

EARTH ARCHITECTURE IN THE SOUTH OF PORTUGAL

thermal efficiency of rammed earth buildings

Manuel Arriaga Correia Guedes
Instituto Superior Técnico

Bruno Marques
Construct-FEUP

Helena Corvacho
FEUP

António Andresen
FAAULP





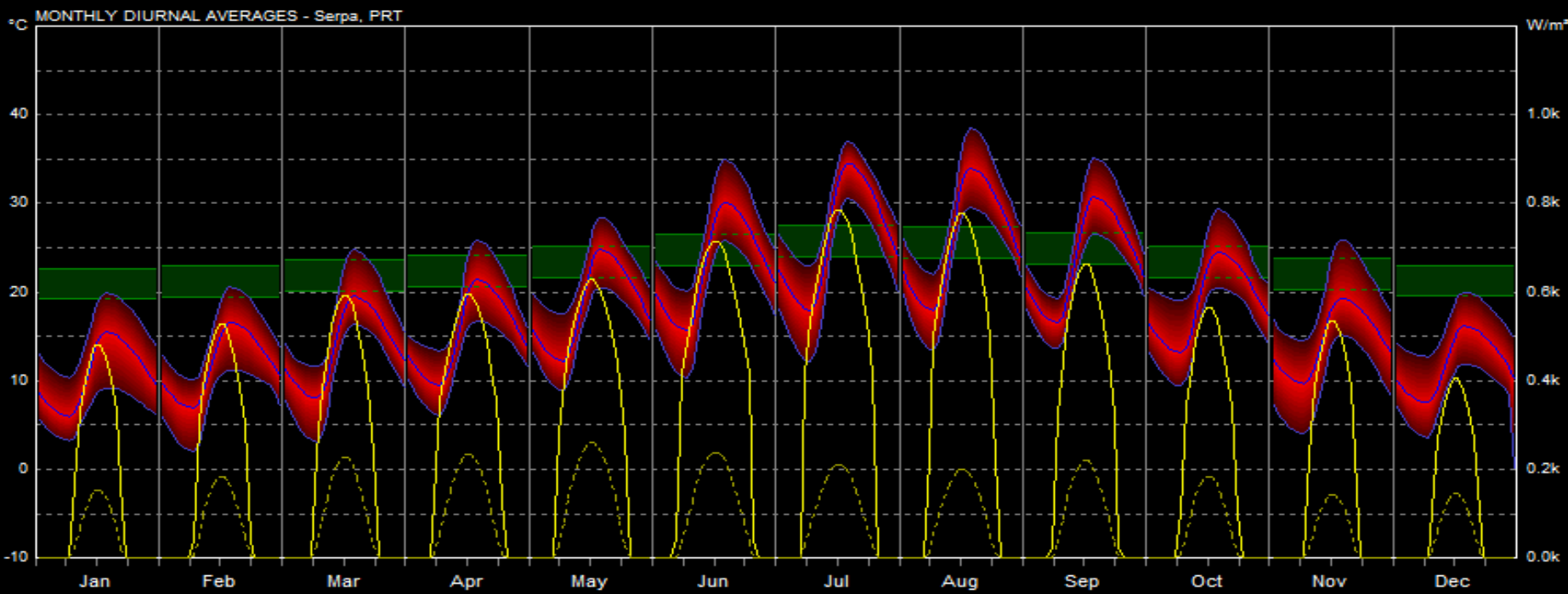
Serpa
Portugal

Köppen: Bsk
Semi arid

Serpa



annual climatic data



LEGEND

Comfort: Thermal Neutrality	
Temperature	Direct Solar
Rel. Humidity	Diffuse Solar
Wind Speed	Cloud Cover

