ReNew Perth Branch

Designing a more eco-effective home

sidthoo

PRESENTATION OVERVIEW

- A bit about climate change
- Eco-effective design strategies for a more sustainable home
- Summary & Questions

ALL YOU NEED TO KNOW ABOUT CLIMATE CHANGE IN FIVE SLIDES

A VERY BRIEF HISTORY LESSON

"If our designs for private houses are to be correct, we must at the outset take note of the countries and climates in which they are built."

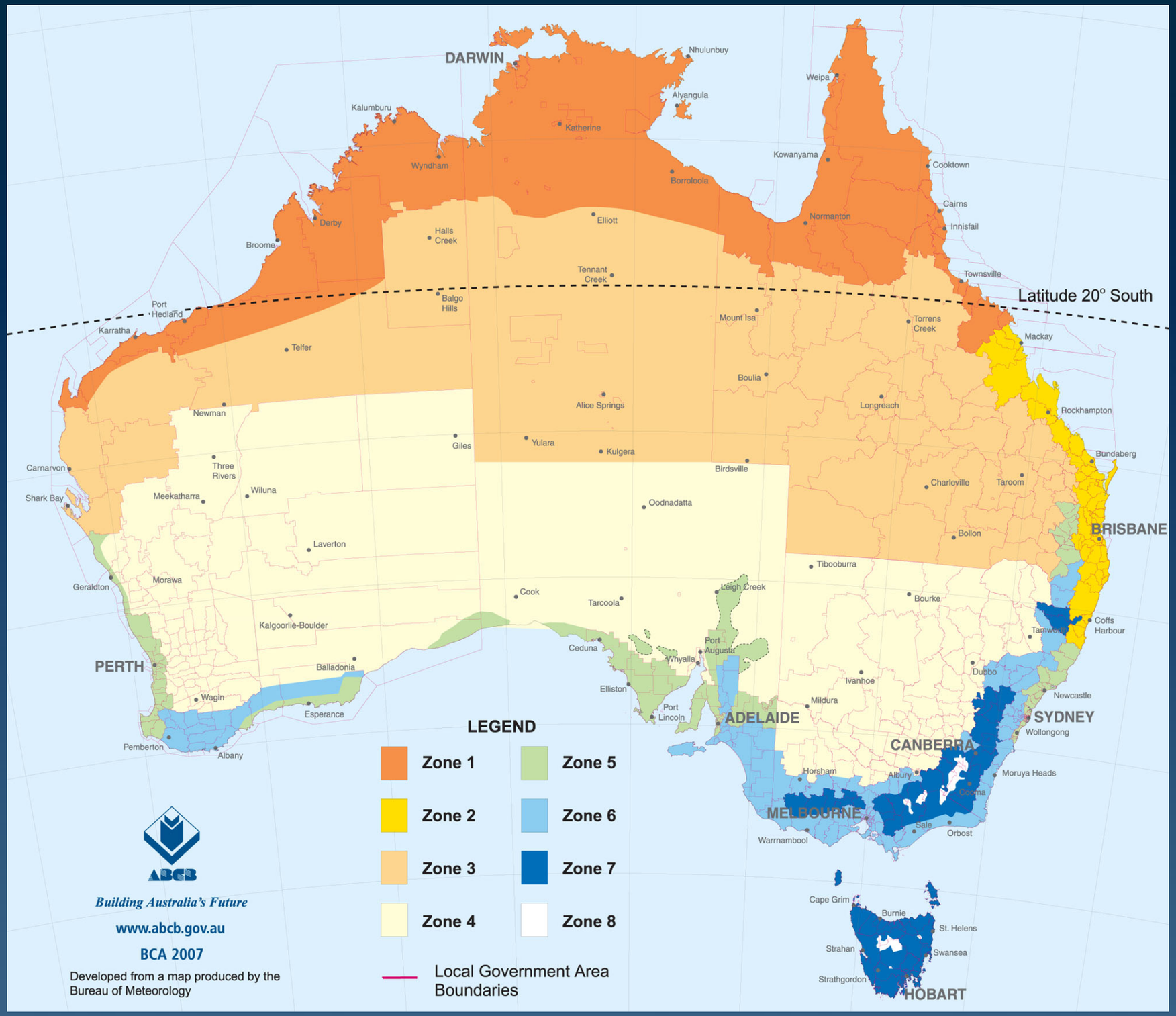
- Marcus Vitruvius Pollio (c. 75 - 15 BC)

SIX ECO-EFFECTIVE DESIGN PRINCIPLES

1. Understand the climate and get the orientation right.
2. Select appropriate building materials.
3. Select the best windows for summer and winter.
4. Shade the building in summer; allow sun to enter during winter.
5. Encourage air movement and ventilation when it’s hot.
6. Consider energy and water efficient technologies.

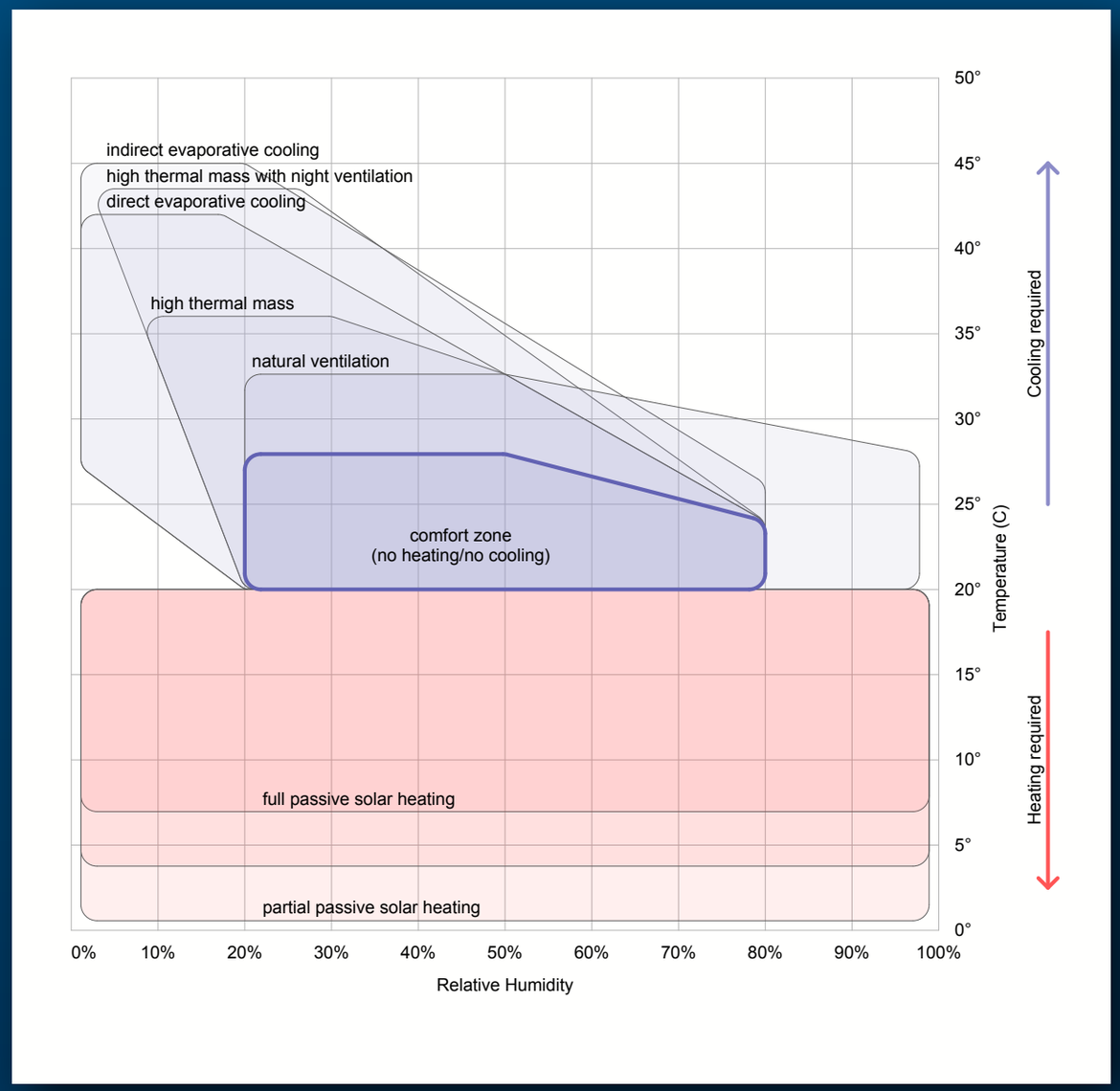
1. Understand the climate and get the orientation right.

