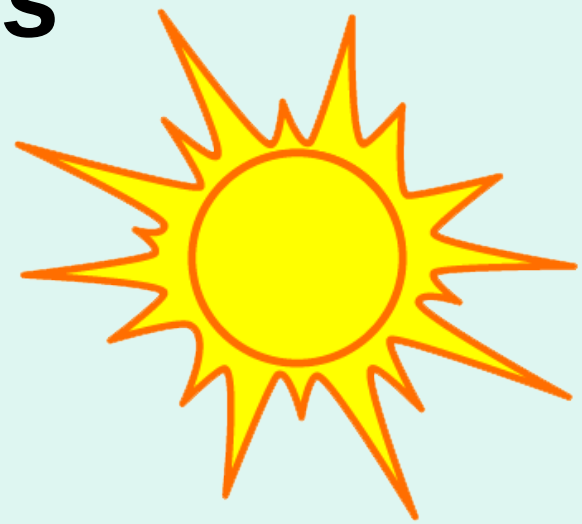
DESIGNING SOLAR HOMES
Summer Institute 2017

Solar Design Principles

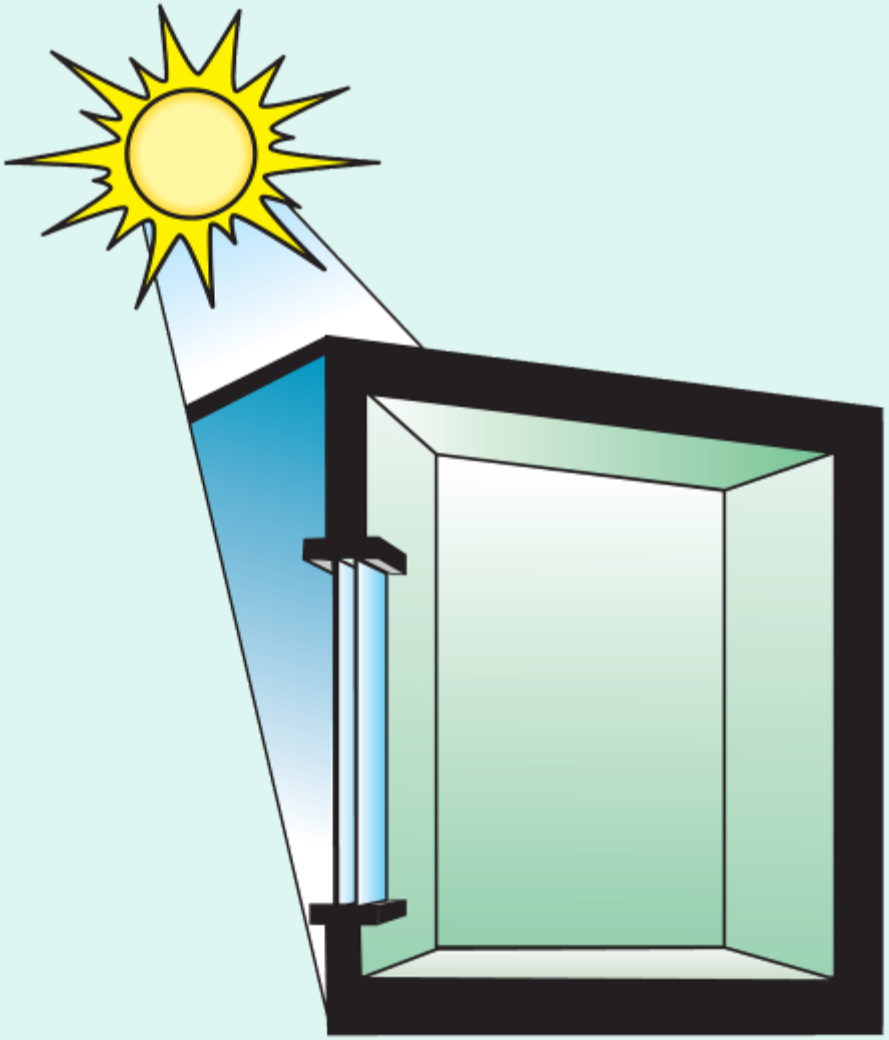
Solar Design Principles



1.

