Office As Built, and six for pilot tools. These projects were concentrated in Victoria, Queensland and NSW, but there were Green Star –rated projects in every State and Territory of Australia apart from the Northern Territory.

To indicate the spread of ratings, GBCA 2009 provides a breakdown of the 125 ratings that were awarded to January 2009 (including six for pilot projects): 46 (approximately 37%) were awarded 4 Stars, 62 (50%) were awarded 5 Stars and 17 (14%) were awarded 6 Stars. A further 511 projects were registered for assessment.

The figures for certified and registered projects show that, while increasing proportions of new buildings are obtaining Green Star ratings, this growth is from a low base.

National Australian Built Environment Rating System

The National Australian Built Environment Rating System (NABERS) is a collection of separate tools, each of which calculates and rates the performance of an existing building (or part of one) on a particular environmental indicator as at a certain point in time. Thus it differs crucially from Green Star, which rates design rather than performance. (On a simplistic level, the difference is that Green Star asks, among other things, "Does your building have separate light switches for each zone?", being a design feature that can help reduce electricity use, whereas NABERS asks, "How much electricity did you use last year?") NABERS has some similarities to the US Environment Protection Authority's Energy Star Portfolio Manager.

The NABERS website states that its objectives in developing NABERS benchmarks are to ensure relevance, realism and practicality, with the objective being to provide a framework for improving the environmental performance of buildings.

Background of the tool

NABERS includes the tool formerly known as the Australian Building Greenhouse Rating tool (ABGR), now NABERS Energy. Unlike Green Star, ABGR was developed from scratch by government agencies. It was launched in 1999, and in 2008 ABGR became part of the NABERS suite of tools, also developed and administered by government.

Types of NABERS tools

NABERS tools have been developed for offices, hotels and residential buildings, and are currently being developed for retail buildings. For each building type, the following environmental aspects can be rated separately (with details taken from the NABERS Office rating tool):

Energy, looking at the amount of each type of energy (electricity, gas, coal, oil) consumed on the premises in a year, and how much of it is supplied from "Green Power" (renewable energy which can be purchased from electricity retailers in respect of electricity and gas use);

Water, looking at the amount of water used on the premises in a year, and how much of this is externally-supplied recycled water;

Indoor Environment, which requires sub-ratings of the premises' thermal comfort, air quality, acoustic comfort, lighting and office layout; and

Waste, a relatively new addition to the suite of tools, looking at the total materials used (eg paper) per person per day, and the amount of those materials that are recycled or reused.

By far the most commonly used tool is the NABERS Energy rating. NABERS Water is also commonly used. The NABERS website also notes that other elements are being developed to enable buildings to be rated on a full range of measured operational impacts, including

refrigerants (greenhouse and ozone depletion potential), stormwater runoff and pollution, sewage, landscape diversity and transport. Once completed, this suite of measures would cover similar topics to those assessed as part of a Green Star rating. This is broader than the US program Energy Star, which currently covers only energy use and emissions, and water use.

How a NABERS rating is calculated

NABERS ratings may be undertaken individually (eg a company may decide to rate its building only in Energy and Water), and they are not combined into an overall rating, unlike Green Star. A further elaboration, available in respect of the office rating tool, is that a rating may be prepared in respect of the whole building, the base building or a particular tenancy. This provides useful flexibility, which is not available in many other rating tools.

Ratings for Energy and Water are calculated by reference to data from 12 months' occupation/ use of the building.

In relation to NABERS Energy, the first step is converting the energy used by the relevant area in the 12-month period into greenhouse gas equivalents by reference to the emissions intensity of the standard energy mix used in the relevant State of Australia. (For example, if the building was located in Victoria the emissions relating to its electricity use would be calculated with reference to the fact that in Victoria most electricity comes from high-emitting brown-coal-fired power stations.) The raw emissions figures are then "normalised" to take into account the hours of use of the premises, the occupant and equipment density and local climate. The normalised figures are then divided by the rated area, giving a figure expressing emissions per square metre. Finally, this figure is compared against the benchmark for the relevant State/ Territory and type of building (based on 10 years of data collection for this tool), resulting in a rating.

One interesting (and somewhat controversial) feature of NABERS Energy is that a somewhat higher rating of an existing building can be "purchased" if the building buys renewable energy (through the Green Power scheme). This option is not available for new buildings.

