



The Thermal Performance of Residential Buildings – An Overview

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SmartRate

**Thermal Performance
Assessments**

Training

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B. Architecture

B Design Studies

Cert 4 Training & Assessment

Director ABSA

Member BCQ Peer Review Panel

HIA National Technical Committee

BCQ Energy Efficiency Housing Committee

**CPSISC Steering Committee – Cert 4 Home
Sustainability Assessment**

**What options are available
under proposed BCA 2010?**

**How does Second
Generation thermal
performance software work?**

BCA 2009 Volume 2

O2.6

Objective

The objective is to reduce greenhouse gas emissions by using energy efficiently.



BCA 2009 Volume 2

F2.6

Functional Statements

To reduce greenhouse gas emissions, a building, including its domestic services, is to be capable of efficiently using energy.

Part 2.6 Performance Requirement

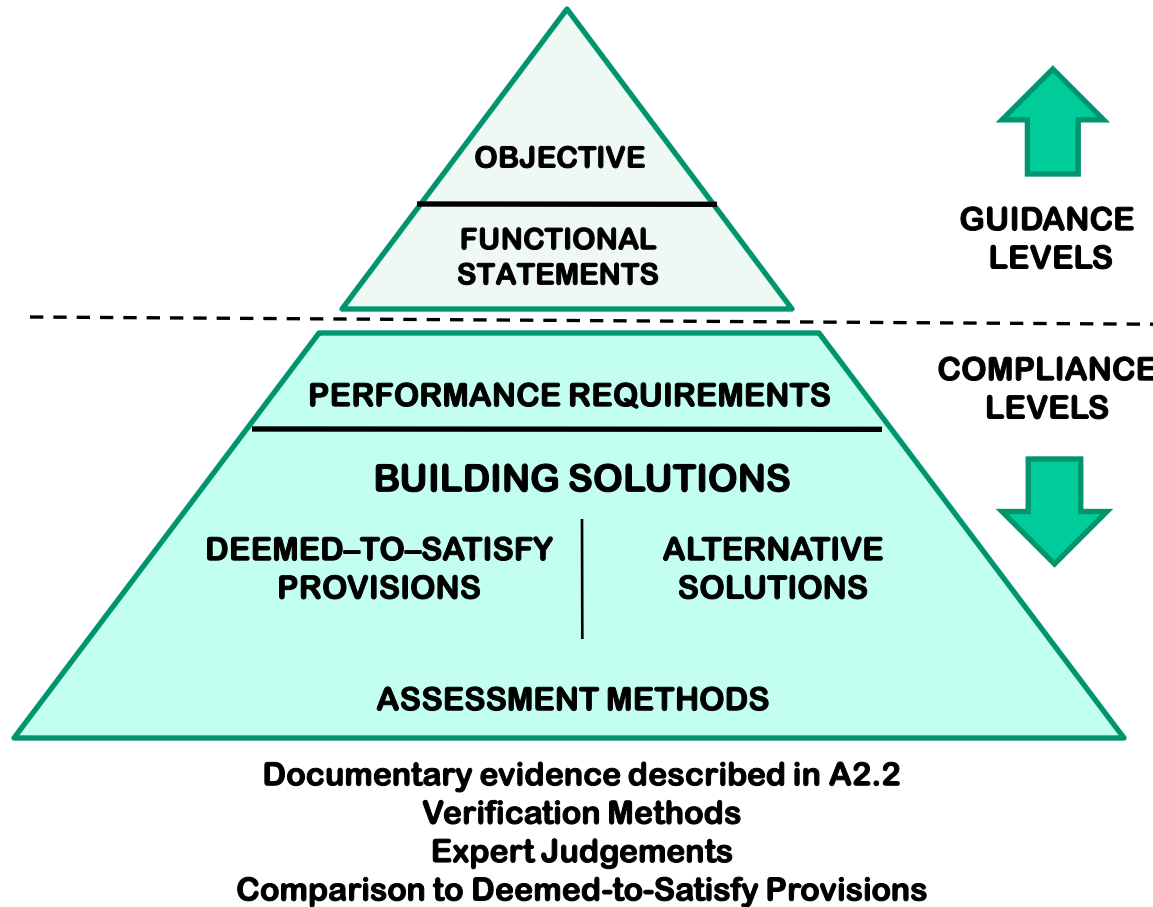
P2.6.1 Building

A building must have, to the degree necessary, a level of thermal performance to facilitate the efficient use of energy for artificial heating and cooling...

P2.6.2 Services

A building's domestic services...must have features that, to the degree necessary, facilitate the efficient use of energy...

BCA Structure



Deemed to Satisfy

**Thermal
Calculation Method
(Software)**

Peer Review

Thermal Calculation Method (Software)

Flexible

Class 1, 2 and 10a buildings

**Bers Pro
FirstRate5
AccuRate**

**Based on 69 BOM climate
files**



FirstRate5



Peer Review

Introduced September 2009

Opinion from expert panel member

Software analysis first

Written report on compliance

Application

Deemed to Satisfy

New buildings

Extensions

**Alterations and
Additions**

Application

Thermal Calculation Method (Software)

New homes

Some Extensions

Not Alterations and Additions

BCA 2010 – Proposed Stringency Levels

6 Stars – 1st May 2010

New provisions

- hot water systems**
- pool pumps and heaters**
- lighting – 5 watts/m²**

Deemed to Satisfy – deleted eventually

Mandatory Disclosure – 1st May 2011

Qld Sustainability Disclosure – 2010 (proposed)

BCA 2010 – Proposed Concessions

6 Stars – 1st May 2010

5 ½ stars – patio that meets certain requirements

5 stars – patio as above plus a fan

Applies to BCA Climate Zone 1 & 2 only

Questions, so far??

