MILDURA RIVER HOUSE
PERFORMANCE

part 1
measured data
vs
computer simulated predictions

conclusion part 1

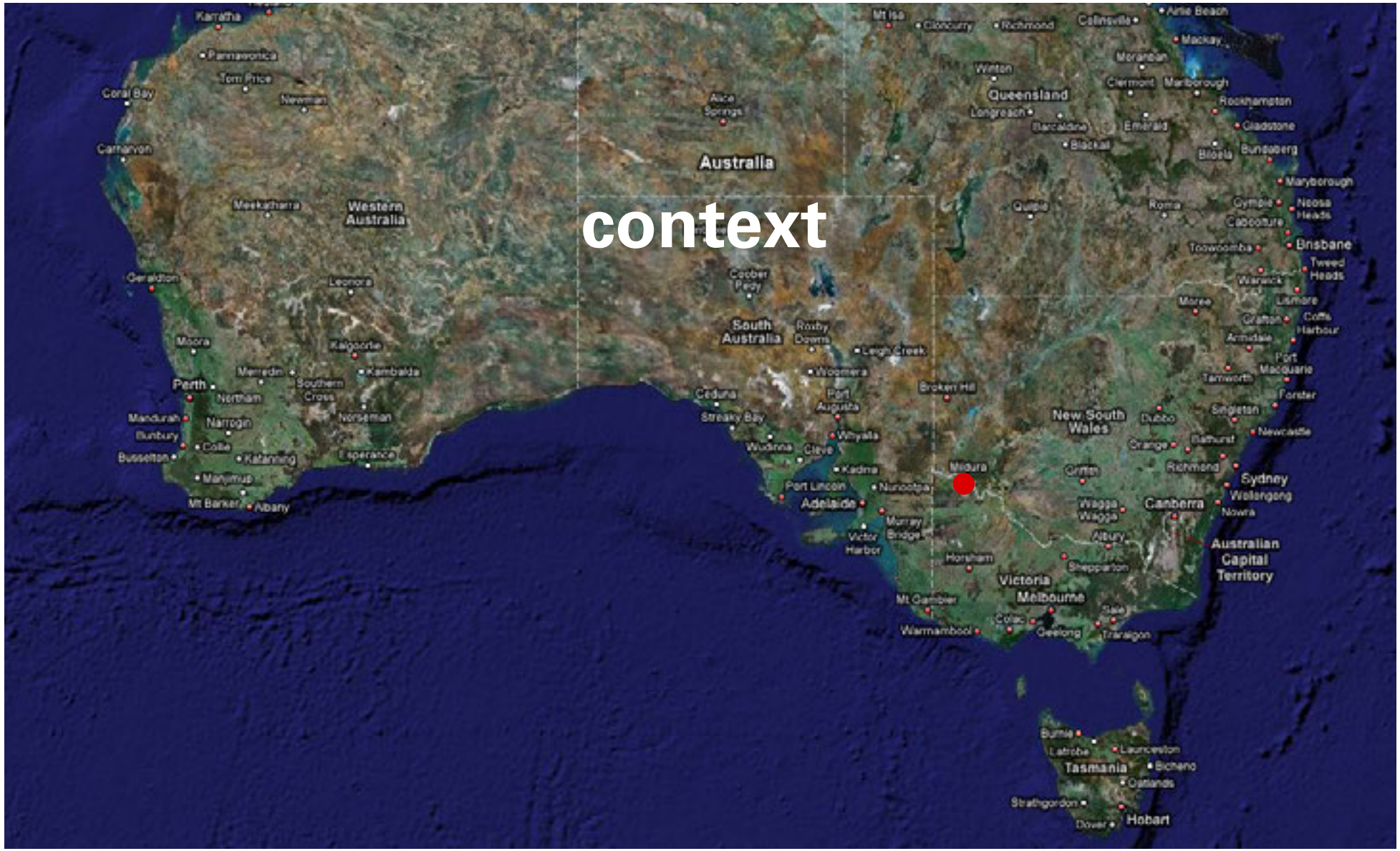
part 2

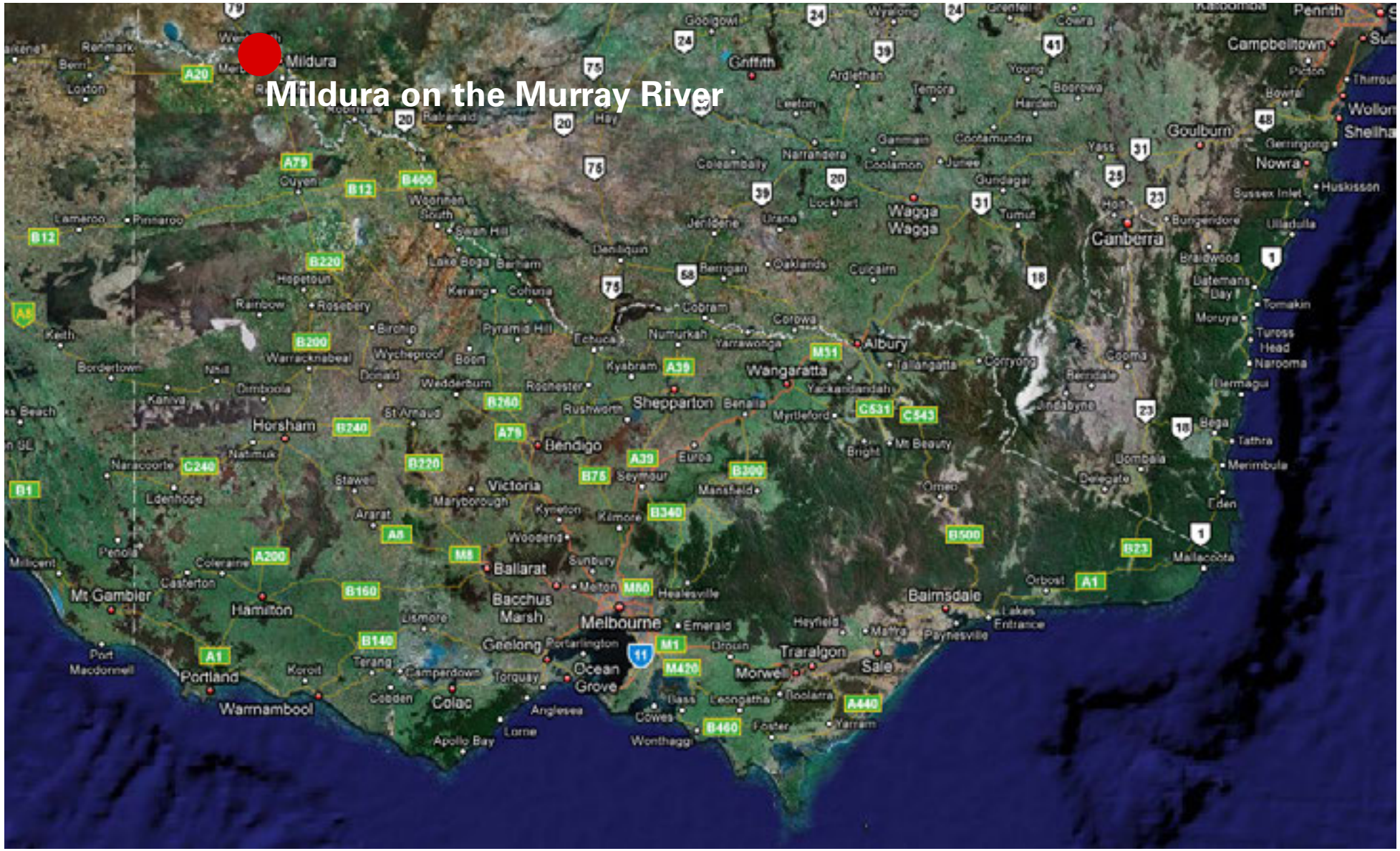
improving analysis

our process - professional leader-ship

feedback loops

further possibilities


context
Australia
Western Australia
South Australia
Queensland
New South Wales
Victoria
Australian Capital Territory
Tasmania
Perth
Adelaide
Melbourne
Sydney
Canberra
Brisbane
Hobart
Mildura