NABERS Water follows a similar process to NABERS Energy, but using water bills instead of energy bills. For Indoor Environment, metering of indoor environment conditions and an occupant satisfaction questionnaire are required. For Waste, a daily waste audit is conducted for 10 consecutive working days.

Ratings for each component are expressed in stars, as with Green Star, but the maximum number of NABERS stars is five (rather than six for Green Star), with five stars being top performance. Half-stars are available, allowing greater discrimination on performance than the whole stars used in Green Star.

The table below sets out comments on what each whole star rating represents. The normalised emissions per square metre that would result in such a rating will differ depending on the State or Territory in which the rated area located, and whether the rated area is the base building, a tenancy or the whole building. As an indication, the table below lists the normalised emissions per square metre for a base building in NSW.

Table 2: NABERS ratings

Star rating	Comments	Emissions (kg CO2/ m2)
One Star	Poor – poor energy management or outdated systems	199
Two Stars	Average building performance	167
Three Stars	Very good – current market best practice	135
Four Stars	Excellent – strong performance	103
Five Stars	Exceptional – best building performance	71

Source: DEWHA 2008

As it rates actual performance, which may vary over time, NABERS is a point-in-time rating tool and its ratings remain valid only for one year from the date of the rating.

The normalisation and benchmarking process is reviewed periodically (eg Ostoja 2008), and recommendations for corrections are made where necessary to ensure that the rating bands reflect current performance, with median performance earning 2.5 stars, that they allow for superior performance, and that they are fair and comparable. For example, the 2008 review recommended some changes to the system for adjusting for the different energy sources and climate of different States/ Territories of Australia, to allow greater comparability between buildings in different States (Ostoja 2008).

Independent assessment or certification

The NABERS website (www.nabers.com.au) provides some calculation tools to allow entities to calculate the rating of any building for which they have 12 months' data. Calculation of an office building's NABERS Energy rating, for example, can be a simple process of entering the address and size of the area to be rated, its operating hours per week, the number of people and computers on the site, and the amount of electricity and gas used over 12 months (assuming the building does not use any other forms of energy).

However, in order to be able to use the NABERS trademark a building will need to receive an official rating calculated by a NABERS-accredited assessor (a list of whom is available on the NABERS website). The assessor will, with the building owner's assistance, collate the relevant data (original documents are required), enter it into a spreadsheet, calculate the rating, and submit the rating to the NABERS national administrator for auditing and certification (McAteer 2008).

Prevalence of NABERS ratings

NABERS Energy is widely used, particularly in relation to large office buildings, with estimates that nearly 40% of the office space in Australia has been rated using NABERS Energy (DEWHA 2008). However, the vast majority of this rated space has been self-assessed, rather than going through the official process.

Although there are rated buildings across Australia, NSW has a greater rated area than any other State or Territory (no doubt related to the fact that NABERS is administered by a NSW body and was first launched in NSW).

Median NABERS Energy performance for base buildings across Australia (without taking into account any Green Power uplift) has been assessed to be approximately 2.5 stars (DEWHA 2008). In May 2009, there were 71 premises with an accredited NABERS Energy rating of 5 stars listed on the NABERS website.

Relative costs and ease of use of the tools

Given the differences between the NABERS and Green Star tools, and their different uses, it is not surprising that opinions on the values and virtues of these ratings tools vary.

Although Green Star is based on the internationally-accepted and widely-used BREEAM and LEED tools, there is a perception that it is, in some circumstances, impractical. One comment expressed to me was that Green Star shows the hallmarks of being developed by architects rather than by people with practical experience in building commercial properties – that it is more idealistic than practical. Another industry participant stated that, while the tool has its purpose, her company would not wish to obtain a Green Star rating for every building it develops, due to the time and cost to obtain one. It is time-consuming to amass the supporting information required to substantiate sufficient points to earn a high Green Star rating (particularly in relation to As-Built tools – Design ratings are easier in this respect, and this may be one reason why so many more Green Star Design ratings have been awarded than any

other kind). It is perceived to be difficult to obtain a high rating without incurring increased building costs and reducing the flexibility of use of the building. Actions to obtain some Green Star points, such as reducing the number of car spaces or reducing night-time lighting, may be seen to reduce the value of the property, while others depend on external factors and cannot be achieved by design alone (such as being close to a public transport node).

These comments, particularly in relation to the time and cost of obtaining a rating, echo those expressed in studies of other similar rating tools such as LEED and BREEAM (see eg Larsson 2004, Smith et al 2006 and Hes 2007).

