Northern Territory Government

DEPARTMENT OF **PLANNING AND INFRASTRUCTURE**

House Energy Rating Industry Reference Group

Discussion Paper May 2008

The House Energy Rating Industry Reference Group

The House Energy Rating Industry Reference Group (HER IRG) was formed by invitation from the Minister for Infrastructure and Planning in late 2005. The Terms of Reference for the HER IRG were to evaluate, and make recommendations to the Building Advisory Committee regarding the applicability of the AccuRate house energy rating software for Northern Territory conditions.

Attachment A contains HER IRG membership details as of May 2008. All participating industry organisations were invited to nominate both Alice Springs and Darwin representatives.

The HER IRG has met on twelve occasions and has considered the results from numerous house energy rating studies including a comparison of measured internal conditions with AccuRate predicted conditions for three Darwin houses. The HER IRG did not meet in 2007 as it was waiting for work to be done by the Commonwealth Government and the CSIRO to address tropical house energy rating issues identified by the Group.

This paper has been developed to assist HER IRG members consult with their industry groups on the HER IRG Preliminary Recommendations.

Introduction to NatHERS Software

Nation-wide House Energy Rating Scheme (NatHERS) software calculates the thermal conditions inside any given house or unit in a given location on an hour by hour basis throughout a typical year. The software calculates how much heat must be added or removed by heaters or air conditioners each hour to provide comfortable conditions to occupants and the resultant annual total cooling and heating loads are summed and divided by the building area to calculate the final star rating.

The software contains a reference library of climate data for a typical year for 69 locations in Australia (including Darwin, Tennant Creek and Alice Springs) and locations with similar climatic conditions share data sets.

Recent developments, to improve the modeling of air flow and comfort, have resulted in what is termed ‘Second Generation NatHERS Software’.

Development of the main software ‘engine’ (now called the ‘AccuRate Engine’) has been funded by Australian governments over the past decade. Other house energy rating software (for example BERS and FirstRate) is marketed in Australia. Such software has to meet the requirements of a national House Energy Rating Software Protocol, and produce results which closely correlate to AccuRate software results, before being accepted for use in the NatHERS scheme.

The main use of house energy rating software is as an Alternative Verification path for meeting minimum energy efficiency requirements in the Building Code of Australia (BCA) for Class 1 and 2 buildings and Class 4 parts of buildings.

Other methods of meeting BCA minimum efficiency requirements include Deemed-To-Satisfy provisions and expert judgment.

The use of house energy rating software provides a more flexible and thorough approach to meeting BCA minimum efficiency requirements than the use of Deemed-To-Satisfy provisions. Through house energy rating, the thermal impact of all key design features on a building's thermal performance is modeled and low or no cost changes can be investigated that improve energy efficiency. Therefore, for individual buildings, the use of house energy rating can result in lower cost, more flexible design solutions to the minimum energy efficiency requirements than taking the Deemed To Satisfy approach.

All other Australian jurisdictions accept the use of NatHERS software as an Alternative Verification path for meeting minimum energy efficiency requirements in the Building Code of Australia.

Concerns regarding how well house energy rating software assesses the thermal performance of residential buildings in the tropics has delayed the acceptance of the use of such software in the Northern Territory.

Hot Arid Issues

Through consideration of house energy rating results for multiple house design variations (refer to Attachment B for more information), and the fact that house energy rating software is being used throughout the rest of Australia in similar climates, the HER IRG has formulated the following Preliminary Recommendation:

> *"The NatHERS second generation software, AccuRate, is appropriate for use as an Alternative Verification method to assess whether residential buildings meet BCA energy efficiency requirements in BCA Climate Zone 3 (hot arid zone)."*

Tropical Issues

It is apparent that much work has been done by the CSIRO and the Commonwealth Government to address how the software algorithms incorporate tropical comfort issues.

The AccuRate software is designed to use advanced numerical analysis to predict internal air flows each hour due to a dwelling's ability to capture the breeze. This new ventilation module has been added to the original NatHERS dynamic thermal performance software (which models heat flows through a house envelop each hour of a year). The software also now incorporates acclimatisation theory (comfort parameters that consider humidity changes and air flow from breezes and fans) which is based on international research on how people's comfort thresholds are affected by the climate where they live.

Issues and outcomes that arose regarding tropical house energy rating included:

- NT Government representatives on the national Energy Efficiency Working Group and its Building Group did not accept the star rating levels set for Darwin in the version of AccuRate released onto the market in early 2006. This was because, intrinsic in the methodology used to establish the star rating levels, was an assumption that not all housing in the tropics has ceiling fans. As fans have a significant affect on star rating levels, it was found that this led to five star rating levels for tropical climate zones that were too lenient. After the release of version

1.1.3 of AccuRate, 'interim tropical star rating levels' which addressed this issue were established and used in HER IRG deliberations.