studied
buildings

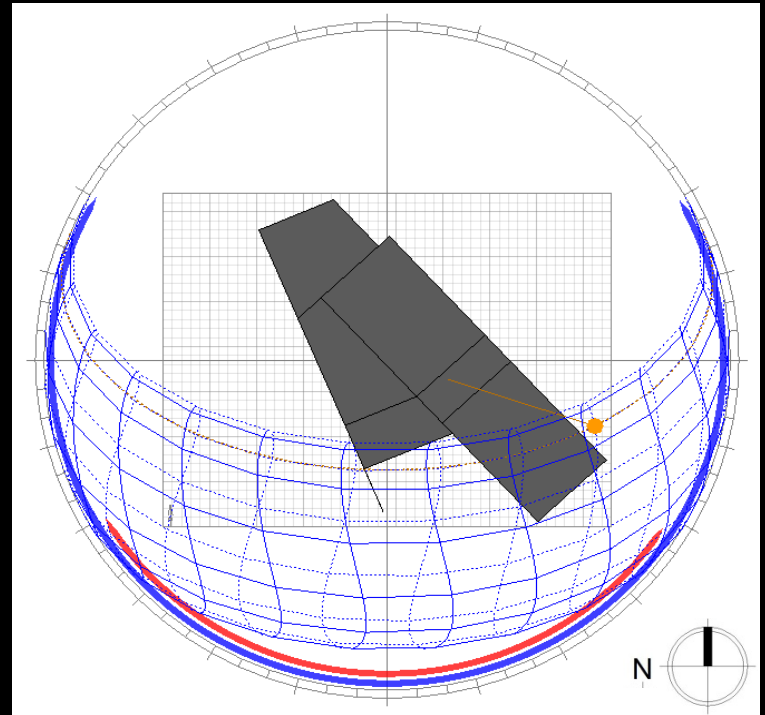
architectural office

half meter thick rammed
earth walls

$$U = 1.60 \text{ W}/(\text{m}^2 \cdot ^\circ\text{C})$$

metal insulated Roof

$$U = 1.670 \text{ W}/(\text{m}^2 \cdot ^\circ\text{C})$$



rural hotel

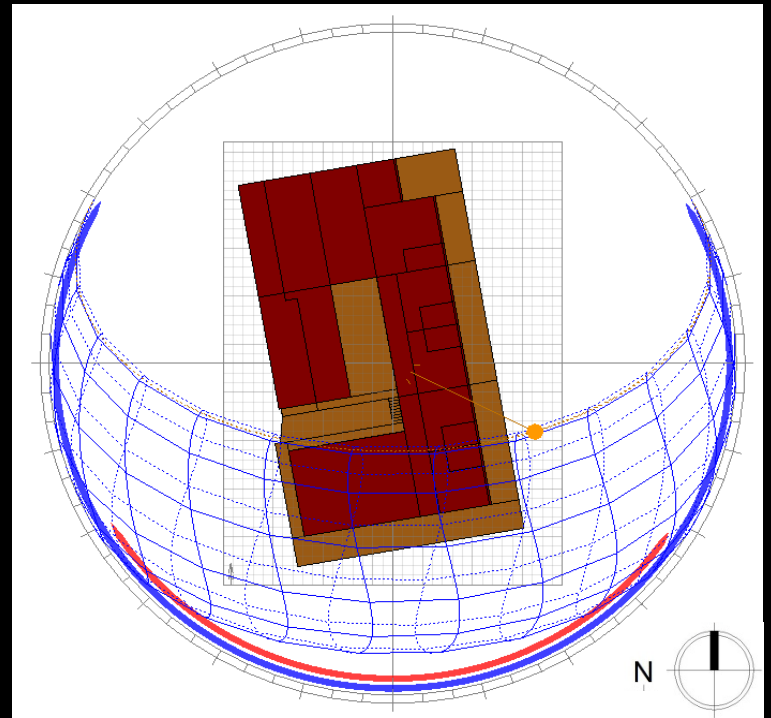


