

Rating Tools

To reduce the environmental impact of a building it is useful to be able to measure and quantify its performance and compare different options. There is a wide range of rating schemes and assessment tools that measure different aspects of building sustainability.

WHY WE NEED RATING SCHEMES

Rating schemes allow us to compare the environmental performance of similar products, whether they be fridges or houses. This allows us to make more informed choices as consumers and provides a means to measure progress in reducing our environmental impacts.

Rating tools are used as part of rating schemes designed to establish agreed levels of environmental performance. Australia is part of a growing international movement in the development of environmental rating schemes and tools for buildings. These range from single issue schemes, such as appliance energy ratings, to whole building environmental assessments.

Most people are familiar with the energy and water efficiency star ratings found on many appliances. These help purchasers choose the most efficient products in the marketplace and are examples of rating tools that measure a particular aspect of environmental performance.

Currently most rating tools focus on one key aspect of environmental performance, but some consider more than one.

Rating tools have an important role to play in helping us achieve more sustainable buildings.

Rating tools provide assessment methods and benchmarks that can be used to set minimum regulatory standards and can encourage better levels of practice that goes beyond those minimum standards. Some rating tools help us to understand better how human behaviour affects a building's environmental performance.

The energy rating of new single dwellings can be determined by computer software provided that it complies with the relevant Australian Building Codes Board (ABCB) *Protocol for House Energy Rating Software*. State and Territory Building Control Administrations should be contacted to ascertain the suitability of a particular type or version of software.

The Building Code of Australia (BCA) provides an excellent example of how rating tools can help improve the environmental performance of homes. In most areas of Australia the BCA now requires a minimum energy star rating for new single dwellings of 5 stars as assessed by the Nationwide House Energy Rating Scheme. While this standard of 5 out of the 10 stars available is not best practice, the standard is considerably higher than the average performance of homes built prior to the regulation.

Minimum standards play an important role eliminating worst practice but consumers play an equally important role in demanding better practice.

Mandatory Disclosure:

Recent studies demonstrate that mandatory disclosure of energy efficiency in the ACT shows a very strong correlation between star ratings and house value – something in the region of 3 per cent for each star. So a \$400,000 house increases value by \$12,000 per star which makes energy efficiency a very good investment.

A good rating scheme should:

- > Encourage innovation by providing flexible compliance paths and not be overly prescriptive.
- > Have the capacity to benchmark higher performance.
- > Be able to measure both minimum mandated and better performance.
- > Integrate the use of current rating tools.
- > Allow more impact categories to be added.

Rating schemes and tools allow assessment of progress towards environmentally sustainable buildings with very low or zero impacts.

WHAT TYPES OF TOOLS ARE AVAILABLE

Rating tools fall into two broad types, although some combine both approaches.

1. Those that predict performance at the design stage, such as house energy rating tools.
2. Those that measure the actual performance of the building, including behaviour and appliances.

This distinction between the two types is important because it defines how the tools can be used. Predictive tools that have standardised user profiles may be used for regulatory purposes by providing a comparison between buildings that assumes similar behaviour patterns. These tools attempt to predict the future performance of new or existing buildings by eliminating the influence of current user behaviour.

Tools that provide feedback on how people are actually using a given building are more valuable for examining how occupant behaviour might be changed to reduce a building's impact on the environment, but these tools cannot be readily used for regulatory purposes. These tools are particularly useful at tracking improvements to the environmental management of a building.

Aspects of building environmental performance that can be rated include:

- > Performance of individual appliances and fixtures such as refrigerators, shower heads and gas heaters.
- > Performance of individual building elements such as windows.
- > Performance of a combination of elements such as the building envelope.
- > Performance of a whole building including all building services.

Building rating tools may cover specific environmental impacts in great detail such as energy or water efficiency or greenhouse performance. Other tools cover a wider range of aspects including waste reduction, the availability of sustainable transport links, building material ecological footprints, and land use impacts, but often at a lower level of detail. Users should select the tool that best suits their need for design or behaviour feedback.