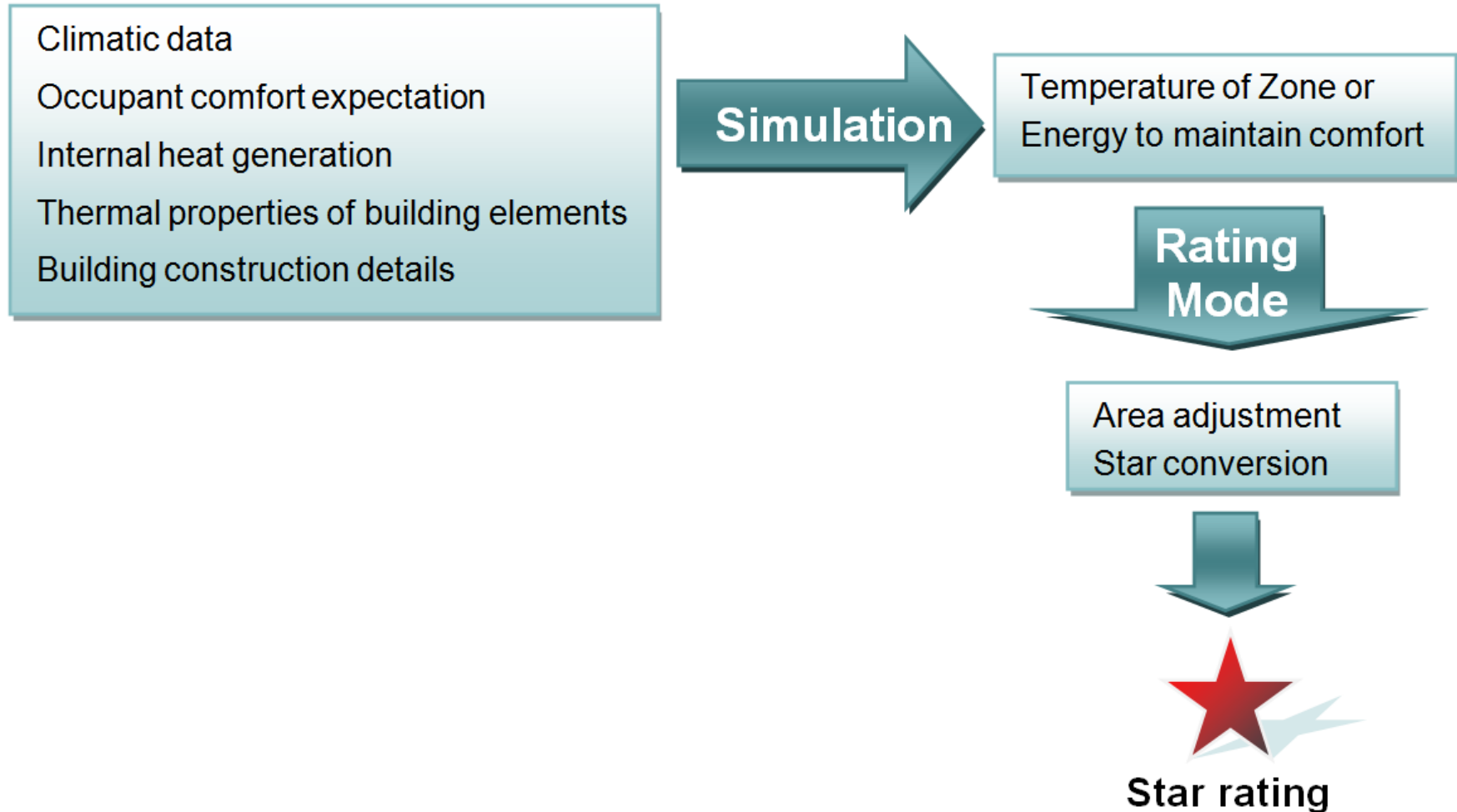


PROTOCOL FOR HOUSE ENERGY RATING SOFTWARE

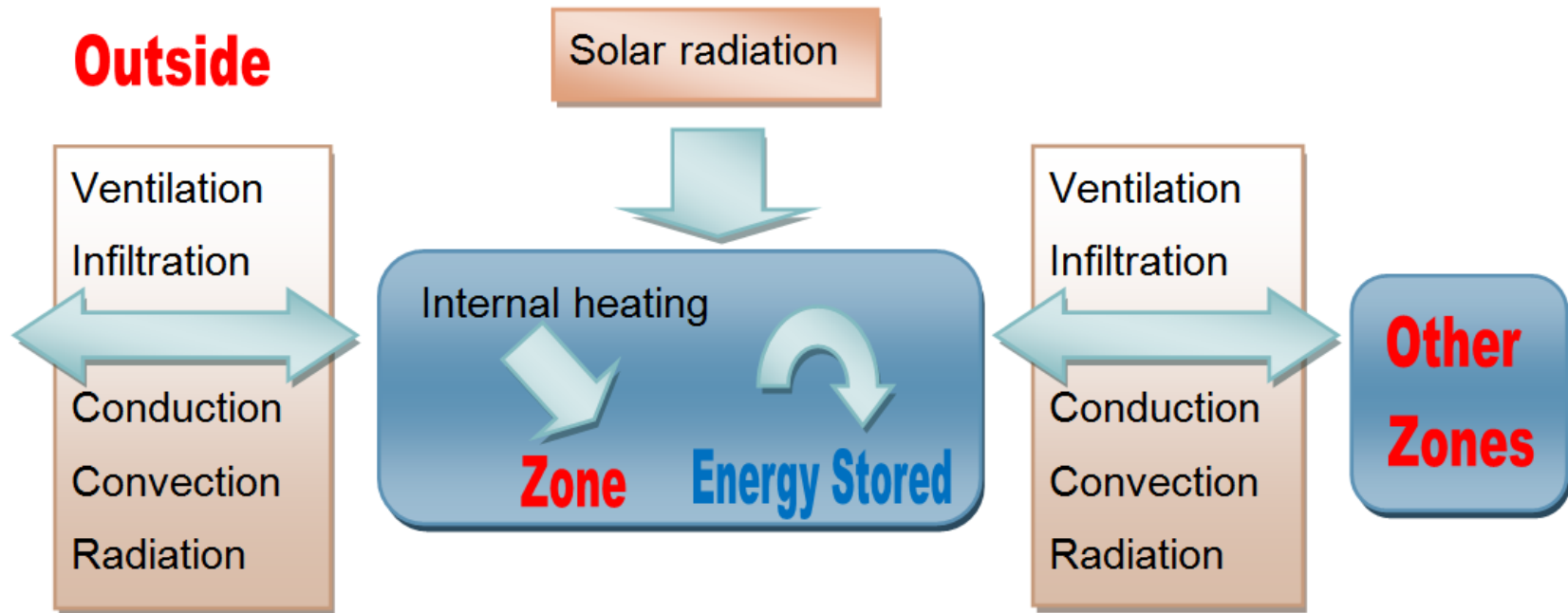
AUSTRALIAN BUILDING CODES BOARD

Version 2006.1

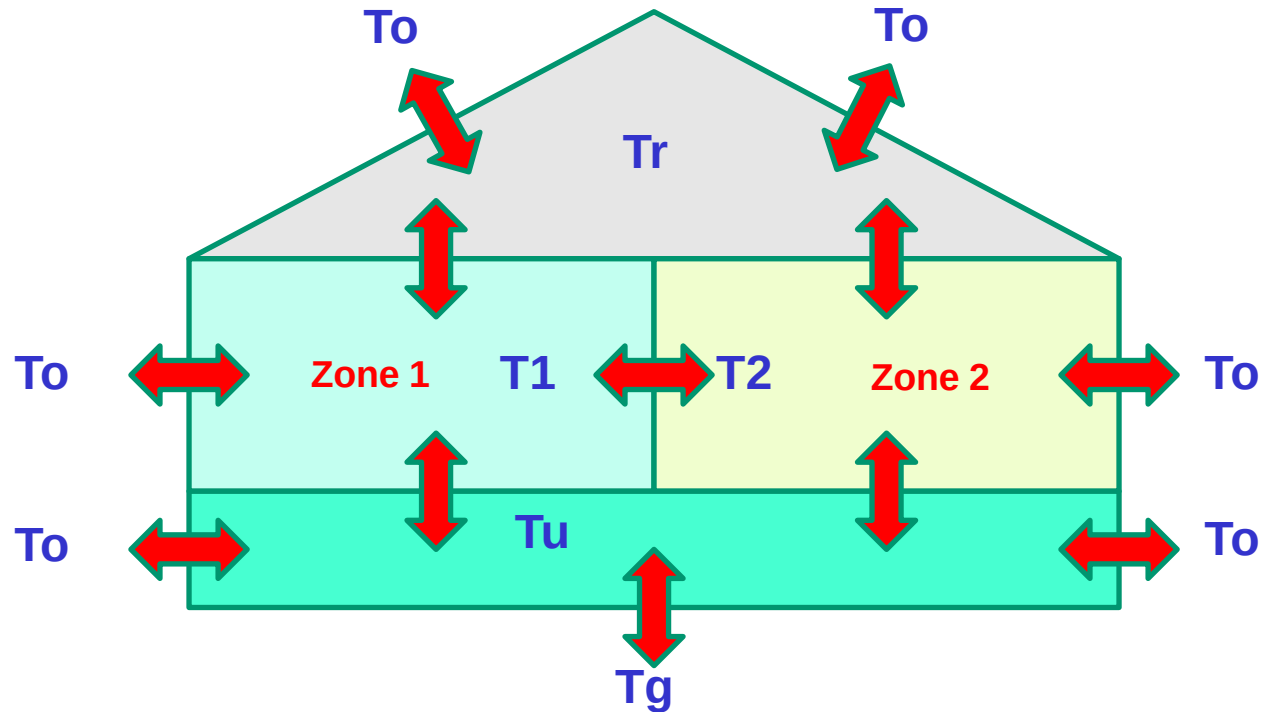
Thermal simulation process



Modelling heat and air flow

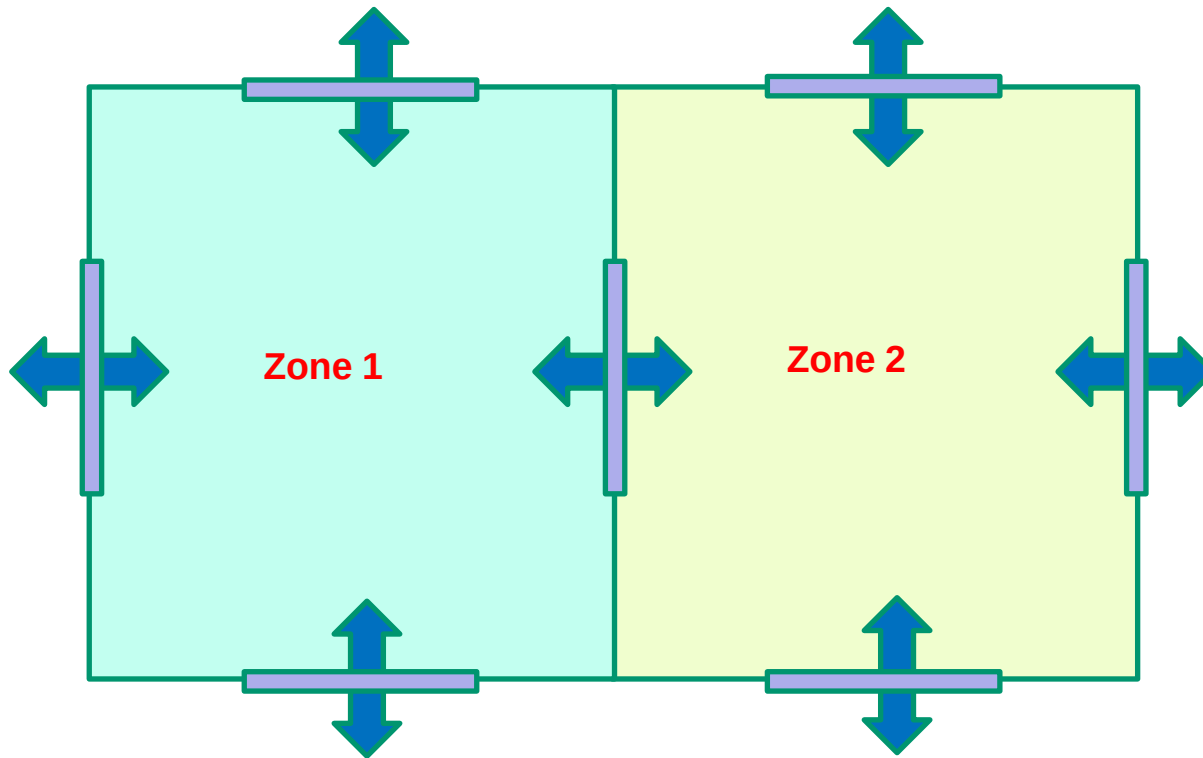


Heat flow through a two room house

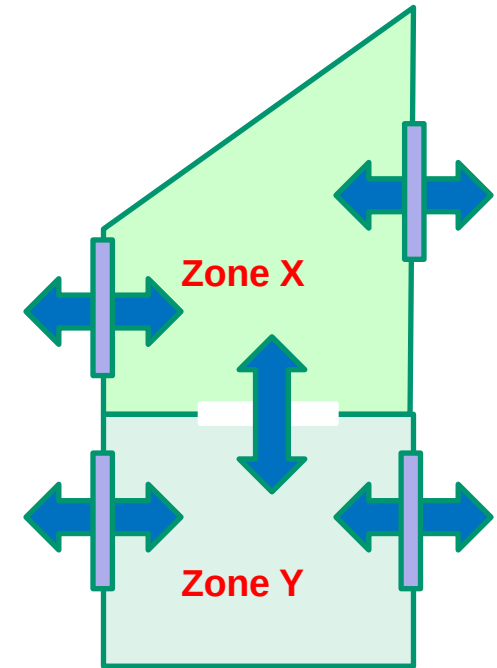


Elevation

Air flow through a two room house



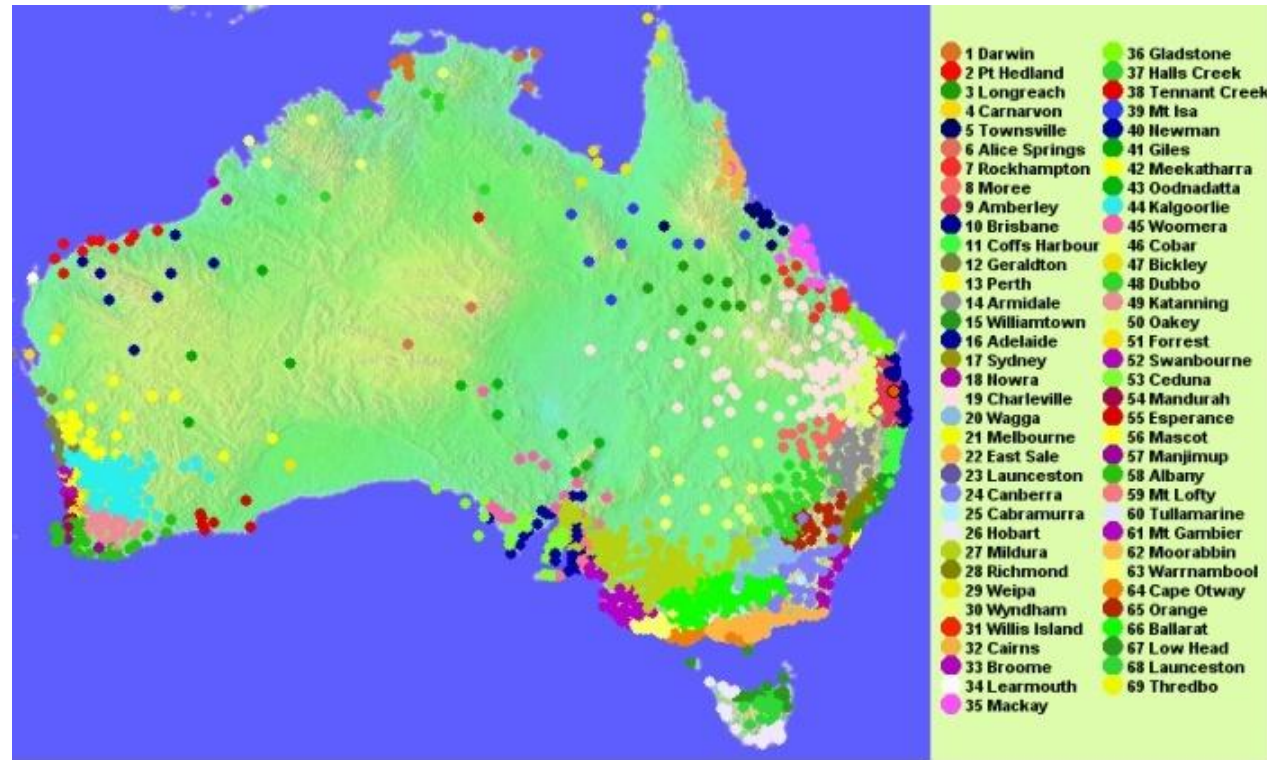
Plan



Elevation

Climate data

- DB Temperature
- Absolute Humidity
- Beam Radiation
- Diffuse Radiation
- Wind Speed
- Wind Direction
- Cloud cover.



Data at hourly intervals for one year
Each post code assigned 1 of 69 climate files

Zone types

Zone type	Normally Conditioned	Period if Conditioned	Heat Gains
<i>Living</i>	Yes	7:00 - 24:00	Non cooking
<i>Sleeping</i>	Yes	16:00 – 9:00	Small
<i>Living/Kitchen</i>	Yes	7:00 - 24:00	Cooking
<i>Other Daytime</i>	Yes	7:00 - 24:00	No
<i>Other Night-time</i>	Yes	16:00 – 9:00	No