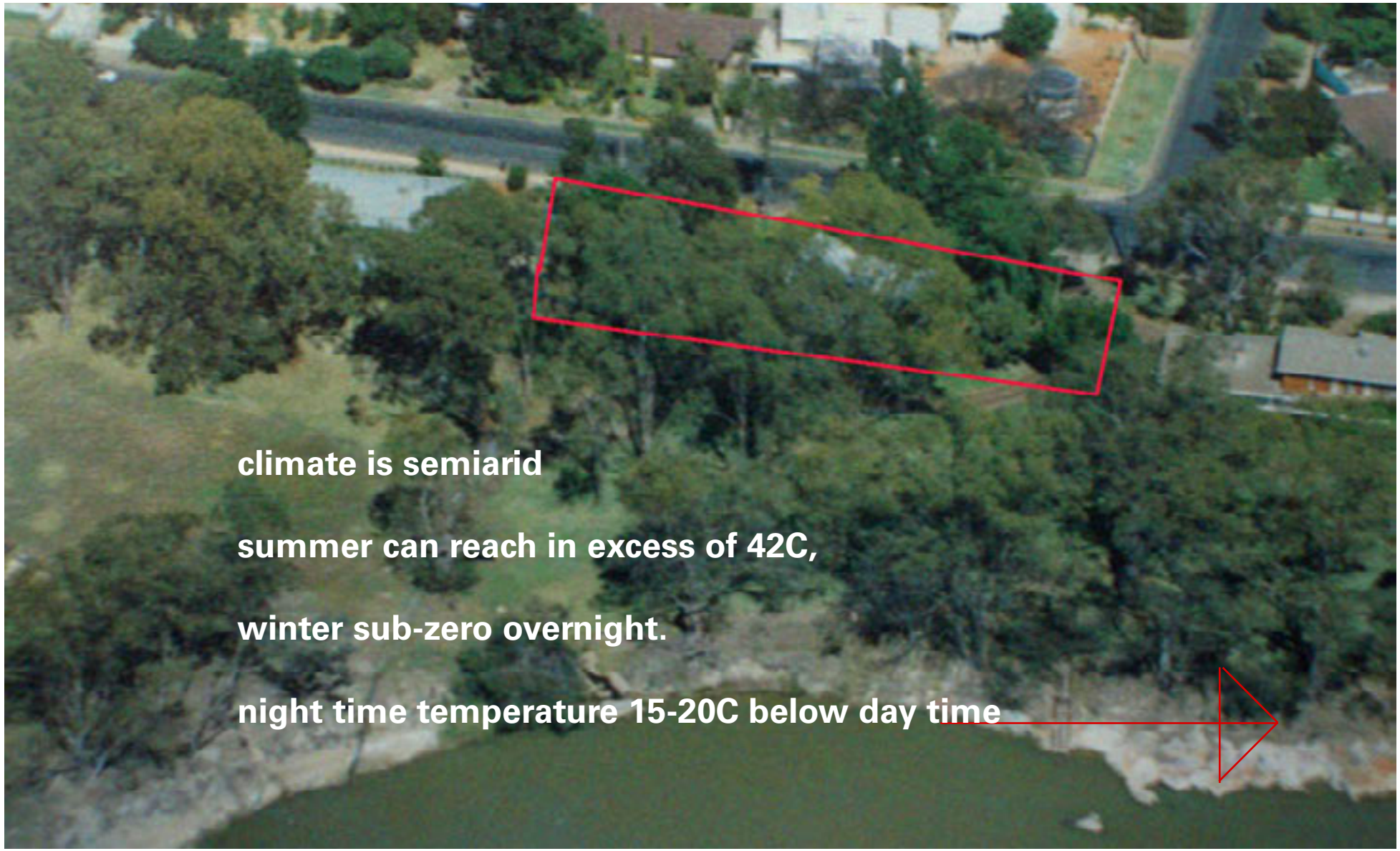


sb08
mildura river house

eme design pty ltd

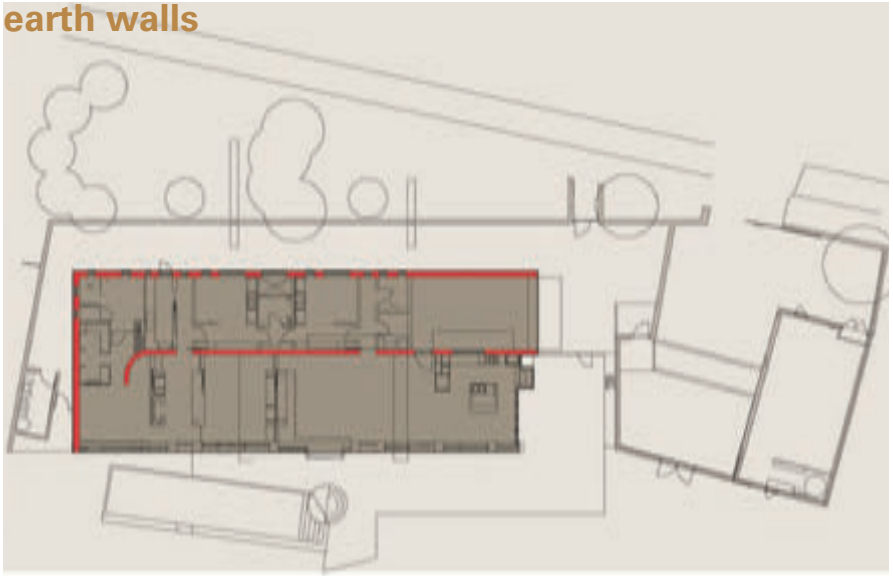
ecologically motivated environments


site
lock
town centre

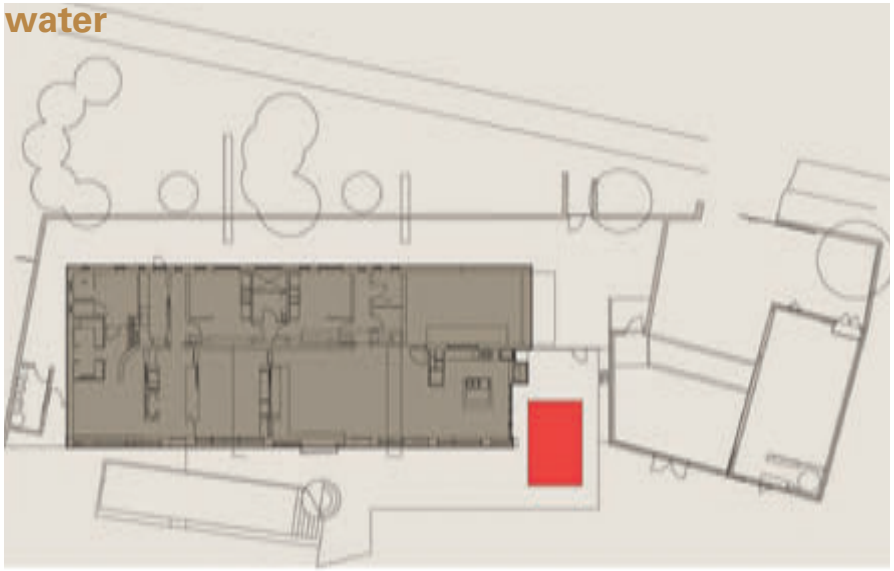

climate is semiarid
summer can reach in excess of 42C,
winter sub-zero overnight.
night time temperature 15-20C below day time