NCC CLIMATE ZONE MAP OF AUSTRALIA



BIOCLIMATIC BUILDING CHART

- A bioclimatic building chart is a modified version of Olgay's original graph showing the effective ranges for different passive design strategies:

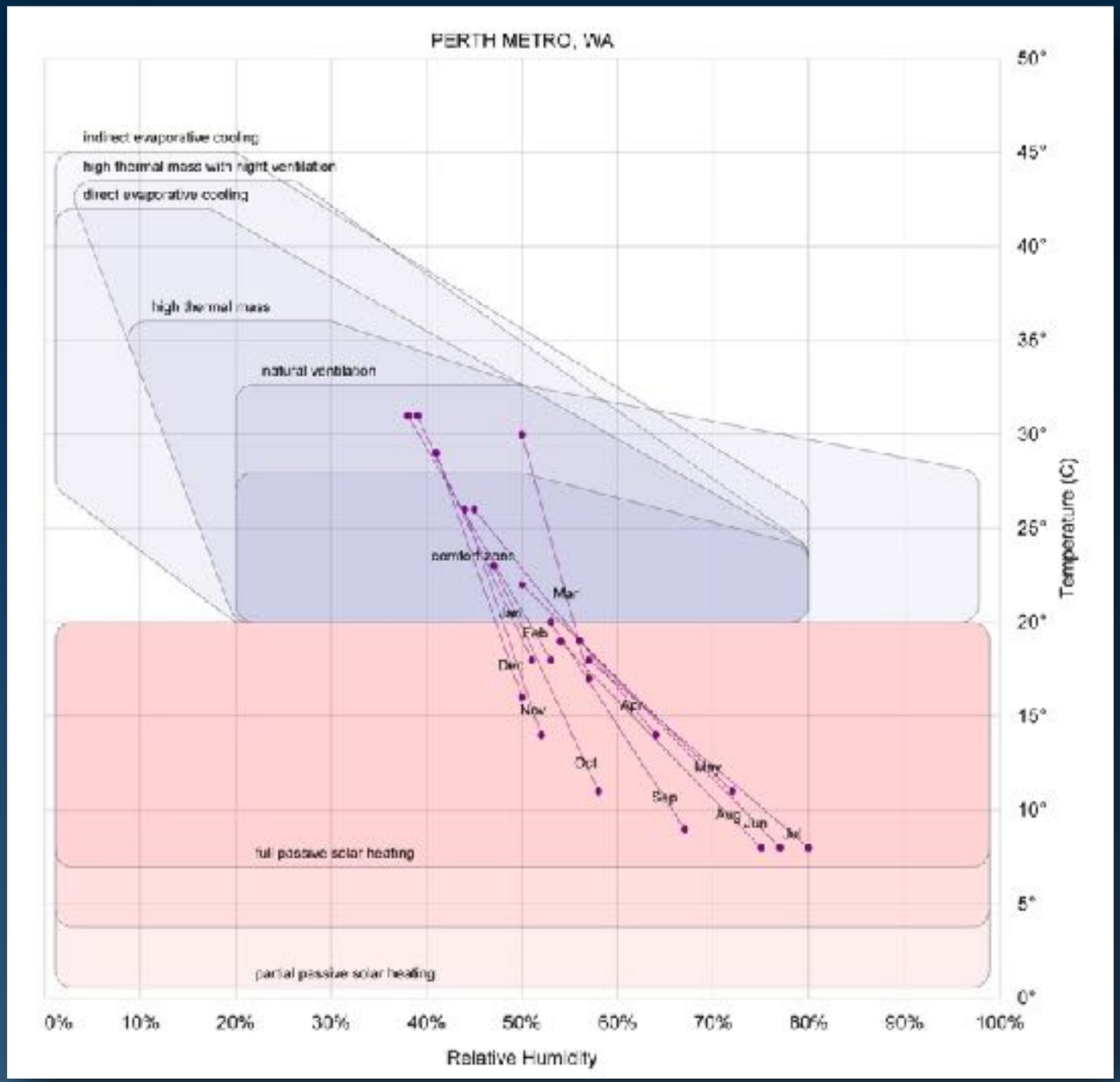


1. Obtain monthly temperature and humidity averages for the location to be analysed

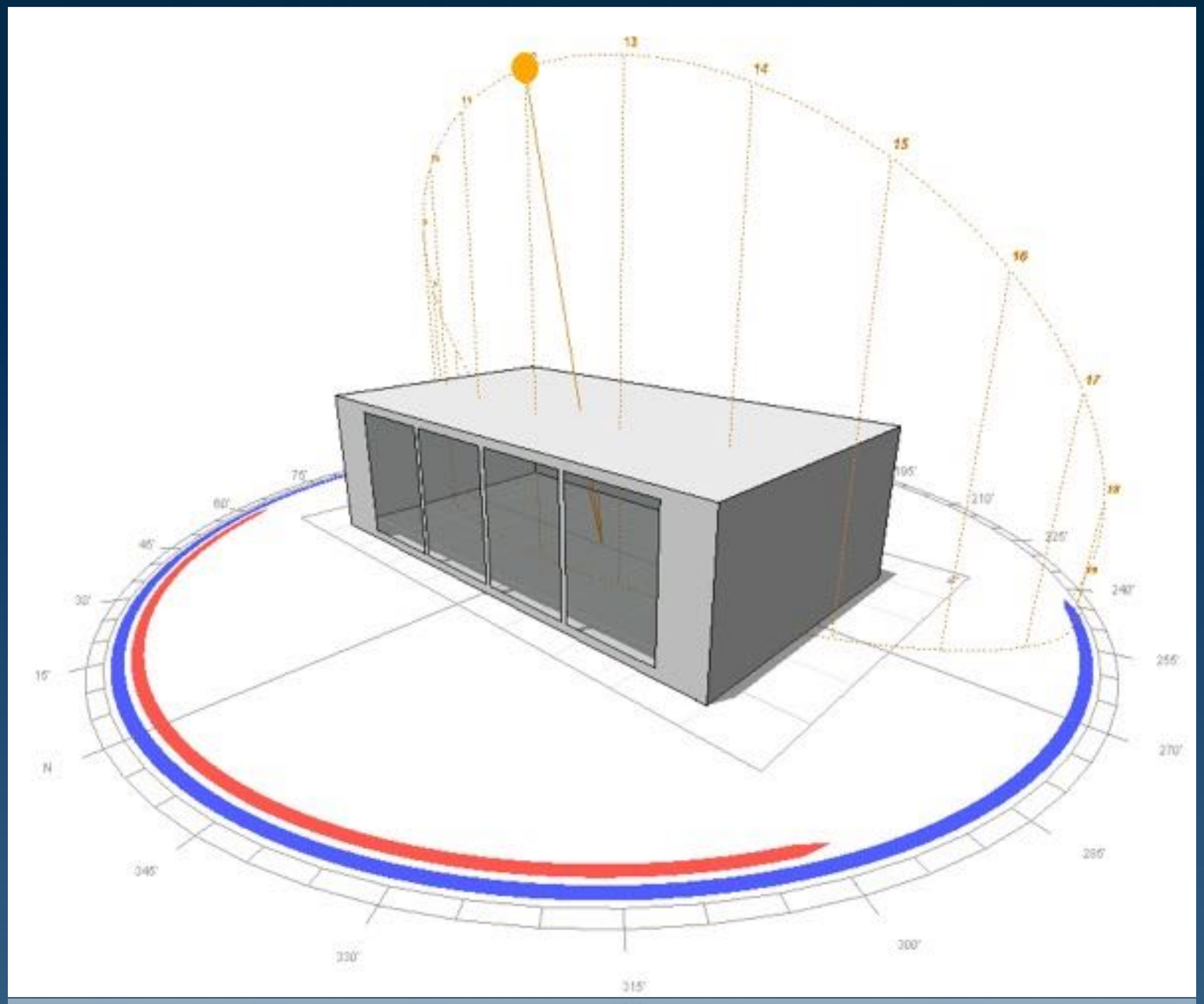
2. For each month, plot two points:
   - max temperature with min humidity
   - min temperature with max humidity