<i>Garage</i>	No	7:00 - 24:00	No
<i>Corridor</i>	No	7:00 - 24:00	No
<i>Wet Area</i>	No	7:00 - 24:00	No
<i>Roof Space</i>	No	None	No
<i>Subfloor Space</i>	No	None	No

Zoning rules

- One and only one **Living/Kitchen** zone.
- Not more than two **Living** zones.
- Lightly occupied by day-**Other daytime conditioned**.
- Ensuite usually forms part of **Sleeping**
- If ensuite is separate-**Other night-time conditioned**.
- **Garages** have different floor characteristics
- Top floor of **void-Free Running**
- **Roof** and **Subfloor Space** automatically created

Comfort band settings

Heating in sleeping zones

- 15°C boundary between midnight and 7.00 am and
- 18°C between 8.00am and 9.00am and 4.00pm and midnight.

Heating in living zones

- 20°C boundary between 7.00 and midnight.

Cooling

- same for living and sleeping zones
- based on thermal neutrality as modified by
- Humidity and
- Air speed

(In fact cooling is used more at night even though cooler.)

Comfort band interface in BERS Pro

Heating Thermostat											
15.0	15.0	15.0	15.0	15.0	15.0	15.0	18.0	18.0	0.0	0.0	0.0
0-1 am	2	3	4	5	6	7	8	9	10	11	12
0.0	0.0	0.0	0.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0
0-1 pm	2	3	4	5	6	7	8	9	10	11	12
13	14	15	16	17	18	19	20	21	22	23	24

Cooling Thermostat											
24.5	24.5	24.5	24.5	24.5	24.5	24.5	24.5	24.5	0.0	0.0	0.0
0-1 am	2	3	4	5	6	7	8	9	10	11	12
0.0	0.0	0.0	0.0	24.5	24.5	24.5	24.5	24.5	24.5	24.5	24.5
0-1 pm	2	3	4	5	6	7	8	9	10	11	12
13	14	15	16	17	18	19	20	21	22	23	24

Sleeping

Living

Heating Thermostat											
0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.0	20.0	20.0	20.0	20.0
0-1 am	2	3	4	5	6	7	8	9	10	11	12
20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
0-1 pm	2	3	4	5	6	7	8	9	10	11	12
13	14	15	16	17	18	19	20	21	22	23	24

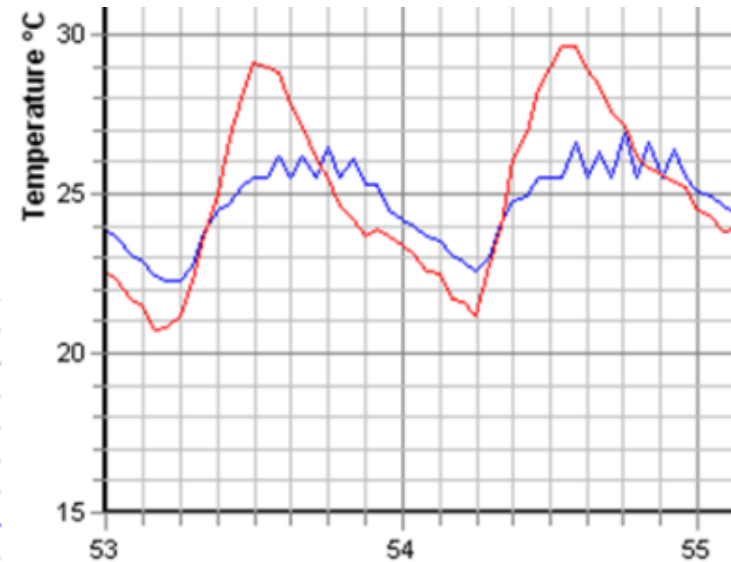
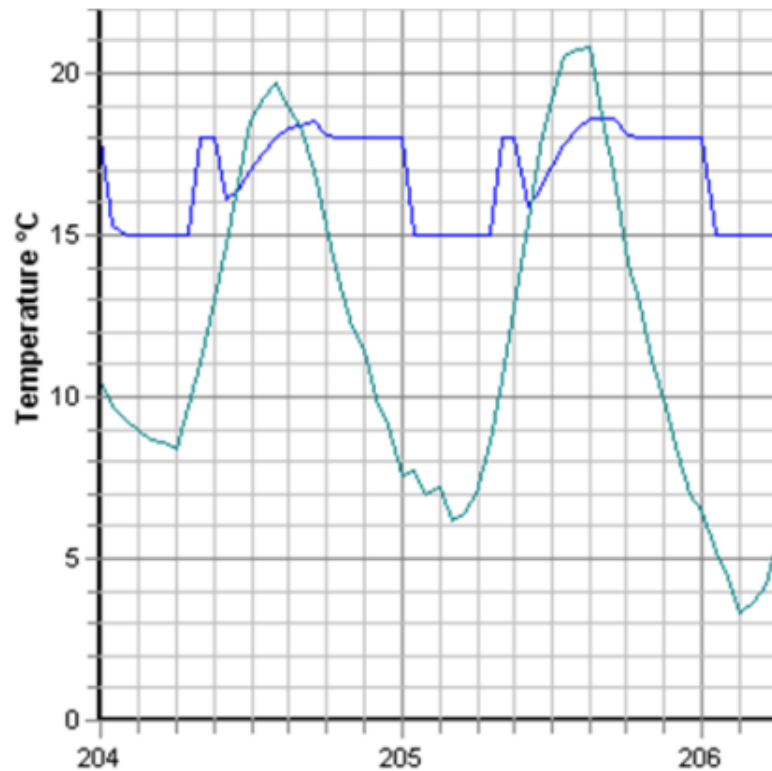
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0-1 pm	2	3	4	5	6	7	8	9	10	11	12
13	14	15	16	17	18	19	20	21	22	23	24