ock 272
Cureton Avenue
Lock 276
Murry River

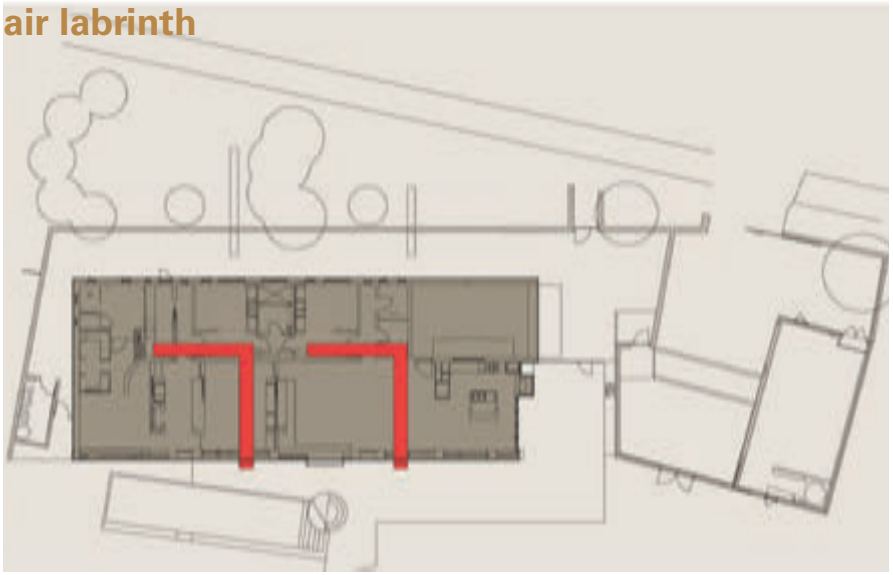
earth walls



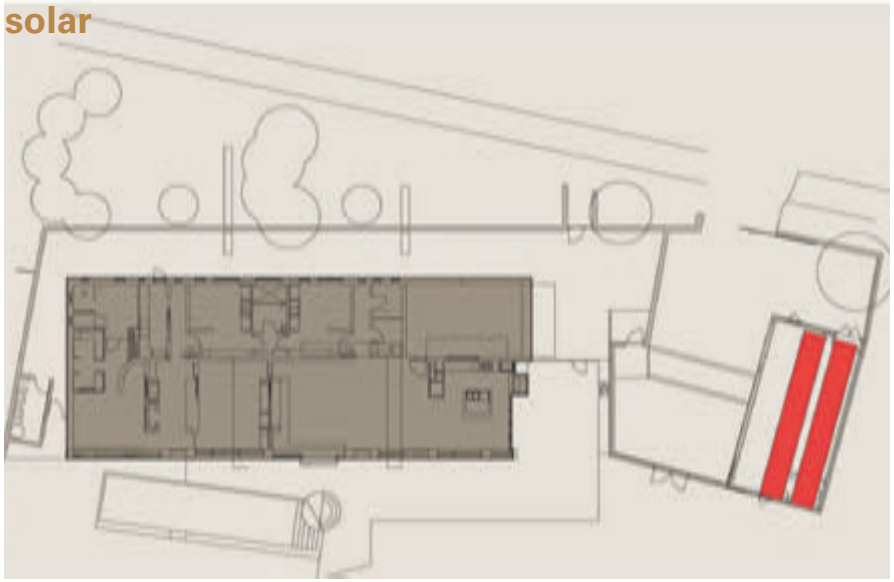
water



air labrinth



solar



labyrinth inlet sensors

labyrinth sensor

labyrinth outlet sensors

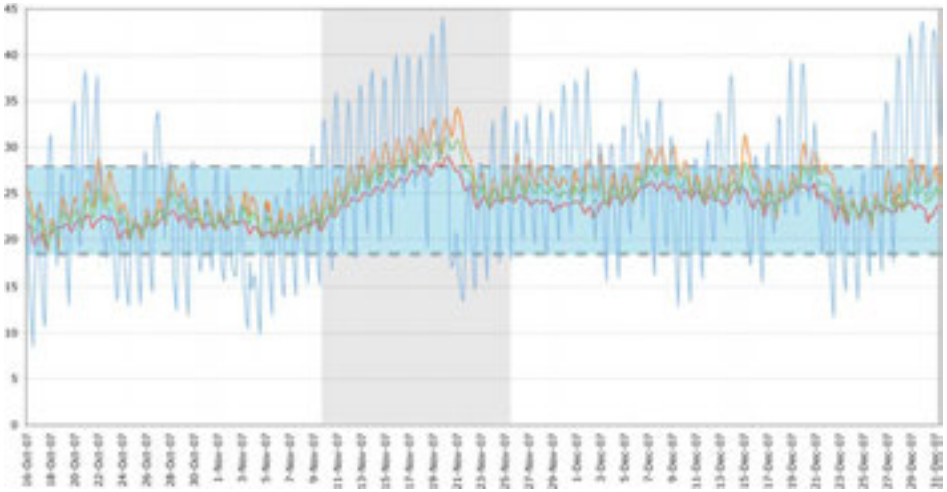
high level sensor

heating manifold sensor

Actual October - November 2007

Outdoor temperatures on average 5 degrees higher

measured internal temperatures remained within the comfort range

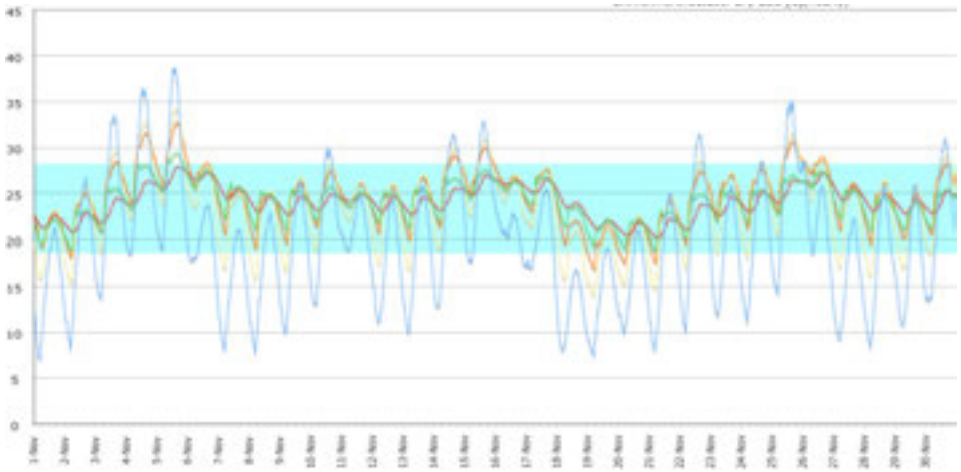


October there was no backup air-conditioning used

November the house was unoccupied and no night purging occurred

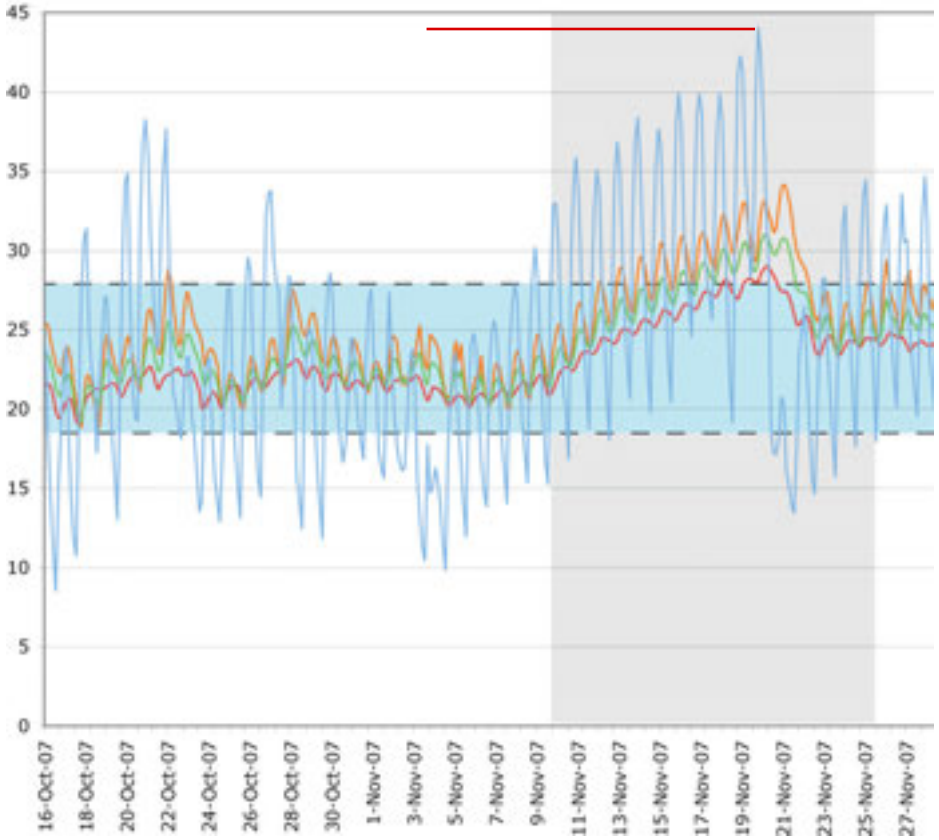
Energy Plus November

The EnergyPlus model provides for night time purging with the labyrinth from 8pm to 6am



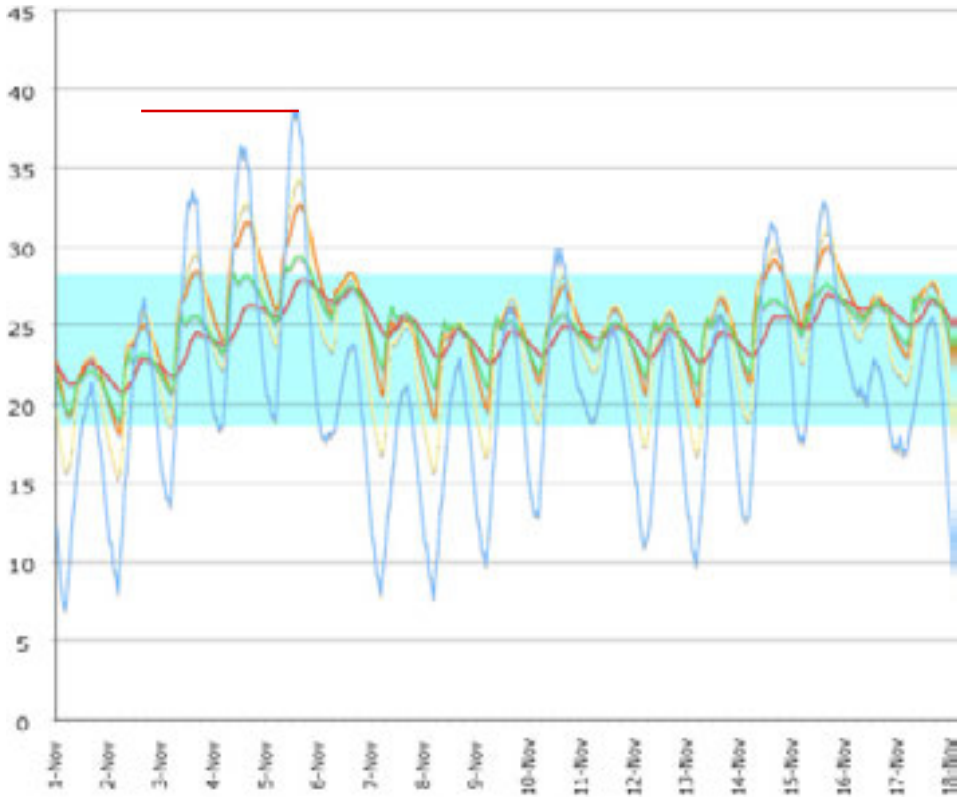
Energy Plus predicted greater day to night temperature fluctuations and higher peak temperatures