3. Join these two points with a line; repeat for the entire year

BIOCLIMATIC BUILDING CHART FOR PERTH

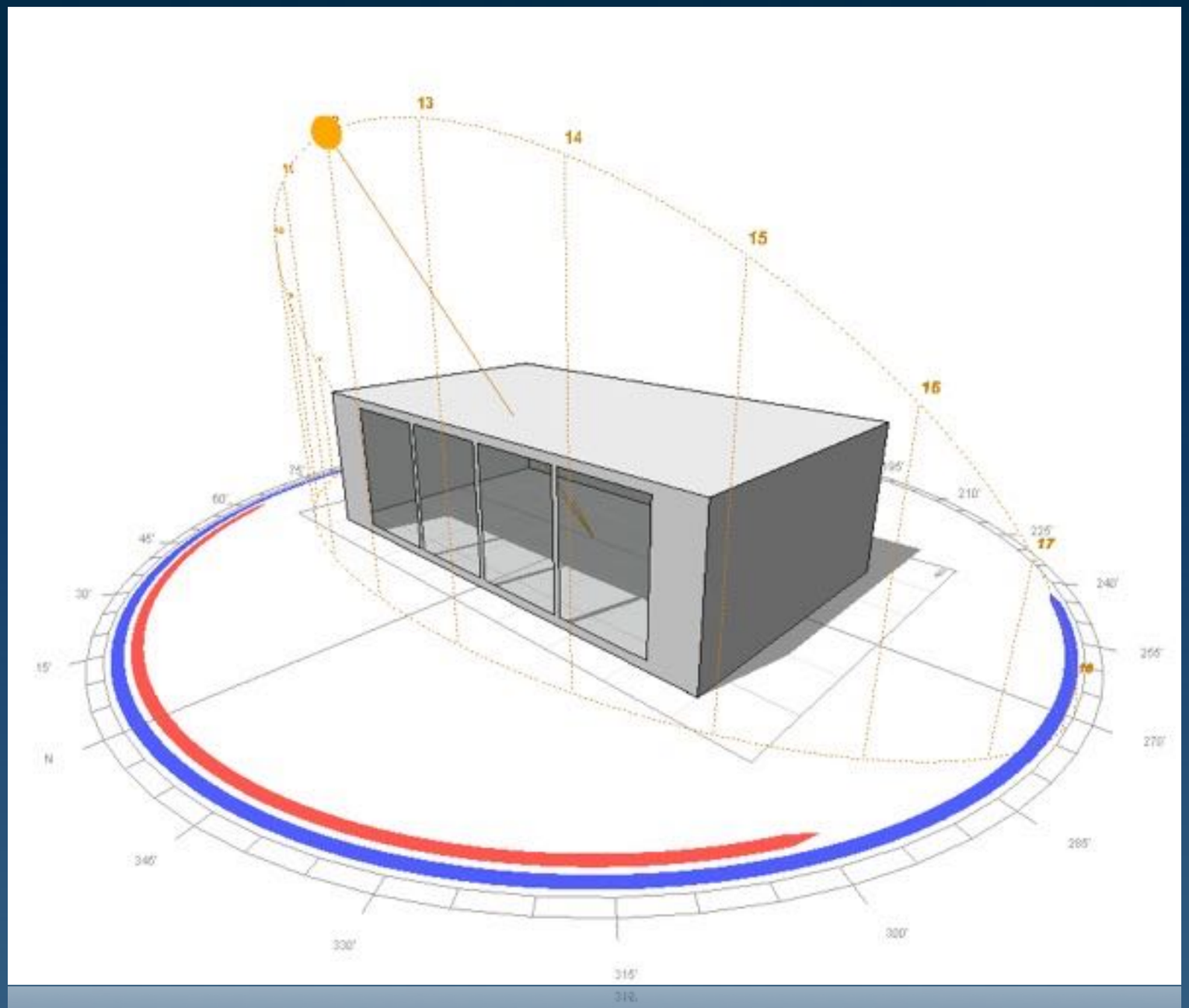


GETTING THE ORIENTATION RIGHT



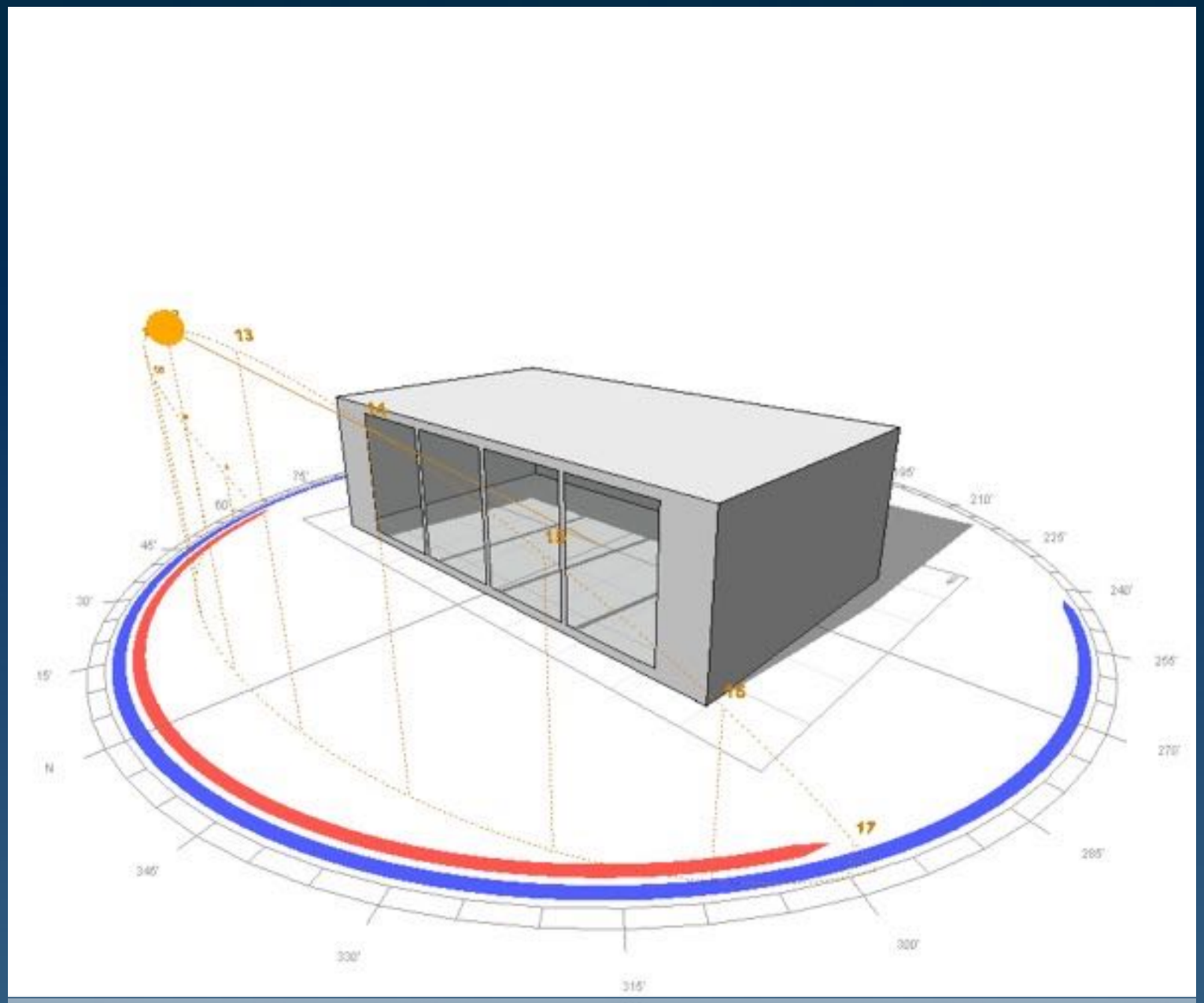
December 21st 12:00pm

GETTING THE ORIENTATION RIGHT



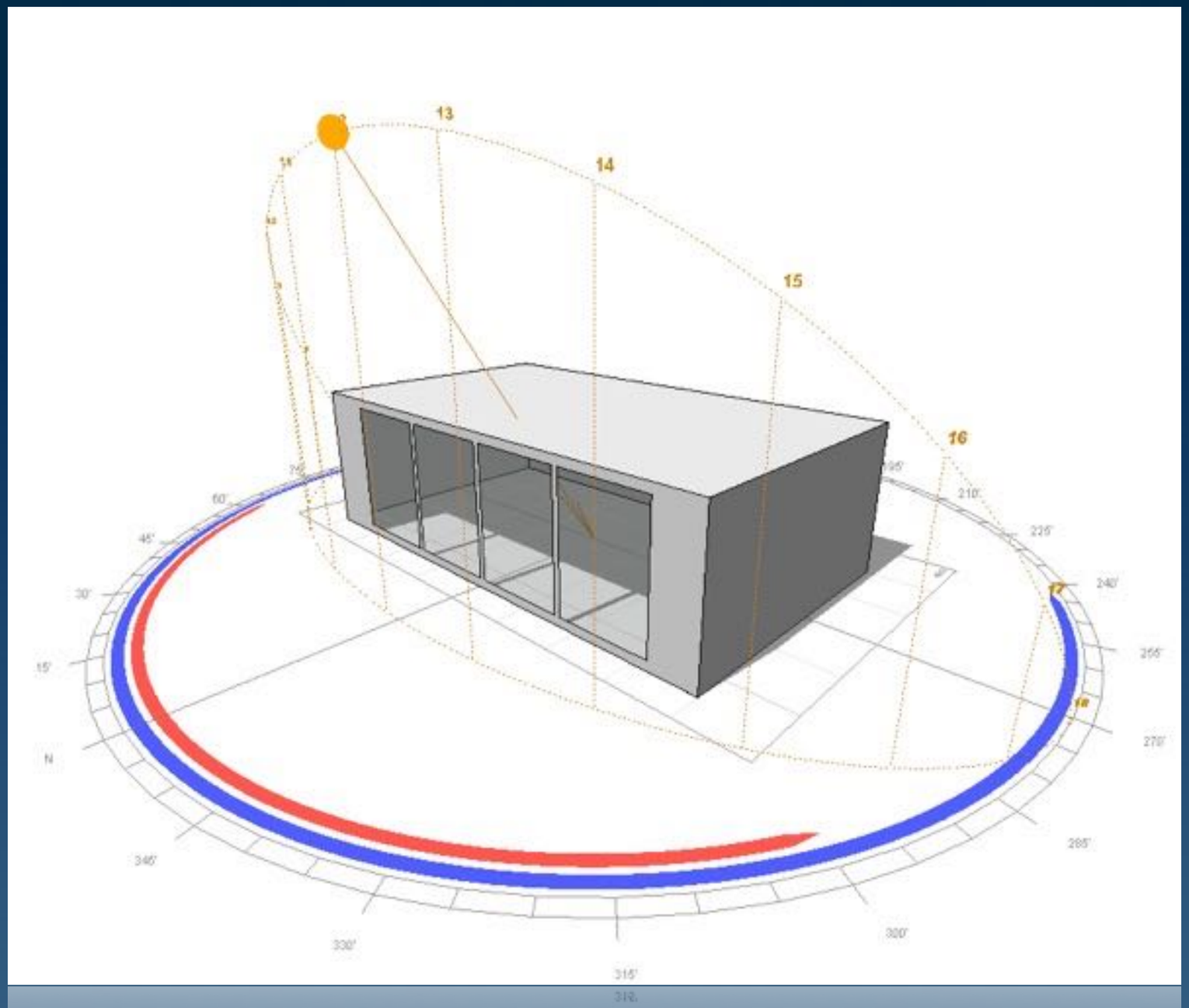
March 21st 12:00pm

GETTING THE ORIENTATION RIGHT

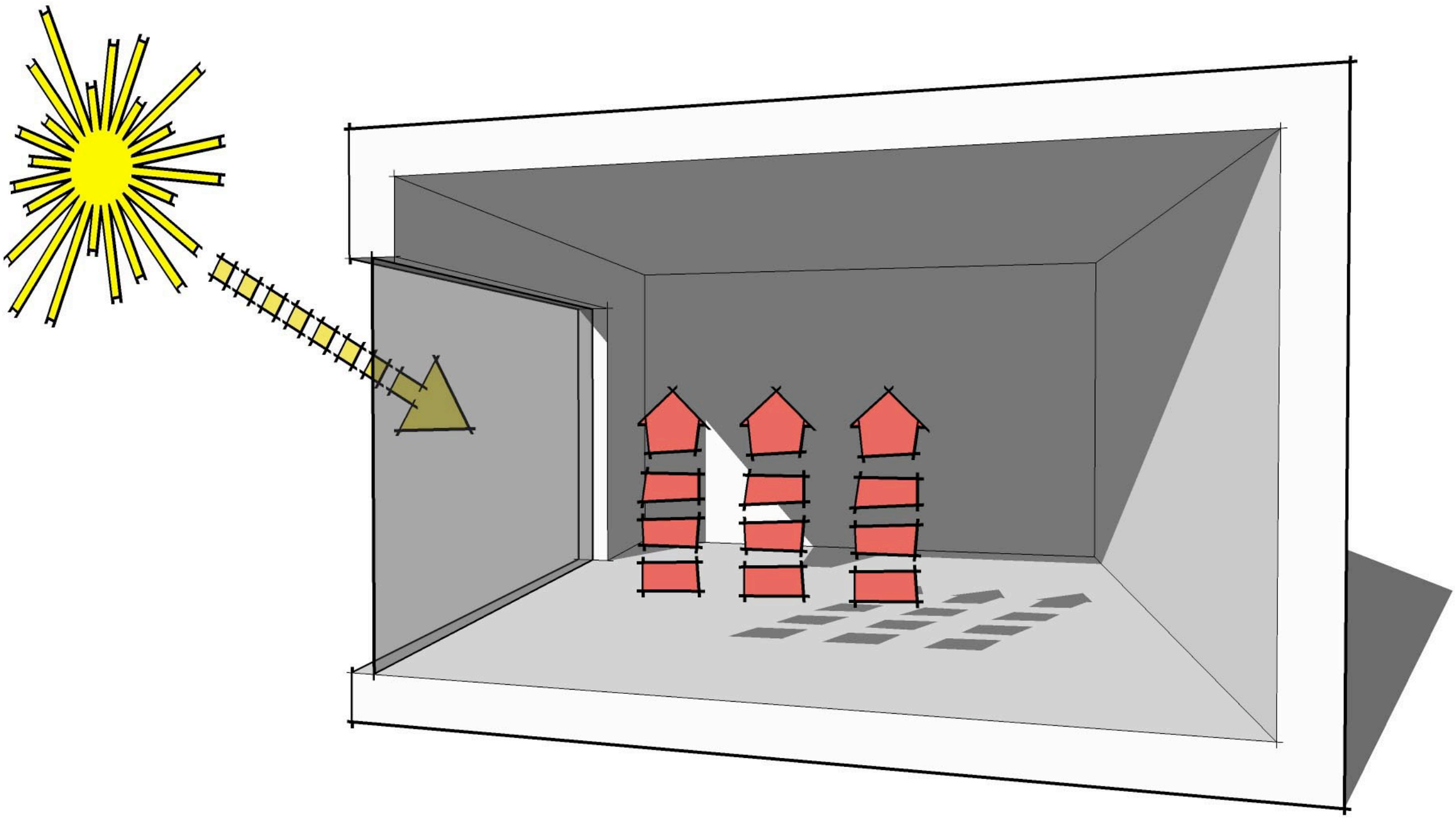