Cooling thermostat settings in BERS Pro

<i>Climate Number</i>	<i>Location Name</i>	<i>Cooling °C</i>
1	Darwin NT	26.5
2	Pt Hedland WA	27.0
3	Longreach QLD	27.0
4	Carnarvon WA	26.0
5	Townsville QLD	26.5
6	Alice Springs NT	26.5
7	Rockhampton QLD	26.0
8	Moree NSW	26.0
9	Amberley QLD	26.0
10	Brisbane QLD	25.5
11	Coffs Harbour NSW	25.0
12	Geraldton WA	25.0
13	Perth WA	25.0
14	Armidale NSW	24.0

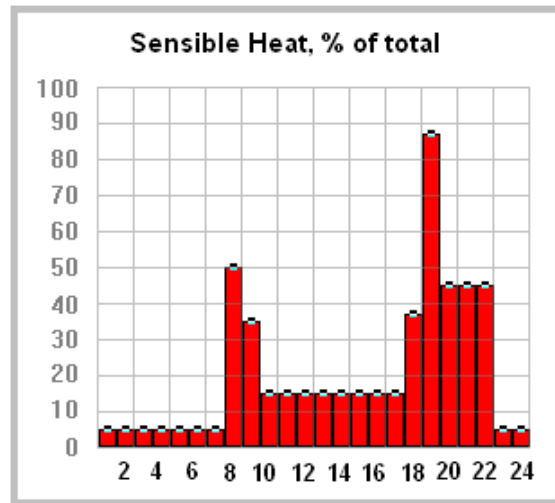
Upper and lower comfort band limits controlling temperature

Heating

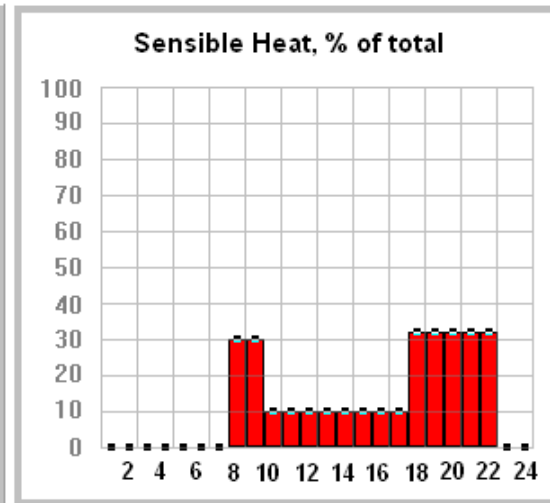


Cooling

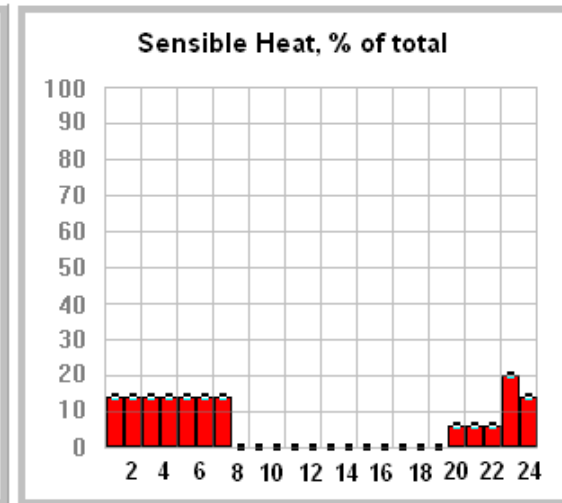
Internal heat gains



Living / Kitchen



Living



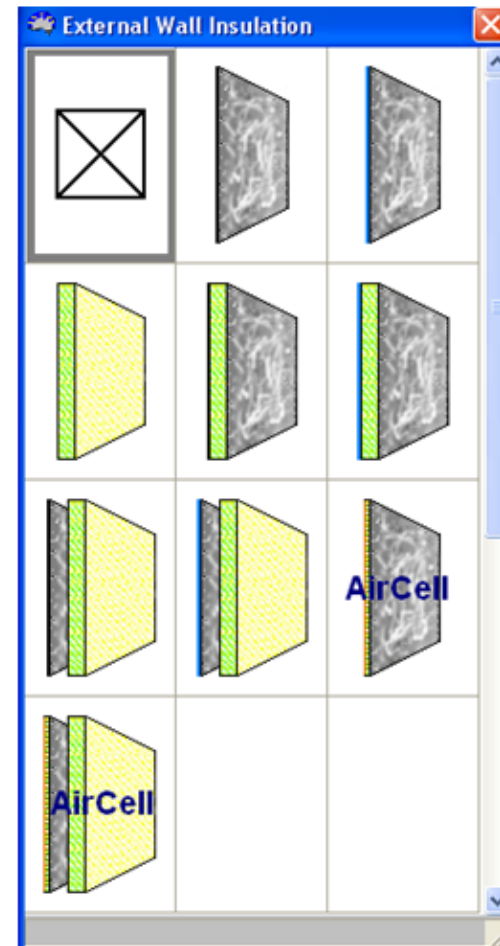
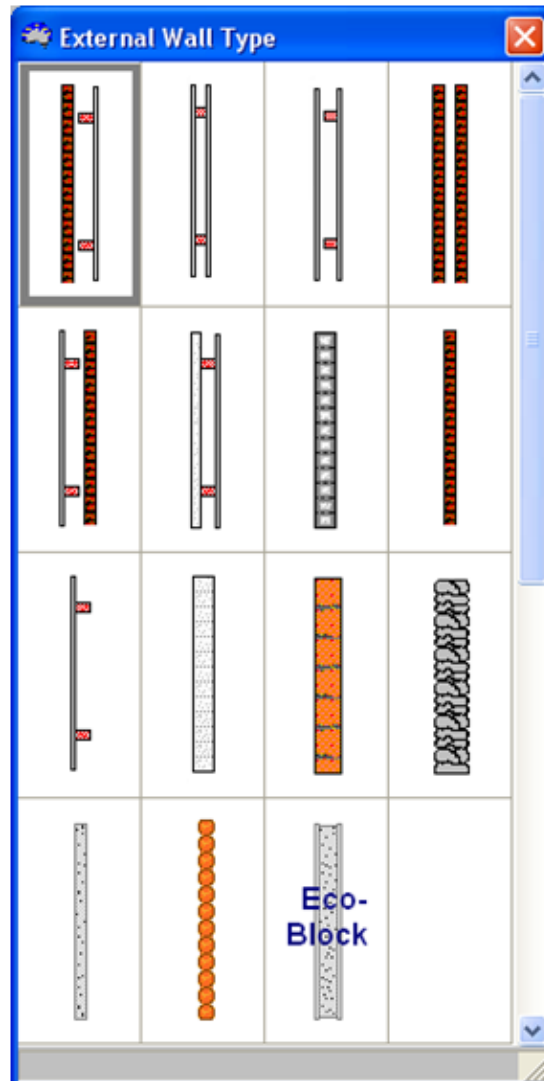
Sleeping