Actual October - November 2007



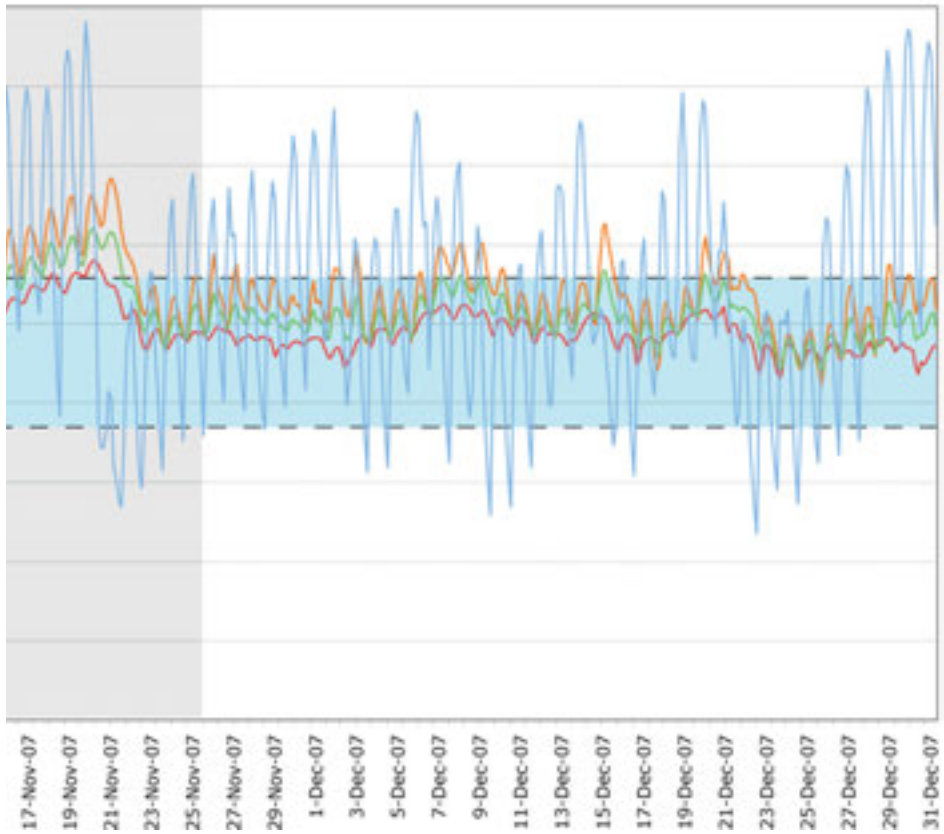
November - outside temp rose to 36.9 the internal living room temperature was 28.9C. - without heat purge

Energy Plus November



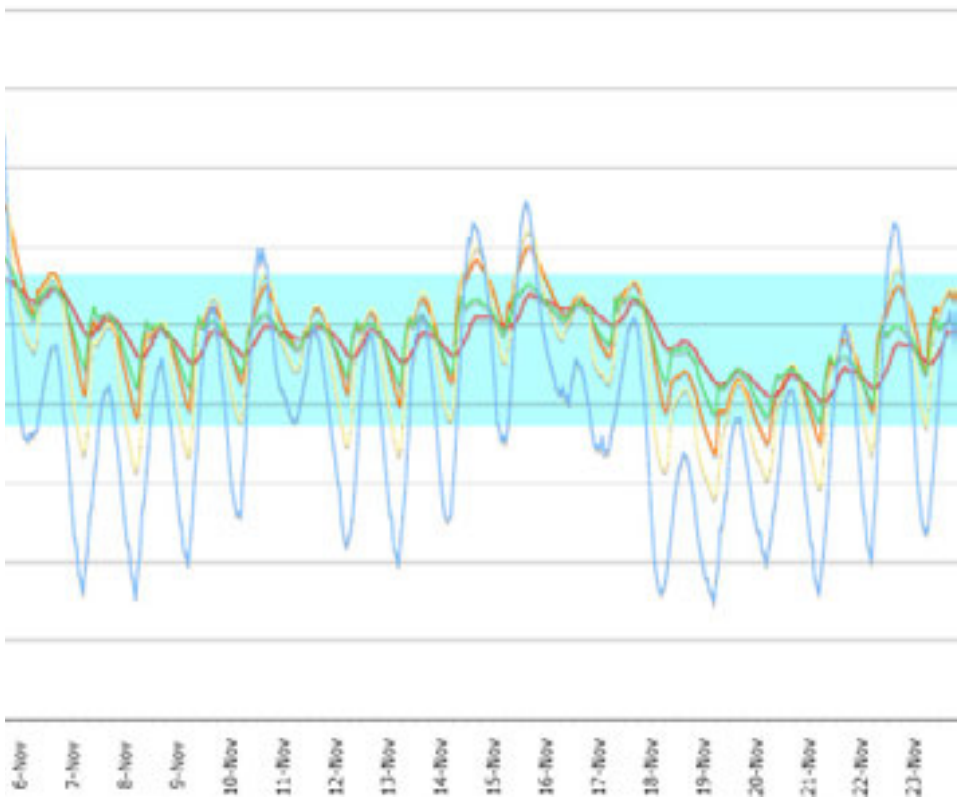
November - prediction outside temperature rose to 36.5C the internal living room temperature was 31.6C

Actual December 2007



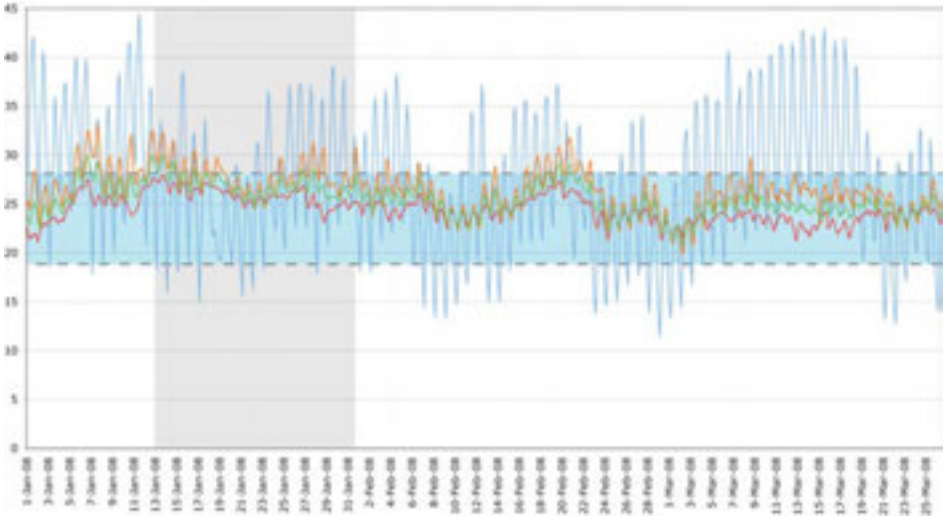
during the excessive and prolonged heatwave experienced at the end of December the occupants utilised the backup air-conditioning

Energy Plus December



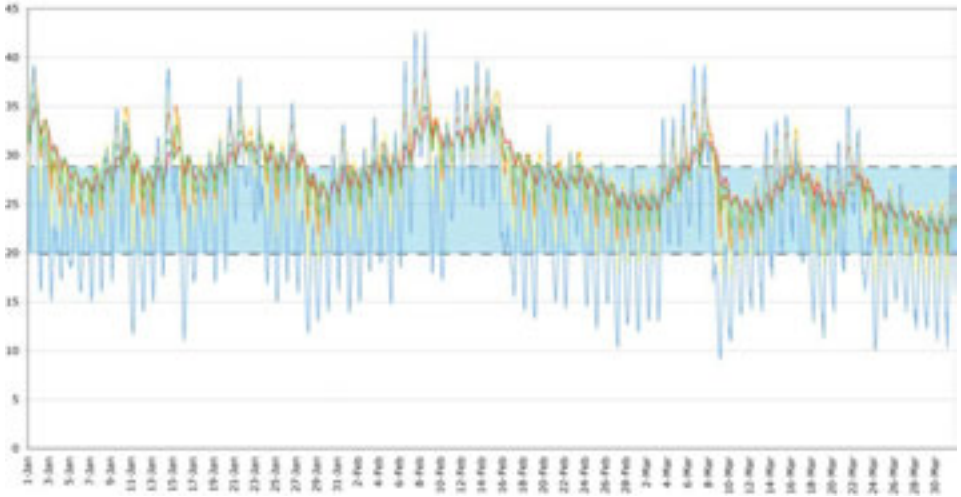
actual outdoor temperatures were far higher than the EnergyPlus weather file