June 21st 12:00pm

GETTING THE ORIENTATION RIGHT



September 21st 12:00pm



PASSIVE HEATING

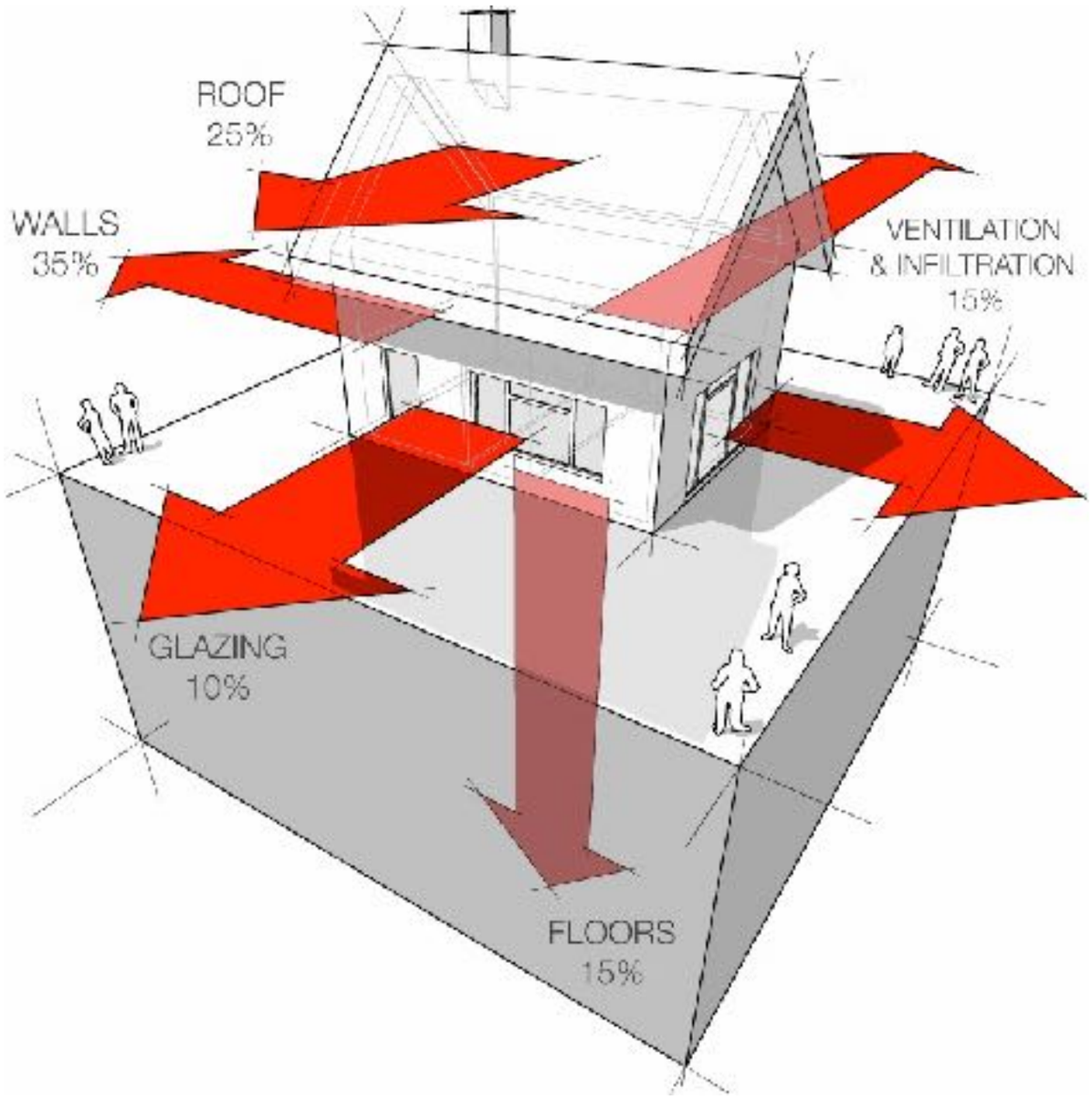
Direct Gain

1
192
2
3

2. Select appropriate building materials.

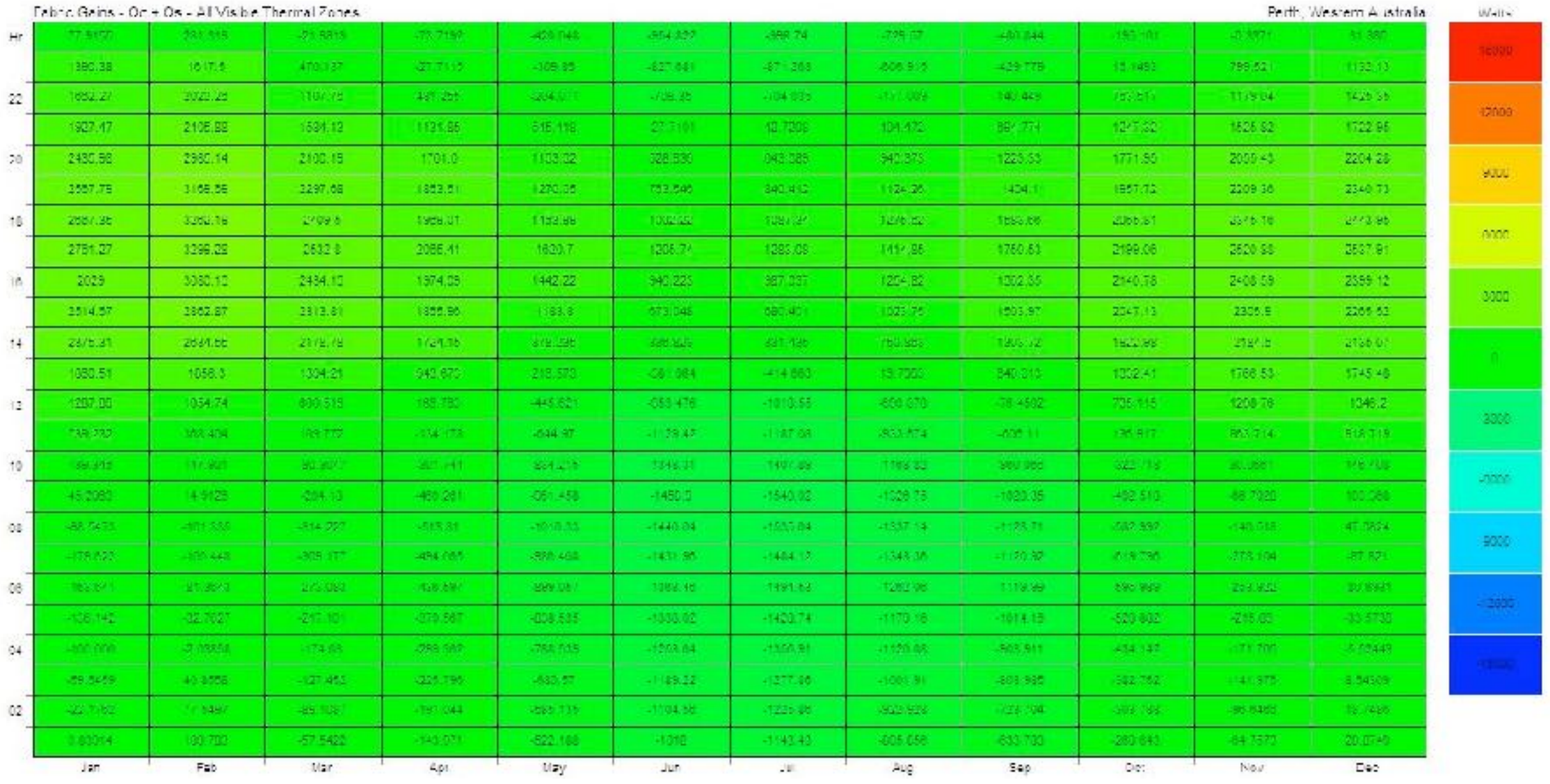
CHOOSE APPROPRIATE BUILDING MATERIALS

Heat loss and gain through a typical residential building:



The floors, walls and roofs in total represent around 75% heat gain or loss!