The Commonwealth Department of the Environment, Water, Heritage and the Arts (the National NatHERS Administrator) has clarified that the appropriateness of future star rating levels for the tropics will be assessed and approved by jurisdictions prior to future software releases.

- The HER IRG raised concerns regarding a possible lack of sensitivity of star ratings to the night time performance of tropical housing - and the impact of this on the relative ratings of masonry buildings compared to light weight buildings.

  The NatHERS National Administrator is aiming to address this issue through the release of a new version of AccuRate which will incorporate new cooling settings which differentiate between night time and day time comfort levels.

- Rooms that do not seal (eg. flyscreen only, unglazed openings) can not be rated using AccuRate in its current configuration.

  The adequacy of the Deemed To Satisfy BCA energy efficiency requirements to deal with such houses is being considered by the Building Advisory Committee.

  HER IRG Preliminary Recommendation:

  > *"It is recommended that industry education occur to clarify how rooms that do not seal should be assessed with respect to BCA minimum energy efficiency requirements."*

Through discussion of house energy rating results for multiple house design variations (refer to Attachment B for more information); a comparison of measured internal temperatures with AccuRate predicted internal temperatures for three Darwin houses; and discussions on future development issues with Department of Planning and Infrastructure and Commonwealth Government representatives, the HER IRG has formulated the following Preliminary Recommendation:

> *"The NatHERS second generation software, AccuRate, is appropriate for use as an Alternative Verification method to assess whether residential buildings meet BCA energy efficiency requirements in BCA Climate Zone 1 (hot humid tropics).*
>
> *"It is strongly preferred that new cooling settings which differentiate between waking and sleeping comfort are incorporated into a new commercially released version of Accurate prior to it being used for Building Code of Australia energy efficiency assessments in the Northern Territory.*
>
> *"The HER IRG considers that there is a need for on-going research and development regarding how AccuRate rates residential buildings in the tropics, particularly in areas such as comfort ratings, separate day time and night time performance indicators and the validation of predicted roof and room ventilation rates. It is considered imperative that this work progress in parallel to the introduction of house energy rating in the Northern Territory."*

Accreditation and Quality Control for Residential Thermal Performance Assessors

HER IRG Preliminary Recommendation:

> *"It is recommended that, if the house energy rating is to be adopted as an option to assess the Building Code of Australia energy efficiency requirements for Class 1, 2 and 4 buildings, a system for recognizing /accrediting persons providing house energy rating assessments be considered."*

The HER IRG has considered relevant national documents, and consulted with the National NatHERS Administrator and the Association of Building Sustainability Assessors (ABSA) on possible NT residential thermal performance assessor accreditation arrangements.

HER IRG considers that residential thermal performance assessor accreditation arrangements put in place nationally could meet the NT's needs if these arrangements were supplemented with a special assessor accreditation category, and a tailored qualification exam, for BCA Climate Zone 1 (the tropics) as tropical design issues are significantly different to design issues in other climates.

Current national assessor accreditation arrangements that could be considered by the NT include:

- A NSW VTAB approved (40 hour) course and qualification
- The National NatHERS Administrator approving course providers and exam contents
- ABSA accrediting assessors if they have the required qualification, maintain professional indemnity insurance and agree to abide by a code of professional practice and an ongoing quality assurance system that includes auditing, training and support
- The use of ABSA's Certificate Manager software to develop thermal performance certificates to be submitted to Building Certifiers by Thermal Performance Assessors
- Submission of all accredited thermal performance assessment details onto ABSA's database for level 1 auditing
- An auditing framework for three levels of assessor auditing by ABSA established in a national "Protocol for Assessor Accrediting Organisations"

Accredited assessors could include existing members of the housing industry (eg designers or certifiers) adding another string to their bow or new specialists in residential thermal assessment.

The HER IRG notes that, should house energy rating be adopted in the Northern Territory, the final method of accrediting house energy rating assessors will be a decision of the Northern Territory Government.