- ☐ 200 W
- ☐ 500 W
- ☐ 1 kW
- ☒ 2 kW
- ☐ 5 kW
- ☐ 10 kW
- ☐ 20 kW
- ☐ 50 kW

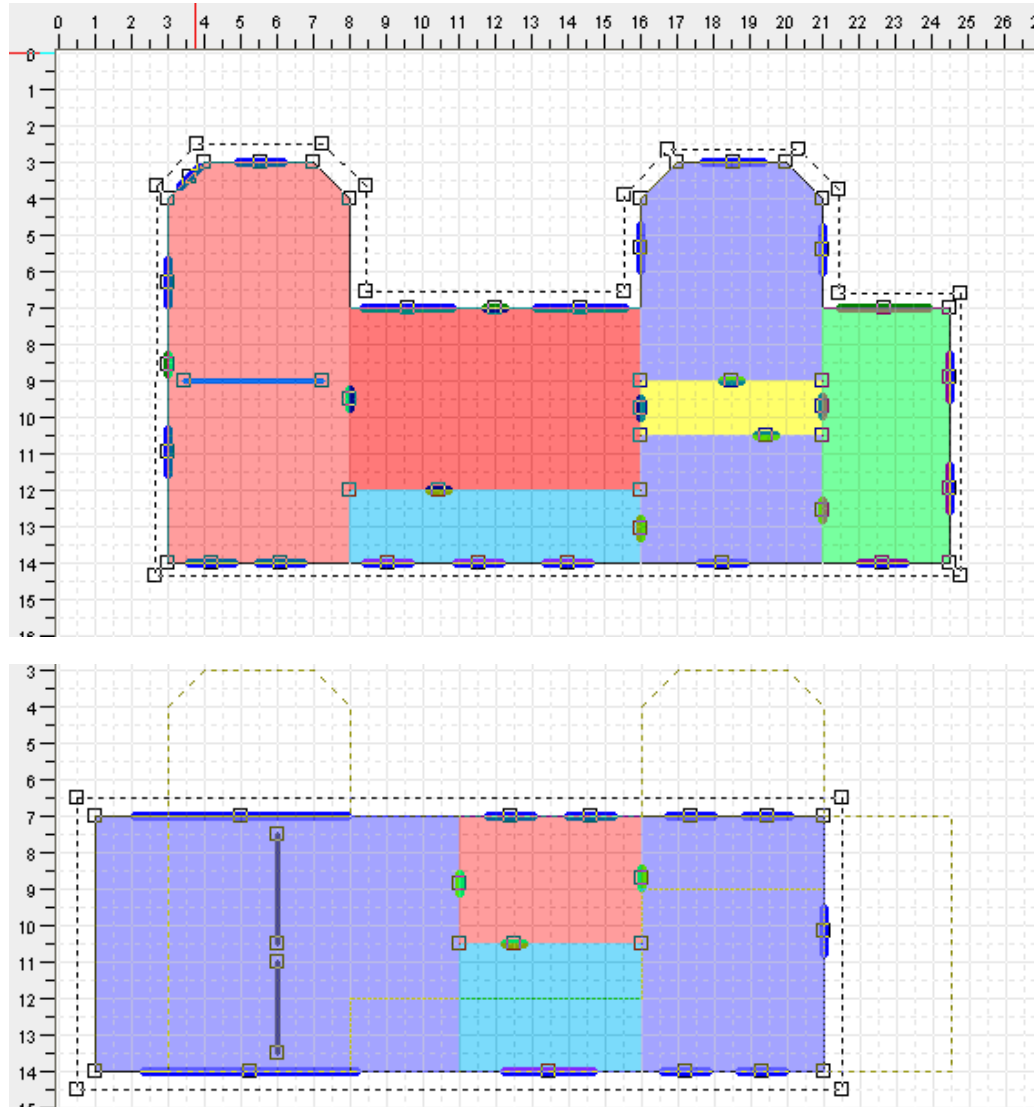
CSIRO thermal properties data base

<i>Index</i>	<i>Name</i>	<i>Capacitance</i>	<i>R for 1 m</i>
1	'Aerated autoclaved concrete block'	525	7.700
2	'Aluminium'	2358	0.005
3	'Bituminous roof membrane'	1646	6.250
4	'Brickwork: generic extruded clay brick (typical density)'	1454	1.640
5	'Brickwork: generic pressed clay brick (typical density)'	1929	1.110
6	'Carpet'	148	17.600
7	'Carpet underlay (felt)'	148	25.000
8	'Carpet underlay (rubber)'	471	12.500
9	'Carpet 10 + felt underlay 10'	148	21.300
10	'Carpet 10 + rubber underlay 8'	279	15.330
11	'Ceramic tile'	1600	0.880
12	'Concrete block 190 denseweight (not core-filled)'	969	0.963
84	'Concrete block 190 denseweight (core-filled at 1800 centres)'	1172	0.953
18	'Concrete: standard (2400 kg/m ³)'	2112	0.690
66	'Conpolcrete'	329	12.800
19	'Copper'	3516	0.003
20	'Cork tile'	900	12.500
21	'Felt (undercarpet)'	166	21.700
63	'Fibre-cement sheet'	1252	3.125
22	'Fibre-cement sheet (compressed)'	1680	2.000
25	'Glass'	2108	0.950