HOW INSULATION WORKS



TYPES OF INSULATION

There are two main types of insulation:

- Bulk insulation: examples include batts (eg. glasswool, polyester, rockwool) and “blow-in” insulation - best for winter
- Doesn’t work if compressed so check wall and roof thicknesses are adequate

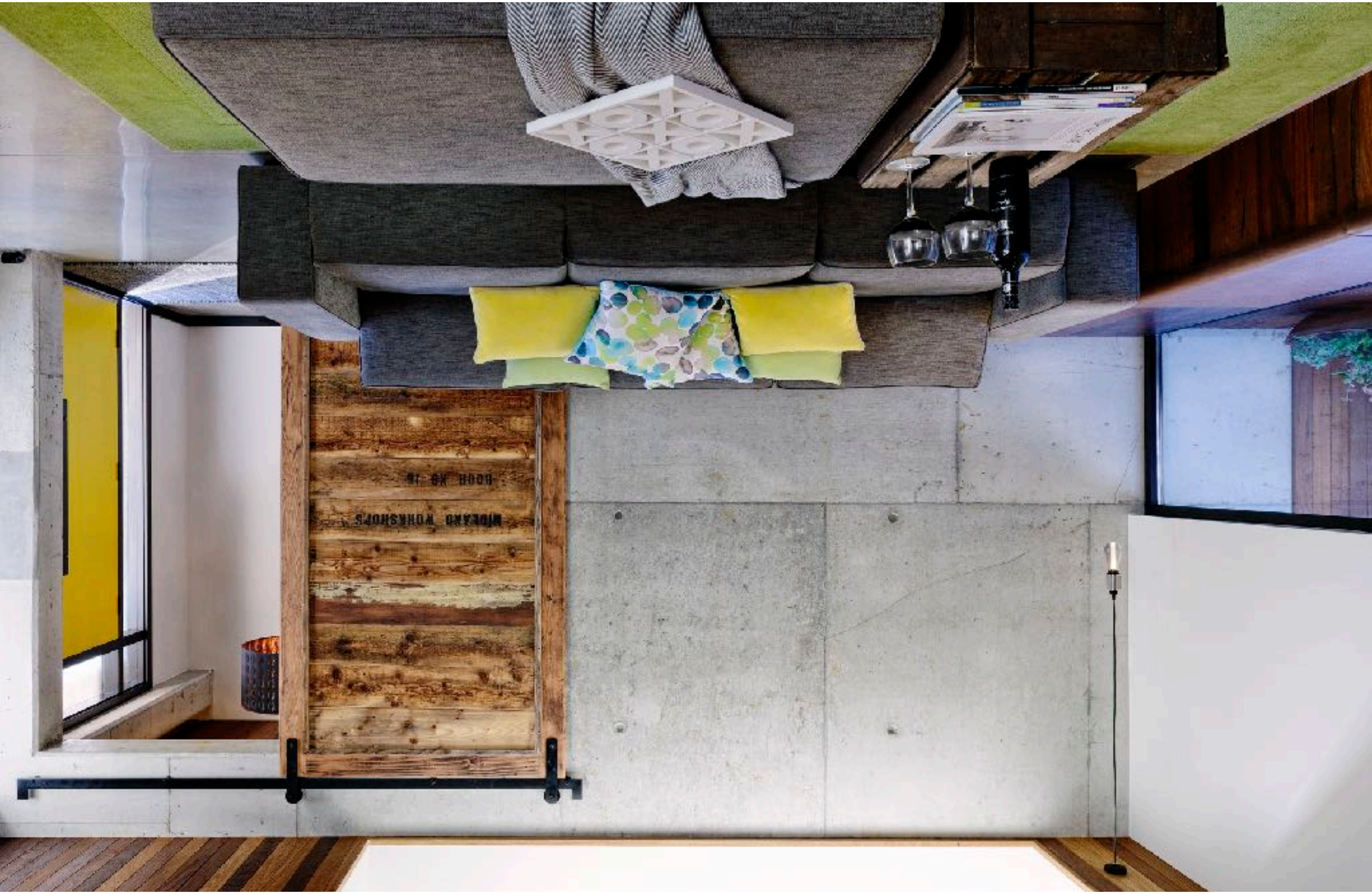
- Reflective insulation: examples include foils, sarking, double-cell and anti-condensation blankets - best for summer
- Doesn’t work if there is no air gap adjacent to the shiny side or if covered in dust

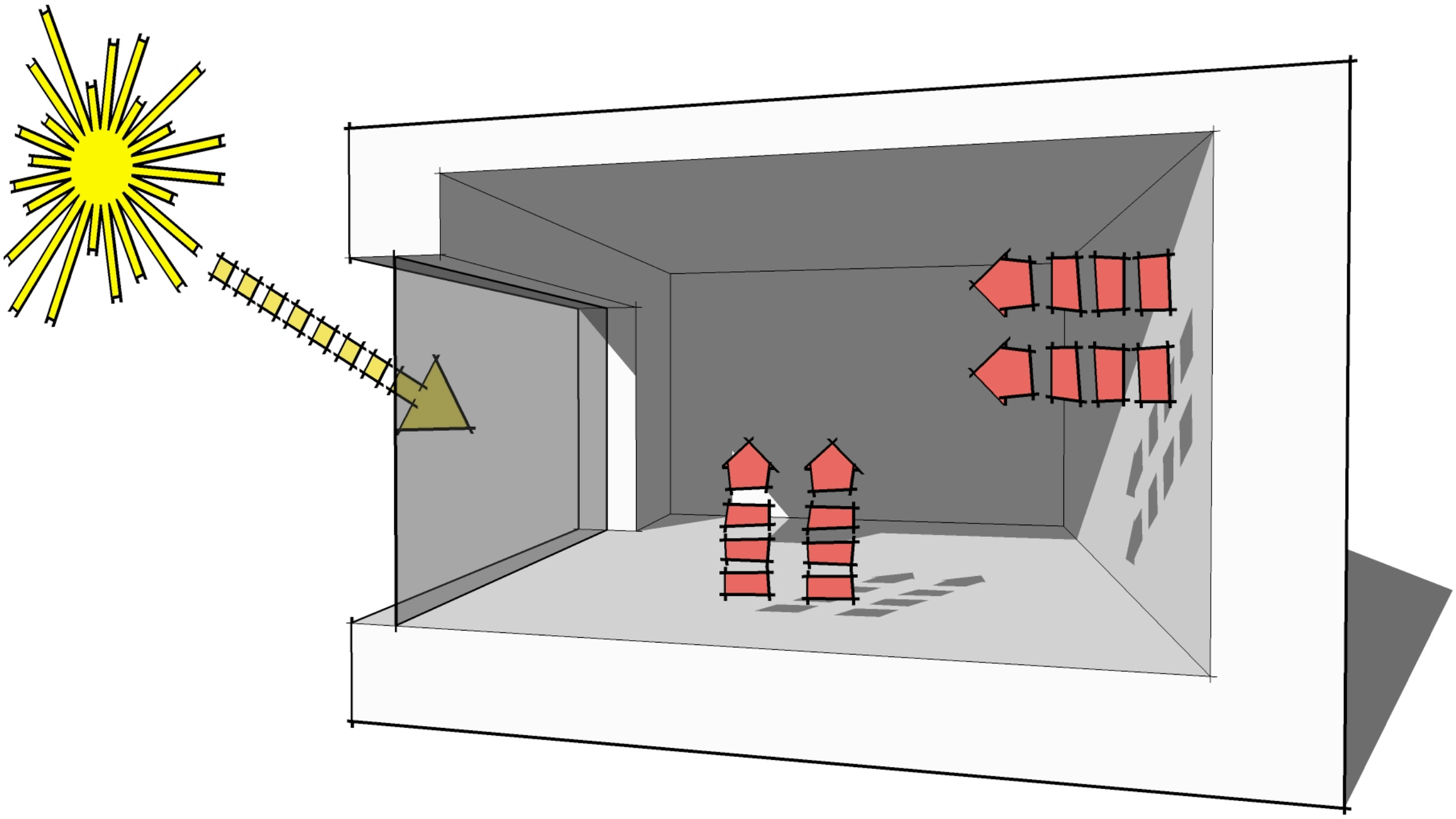
USEFUL THINGS TO KNOW ABOUT INSULATION

- Insulate walls, roofs, ceilings and exposed floors:

Suspended Floors	Walls	Roofs & Ceilings
1.0	**2.4 - 2.8**	**4.1 - 5.1**

- Higher insulation levels can be installed, but twice the thickness doesn't mean twice the performance (thermal resistivity diminishes exponentially with thickness)
- Insulation should meet the following Australian Standards:
  - *AS4859.1 Materials for the thermal insulation of buildings*
  - *AS 3999 Bulk thermal insulation – installation requirements*
- Extruded or expanded foam boards can provide high levels of insulation (but are made from petrochemicals and can be a fire risk if not installed appropriately)
- Reflective foils with cellular insulation backing perform best in summer, but may not provide the best performance in winter
- Consider bulk insulation made from natural products or that contain recycled content