It is possible to develop cheaper, easier-to-use online versions of design rating tools, as Green Globes has aimed to do in the US. Green Star does have the online self-assessment option, but this does not lead to a certified Green Star rating.

The cost in obtaining a Green Star rating is likely to mean that it will be used only, or predominantly, in developed countries, and then only at the top of the property market.

A NABERS rating can be quicker and cheaper to obtain (once the requisite 12 months of data is available), and does not have the preconditions and restrictions of Green Star. Therefore NABERS may be better suited to a broad-based push to rate and compare buildings. However, to obtain NABERS ratings across the full suite of indicators (so as to be more comparable to Green Star as a broad sustainability measure) would still require some investment of time.

Design or performance rating?

Design rating tools and performance rating tools each have their strengths and weaknesses, and it is important to note that what one player in the building sector sees as a strength, at one phase of a building's lifecycle, may be a weakness to another player or in another phase.

As a design rating, Green Star encourages sustainable decision-making at the design stage, which is crucial for the overall sustainability of the building. However, the tool provides no incentive for efficient management when the building is in use. Performance in practice may not be as good as the potential, particularly in relation to ongoing energy use where building management and tenant activity play an important role (Hes 2007).

NABERS focuses attention on the commissioning, operation and maintenance of a building, which are key factors in ensuring efficiency over the long operating lives of buildings (DEWHA 2008). It also captures the impact of decisions made during the design and construction phases, and thus complements design ratings (McAteer 2008). As a NABERS rating is only valid for one year, a building may obtain many NABERS ratings over its life, and is rewarded with a higher rating if its performance improves over time.

In terms of educational aspects, in Green Star the detailed process of accruing points in each category towards a rating helps building designers and developers learn about sustainability features, and makes it clear where there are areas in which more points could be earned. The simpler NABERS process does not, of itself, indicate to building operators where or how improvements can be made.

While a design rating might be thought most appropriate when advertising a building that is as yet unbuilt, or incomplete, both NABERS and Green Star allow for registration of a development as aiming to achieve a rating, prior to the time at which an official rating can be obtained, thus allowing for early marketing of the building as "green". (When a building is able to be rated, it must obtain a rating or cease using the symbols of the relevant rating tool.)

The appropriateness of a rating tool for use with existing buildings (rather than just new or significantly renovated buildings) is now receiving increased attention, given the importance of upgrading existing building stock (Campbell & Hood 2006; DEWHA 2008). Of course, a

performance rating tool such as NABERS is well adapted for this. Green Star ratings are currently restricted in this regard, as they can only be awarded within two years of completion of the building (or the renovation project). However, a Green Star Office Existing Building rating tool is now being developed to address this issue.

One virtue of the Green Star tool which is not shared by the NABERS tools is the ability to take into account wider factors (including some relevant to supply chain and life cycle assessment) such as the sustainability of the materials used in building construction, the treatment of construction waste, the siting of a building and transport links to the building. (Larsson 2004 notes that transport emissions in the journey to and from a building are of the same order of magnitude as the building's operating energy.) NABERS currently cannot assess these things. It may be possible to build performance ratings for some of these issues, but collecting actual performance data is likely to be difficult and time-consuming.

Moving beyond voluntary use of green rating tools

In addition to voluntary use of the Green Star or NABERS rating tools by private parties seeking to market their building as environmentally friendly, it is increasingly the case that certain ratings are required by various agencies. As noted by Larsson (2004) and Hes (2007), rating tools with a narrow focus and more objective measurements are more likely to become part of regulatory systems than the broader, more aspirational rating tools. In Australia both NABERS and Green Star ratings are now being required in certain circumstances, but there is greater focus on NABERS (no doubt partly due to the fact that it fits the criteria Larsson and Hes noted).

Concerns have been expressed about the tendency for hitherto voluntary standards to become part of mandatory regulation, particularly where the relevant tools are developed and administered by commercial, non-government organisations (such as the GBCA, whose paying members include the organisations required to have their properties rated).

Accountability, transparency and industry capture issues may arise (Baines & Bowman 2008), though there is no suggestion that this is currently an issue with Green Star and the GBCA. NABERS may be less of a concern in this regard, as it is government-operated.