HOUSE ENERGY RATING TOOLS (HERS)

House Energy Rating Schemes (HERS) in Australia such as the Nationwide House Energy Rating Scheme (NatHERS)



have traditionally only assessed the thermal performance of residential buildings. HERS tools calculate the heat energy gains and losses associated with the design of the building in a particular location, and determine how much artificial heating and cooling may be required to maintain human thermal comfort. NatHERS is managed by the Department of the Environment, Water, Heritage and the Arts. HERS software accredited under NatHERS can be used to assess compliance with the BCA and other regulations.

Currently available HERS do not include the energy use of appliances or the embodied energy of building materials, although work is underway to broaden Australian HERS tools to cover other energy impacts such as lighting, hot water, and major fixed appliances.

The actual amount of gas or electricity used for artificial heating and cooling is influenced by the behaviour of the occupants and efficiency of appliances, in addition to the thermal performance of the building.

HERS tools are typically computer based due to the millions of individual calculations necessary. Shorthand scorecards have been trialed in Australia but do not have sufficient rigor or sophistication to provide accurate assessments of environmental performance.

The main software tools in use are:

- > AccuRate.
- > BERS.
- > FirstRate.

These tools are based on a HERS calculation engine developed by CSIRO that enables assessment of a building on an hour by hour basis for a whole year. Included in the

calculations are regional climate data and the individual design of the building, as well as thermal properties of all major materials.

To enable comparison of the building performance, distinct from variables such as occupant behaviour, ratings are based on standardised assumptions about the occupation and operation of the building. Performance can be described in terms of heating and cooling loads or degree hours, hours of discomfort or indoor temperatures.

For regulatory purposes, the assessment is often expressed as a star rating. The more stars the better the performance. Star bands are set for each specific climate zone to allow fair comparison of buildings across climates.

Anyone can buy and use the HERS software, but ratings used for assessing compliance with regulations can only be issued by trained and accredited assessors.

Contact details for Accredited Assessors in your area can be found at: www.nathers.gov.au

NatHERS

The original NatHERS branded software, not to be confused with the NatHERS Scheme, was an envelope energy rating tool developed by CSIRO. NatHERS branded software was the most widely used of the early HERS tools but was replaced by the second generation HERS tool AccuRate in 2007.

AccuRate

Use of NatHERS software over several years uncovered limitations in the original software, and the governments of Australia commissioned CSIRO to overhaul both the data input method and the calculation engine.

Designed to address these issues, AccuRate was released in 2006. It now simulates energy performance more accurately in all Australian climate zones, and work is progressing to expand the tool to cover NZ climate zones.

Improvements include:

- > Better modelling of the cooling effect of air movement.
- > A floor area correction so that smaller houses are not penalised in the star rating.
- > Better internal zoning.

- > A wider range of construction materials.
- > Improved modelling of reflective insulation.
- > Integration with the Windows Energy Rating Scheme (WERS).
- > Starbands that recognise performance up to 10 stars.
- > An easier-to-use interface more suited to newer computer operating systems.

AccuRate has been widely tested, calibrated and verified to produce consistent results for all climate zones.

AccuRate Interface

AccuRate V1.1.3.2									
HOUSE ENERGY RATING		Nationwide House Energy Rating Scheme							
Project									
Project Name: Residence									
File Name:									
Project No: 2000									
Design Option: Base Design									
Climate Zone: 24									
Description:									
Client Details									
Client Name:									
Phone:		Fax:		Email:					
Postal Address:									
Site Address (optional):									
Contact authorized by (Name by assessor):									
Assessor Details									
Assessor Name:									
Phone:		Fax:		Email:					
Assessment Date (YYYYMMDD):									
Project Code - Residence:									
Assessor Signature:									
CALCULATED ENERGY REQUIREMENTS*									
Heating	Cooling (max)	Cooling (design)	Total Energy	Units					
111.8	8.0	1.7	122.0	MJ/m ² area					
<small>* From energy requirements have been calculated using standard set of assumed behaviours and as an industry average the energy values in terms of the thermal envelope. They should be used only for the purposes of rating. See below. They should not be used to size other energy components of a building such as heating and/or cooling systems or for building design.</small>									
AREA-ADJUSTED ENERGY									
Heating	Cooling (max)	Cooling (design)	Total Energy	Units					
105.5	8.0	1.6	115.8	MJ/m ² area					
Conditioned floor area: 149.1m ²									
Star Rating									
★★★★★ 7.1 STARS									
<small>Area-adjusted star band score thresholds</small>									
1 Star	2 Stars	3 Stars	4 Stars	5 Stars	6 Stars	7 Stars	8 Stars	9 Stars	10 Stars
52	64.5	78.5	94	111	129	149	171	195	221