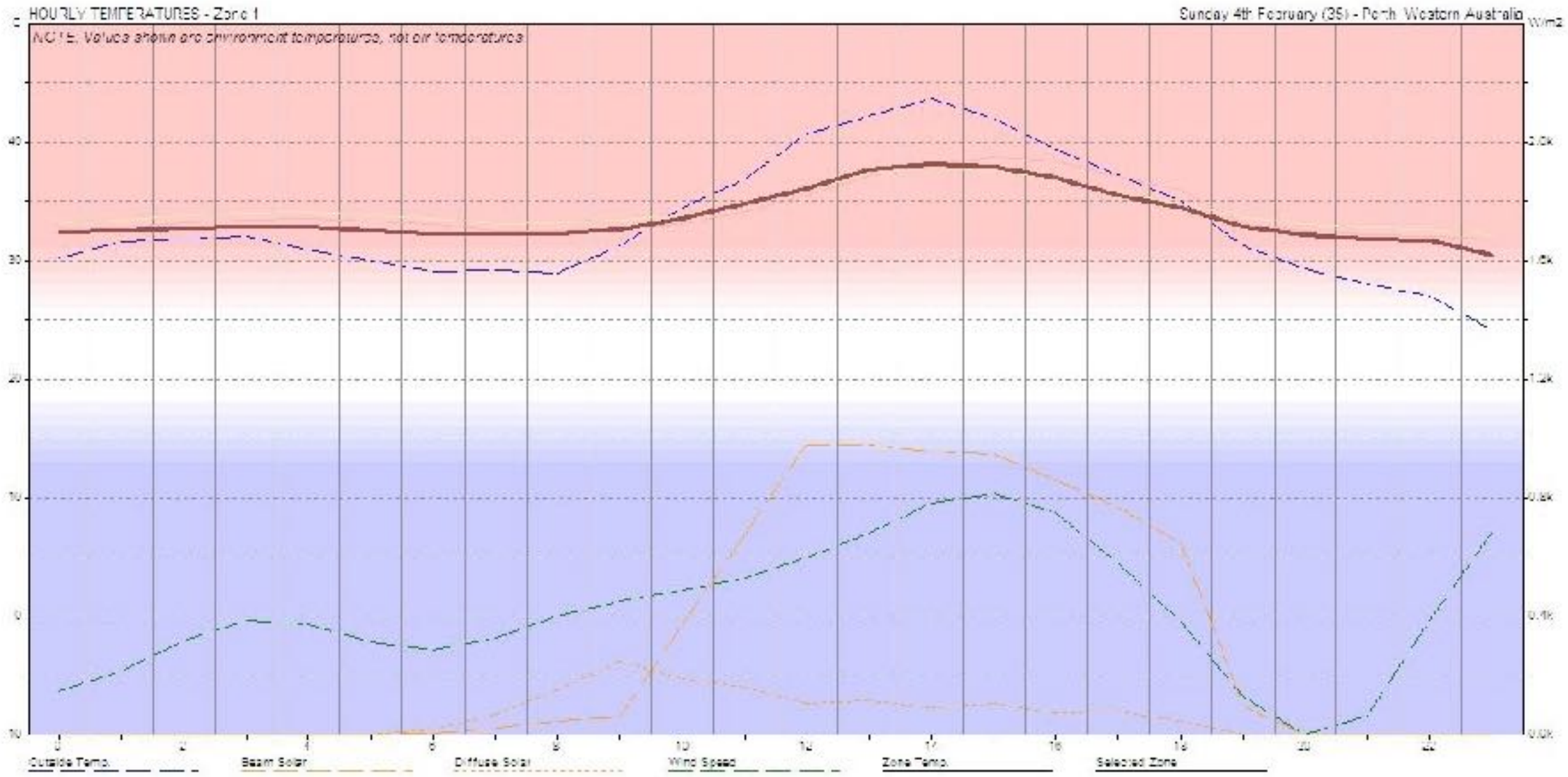

MIDLAND WORKSHOPS
ROOM NO 18



THERMAL MASS

regulate internal temperatures

HOW THERMAL MASS WORKS



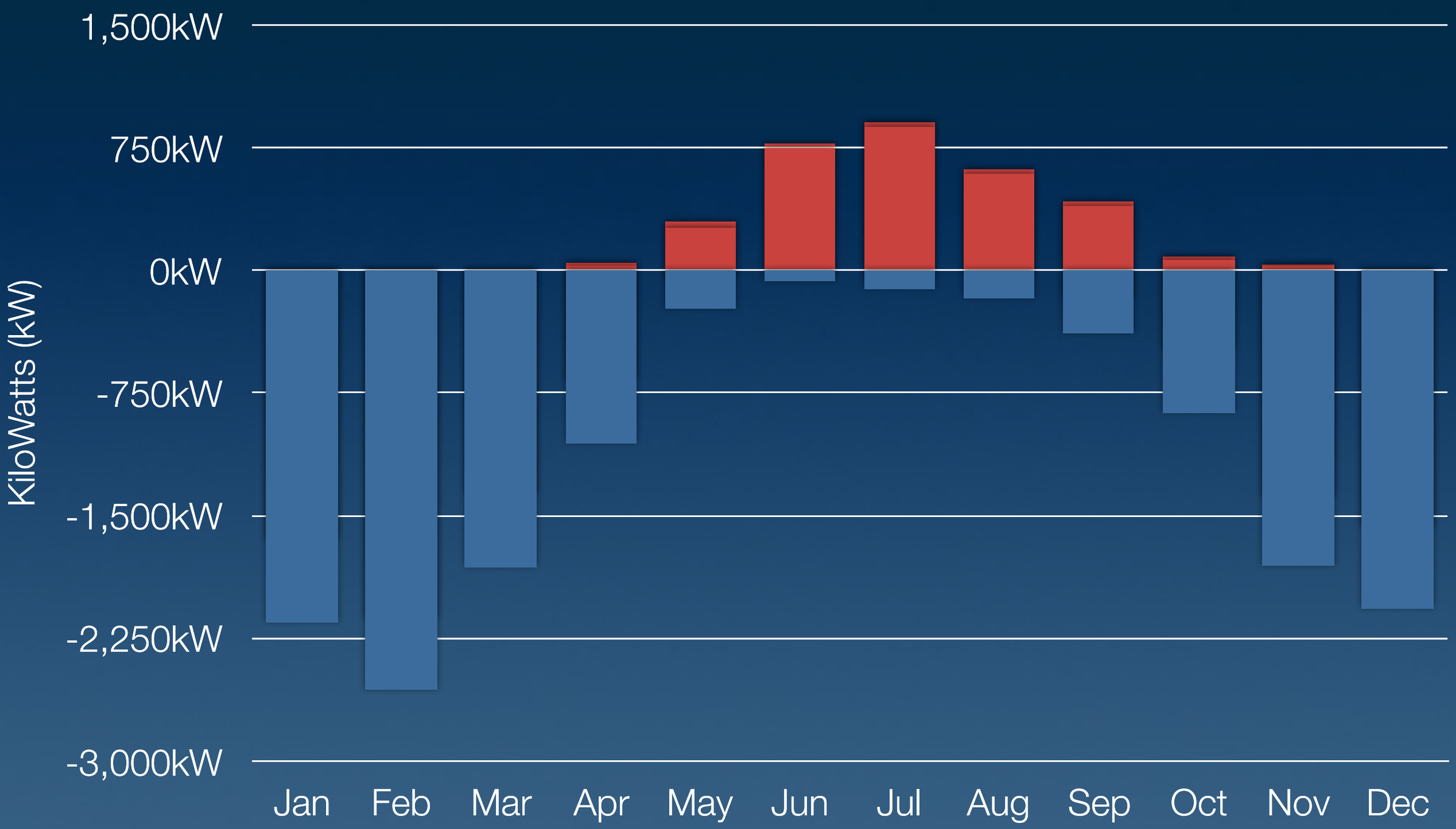
COLOUR CONSIDERATIONS

- Colour determines how much solar radiation a surface will absorb
- Solar absorptance determines how much solar energy is then re-radiated
- The lower the solar absorptance and emissivity the better the thermal performance
- Heat reflective paints and coatings can also help, but only if they are dirt- and dust-free

Colour	Solar Absorptance
Classic Cream™	0.31
Surfmist®	0.318
Paperbark®	0.421
Evening Haze®	0.427
Shale Grey™	0.433
Sandbank®	0.455
Dune®	0.466
Windspray®	0.584
Pale Eucalypt®	0.597
Bushland®	0.619
Headland®	0.632
Wilderness®	0.651
Jasper®	0.682
Manor Red®	0.688
Woodland Grey®	0.706
Loft®	0.711
Monument®	0.732
Ironstone®	0.743
Cottage Green®	0.746
Deep Ocean®	0.749

image source: www.colorbondcolours.com

WHAT ABOUT COLOUR?



SUMMARY OF BUILDING MATERIALS

When selecting building materials for your home:

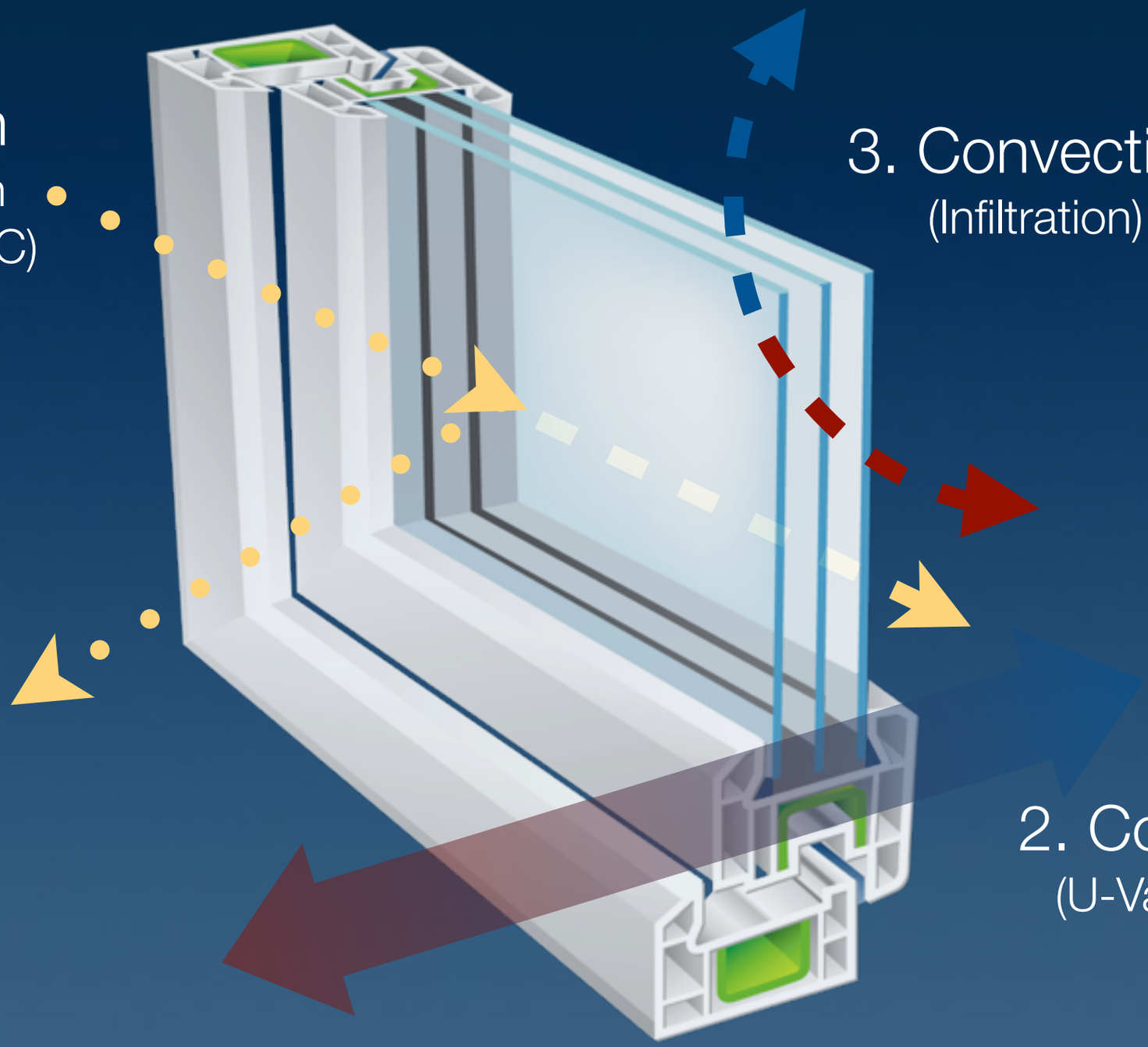
- ➔ Use a combination of bulk and reflective insulation types to suit both summer and winter conditions
- ➔ Incorporate thermal mass in floors with non-insulating floor coverings eg. polished concrete or ceramic tiles
- ➔ Consider reverse brick veneer or insulated cavity brick construction for walls to optimise thermal mass
- ➔ Select light coloured materials for external finishes; also consider heat reflective paint finishes for roofs
- ➔ **Beware of any builder who claims they can build a cavity brick home without installing cavity insulation!**

3. Select the best windows for summer and winter.

BEST WINDOWS FOR SUMMER AND WINTER

Windows gain and lose heat in three ways:

1. Radiation
Solar Heat Gain Coefficient (SHGC)

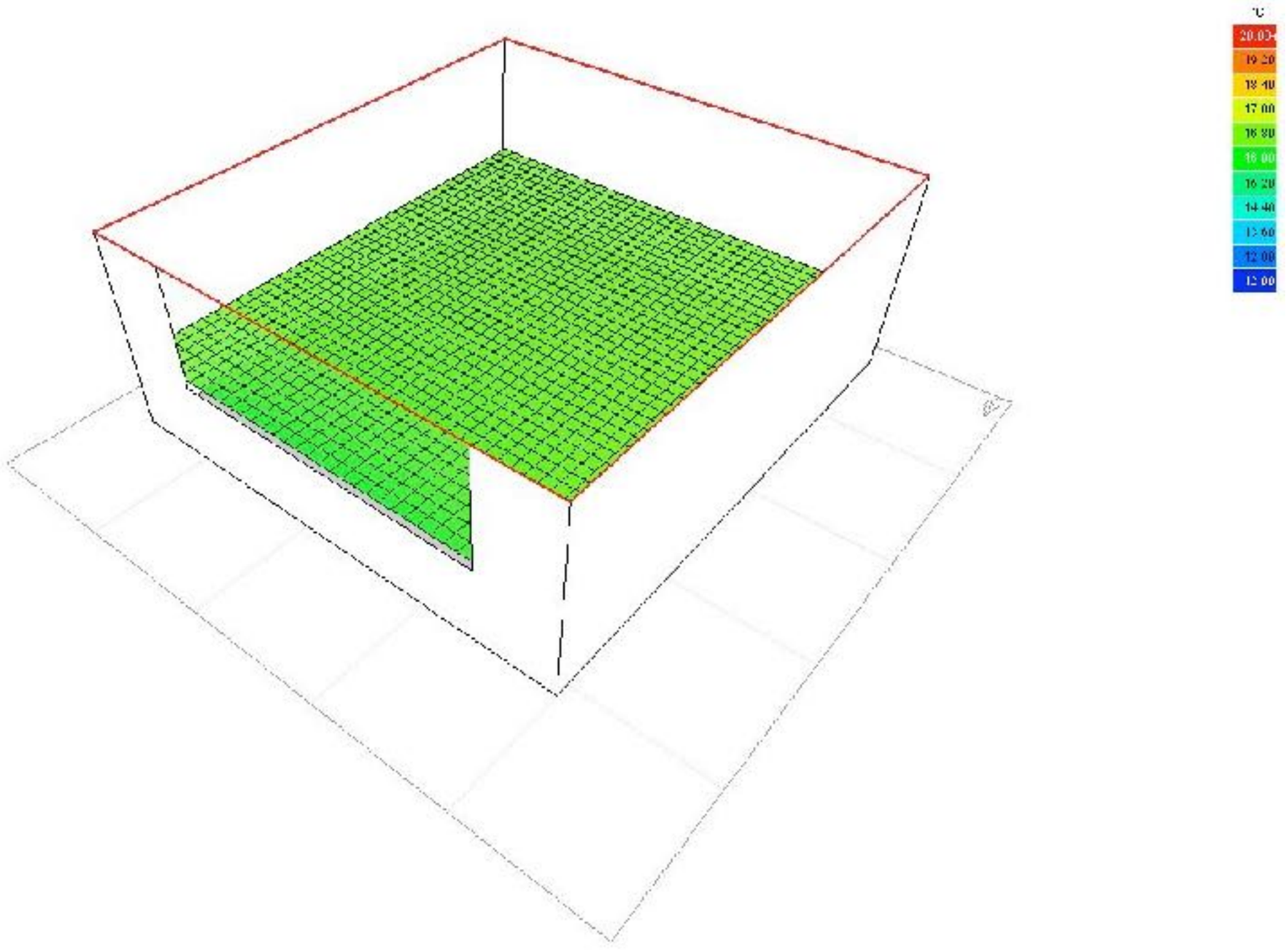


3. Convection
(Infiltration)

2. Conduction
(U-Value = 1/R)

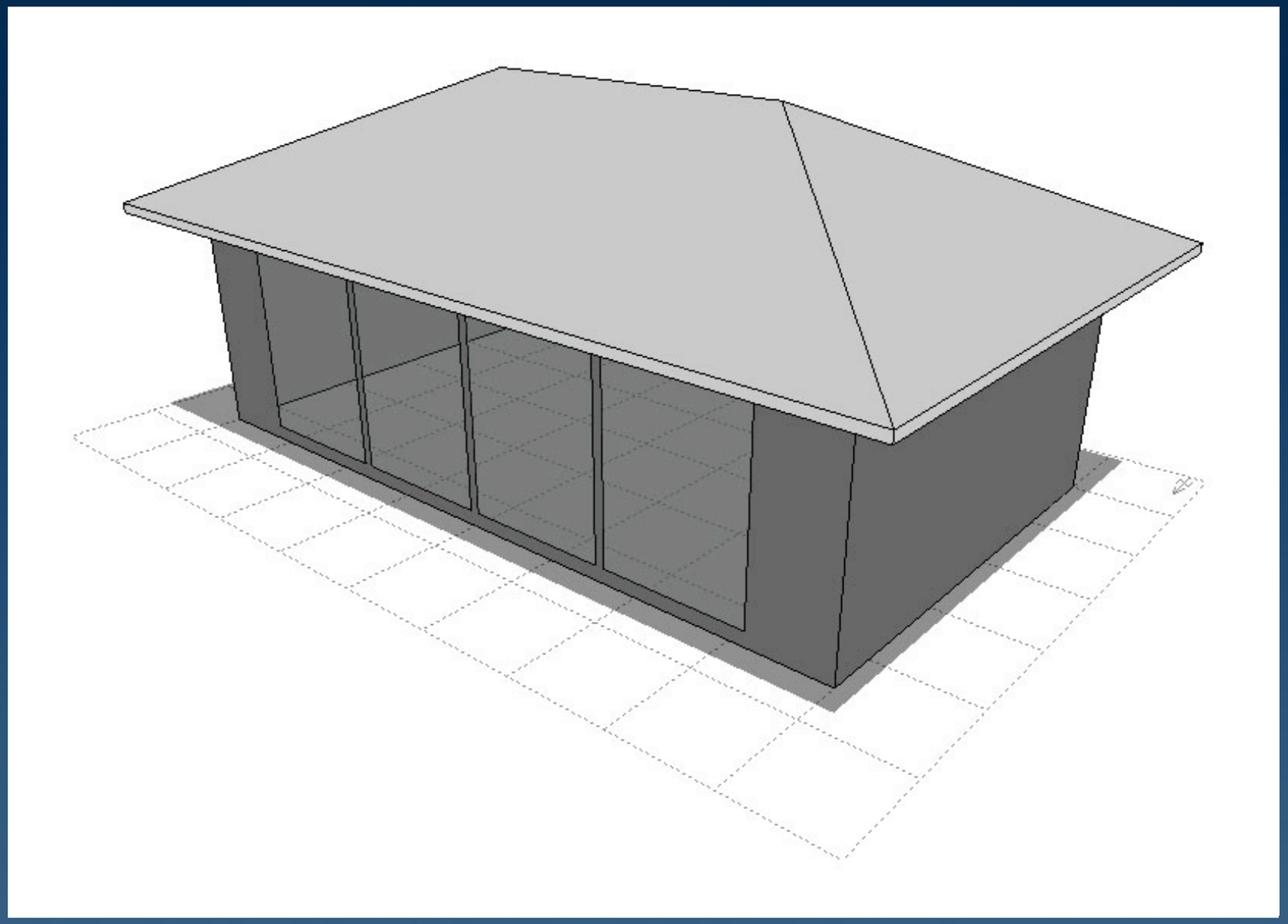
More info: The CSIRO Home Energy Saving Handbook - Chapter 6 page 125-127.