Current requirements to have certain ratings

The Australian Government and several State/ Territory governments have introduced NABERS Energy requirements for office premises owned or leased by government – an important market driver, given that the Australian Government alone represents approximately 13% of the commercial office market (COAG 2009). Under the Energy Efficiency in Government Operations Policy 2006, the Australian Government requires a 4.5 star NABERS Energy rating for new buildings and major refurbishments, and all new leases must include a requirement for annual NABERS Energy ratings. The policy notes (on p.16) that NABERS Energy was adopted "as the preferred rating tool due to its broad acceptance by the industry and access to a low cost independent performance certification scheme."

State/ Territory government requirements range between 3 to 5 stars, depending on the type, size and age of the property. However, these standards are not always complied with in practice.

In a second important driver of green rating tools, the Property Council of Australia (PCA) has included NABERS and Green Star ratings as part of its new building quality criteria. For a building to be considered Premium or Grade A under the PCA criteria (top-quality buildings that attract significantly higher rentals than lower-grade buildings), it must have a NABERS Energy rating of at least 4.5 stars and a Green Star rating of at least 4 stars. For Grade B, 4 NABERS Energy stars and 3 Green Stars are required.

The City of Sydney Council's Draft Ecological Sustainable Development Control Plan requires new or refurbished office buildings with a net lettable area greater than 1,000 square

metres to have a minimum of 4.5 stars under NABERS Energy, and new office buildings are also required to have a minimum of 4 stars under the Green Star Office Design and Office As Built tools (City of Sydney 2007).

In NSW, the emissions trading system known as GGAS (soon to be transitioned into the Energy Saving Scheme) employs NABERS Energy for office buildings to normalise the energy use baseline for a demand-side abatement project in an office building (GGAS Demand Side Abatement Rule 10.8). The Energy Saving Scheme may also use Green Star ratings in relation to the project impact assessment method of earning energy saving credits.

Upcoming: mandatory NABERS Energy disclosure

In an important development, the Australian Government is proposing to require the owner/lessor of an office building to obtain and disclose a NABERS Energy rating (with certain modifications) on sale or lease of an area of 2,000 square metres or more, from 2010 (DEWHA 2008). This is similar to the requirement in Europe to disclose Energy Performance Certificates on sale or lease, under the Energy Performance for Buildings Directive (2002/91/EC).

While NABERS Energy is currently the only rating tool proposed for use under this scheme, DEWHA 2008 notes that other tools may be considered at a later stage. Green Star (at least in its current form) was not considered appropriate, as it assesses predicted rather than actual performance, and thus does not allow comparison of the actual energy efficiency of buildings. It also includes a wider range of considerations than were thought relevant for the mandatory disclosure scheme (DEWHA 2008).

A requirement on building owners to obtain and disclose a green building rating can assist in overcoming the principal-agent and information market failures identified as some of the reasons why building energy efficiency measures are so under-utilized (DEWHA 2008;

ASBEC 2008). It raises awareness among building sector customers of the differing performance of different buildings, making it easier for them to compare buildings and take into account a building's "green" performance in deciding whether to buy or lease a property – and what price to pay for it.

It may also influence the landlord to increase the energy efficiency of the building (Nelson 2008). In fact, a recent study from a large sample of buildings found that buildings that disclose their NABERS Energy ratings to their tenants perform better, to the extent of half a NABERS Energy star, than those that do not (Warren Centre 2009).

Integration of rating tools?

Green Star and NABERS have different aims and approaches. Green Star is intended to distinguish new or refurbished buildings with the potential for above-market environmental performance across a full range of indicators. NABERS tools offer a snapshot of how a building, or part of one, is performing on specified indicators (eg energy use, or indoor air quality) at a point in time, allowing comparability between premises.

However, Evans & Wotton (2008) state that, although the trademarks of both Green Star and NABERS are well-recognised and accepted, the existence of two schemes "has caused some confusion among building owners and tenants." This has been echoed in comments made by representatives of the GBCA and the PCA (Lenaghan 2008). The fact that both tools use "stars", yet the stars are awarded for different things (and an equal star rating on both tools does not mean equal performance), tends to increase confusion, as it is not always clear which type of star rating is being referred to.

There has been some discussion of whether and how to integrate the two tools, to address the confusion in the marketplace. It is recognised that if the issue of having two very different but competing rating tools can be addressed, the integrated design/performance tool would be

attractive for use around the world, as no other country has yet resolved this issue (Lenaghan 2008).