Building element type and insulation



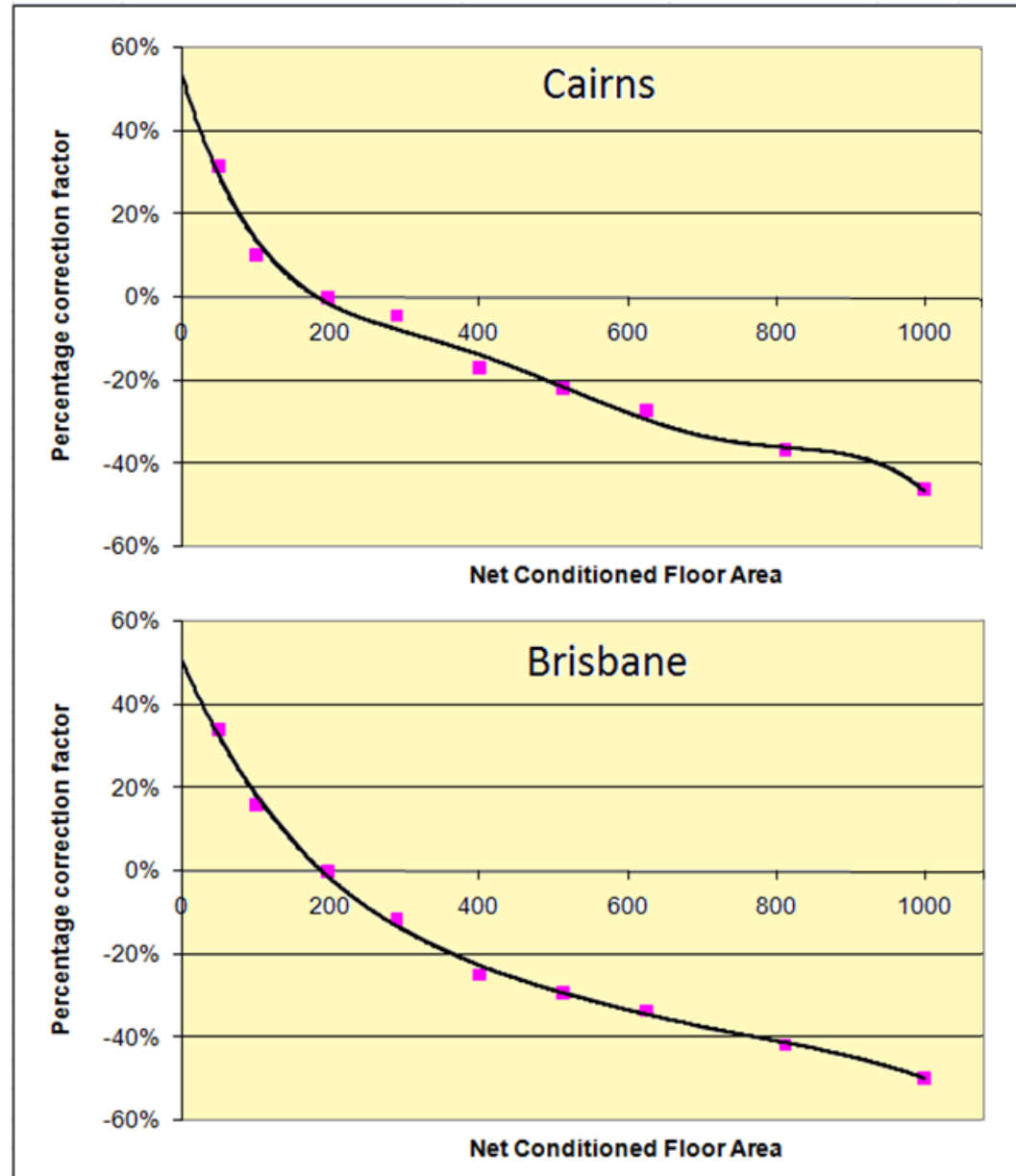
Building dimensions are calculated from the drawing



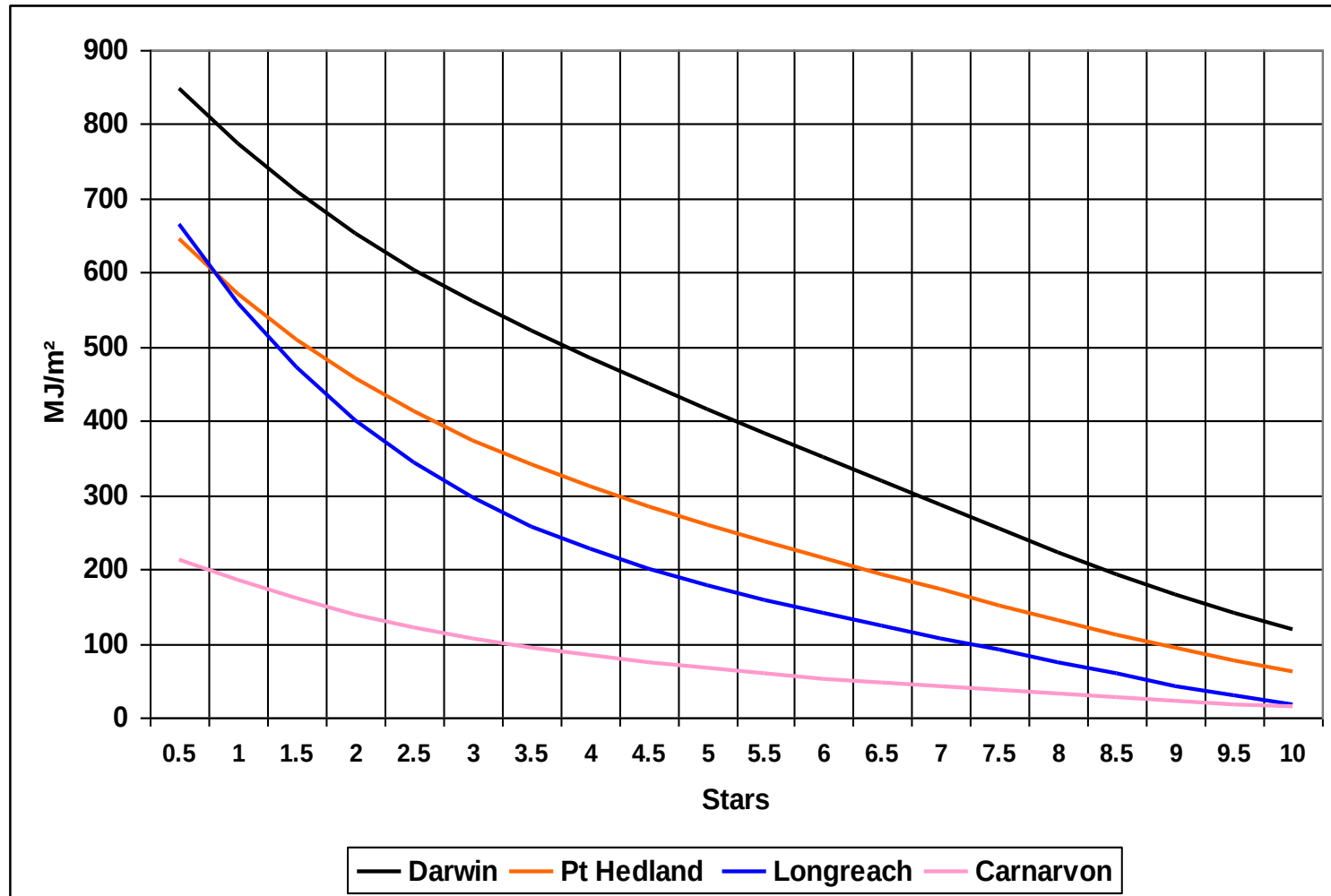
Calculation that are performed internally