Actual Jan - Marc 2008



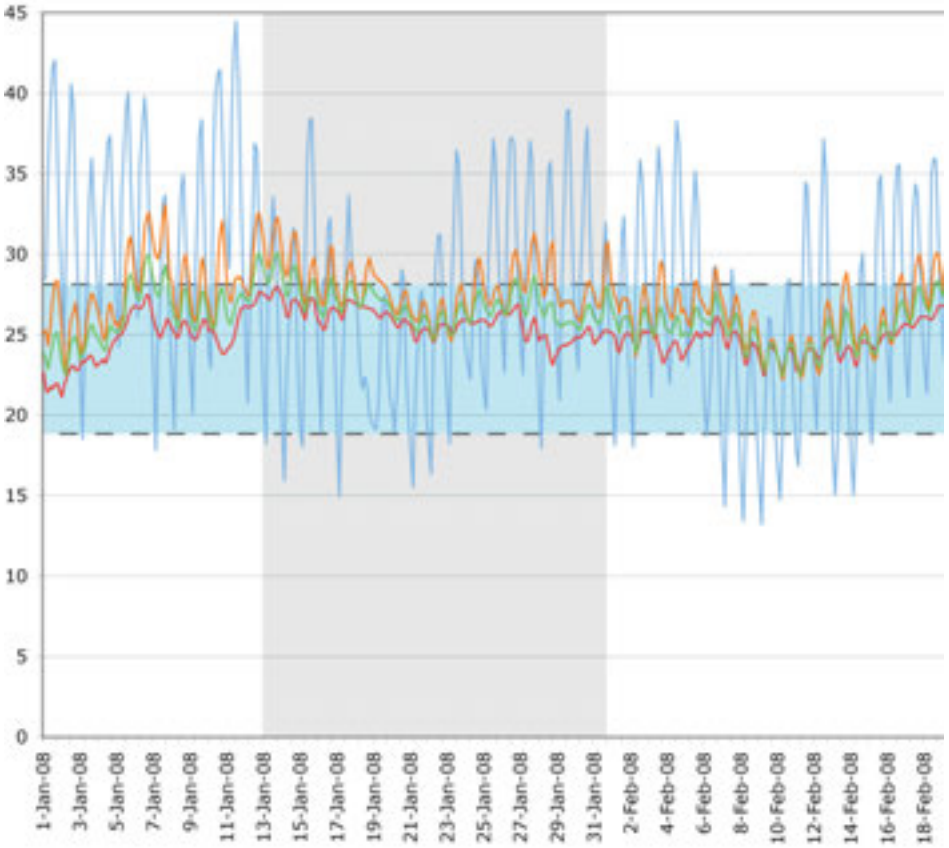
passive systems provide a greater level of comfort than predicted

Energy Plus Jan - Marc



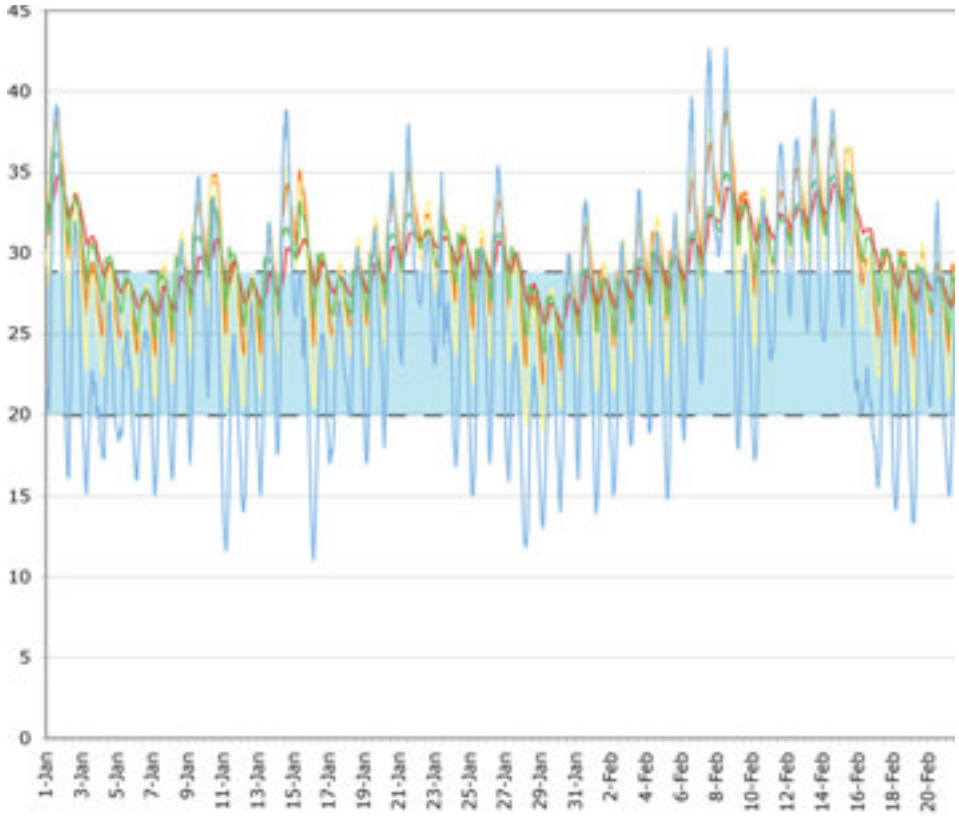
simulated model predicted the living spaces to fluctuate by up to 7.5 degrees

Actual Jan - Marc 2008



zones surrounded by thermal mass day to night temperature fluctuations were reduced to less than 3 degrees (outdoor temperature fluctuation 20oC)

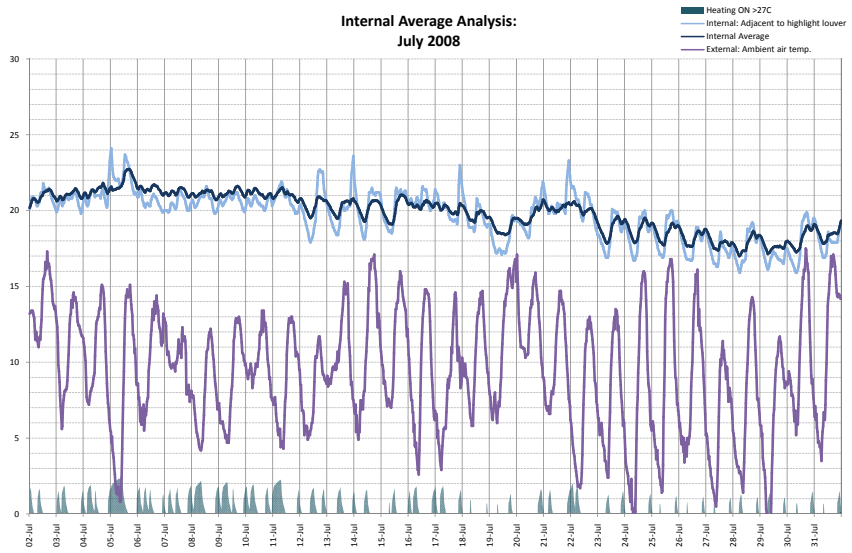
Energy Plus Jan - Marc



living spaces where the design criteria necessitated significant areas of glazing the internal temperature variants was generally limited to less than 5 degrees

Actual July 2008

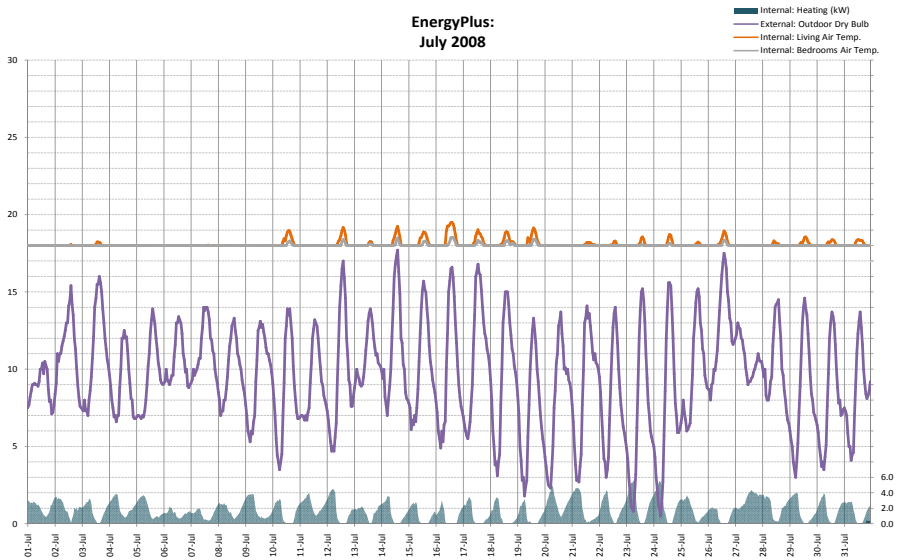
Outdoor temperatures on average 1.5 degrees lower