Regulatory Rating Mode Settings

House energy rating software can model many variables related to building thermal performance and it is necessary to control how some variables are used in ratings relating to Building Code compliance. Generally, the HER IRG has considered and accepted national regulatory rating mode settings as outlined in the Draft Protocol for Assessor Accrediting Organisations (September 2006) including:

- Ground reflectance to use a default setting which is equivalent to the reflectance from grass.
- Floor coverings are to be modelled as specified on drawings and, if not specified, wet areas are modelled with tiles and all other habitable rooms are modelled with carpet. This is a conservative approach in relation to building thermal performance which will encourage specification of tiles on drawings where they are to be used.
- Regardless of window coverings nominated on drawings, internal window treatments are to be modelled as low performance holland blinds. This is approach is to avoid the need for certifiers to be concerned with window coverings.
- Any window not clearly identified on plans as being openable will be modelled as not being openable.
- The exposure of a dwelling to the breeze is allowed to be varied between accredited assessments to reflect the advantage of some sites over others. However, as tropical rating results are very sensitive to the exposure setting modeled, the accredited assessor auditing system is to check any assessments that do not use the 'suburban' exposure setting. Guidelines will need to be developed in relation to the selection of exposure settings.

  A Preliminary Recommendation of the HER IRG is that the following national regulatory rating mode settings be adjusted:

  1. *Roof and wall colour types (eg. light, medium or dark or solar absorptance range) to be specified on drawings and modelled as per the specified details and modelled as dark if colour is not specified. This is because colour has a significant impact on thermal performance and is a zero or low cost important design decision. The draft protocol approach is that wall and roof colours do not have to be specified and, if not, are modeled as having a medium colour. The HER IRG is of the opinion that this could lead to dark colours being used where colour is not specified on drawings yet building assessments are advantaged by the relatively good thermal performance of medium colours.*
  2. *Regardless of whether or not flyscreens are nominated on drawings, the software should assume flyscreens are present on all openings (and therefore internal air velocities are slightly reduced) in regulatory ratings. This is because flyscreens should generally be used to avoid mosquito born diseases, and, as there is a small advantage to ratings if openings are modelled without flyscreens, avoids the need for auditing of whether flyscreens have been included or not in future accredited assessment quality control arrangements.*

Cost of House Energy Rating Assessments

House energy rating, as an alternative solution method to satisfy the BCA energy efficiency requirements, generally offers the most cost effective options for meeting the new “5 Star” Building code of Australia housing energy efficiency requirements.

If house energy rating is adopted for use in the Northern Territory, house energy rating assessors would establish their own fee calculations based on their probable costs, perceived value and other pertinent financial aspects. Interstate experiences suggest that the cost of ratings could vary from a few hundred dollars up to $1500 each depending on the complexity of the design being rated and level of design advice being requested. It is expected that, in many cases, the additional cost of the house energy rating assessments would be off-set by the benefits of reduced construction costs (compared to a Deemed To Satisfy design solutions) and increased design flexibility to respond to client and site needs.

Summary

Members of the House Energy Rating Industry Reference Group have met on twelve occasions since late 2005 to consider the appropriateness of the second generation Nationwide House Energy Rating (NatHERS) software, AccuRate, for use assessing residential building compliance against Building Code of Australia minimum energy efficiency requirements in Northern Territory climate zones.

Preliminary Recommendations of the House Energy Rating Industry Reference Group, to be referred to each members' industry organisation before they are finalised are:

1. *That NatHERS second generation software, AccuRate, is appropriate for use as an Alternative Verification method to assess whether residential buildings meet BCA energy efficiency requirements in BCA Climate Zone 3 (hot arid zone).*

2. *That NatHERS second generation software, AccuRate, is appropriate for use as an Alternative Verification method to assess whether residential buildings meet BCA energy efficiency requirements in BCA Climate Zone 1 (hot humid tropics).*

   It is strongly preferred that new cooling settings which differentiate between waking and sleeping comfort are incorporated into a new commercially released version of Accurate prior to it being used for Building Code of Australia energy efficiency assessments in the Northern Territory.

   The HER IRG considers that there is a need for on-going research and development regarding how AccuRate rates residential buildings in the tropics, particularly in areas such as comfort ratings, separate day time and night time performance indicators and the validation of predicted roof and room ventilation rates. It is considered imperative that this work progress in parallel to the introduction of house energy rating in the Northern Territory.

3. *It is recommended that, if the house energy rating is to be adopted as an option to assess the Building Code of Australia energy efficiency requirements for Class 1, 2 and 4 buildings, a system for recognizing /accrediting persons providing house energy rating assessments be considered.*

4. *That the following national regulatory rating mode settings be adjusted:*

   - *Roof and wall colour categories to be specified on drawings and modelled as per the specified details. Wall colours should be modelled as dark where colour is not specified.*
   - *The software should assume flyscreens are present on all openings*

5. *That industry education occur to clarify how rooms that do not seal should be assessed with respect to BCA minimum energy efficiency requirements.*

ATTACHMENT A

HOUSE ENERGY RATING INDUSTRY REFERENCE GROUP MEMBERSHIP IN MAY 2008

Chair: Jo Kieboom	Infrastructure Sustainability Unit, DPI
Secretary: Jennifer Harlock	Infrastructure Sustainability Unit, DPI