AccuRate, like all NatHERS family software, requires detailed information about the building such as orientation, construction materials, insulation levels, window size and orientation, shading, overshadowing, ventilation, etc. For an experienced operator, data entry can take from 30 minutes for a simple design to more than an hour for a complex design. AccuRate software can produce detailed information on the building's thermal performance on an hourly, daily and even monthly basis. AccuRate software can also be run without heating and cooling energy inputs to show the hourly internal zone temperatures. These functions can help architects and building designers improve the design.

The basic output is a simple report that shows how much heating and cooling energy would be required to keep the house comfortable, as well as the star rating of the energy performance.

AccuRate provides the benchmark for accrediting other HERS software for use with the BCA requirements. To be accredited to the NatHERS other software packages are required to give results consistent with AccuRate.

The case studies in this Technical Manual have all been rated using AccuRate. See Case Study Introduction on page 243 for more information.

BERS

BERS (Building Energy Rating Scheme) is a NatHERS family software tool based



on CSIRO's calculation engine and incorporates many of the same improvements as AccuRate. BERS has the added feature of a graphical data input process that lets designers draw houseplans rather than typing in all the data. Much of the information about the building is selected from pictures displayed on the screen, making data entry quicker and easier.

BERS is most widely used in Queensland but can be used in all Australian climate zones.

FirstRate 5

The FirstRate House Energy Rating software was developed by the Victorian Government to speed up the rating process. It provides a simple and quick method to assess and improve the energy efficiency of house designs and completed homes.

FirstRate was originally developed as a correlating program against NatHERS computations, but the latest FirstRate product incorporates the full CSIRO HERS calculation engine like the AccuRate and BERS branded products.

FirstRate has been the most popular HERS software in Victoria, although other NatHERS family software can also be used. FirstRate is also popular in Western Australia, South Australia and the ACT.

BUILDING COMPONENT RATING TOOLS

WERS

The Window Energy Rating Scheme (WERS) ranks windows for their energy performance in typical housing anywhere in Australia. It will tell you whether a given window is suitable for the climate or not.

> WERS is independent of any one manufacturer and acts as a fair, rigorous and credible system for testing performance claims.

> Rated windows in WERS get from 0 to 5 stars for both cooling (summer) and heating (winter), depending on how they rank against the alternatives.

> WERS rates the performance of a window, not the performance of the amount of windows used in a design.

> WERS complements manufacturer's existing standards for wind, water penetration and safety (AS 1288 and AS 2047).

> WERS enables windows to be rated and labelled for their energy and comfort impact on a whole house, in any Australian climate.

> WERS complements other energy rating and is plugged into NatHERS to provide star ratings for houses.

Rating of a window for energy performance starts with establishment of basic solar, thermal and optical properties of the glazing unit and window frame. These properties are determined by a combination of laboratory measurements and computer simulations.

WERS ranks windows in terms of their whole-house energy improvement when compared to the base-case window (a singleglazed clear window with a thermally unbroken aluminium frame). The rankings are then used to generate star ratings for cooling (summer and solar control performance) and heating (winter performance).

Windows that have been rated will carry a sticker certifying energy rating performance.

The three basic steps to select a window using the WERS rating are:

1. Identify the climate classification for the site (see WERS map on their website).
2. Follow the window selection guidelines for climate type and identify generic window types that might be suitable.
3. Compare the WERS star ratings for the suitable generic windows with products recommended by local distributors and make a selection based on cost and performance.

For more information see www.wers.net

Appliance ratings

Energy and water efficiency ratings are available for many popular household appliances and equipment and provide good guidance to consumers.

