



# Darwin Home Comfort Rating Project Introduction

Darwin Living Lab Symposium - 4 August 2022

Jo Kieboom  
Senior Engineer Ecological Sustainability  
Strategic Asset Management  
Infrastructure, Investment and Contracts  
Department of Infrastructure, Planning and Logistics



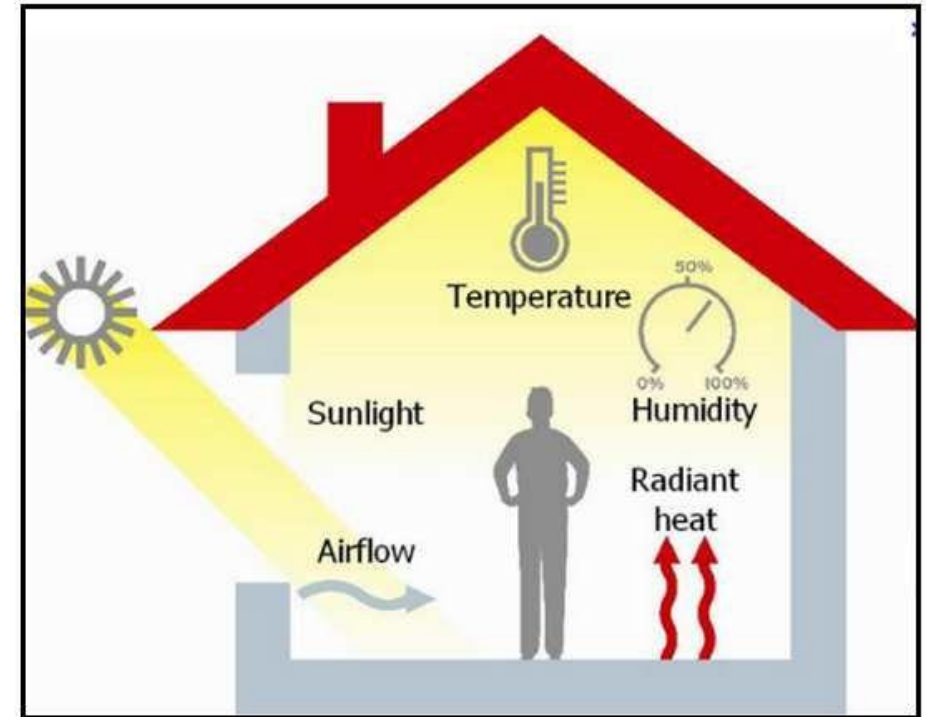
# Why develop Comfort Ratings?

As the impacts of climate change are felt more in the future, it is likely reliance on air conditioning for comfort is going to increase.

Studies have shown that there is a clear, but not exact, correlation between energy ratings and comfort.

Voluntary, 'for information' comfort ratings are important because:

- not everyone can afford to rely on air conditioning
- over-heating can affect people's health, quality of life and willingness to live and work in the Territory
- houses should be as comfortable as possible during black outs
- energy use from air conditioning is a major contributor to greenhouse gas emissions and climate change



[Image: The most important environmental factors affecting thermal comfort | Download Scientific Diagram \(researchgate.net\)](#)

# Comfort ratings will also:

- Provide separate feedback on bedroom and living area performance
- Enable evidence-based assessments of the passive comfort performance of different design approaches
- Educate stakeholders about good climate sensitive design for Darwin housing



Darwin River, Northern Territory | YourHome  
yourhome.gov.au



About Homes NT: Darwin Home Builders  
abouthomesnt.com.au



Houses for Sale in Darwin - Greater ...  
m.realestate.com.au



18 hours ago

197 Rental Properties in Darwin ...  
domain.com.au

# Key Project Outcome

- From early 2023: Home Comfort Ratings included for Darwin postcodes in CSIRO's accredited NatHERS software, AccuRate

It is also hoped that other accredited NatHERS software providers will build the Comfort Ratings into their software.