half meter thick rammed
earth walls

$$U = 1.60 \text{ W}/(\text{m}^2 \cdot ^\circ\text{C})$$

tile insulated Roof

$$U = 1.43 \text{ W}/(\text{m}^2 \cdot ^\circ\text{C})$$

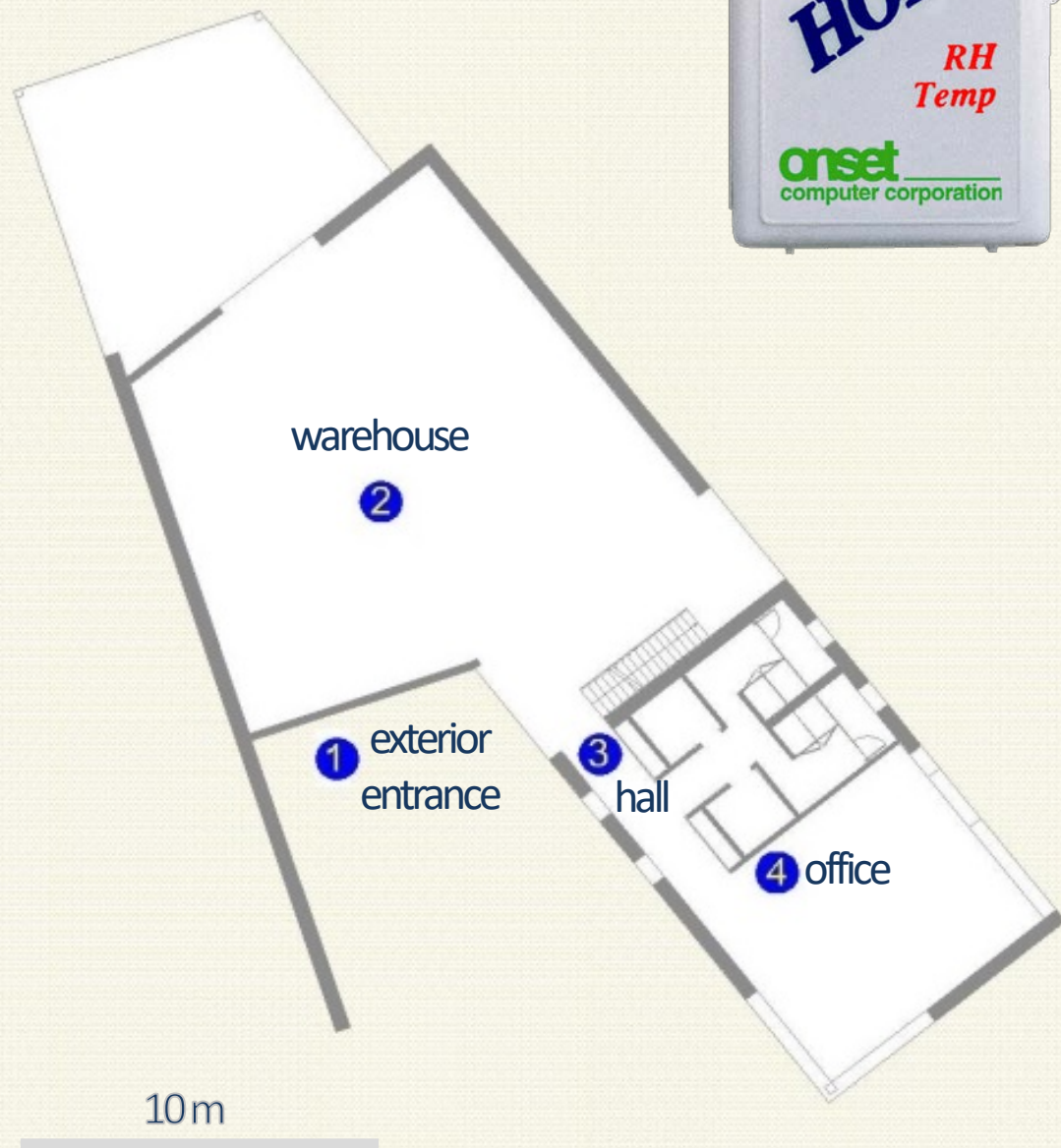


temperature
readings

data loggers layout

temperature
readings on each
30 minutes