HOW WINDOWS MAKE A DIFFERENCE



4. Shade the building in summer;
allow sun to enter during winter.

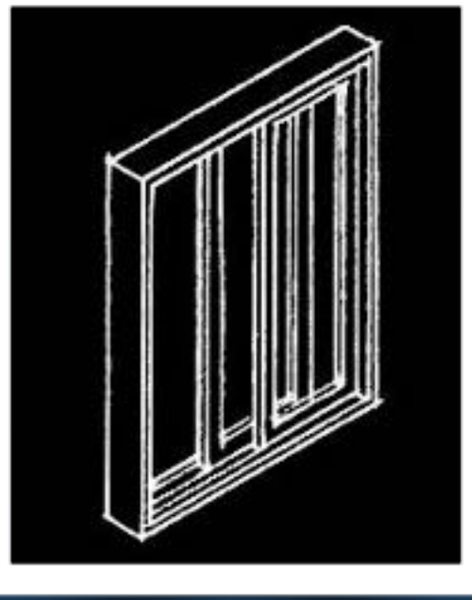
THE IMPORTANCE OF EAVES



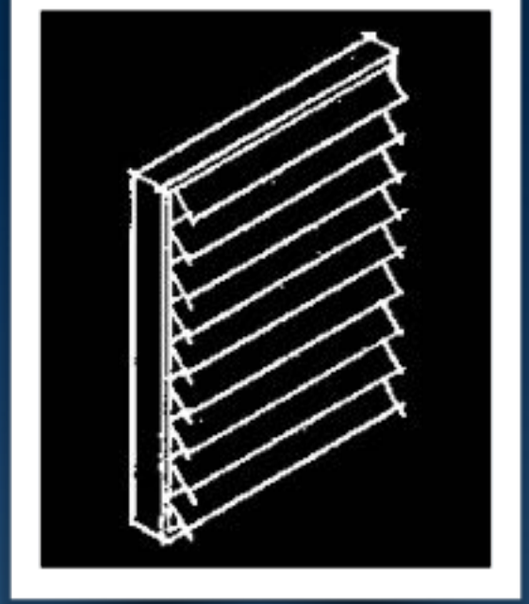
OTHER SHADING STRATEGIES

5. Encourage air movement and ventilation when it’s hot.

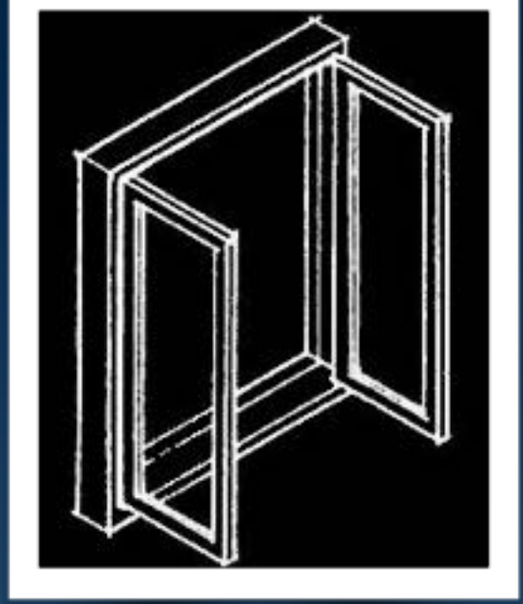
ALLOW VENTILATION WHEN IT'S HOT



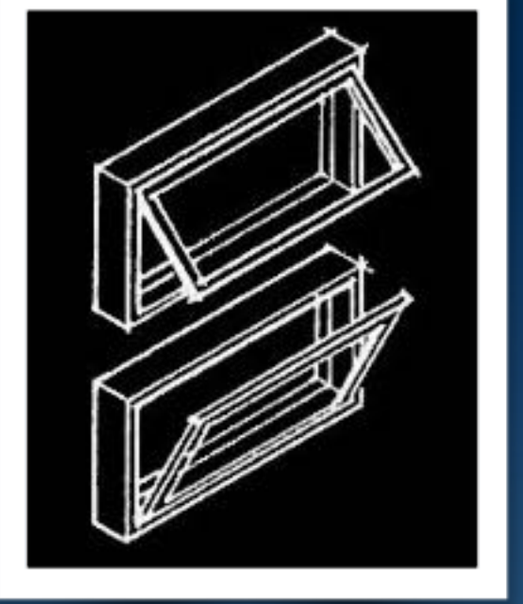
Sliding 33-45%



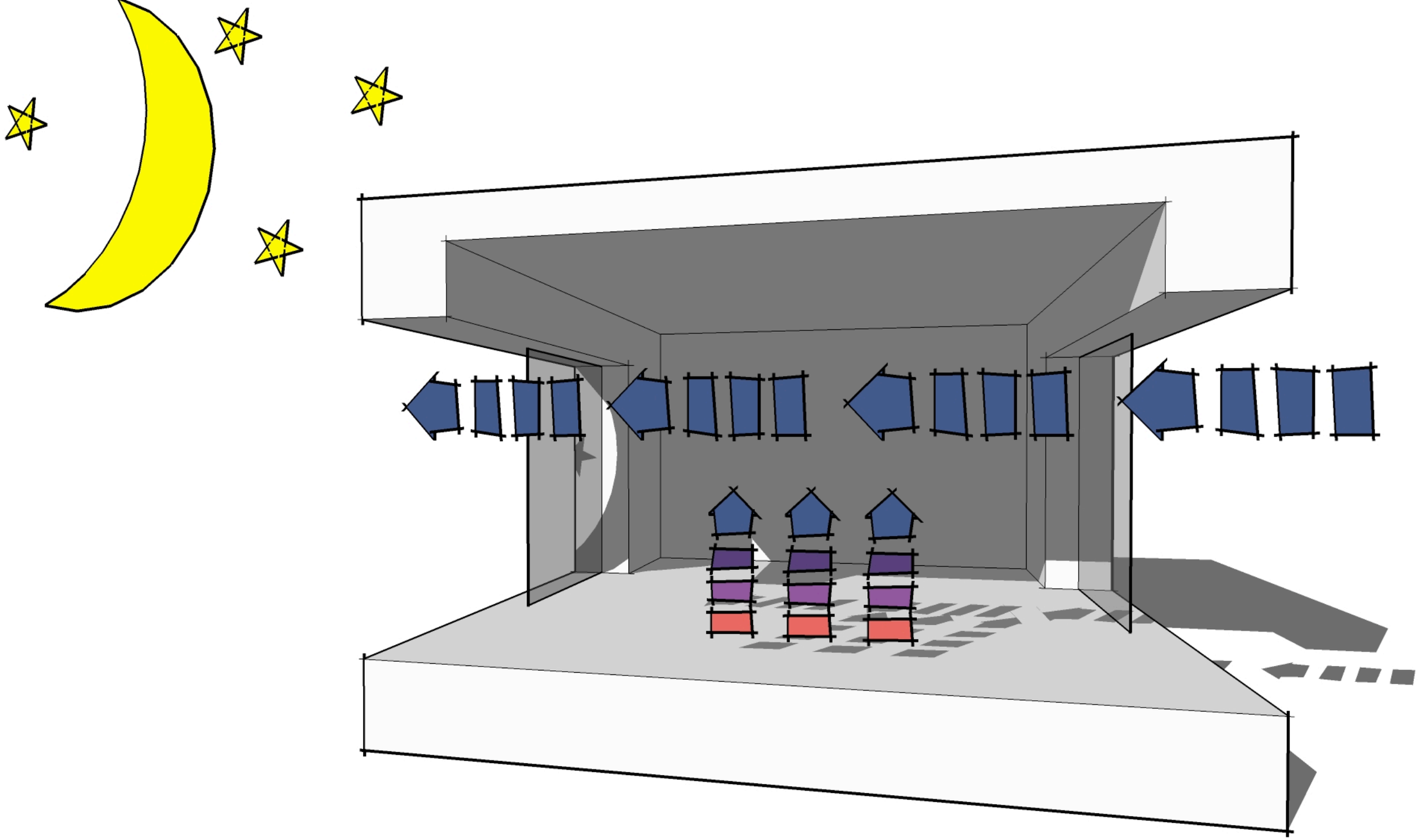
Louvre 90%



Casement 90%



Awning 15%



NIGHT PURGE VENTILATION

of thermal mass

6. Consider energy and water efficient technologies.

EDGE

123 Main St.

Inside 68°

Outside 79°

Friday, May 24

5:20PM

TODAY

Estimated Savings:

$24.15

or **40%** of your projected monthly energy cost

$0.10

$1.10

-0.05

$0.90

1 A/C and Heat

2 Lights

3 Appliances

4 Miscellaneous

EDGE TIP: Your efficient neighbors are using 15% less energy than you.

Scenes **Performance** **Dashboard** **System Map**

THE SIX ECO-EFFECTIVE DESIGN PRINCIPLES

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ALMOST DONE!

SOME USEFUL FREE RESOURCES

- Your Home Technical Manual:

  http://www.yourhome.gov.au

- Alternative Technology Association Sunulator:

  http://www.ata.org.au/ata-research/sunulator

- Alternative Technology Association Tankulator:

  http://tankulator.ata.org.au/

- National House Energy Rating Scheme (NATHERS):

  http://www.nathers.gov.au

- Window Energy Rating Scheme (WERS):

  http://www.wers.net

- Insulation Council of Australia & New Zealand (ICANZ):

  http://icanz.org.au/technical-resource-drawings/

- Energy efficiency and maintaining the building envelope:

  https://www.youtube.com/watch?v=cBb0sWS8_Mo

ANY QUESTIONS?

THANK YOU