# Project Technical Reference Group

|                          |  |  |
|--------------------------|--|--|
| Jo Kieboom (Chair)       | Senior Engineer Ecological Sustainability – DIPL (Infrastructure Investment and Contracts, Strategic Asset Management) | <ul style="list-style-type: none"> <li>Chair: NT House Energy Rating Industry Reference Group (2006 – 2008)</li> <li>NT rep.: NatHERS software development Technical Reference Group (2002-2008)</li> </ul>                              |
| Dr Zhengdong (Dong) Chen | Senior Principal Research Scientist - Building Simulation, CSIRO Energy  | Lead CHENATH developer   |
| Dr Terry Williamson      | Adjunct Professor School of Architecture and Built Environment, University of Adelaide                                 | Supervisor of multiple Phd research projects on Darwin residential building comfort  |
| Dr Wendy Miller          | Associate Professor, School of Architecture and Built Environment, Queensland University of Architecture               | Member: <ul style="list-style-type: none"> <li>International Energy Agency Annex 80 Resilient Cooling Task Force</li> <li>Australian Institute of Refrigeration, Air conditioning and Heating - Resilience Special Task Group</li> </ul> |
| Dr Mahsan Sadeghi        | CERC Postdoctoral Fellow, CSIRO Energy   | Thermal comfort measurement expert   |
| Ray Fogolyan             | Accredited NT house energy rating assessor (Home Star Australia)   | NatHERS Technical Reference Group member and past ABSA Chair   |
| Dr Hooman Mehdizadeh-Rad | Mechanical Engineering Lecturer & Postgrad. Course Coordinator, Charles Darwin University                              | Energy modelling research project supervisor   |



# How rate comfort?

- As well as 'clocking' MJ coolth provided by air conditioning to achieve comfort ...
- Software will sum how uncomfortable each room is without air conditioning each hour of a year
- Quality of design for natural ventilation and air flow from ceiling fans will be taken into account

Comfort Rating module of software will reflect current international best practice comfort calculation methodologies including:

- ASHRAE adaptive comfort threshold formulae calibrated by University of Adelaide Darwin housing research results

# Degrees Discomfort each hour (°c)

$$\text{Degrees Discomfort (DD)} = ET^* - (\text{CET} + \text{Acceptable Range}) - \text{CEV}$$

Where:

$ET^*$  = Predicted 'Effective Temperature' in room each hour (considers dry bulb temperature, radiant temperature, humidity and assumed level of activity and clothing)

$\text{CET} + \text{Acceptable Range}$  = Comfort threshold

$\text{CEV}$  = The Cooling Effect of Ventilation at each hour

# New CHENATH/AccuRate Comfort Rating Outputs

For each living area and bedroom:

DD – Degrees Discomfort of overheating (hourly)

CET - Thermal comfort threshold ET\* (monthly)

CEV - Cooling effect due to air movement (hourly)

Annual % of time windows are open

Annual % of ceiling fans are on

Annual % of time above comfort threshold

Thermal Comfort Rating



# Comfort rating design options

**DHD** (Degree Hours Discomfort)

**OR**

**%POR** (Percentage [of Hours] Outside [Comfort] Range)

**80% Acceptability threshold** ('average population')

**OR**

**90% Acceptability threshold** ('very sensitive and fragile persons')

**Ratings based on worst bedroom/living area**

**OR**

**Average bedroom/living area performance**

# Key Work Plan Elements

Investigate if relative rankings of different designs are affected if:

- 80% or 90% acceptability limit is used
- NatHERS standard weather file or 2050 'worst case' weather file is used

Recommend '0 to 10' Comfort Rating thresholds based on:

- Modelling 96 variants of 4 houses, 2 townhouses and 2 apartment designs
- Modifying best designs to examine the lowest DHD that could be achieved
- Analysing the range of Comfort Rating results for all Darwin homes rated from 2020 – 2021
- Applying energy rating 0 to 10 star bandwidth mathematical formulae to comfort rating results

Report on any correlation of energy ratings with proposed comfort star ratings

# Industry & community project input

- DIPL project manager can be invited to discuss the project with members of NT stakeholder organisations
- Feedback on Comfort Rating parameters will be sought in this afternoon's Darwin Living Lab workshop session.
- Two industry and community presentations on the new comfort ratings will be held in 2023:
  - Early in the year to present the proposed comfort rating methodology
  - Later in the year to report back on the Comfort Ratings' initial use.