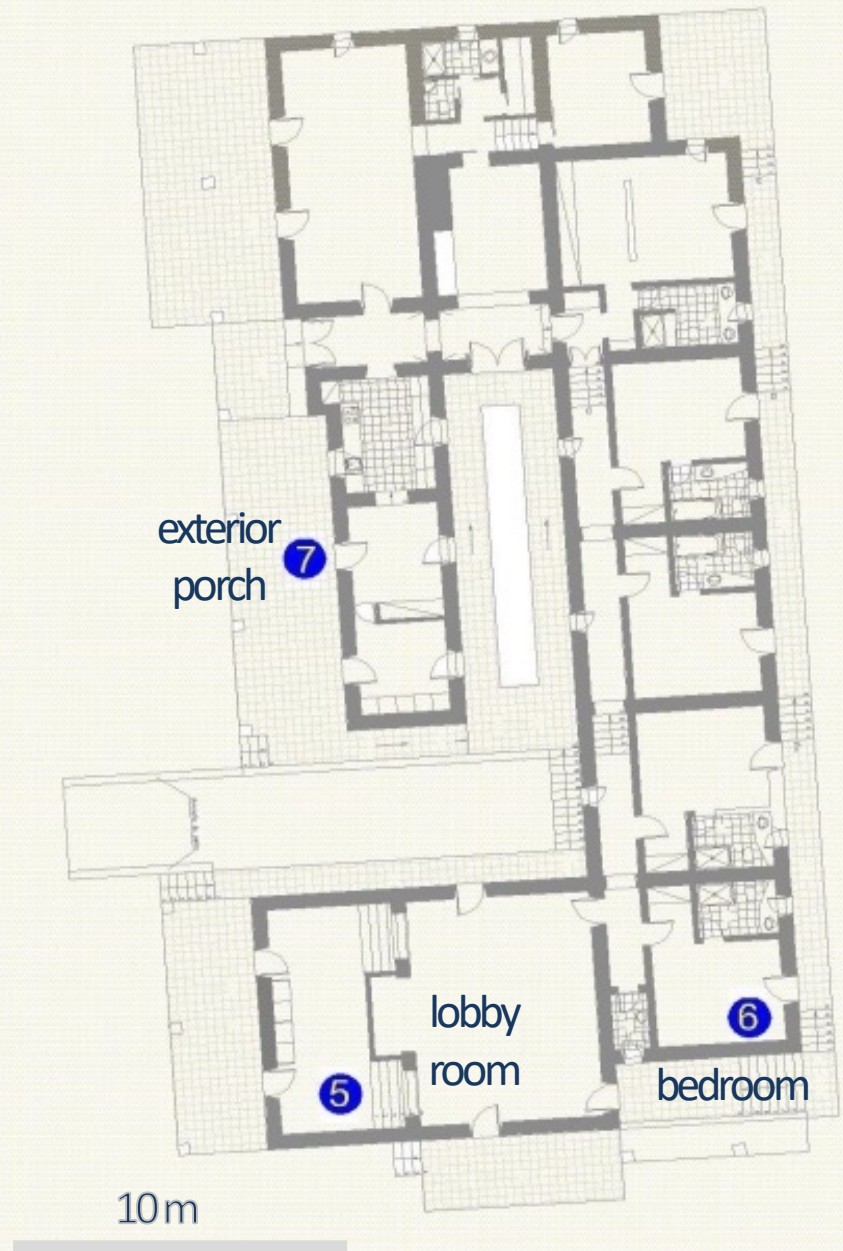
5th August
10th October



data loggers layout

temperature
readings on each
30 minutes

14th August 10th
October



Beja Air Force Base air temperature records to compare to our outside readings



not influenced
by form factor
and
orientation

air force
base
T

hotel
exterior