occupants have maintained high indoor temperatures

Energy Plus July

The EnergyPlus model with zoned purchase heat requirement

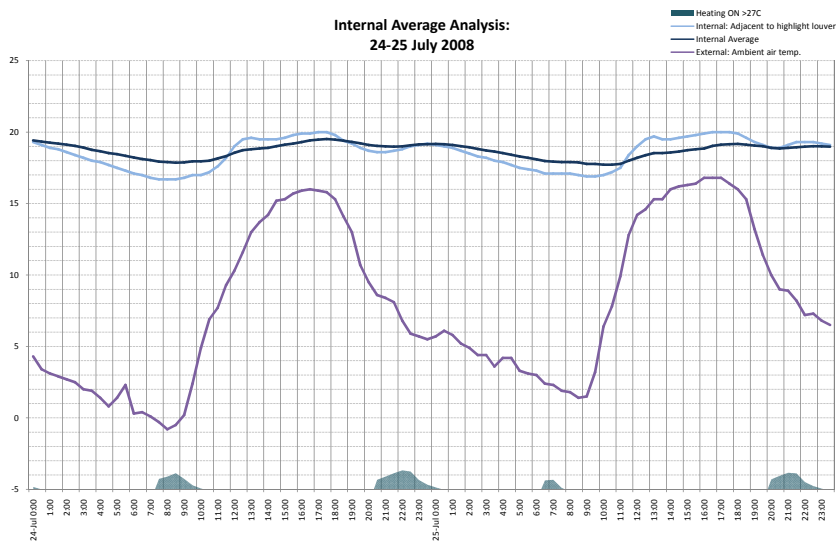


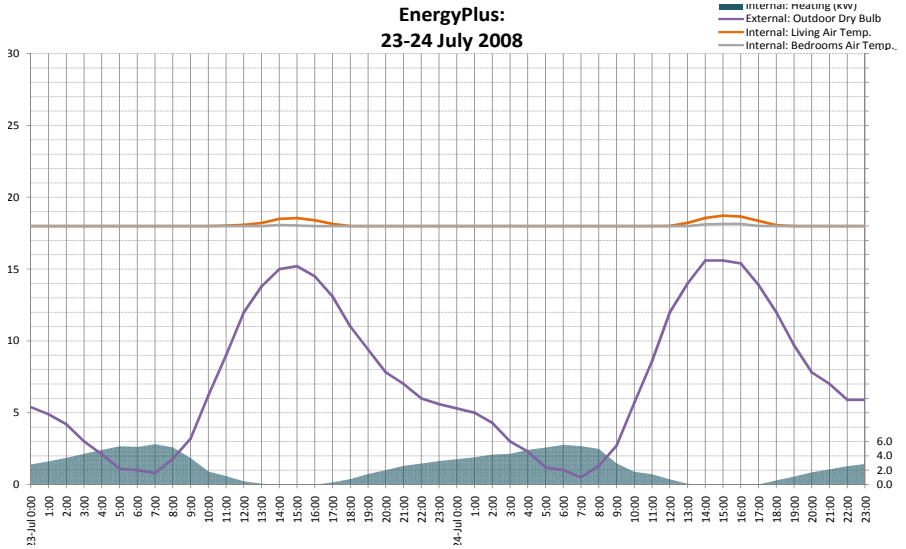
Energy Plus predicted greater requirement for heating to maintain comfortable indoor temp

Actual 24 - 25 July 2008

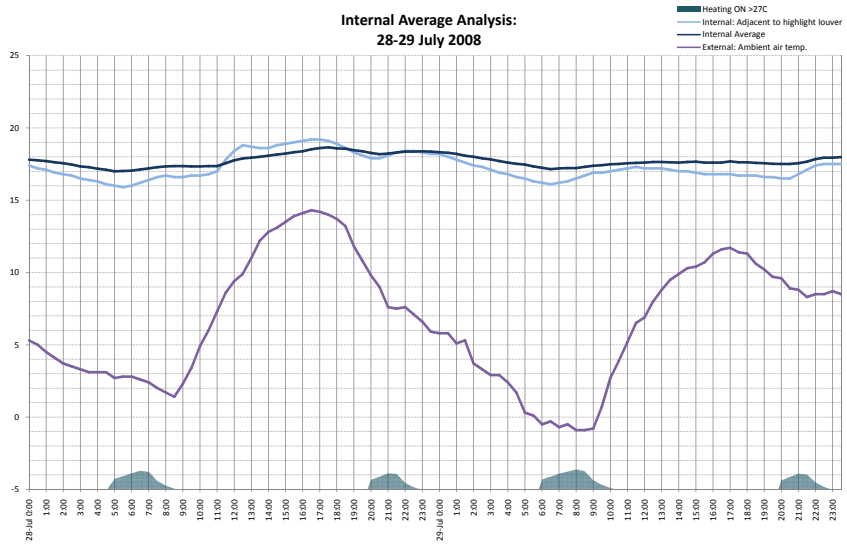
Energy Plus 23 - 24 July

Outdoor temperatures drop below zero

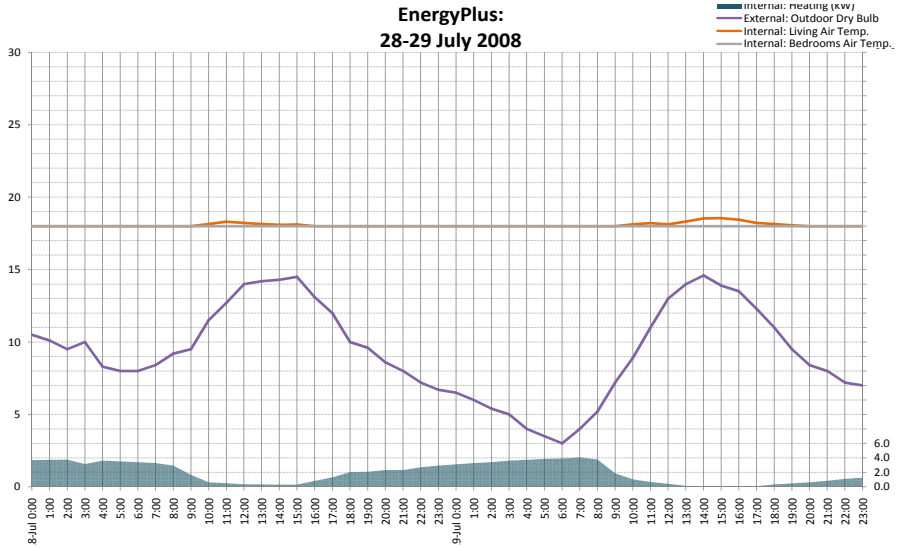




Actual 28 - 29 July 2008

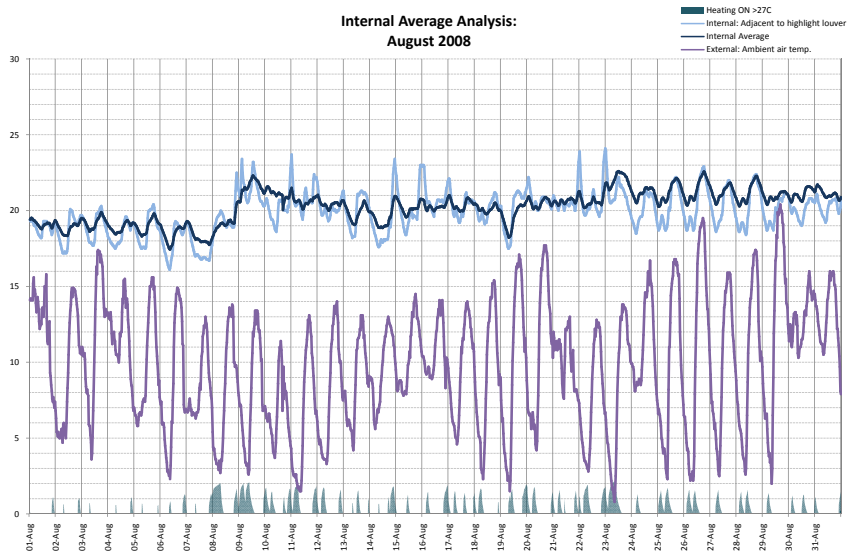


Energy Plus 28 - 29 July



Actual August 2008

outdoor night time temperatures more frequently lower

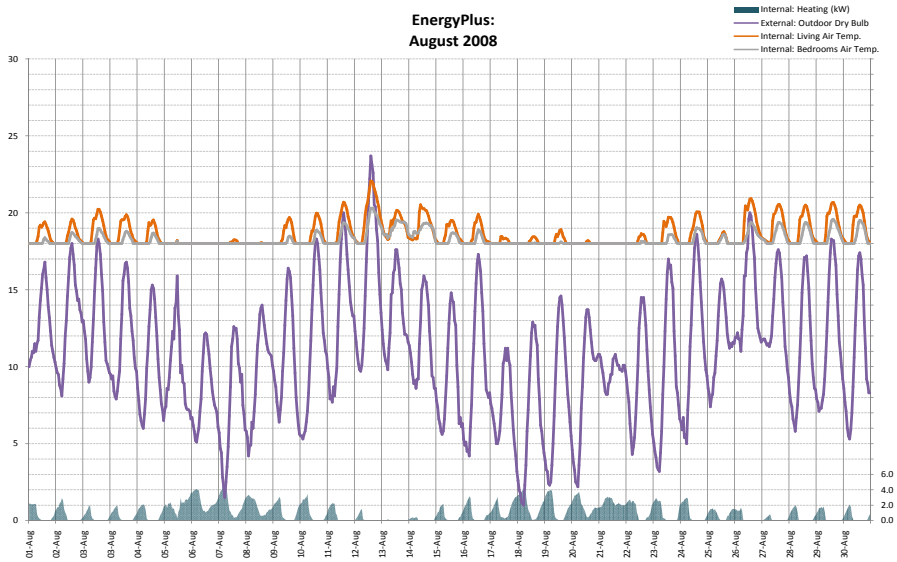


1 - 8 august more realistic internal temperatures

occupants have maintained high indoor temperatures during most of august

Energy Plus August

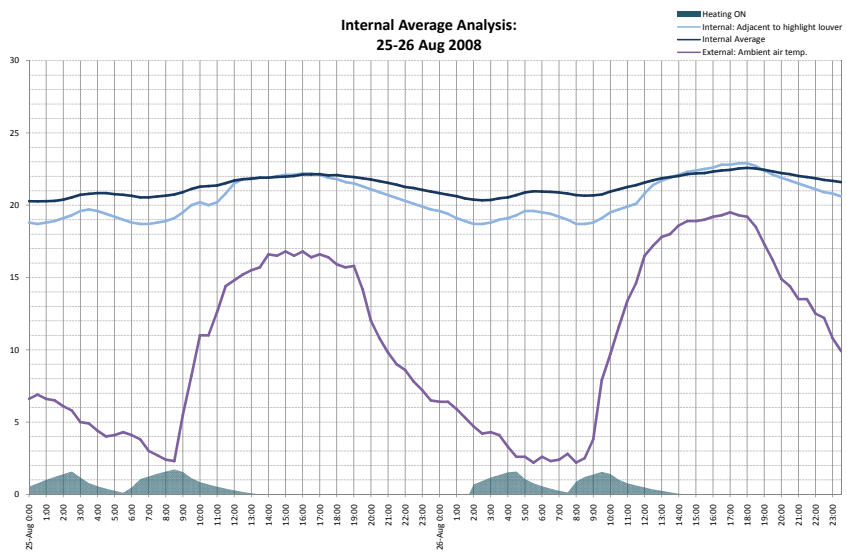
The EnergyPlus model to maintain 18.5 degrees C internal temp