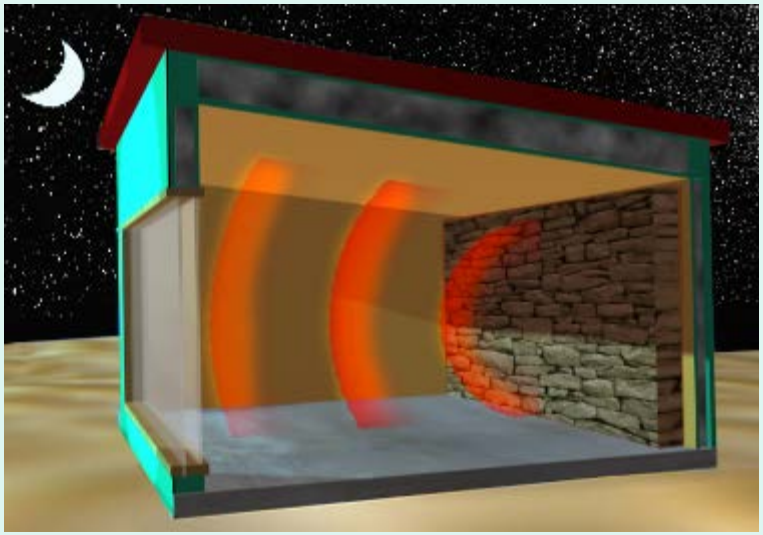
Use sunlight for warmth.

Solar Design Principles



2.
Use shade to stay cool.

Solar Design Principles



3.

Use thermal mass to store warmth &“coolth.”

Solar Design Principles

4.

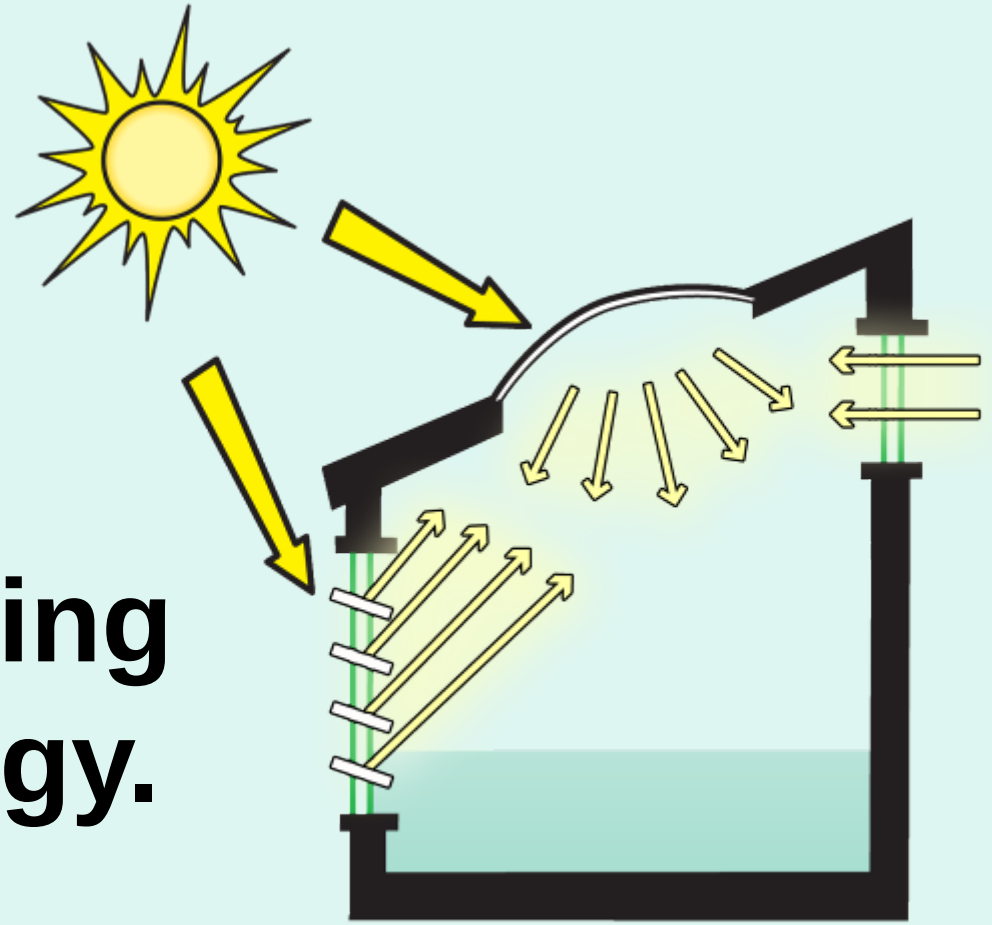
Use insulation to keep heat in or out.