porch
T

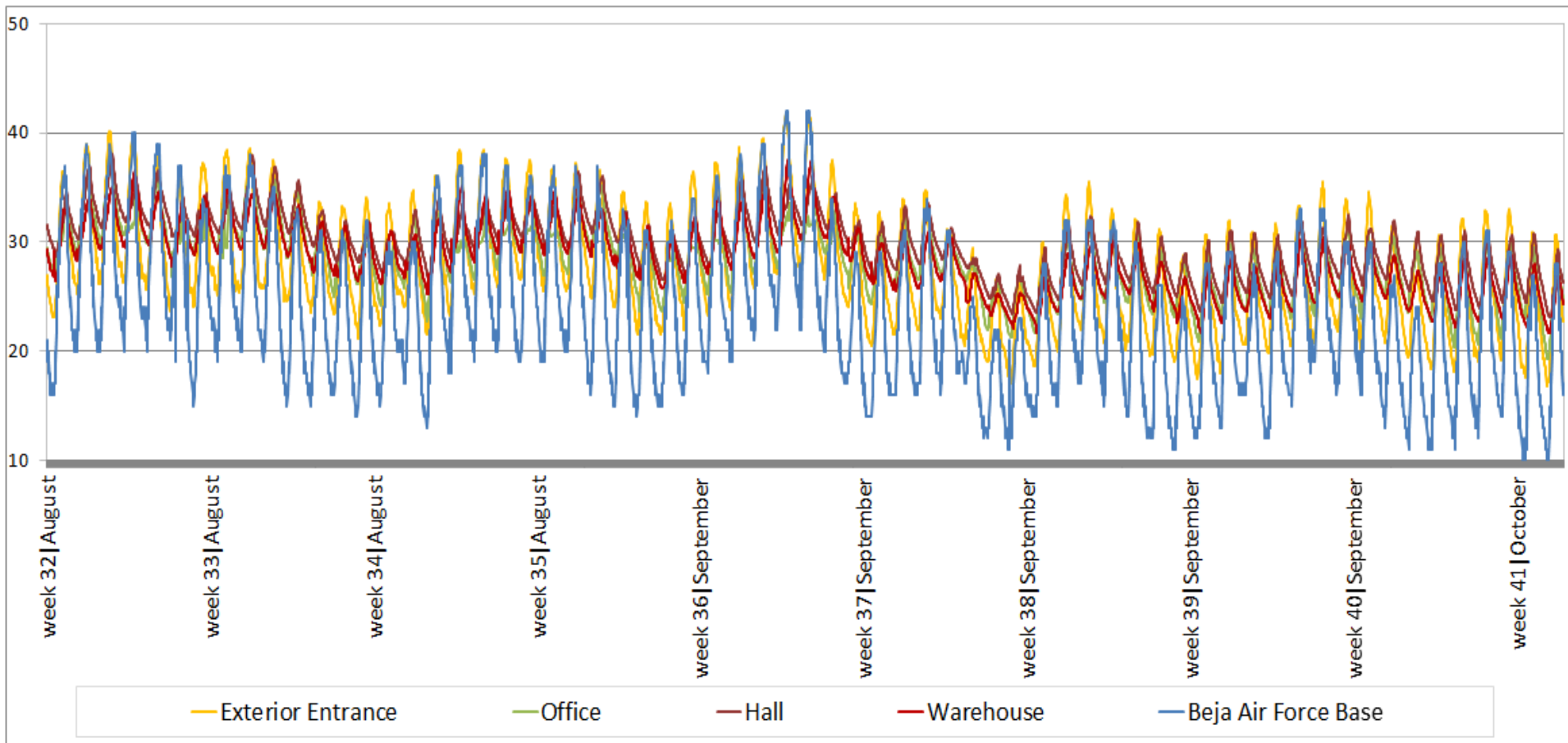
office
exterior
entrance
T

influenced by
form factor
and
orientation

main

measurement

results



architectural office

air Force Base

exterior Entrance

office

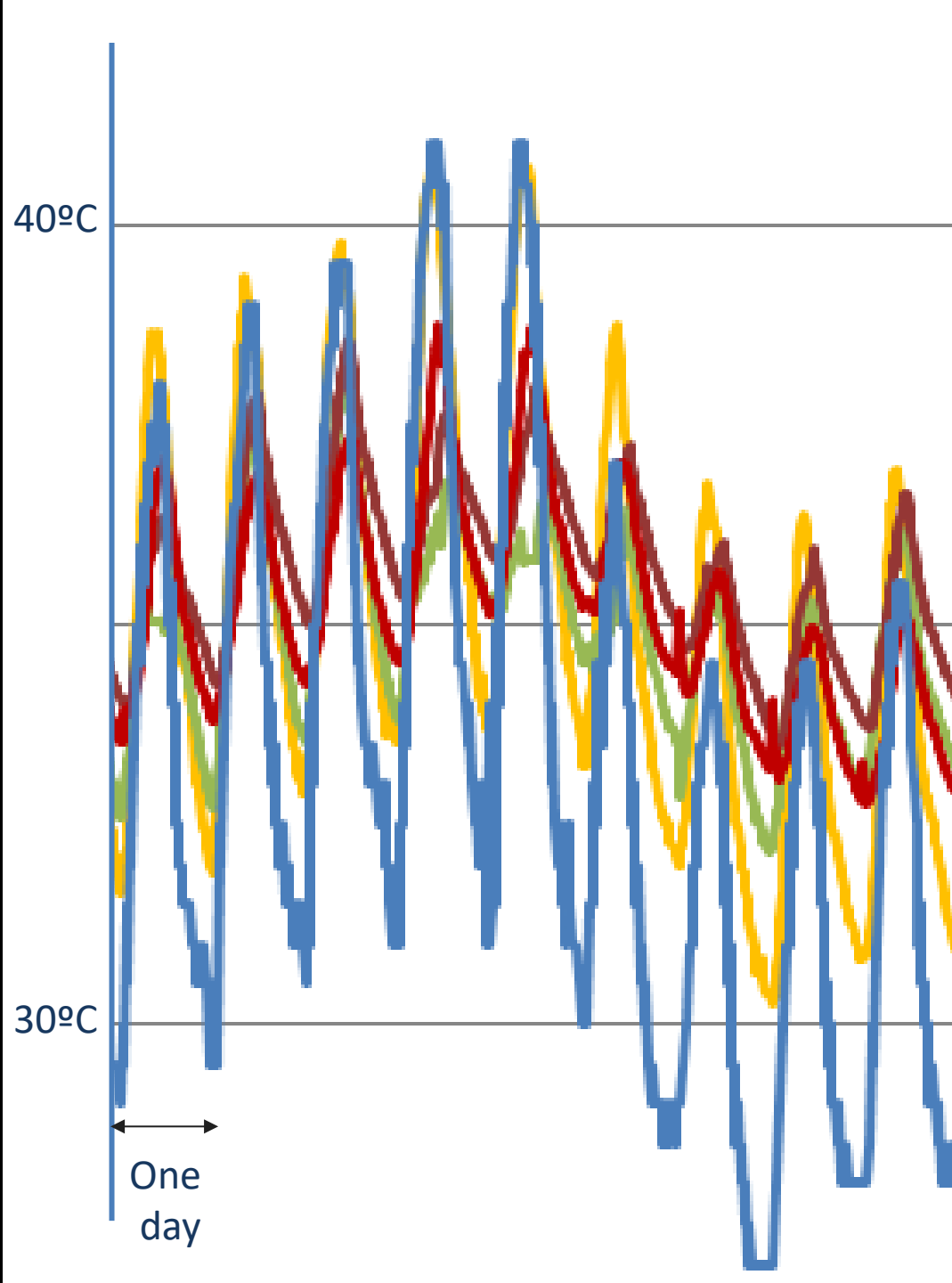
hall

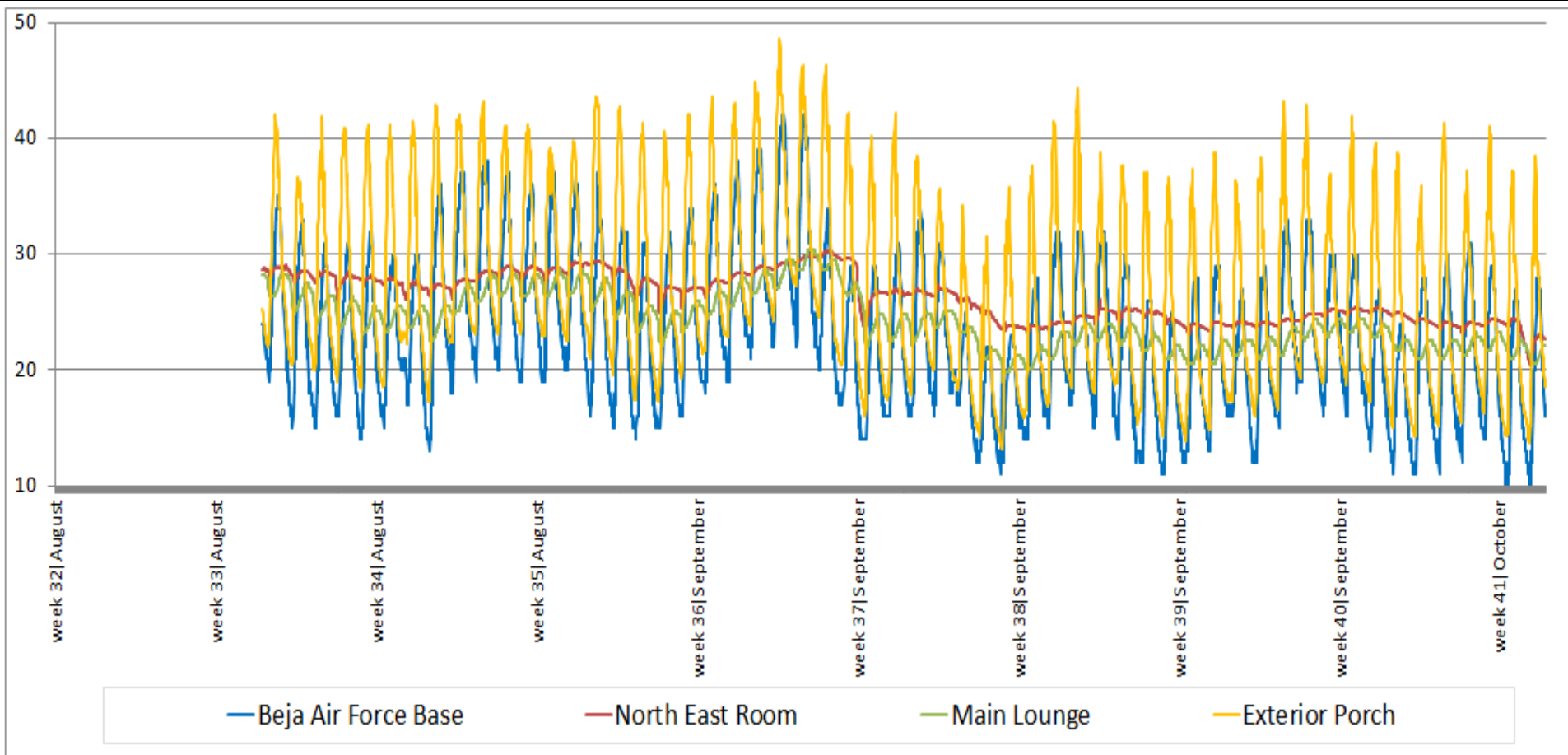
warehouse