Energy Plus predicted greater requirement for heating to maintain comfortable indoor temp

Actual 3 - 4 August 2008

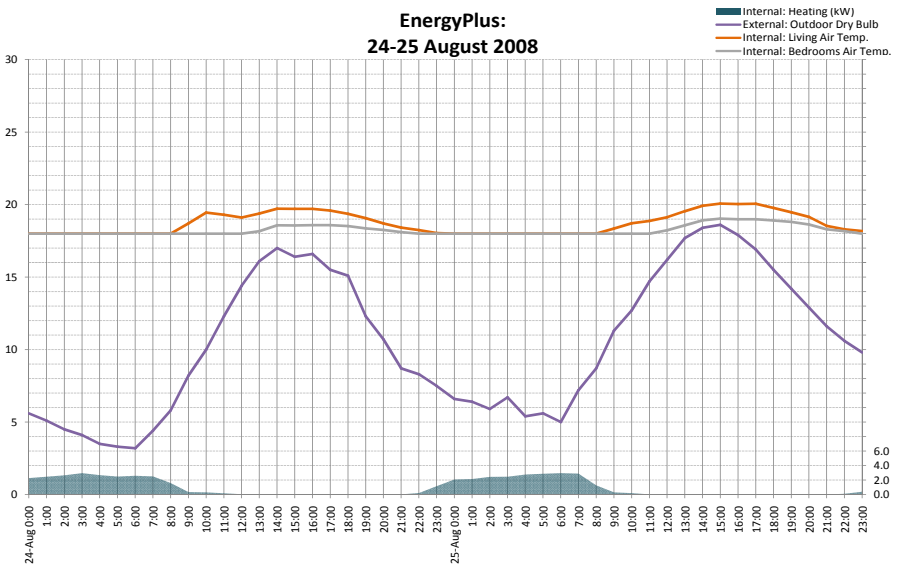
outdoor night temperature drops to 2.5 and 2 degrees



internal temperature average 21 degrees

Energy Plus 3 - 4 August

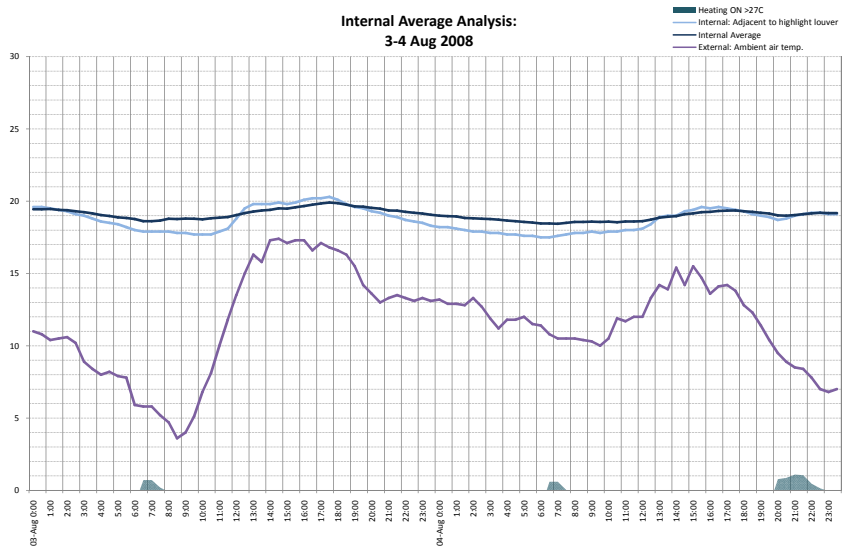
outdoor night temperature drops to 3 and 5 degrees



internal temperature average 19 degrees

Actual 3 - 4 August 2008

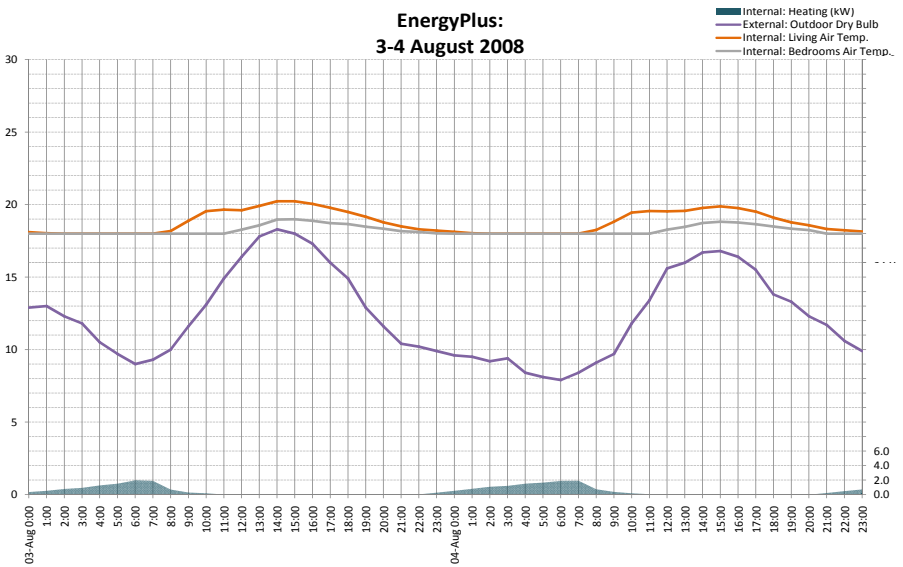
outdoor night temperature drops to 4 degrees



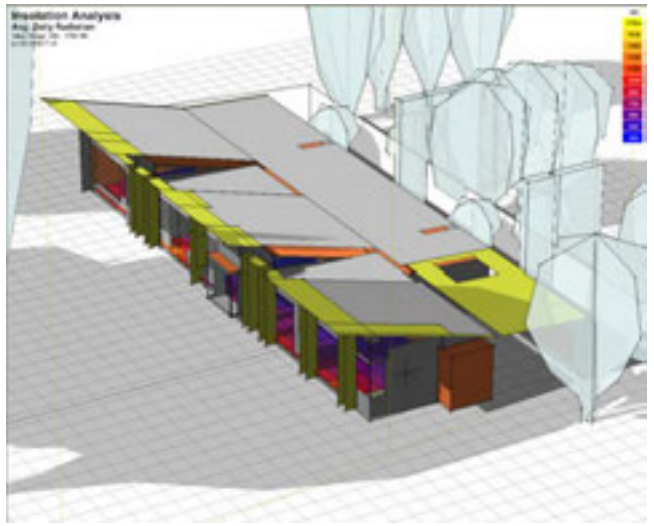
internal temperature average 19 degrees

Energy Plus 3 - 4 August

outdoor night temperature drops to 9 degrees



greater requirement for heating to maintain comfortable indoor temp



modelled vs actual conclusions

+ computer modelling of passive building design has significant limitations.

+ effectiveness of thermal mass and insulated thermal mass does not seem to be accessed effectively by First Rate and even the more detailed modelling capacity of EnergyPlus does not accurately predict the actual performance of this home.