- Eaves widths from the roofline drawing
- Shading of windows and walls by adjacent walls
- Overshadowing at each level by buildings, vegetation, etc
- Ventilation from the dimensions and location of openings

Area adjustment factors

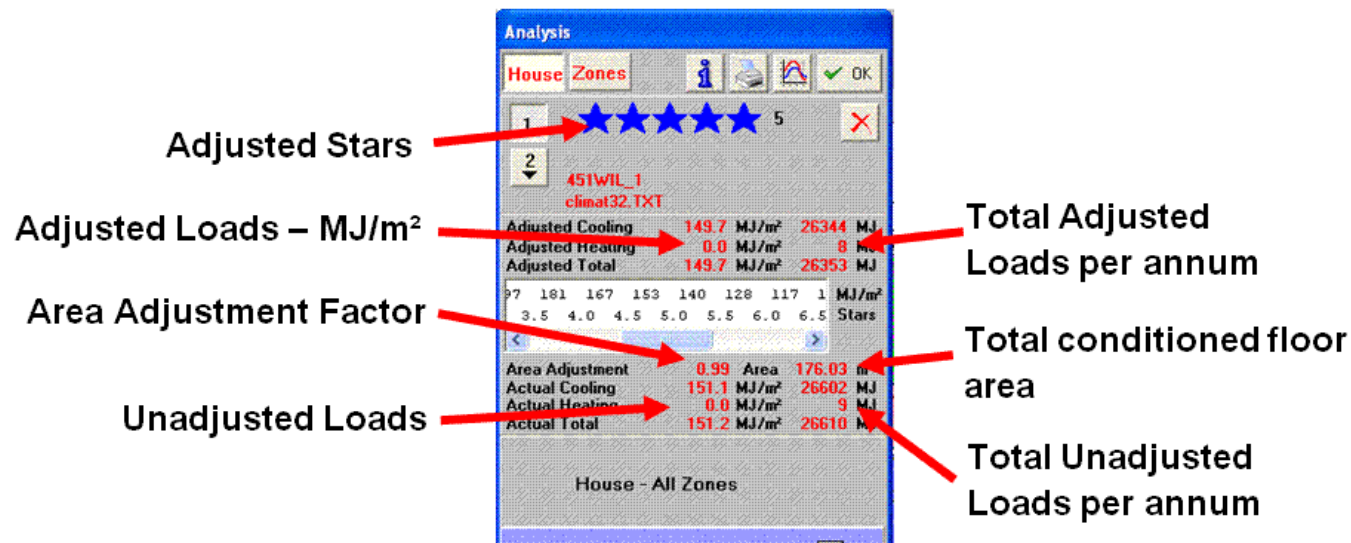


Star bands

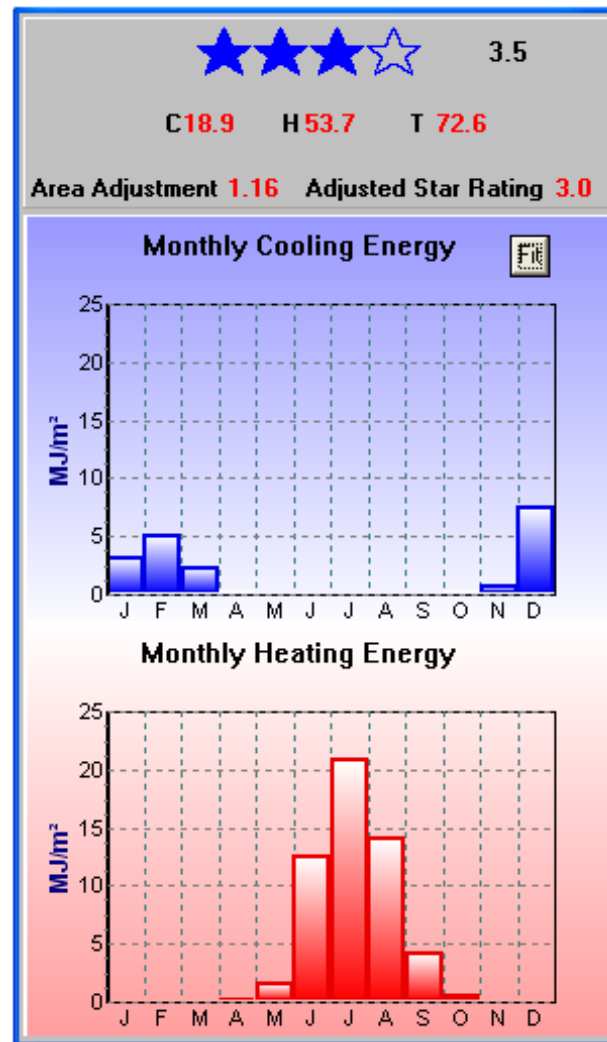


Conversion of Energy/Area to Star Rating

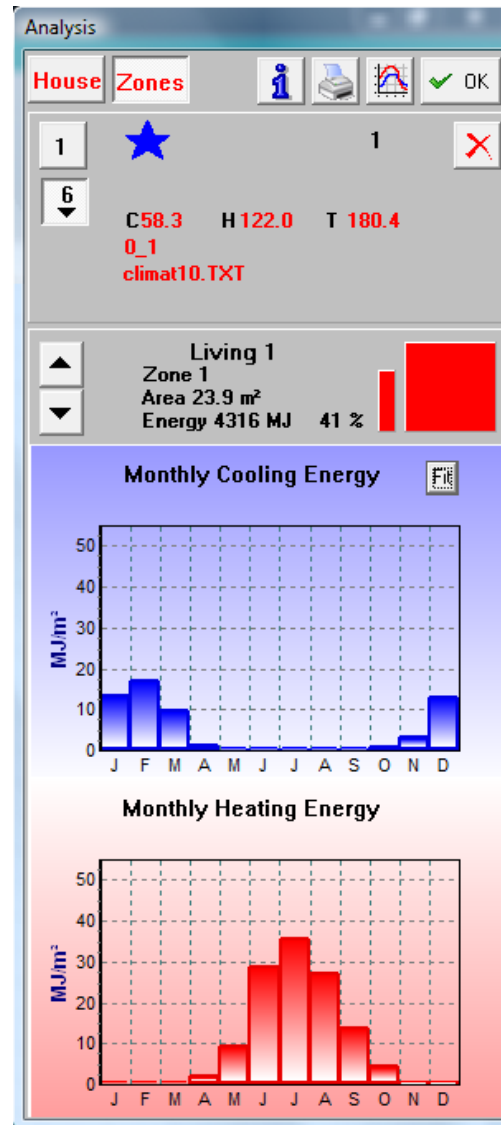
Annual Energy / Conditioned floor area
(MJ/m²)



Monthly heating and cooling loads displayed in BERS Pro



Each zone is assigned a star rating in BERS Pro



Questions??

Thank you

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