40°C

30°C

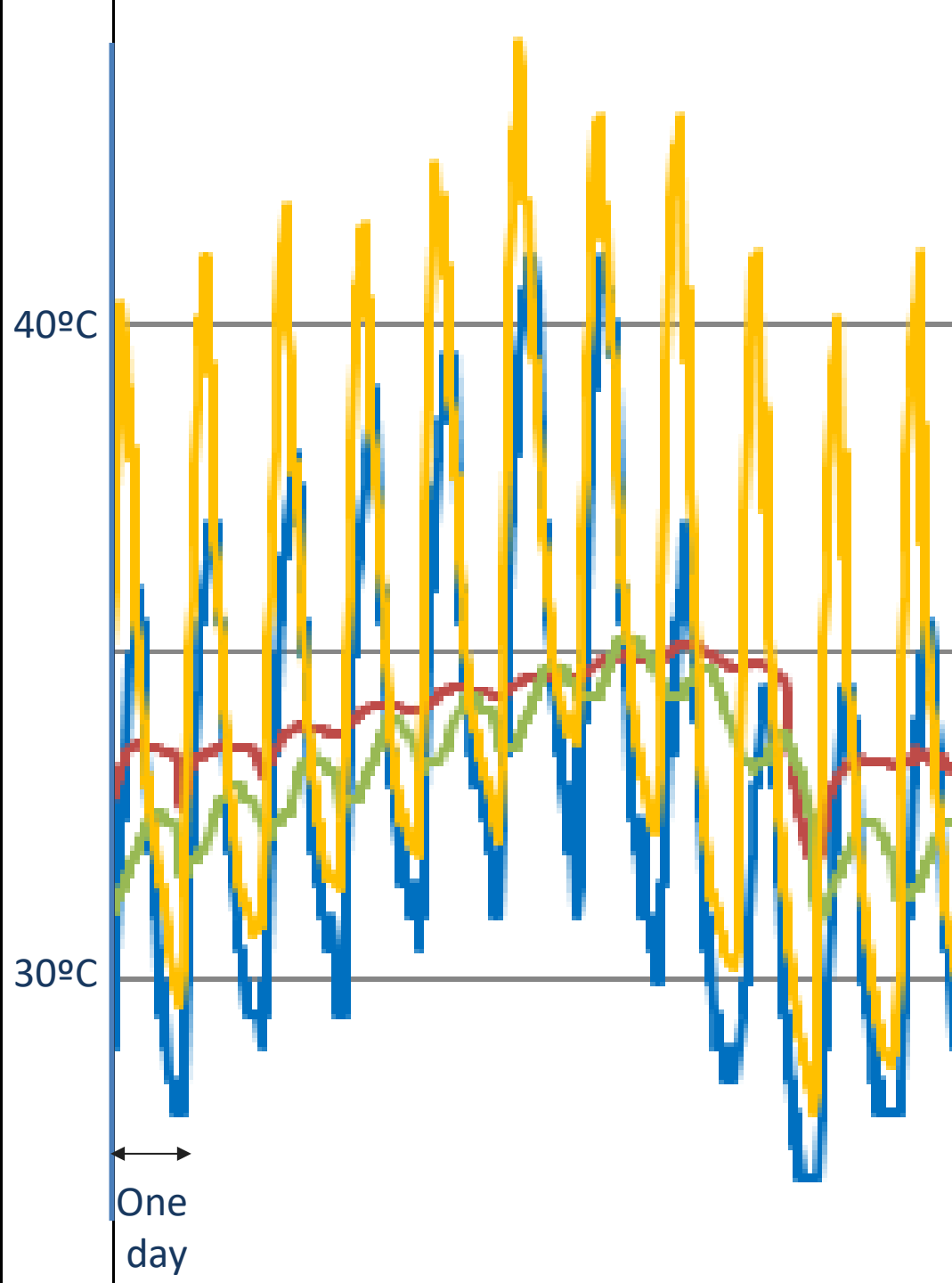
One
day

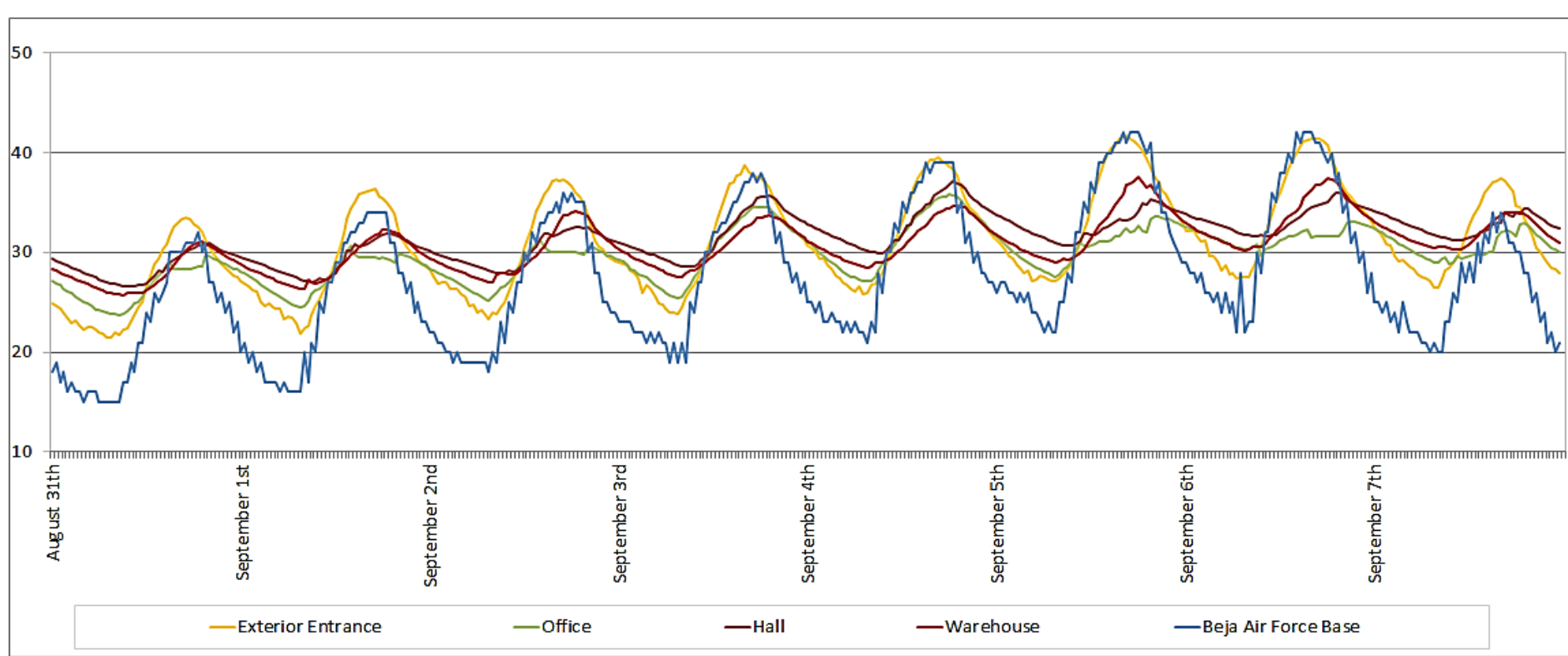




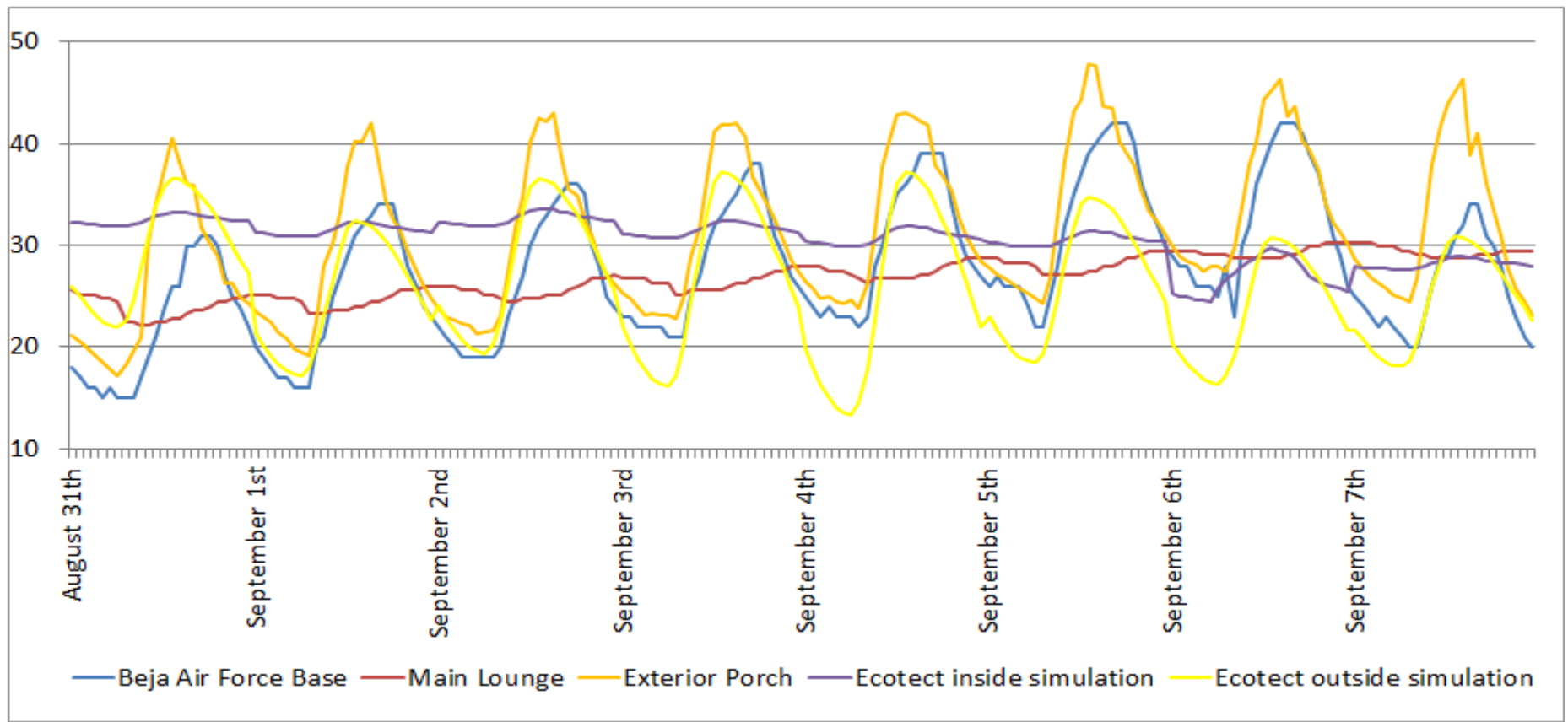
rural hotel

- air Force Base
- exterior Porch
- lobby Room
- bed room





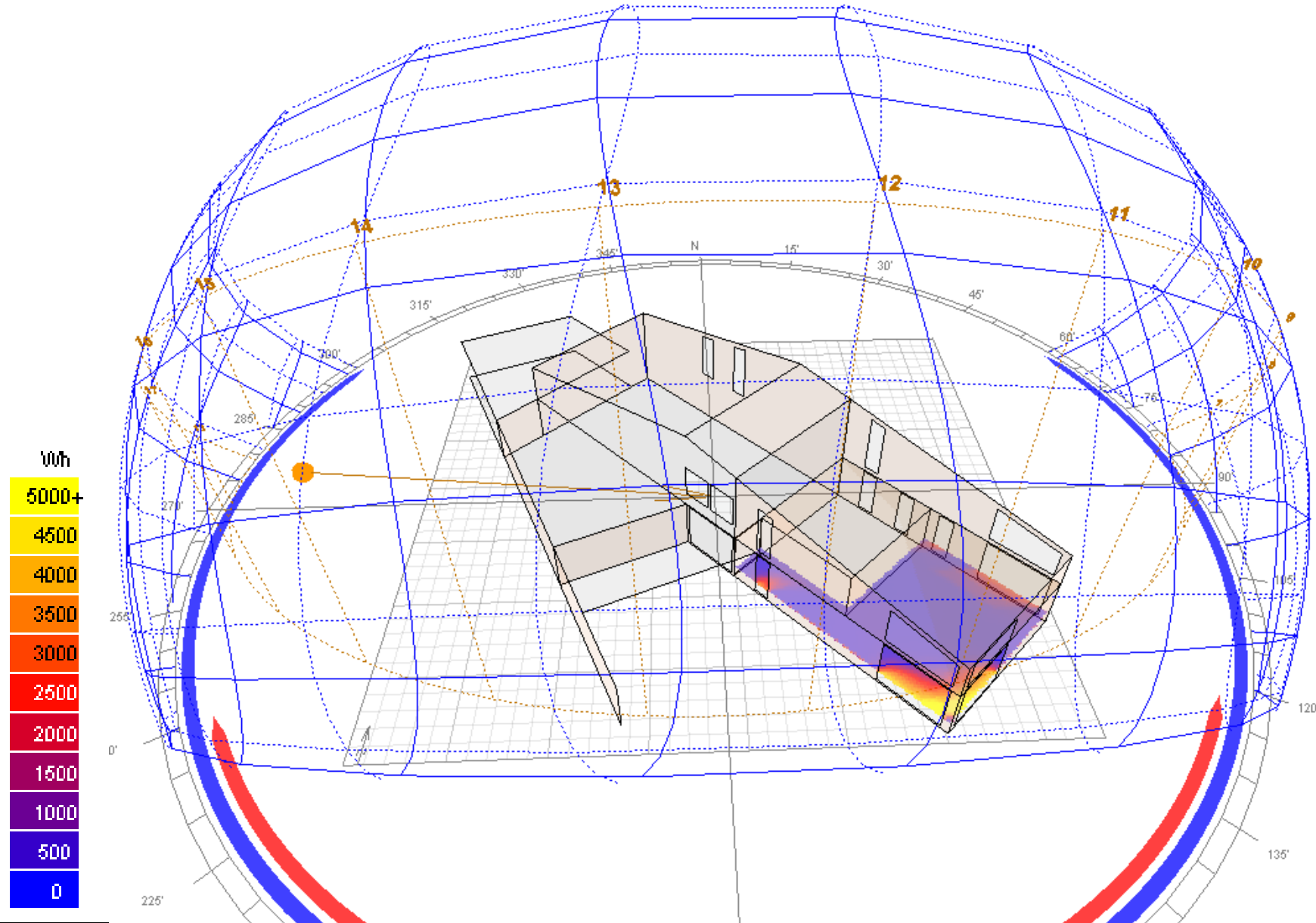
Architectural Office
worst week – heat wave