Rating schemes for energy and water efficiency of appliances are covered in other fact sheets in this manual. [See: 6.1 Energy Use Introduction; 6.4 Appliances; 7.2 Reducing Water Demand]

OTHER BUILDING ASSESSMENT TOOLS

NABERS HOME

NABERS HOME is an easy-to-use tool for comparing the energy and water use of an existing home to that of an average household. The web-based tool is available for anyone to use. The website also provides diagnostic tools, the Energy and Water Explorer, to provide personalised advice. See: www.nabers.gov.au

Because it focuses attention on the interaction between the occupants and the building, rather than the technical potential for that building, NABERS provides a realistic assessment of how a home is actually performing at a particular point in time as used by those occupants. The design of a home is only one factor in its performance which is also greatly affected by choice of appliances and occupant behaviour.

A NABERS HOME rating analyses 12 months of actual energy or water use, and supplies a rating out of 5 stars, with 2.5 stars representing an average household. A 5 star home is very efficient, while a 1 star home has plenty of opportunities to improve!

NABERS is not a predictive tool. It complements, rather than replaces, other rating systems that focus on the design stage, such as HERS. It can only be used for an existing home that has been occupied for 12 months and provides an opportunity to check whether the home is performing as well as it has been designed to.

The NSW Department of Environment and Climate Change, who are developing and managing the NABERS scheme in agreement with the Australian Government, are also working on waste and transport ratings for homes. See the NABERS Home case study at end of this fact sheet.

BASIX

The NSW government introduced the Building Sustainability Index (BASIX) from 1 July 2005 to establish minimum standards for all new dwellings in NSW.

BASIX is a planning regulation that sets greenhouse gas emission and water use percentage reduction targets for new dwellings when compared to similar sized houses in the same geographical location. The percentage reduction approach provides an easy to understand comparison for users.

BASIX covers the building envelope thermal performance, but when determining compliance also includes a wider range of household energy uses such as heating and cooling appliances, lighting and water heating. In common with many multiple issue tools BASIX uses some existing tools such as NatHERS and appliance energy and water ratings as part of the assessment process.

To assess thermal performance compliance, either:

- > The simulated heating and cooling loads predicted by NatHERS family software must be entered; or
- > The building fabric must comply with a set of more restrictive 'Deemed to Satisfy' requirements.

The simulation method provides more flexibility in design options. BASIX sets a maximum limit for both the cooling load alone and the total heating and cooling load. The simulation results must be less than these allowable maximums to achieve compliance. BASIX uses the HERS assessment to estimate greenhouse gas emission impact based on the thermal loads and the efficiency and type of heating and cooling appliances selected.

INTERPRETING RATING TOOL RESULTS

In putting the results of rating tools in perspective some things to consider are:

Does the rated performance of an individual building element give a true representation of its performance in the application proposed?

The performance of a building element needs to be considered in context. For example, in a warm climate, an unshaded wall of WERS 5 star cooling rated windows will cause more overheating in summer than a similar sized bank of zero star rated windows with well designed external shading. An AccuRate, BERS or FirstRate assessment would reveal that the window rating alone does not give the complete picture.

Does the rating reflect all the impacts or simply focus on a single issue?

The rating reflects the aspect being rated. For example, an appliance might carry a 5 star energy rating but be inefficient in its use of water.

In which case would a similar product with a 3 star energy rating and high water rating be the better choice if you live in an area where water is in short supply?

There is also the energy used in pumping and treating the water and wastewater to consider. Fortunately, the most energy efficient appliances are usually also the most water efficient.

Does the rating system address relative scale in assessing the impact?

Not usually. A 400m² home and a 150m² home may have the same HERS star rating. However, the larger home will use more resources and embodied energy in its construction than the smaller home. It will also require more heating and cooling energy to be comfortable due to its larger volume. Many rating systems such as NatHERS and BASIX incorporate an area correction factor to eliminate large house surface area to volume bias and to encourage smaller buildings.

Would alternative options beyond those being rated yield equivalent benefits over total lifecycle?

No rating tool can incorporate every environmental impact but better ratings will generally lead to better environmental outcomes. Whilst accepting the limited breadth of environmental impacts covered by a rating tool, try to also consider those aspects important to the environment that may not be easy to measure.