Industry Organisation Representatives

Ross S Finocchiaro	Royal Australian Institute of Architects Darwin
Stuart Chalmers	Royal Australian Institute of Architects Alice
Paul Nowland	Territory Construction Association
Ron Brown	Building Designers Association
Glyn Williams	Australian Institute of Building Surveyors
Andy Matthewson	Housing Industry Association
David Chin	Engineers Australia

Government Representatives

Paul Purdon	Environmental Protection Agency Program, NRETA
Fabio Finocchiaro	Building Advisory Services, DPI
Peter Zagorski	Building Advisory Services, DPI

ATTACHMENT B - SUMMARY OF SOME HOUSE ENERGY RATING RESULTS

"Evaluation Of Accurate Simulations Of Various Design Strategies To Improve House Thermal Performance In Darwin And Alice Springs" (Isaacs, Tony. Prepared for Department of Planning and Infrastructure, September 2006)

This report (available at www.nt.gov.au/buildingsustainability) uses a one room 'test cell' to investigate the impact and appropriateness of four main factors which affect how much energy a house will need to maintain comfort in Darwin and Alice Springs:

- the amount of solar radiation entering through windows (glass type, orientation and shading),
- the ability of the house to provide air movement to improve comfort in hot conditions,
- the area, colour, shading and insulation level of the building fabric: walls, floors and roof/ceilings, and
- the thermal mass of materials i.e. the ability of the material to absorb and store heat.

Simulation of various house designs in Darwin, Katherine, Tennant Creek and Alice Springs

DPI obtained permission for various house designs to be used in the AccuRate testing process. Numerous design variations for each house design were modeled in Darwin, Katherine, Tennant Creek and Alice Springs. Whilst confidentiality arrangements prevent disclosure of rating results for specific designs, the following summary provides an indication of the rating results for a selection of the houses modeled and some changes that would allow each to achieve a 5 Star NatHERS rating. Note that the house energy rating approach allows a variety of design alternatives to be used to achieve 5 Stars whereas the list below only includes one 5 Star approach for each house.

Alice Springs Simulations		
House ID	**Basecase house design features and star rating**	**Example of design changes required to achieve '5 Stars'**
1A	Blockwork, slab-on-ground, 22% wall area sliding windows, 1.9m verandah to 2/3 south façade, reflective foil under roof (2.5 Stars)	Wall insulation or use of Aerated Autoclaved Concrete (eg Hebel) walls and ceiling insulation
2A	Blockwork, slab-on-ground, 16% wall area sliding windows, 3.9m verandah around entire façade, R2.5 ceiling insulation and reflective foil under roof (4 Stars)	Wall insulation or use of Aerated Autoclaved Concrete (eg Hebel) walls
3A	Double brick, slab-on-ground, 64% wall area louvre windows (well orientated/shaded), reflective	Add ceiling insulation and ceiling fans

	foil under roof (2 Stars)	
4A	Framed walls with R2.5 insulation, slab-on-ground, 50% wall area double-glazed sliding windows, 4.3m verandah to 2/3 northern façade, R3.5 ceiling insulation (6 Stars)	No change needed – already 6 stars
5A	Framed walls with R1.5 insulation, slab-on-ground, 27% wall area sliding windows, 3.9m verandah to 2/3 northern façade, R2.5 ceiling insulation and reflective foil under roof (4.5 Stars)	Higher performance glass and increased window openable areas

Darwin Simulations – note these simulations were completed using AccuRate version 1.1.3 and the 'interim tropical star rating levels.'

House ID	**Basecase house design features and star rating**	**Example of design changes required to achieve '5 Stars'**
1D	Elevated, framed walls with no insulation, timber floor, 25% wall area tinted louvre windows, 4.5m verandah to south east façade, modeled with no roof insulation including no reflective foil (1.5 Stars)	Add roof insulation, ceiling fans and some wall insulation
2D	Elevated, framed walls with reflective foil, timber floor, 15% wall area louvre windows, reflective foil under roof (3.5 Stars)	Add roof insulation and ceiling fans
3D	Concrete block walls and slab-on-ground, 27% wall area clear sliding windows, shading by carport and outdoor living area, R1.5 blanket under roof (4.5 Stars)	Add ceiling fans.
4D	Double brick, slab-on-ground, 64% wall area louvre windows (well orientated/shaded), reflective foil under roof (2.5 Stars)	Add roof insulation and ceiling fans.
5D	Concrete block walls (R1.5 insulation on east and west walls), slab-on-ground, 21% wall area sliding windows, 2.7m verandah to ¾ northern façade, reflective foil under roof (2.5 Stars)	Add roof insulation and ceiling fans.