The Council of Australian Governments (COAG) recently announced a plan to develop a "consistent outcomes-based national building energy standard setting, assessment and rating framework", to be implemented in 2011. This framework is intended to apply to all types of buildings, commercial and residential, new and existing, and will "work towards convergence of existing, measurement-based rating tools (eg NABERS) for existing buildings with predictive or modelling-based tools used for rating new buildings", as well as setting minimum energy performance standards (COAG 2009: 12).

This is the strongest statement yet that convergence or integration of the rating tools, at least in the area of energy, is to be expected. But how could it be achieved?

How can the tools be integrated or harmonised?

It is worth bearing in mind that there are a range of actors in the building sector, and they will need different things from a rating tool depending on their role, the type of building and the phase of the building's lifecycle, among other elements (Campbell & Hood 2006). This is an argument for retaining the most useful aspects of both design and performance rating tools, to have the ability to choose a tool appropriate in the circumstances.

Attention should be directed to ways to reduce confusion between the rating tools, to enable users to pick the tool best suited to their purpose, and to retain the different valuable features of each tool while allowing the greatest possible comparability. This does not necessarily require complete convergence of the tools. What other steps could be taken?

It may not be possible to merge design and performance rating tools completely, given their different nature and purposes. Recognising this, it may help to reduce market confusion by making the ratings more distinct, so that a Green Star rating is not confused for a NABERS

rating (as they mean such different things). A change of terminology may assist – for example, the high performance of a Green Star –rated building across a wide suite of issues may be better conveyed with labels such as Silver/ Gold/ Platinum, as used by LEED, whereas the more specific assessments of NABERS tools for individual issues (which are not limited to top performers but can report the full gamut of performance) is better suited to retain some form of numerical labelling.

The fact that Green Star is an all-encompassing rating whereas NABERS has separate ratings for separate issues could be addressed, if thought desirable, by doing either or both of the following:

Green Star providing sub-ratings for each issue, based on the category score;

NABERS providing overall ratings based on some combination of the individual issue ratings.

The first option may well be adopted, in relation to Green Star's energy category, as part of COAG's proposed new energy framework. The second option would only be possible if the relevant building decided to obtain NABERS ratings for each issue – which is not commonly done.

One suggestion to assist in comparability is that a design rating of a building should be followed, at the appropriate time, with a performance rating using the same assessment structure, to determine the extent to which the potential of the building has been fulfilled in practice (Larsson 2004; Campbell & Hood 2006). This is not always possible, given that design and performance ratings necessarily use different indicators, and are sometimes measuring different things.

However, where practicable measurement criteria should be harmonised. There is at least one instance in which Green Star and NABERS already coincide: Green Star energy use

modelling (at the building design stage) includes an option to use NABERS Energy metrics. No doubt more areas for harmonisation could be identified – perhaps including the treatment of differing energy sources and climatic conditions in different States/ Territories. But there is much work to be done – and some entrenched positions on behalf of the designers and administrators of the different tools to be reconciled – before the practical limits of harmonisation would be reached.

Single responsible agency

The harmonisation process may move more swiftly and effectively if one agency was responsible for both types of rating tools. It may also assist in educating users of the tools (both those trying to choose a rating tool to use for their building, and those trying to understand existing ratings) if all information relating to the tools was available in one place. Having a single agency in charge would make it easier for the regular reviews and updates of the tools to be done concurrently, and would allow for easier cross-referring. Having a single body to accredit assessors and perform other administrative tasks would also be economically efficient.

Given the issues discussed above in relation to rating tools that now form part of legal requirements being operated by commercial non-government entities, it may be preferable if the single agency was a government rather than a private body. However, unless this hand-over to government was done with the consent of the relevant private body (here the GBCA), it may be difficult to enforce, given the essentially voluntary nature of the GBCA's activities.

COAG 2009 proposes that the new energy standard and rating framework would be implemented through the Building Code of Australia, which is maintained by the Australian Building Codes Board, an intergovernmental initiative with representatives from the building industry. As the new framework is only proposed to address energy use, the GBCA may continue to administer the broader Green Star rating.

International movements towards harmonisation

Internationally, the harmonisation of similar types of tools such as LEED, BREEAM and Green Star, eg by using common metrics, is already being discussed (Saunders 2008; UKGBC 2009). This will assist in making comparisons between buildings in different countries, and will make it easier to share best practices between tools (Saunders 2008).

The GBCA, its UK and US counterparts and the agency administering BREEAM recently signed a memorandum of understanding under which they will develop common metrics to measure greenhouse gas emissions relating to new homes and buildings, to be used in Green Star, BREEAM and LEED ratings (UKGBC 2009). The Sustainable Building Alliance, with the backing of several European countries, is also developing common metrics for several indicators, including emissions, though all alliance members will retain their own rating tools.