Tradeoffs are a part of every home design and construction process so it is necessary to consider what level of thermal comfortable is desired and what overall environmental impact is acceptable.

For example, it may be better to build a home from low embodied energy materials but have a slightly lower rating, rather than use a high embodied energy but low maintenance fabric on the building envelope and aim for a higher rating. High ratings in one area may not compromise good performance in other areas of environmental impact.

ADDITIONAL READING

Australian Building Codes Board
www.abcb.gov.au

BASIX
www.basix.nsw.gov.au

BEDP *Environment Design Guide*
DES 23 May 2005 Accurate: 2nd Generation
Nationwide House Energy Rating Scheme.
PRO 32 Glazing, Windows, Skylights and Atria –
Properties and Rating Systems.

BERS Pro
www.solarlogic.com.au

FirstRate
www.sustainability.vic.gov.au/www/html/1491-energy-rating-with-firstrate.asp

NatHERS
www.nathers.gov.au

Windows Energy Rating Scheme
www.wers.net

Authors:

Chris Reidy
Chris Reardon
Geoff Milne

NABERS HOME Rating reveals how you can improve your energy and water efficiency

This case study demonstrates how the NABERS HOME Energy and Water ratings can be used to identify opportunities for improving energy and water efficiency around your home.



Alicia and Jason Campbell set out to build a home in Sydney's northern suburbs that would eventually be self-sufficient – collecting rainwater and generating its own electricity. Major investments included a 25,000L underground rainwater tank and an array of 18 photovoltaic panels. The north facing home has been designed to incorporate passive solar principles, and is very cool in summer. Generous thermal mass, good shading, a white roof and a whole-of-house fan ensure it remains a comfortable 25°C throughout the hottest days, without any need for air conditioning.

Unfortunately the home doesn't receive sufficient solar access in winter to heat the thermal mass, leaving it uncomfortably cold during winter. After using the electric underfloor heating last winter, the Campbells were alarmed by the size of their electricity bill and decided to calculate their NABERS rating to see how their household's energy and water use compared to other homes.

The NABERS HOME Energy and Water ratings use a full year's energy and water consumption, plus the number of people in the household and its heating and cooling needs (using data of the particular climate zone), to give the home a rating out of 5 stars. A 2.5 star rating represents the average home, and a 5 star home is extremely efficient.

The Campbells received a low rating of 0.5 stars with their winter heating bills, indicating that their household's energy use and greenhouse gas emissions were in fact significantly higher than the average home. When an estimate was made on the basis of the summer bills alone, a rating of 2.5 stars was received – bringing the Campbell's energy use in line with the average home. Given the extent of Alicia and Jason's efforts to be self-sufficient, and that the summer bills were comparable to that of an average home, these results suggest that there could be areas where the family could adjust their day-to-day choices in the way they use their electric appliances and save energy.

While it is important to build a thermally efficient home, it is ultimately the use of appliances that determines the energy use of a household. A thorough audit of energy use in the home would help to identify where significant savings could be made.



By calculating the household's energy rating with NABERS HOME, identifying where savings could be made and then calculating their rating again in a year's time, Alicia and Jason will be able to see how successful they have been at improving the energy efficiency of their household, and help them to find further opportunities to improve.

On the other hand, the Campbell's efforts to collect rainwater and use the most efficient showerheads and toilets have earned them a 5 star NABERS HOME Water rating, the highest possible score. Alicia and Jason are passionate about saving water, and have not only managed to collect 100 per cent of their family's water needs as rainwater, but have also recently installed a wastewater treatment system to recycle all the water that is used on-site.

Calculating their NABERS ratings has highlighted for the Campbells the importance of not only careful design when planning a home, but also the impact of ongoing, every day choice of appliances, and the way they are used. By also using NatHERS tools, Alicia and Jason could identify possible changes to the building design that may improve the comfort and energy efficiency of the home during winter.

To calculate your own NABERS HOME Energy and Water ratings, go to www.nabers.com.au.

NABERS is a national initiative, managed by the NSW Department of Environment and Climate Change.