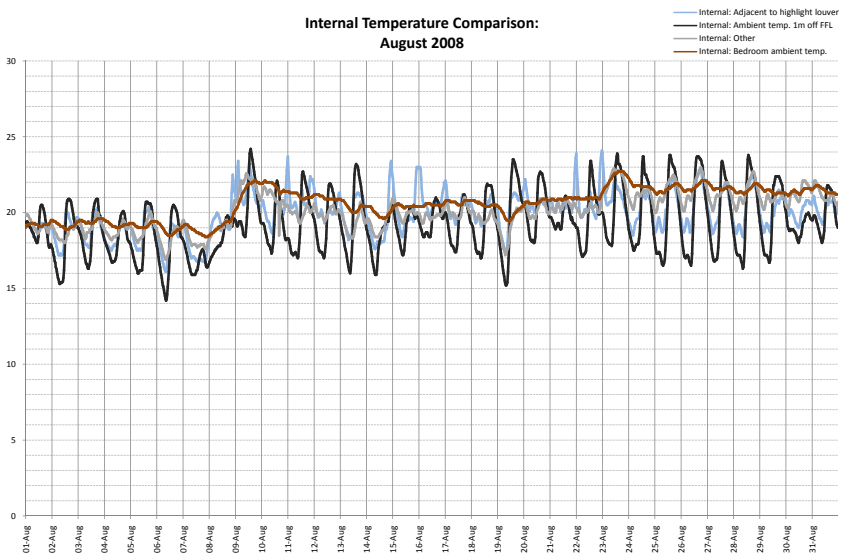
improving the analysis

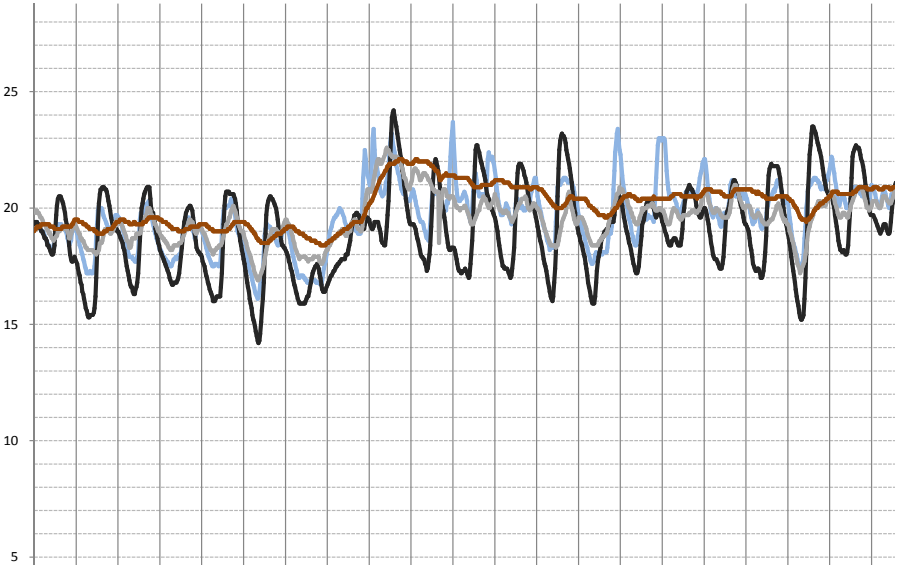
+ analysis of the effectiveness of thermal mass within internal spaces

+ temperature profile of rammed earth walls

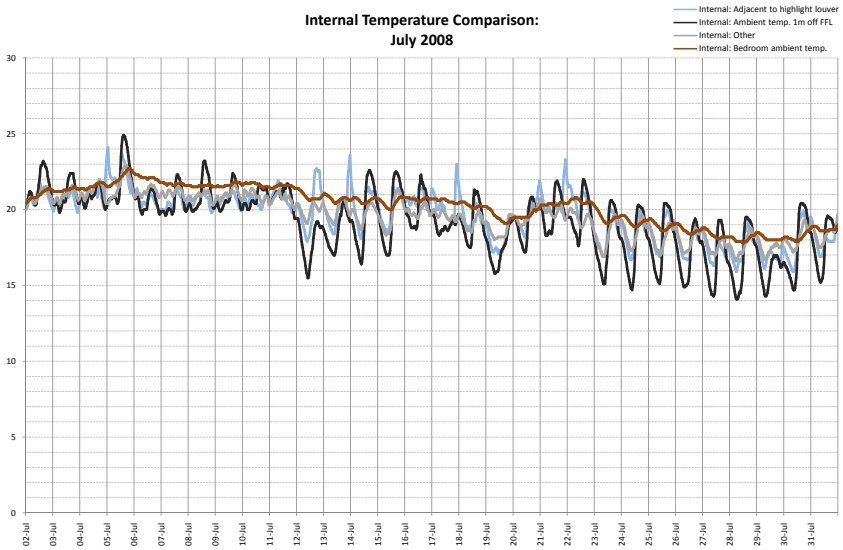
Internal Temperature Comparison
August 2008

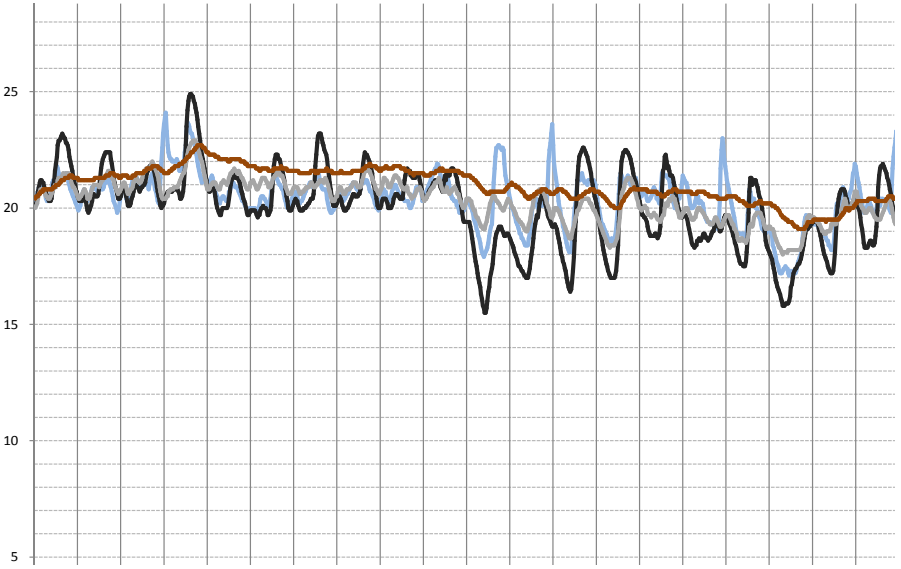
effect of thermal mass





Internal Temperature Comparison
July 2008



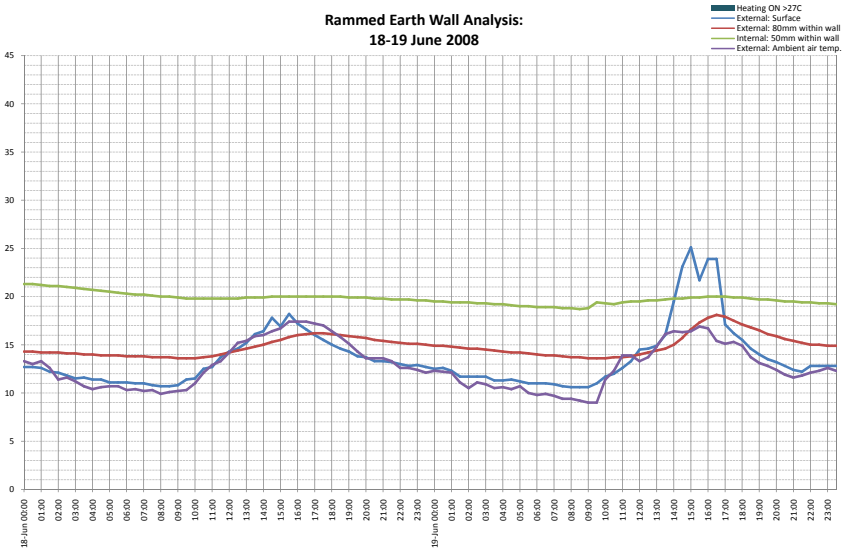


rammed earth wall sensors

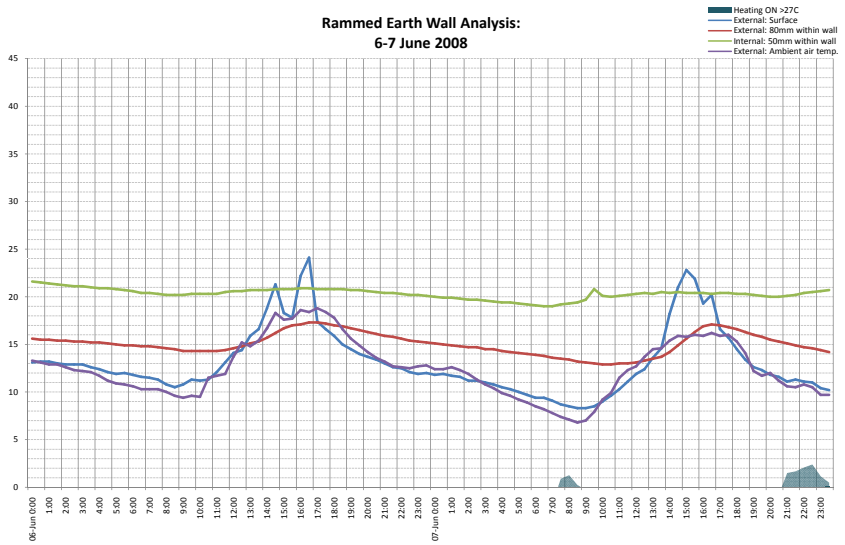
+ external surface
+ external 80mm in to wall
+ internal 50mm in to wall

insulated rammed earth
400mm total thickness
70mm foam insulation

Rammed Earth Wall Analysis
18 - 19 June 2008



Rammed Earth Wall Analysis
6 - 7 June 2008



our process

+ review of brief
+ detailed site investigations
+ asking the difficult question
+ finding the essence behind desires
+ finding opportunities to embed sustainability
+ translate concepts to contractor
+ involve client in process - every step
+ engage client in fundamental principles from day one

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completing the feedback loop = continuous improvement

+ ongoing monitoring aims to **inform and improve the occupants' operation** of the building. With more detailed understanding of specific temperatures throughout the house and within the labyrinth and rammed earth walls, the occupant can make informed decisions about the opening and closing of windows and the operation of the labyrinth duct system.

+ From a design point of view these results are invaluable in consolidation of the original principles and will provide information to **improve similar design approaches.**

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