The International Organisation for Standardization is also working on this issue, and may prove a useful source of standard metrics.

There do not appear to be specific discussions regarding the harmonisation of performance tools such as NABERS and Energy Star – though in fact such tools may be easier to harmonise than design ratings. This may be a fruitful avenue to explore.

Rating tools and climate change adaptation

In the context of climate change, green building rating tools are commonly seen only as a measure to mitigate climate change, predominantly by reducing energy use. But there is also potential for some tools to assist in promoting adaptation to climate change, by including adaptive features as one of the categories in which buildings can earn points towards their rating (in the context of Green Star). Under NABERS, it may be possible to develop a separate tool to measure a building's ability to deal with likely climate change impacts. To some extent, this is already happening (although unintentionally), as insulation, which is

already rewarded under green rating tools for reducing energy use, also reduces vulnerability to weather extremes (Ürge-Vorsatz & Metz 2009). As the effects of climate change become felt more strongly in cities, this option for further development of the tools may receive further attention.

Rating tools are only part of the picture…

Although green building rating tools can be very effective in encouraging the spread of more efficient buildings, without requiring government expenditure, it is important to recognise their limitations. They are one tool among many, and are most effective when accompanied by a series of other measures. One of the most effective of these can be a requirement by certain authorities to use buildings with a certain rating, as under the Energy Efficiency in Government Operations policy.

Financial incentives (eg matching funding, or tax deductions) from government for building owners who retro-fit their buildings to achieve certain efficiency standards (which may be set by reference to a green building rating tool) are currently being discussed in Australia, and may prove very effective if implemented. However, the cost of such measures to government is often a stumbling-block (Larsson 2004). Other types of incentives are possible: Japan has had success with providing preferential planning and development approvals for buildings with high CASBEE ratings, in addition to subsidies and preferential interest rates (Murakami 2009).

In addition, minimum standards set out in a building code (as well as minimum standards for appliances such as air conditioning) remain important to set the baselines. An effective system for improving energy efficiency in cities would set stringent basic requirements for new equipment, new buildings and renovations, provide financial incentives for upgrading existing buildings to certain standards, require official building energy ratings to be obtained and disclosed, and also provide encouragement (and reputational benefits) for top-end

performance via public recognition of high green building ratings. (Japan, which has introduced many of these measures, has shown notable improvements in energy efficiency in the last few decades – Murakami et al 2009. The Australian measures announced in COAG 2009 also make some further progress in this direction.) Each of these measures should ideally be easy to understand and implement, with information readily accessible online, and each measure should be regularly updated to take account of changing technology, practices and expectations.

Conclusion

The Australian experience with a design rating tool, Green Star, and a performance rating tool, NABERS, indicates that these tools, though very different, can each play a valuable role in encouraging higher-performing buildings, but that the presence of two tools can cause confusion in the market. There are some simple measures which could be carried out to reduce market confusion and increase harmonisation of the tools, but Government demands for convergence between these tools may raise difficult questions. The useful features of each tool should not be abandoned merely for the sake of convergence; but nor should the developers of tools resist all calls for change.

Tools that can be applied relatively quickly and inexpensively to new and existing buildings, that allow for maximum comparability, and that recognise and reward both efficient initial design and efficient ongoing operation, are likely to be the most widely used and thus the most effective in reducing emissions. No one tool currently exemplifies all these features, but the movement towards harmonisation or convergence of tools will mean that over the next few years the new generation of rating tools will be developed – watch this space.

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Abbreviations

ABGR	Australian Building Greenhouse Rating
ASBEC	Australian Sustainable Built Environment Council
BREEAM	Building Research Establishment Environmental Assessment Method
CASBEE	Comprehensive Assessment System for Building Environmental Efficiency
CIE	Centre for International Economics
COAG	Council of Australian Governments
DEWHA	Department of the Environment, Water, Heritage and the Arts, Australian Government
GBCA	Green Building Council of Australia
GGAS	Greenhouse Gas Abatement Scheme, NSW
HK-BEAM	Hong Kong Building Environmental Assessment Method
LEED	Leadership in Energy and Design
NABERS	National Australian Built Environment Rating System
NSW	New South Wales
PCA	Property Council of Australia
UKGBC	United Kingdom Green Building Council

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