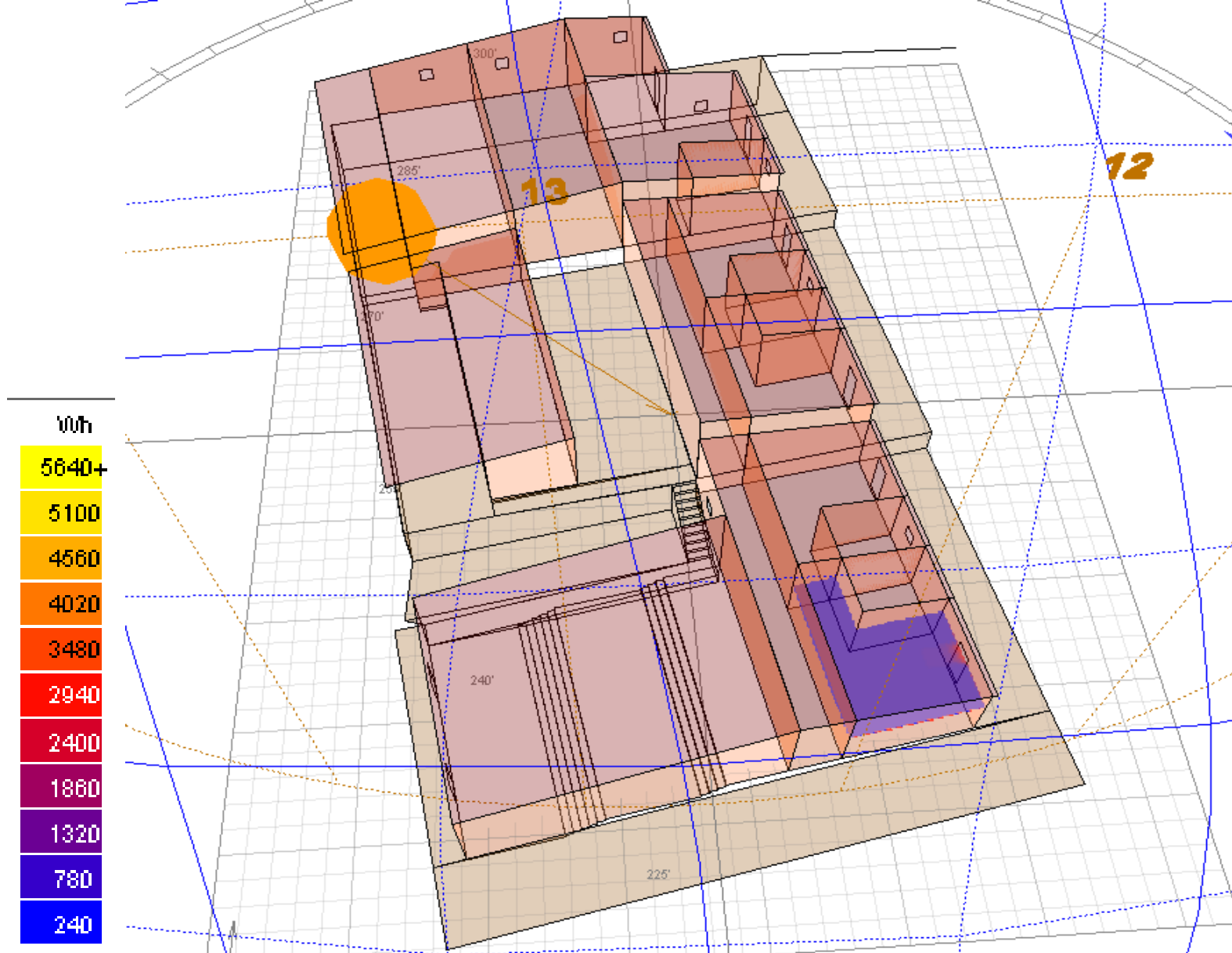
Rural Hotel

worst week – heat wave

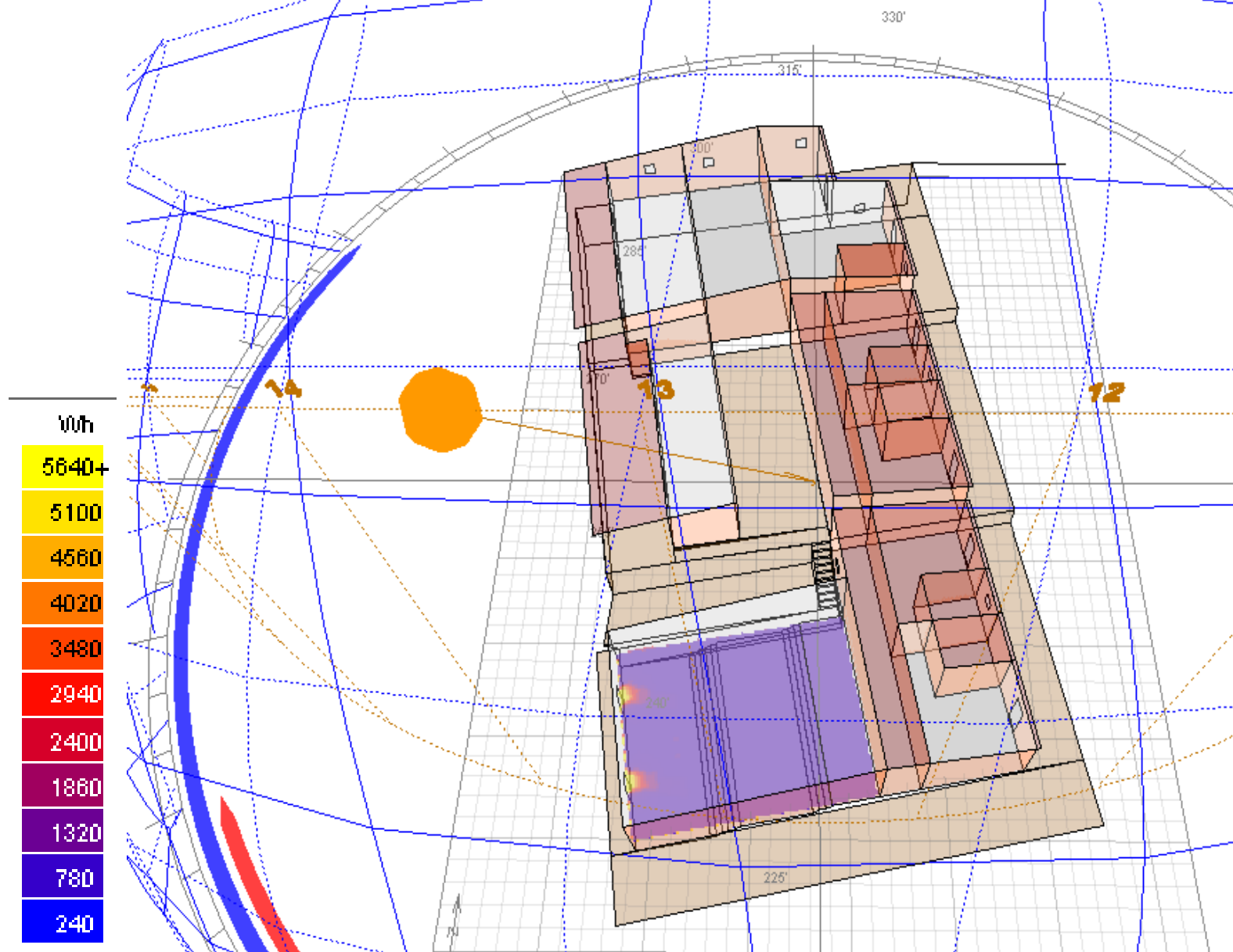
Ecotect Simulations



main working office

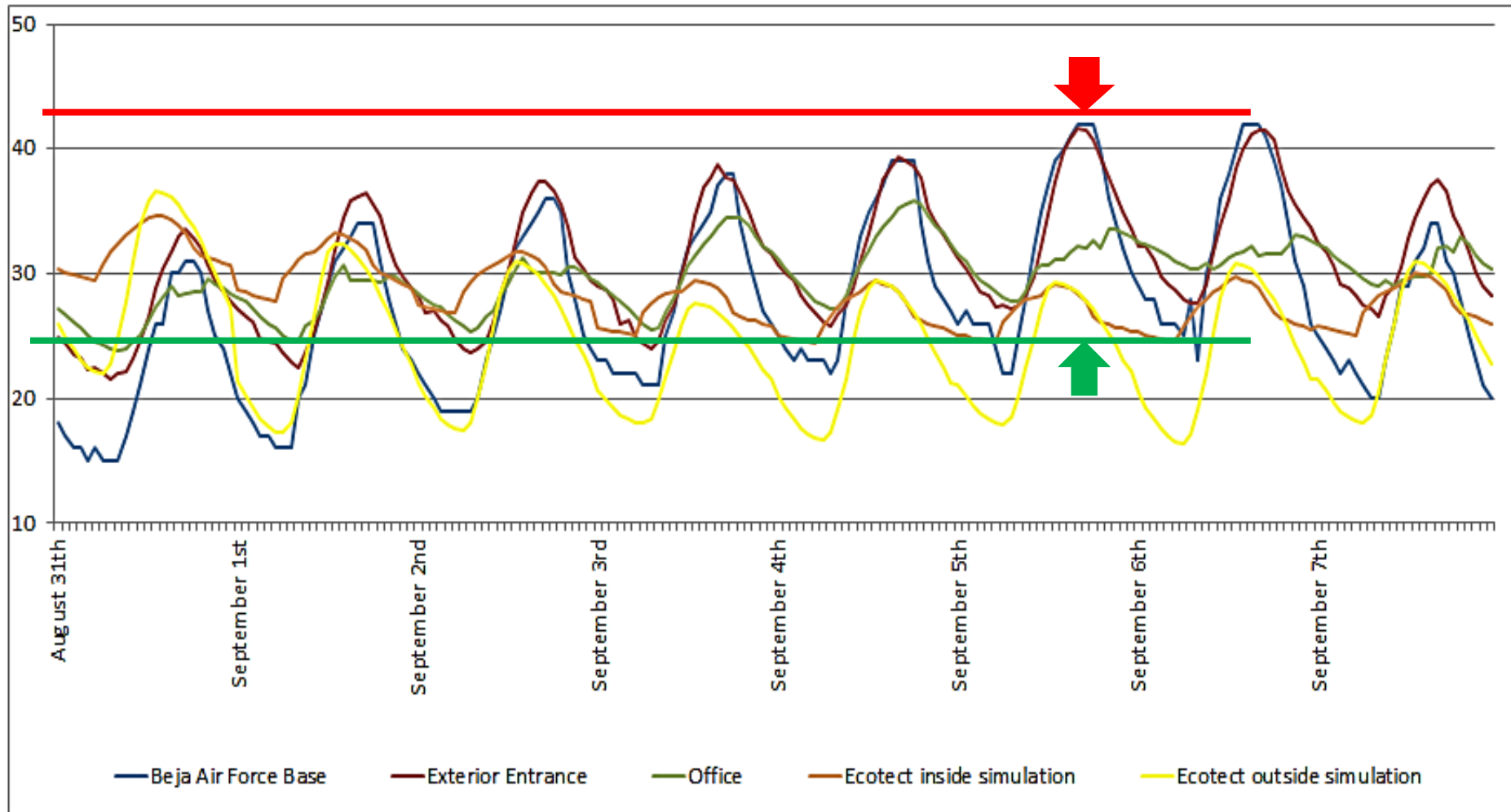


rural hotel bedroom

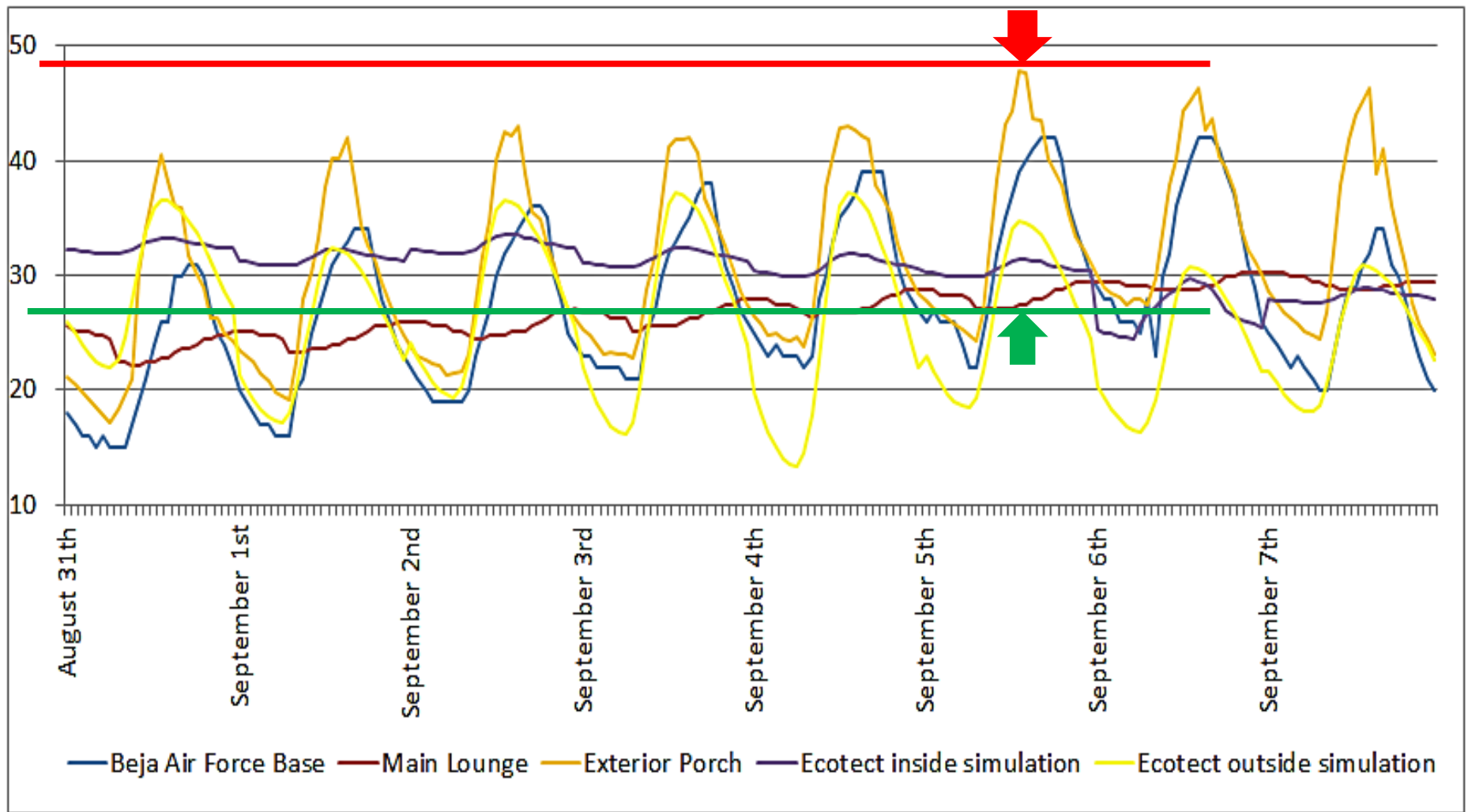


rural hotel lobby

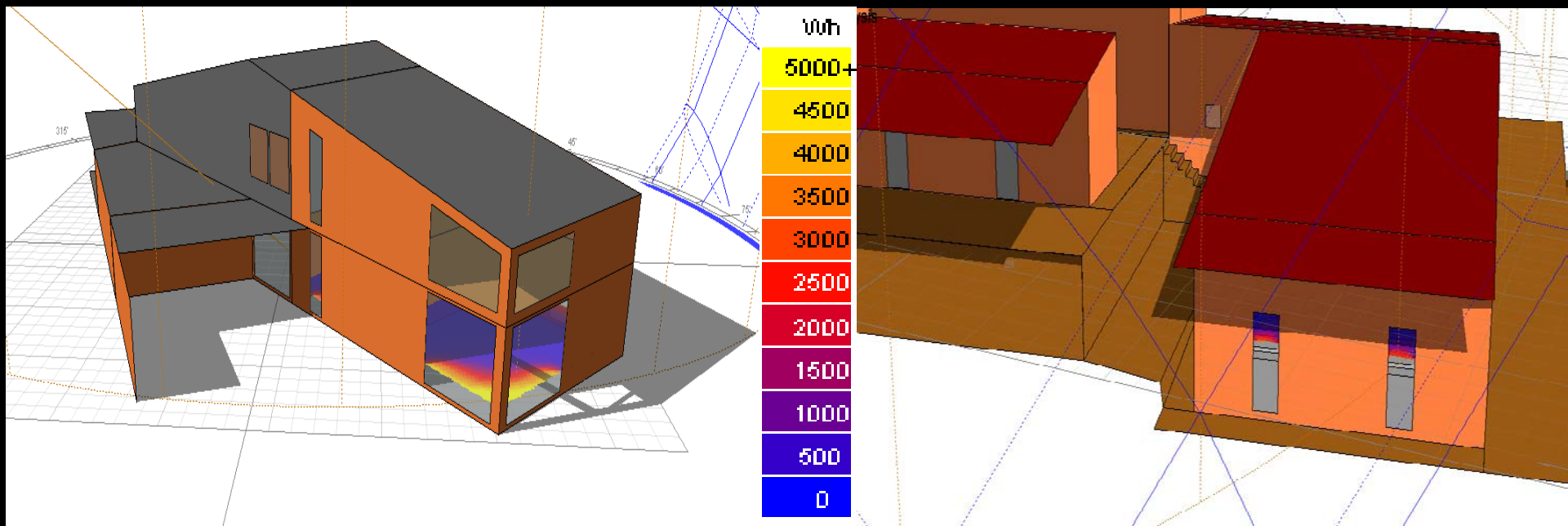
thermal
differences



working office



hotel lounge



glazing produces
striking differences

so exterior
shading is
being
placed

> 35°C were recorded on the inside!



conclusions

outside daily
temperatures
constantly
surpassing 40°C

sun oriented glazing
strongly reduces
comfort



daily outside
temperatures
constantly
surpassing 40°C

room temperatures
always below 30°C

Lepton

great
performance
under
extreme heat

ETSE

Thank you all!

Manuel Arriaga Correia Guedes

Bruno Marques

Helena Corvacho

António Andresen