Solar Design Principles

5.

Use air to move heat & coolness.

Solar Design Principles



6.

Use daylighting to save energy.

Solar Design Principles

1. **Use sunlight for warmth.**

1. **Use shade to stay cool.**

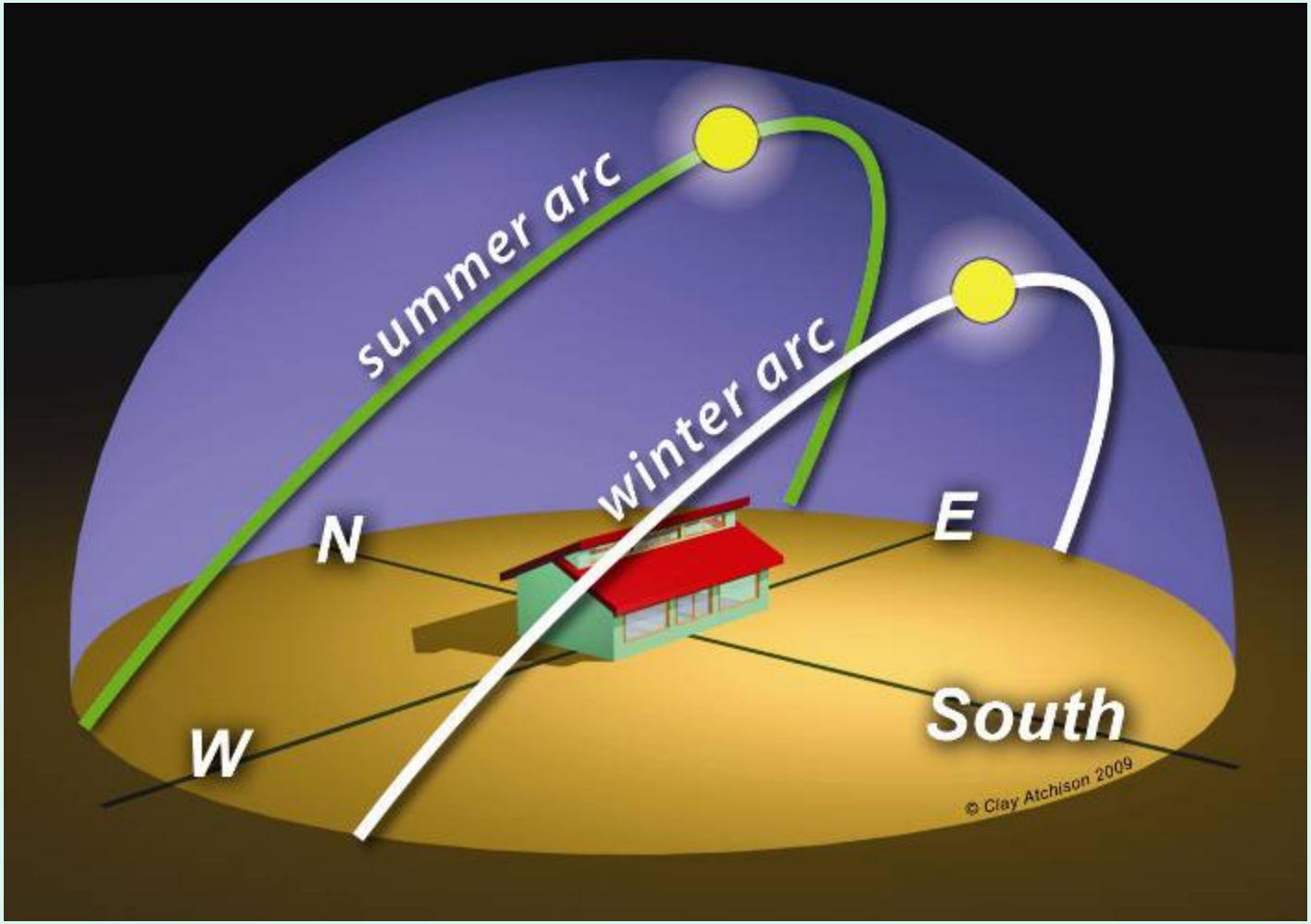
2. **Use thermal mass to store warmth &“coolth.”**

3. **Use insulation to keep heat in or out.**

4. **Use air to move heat & coolness.**

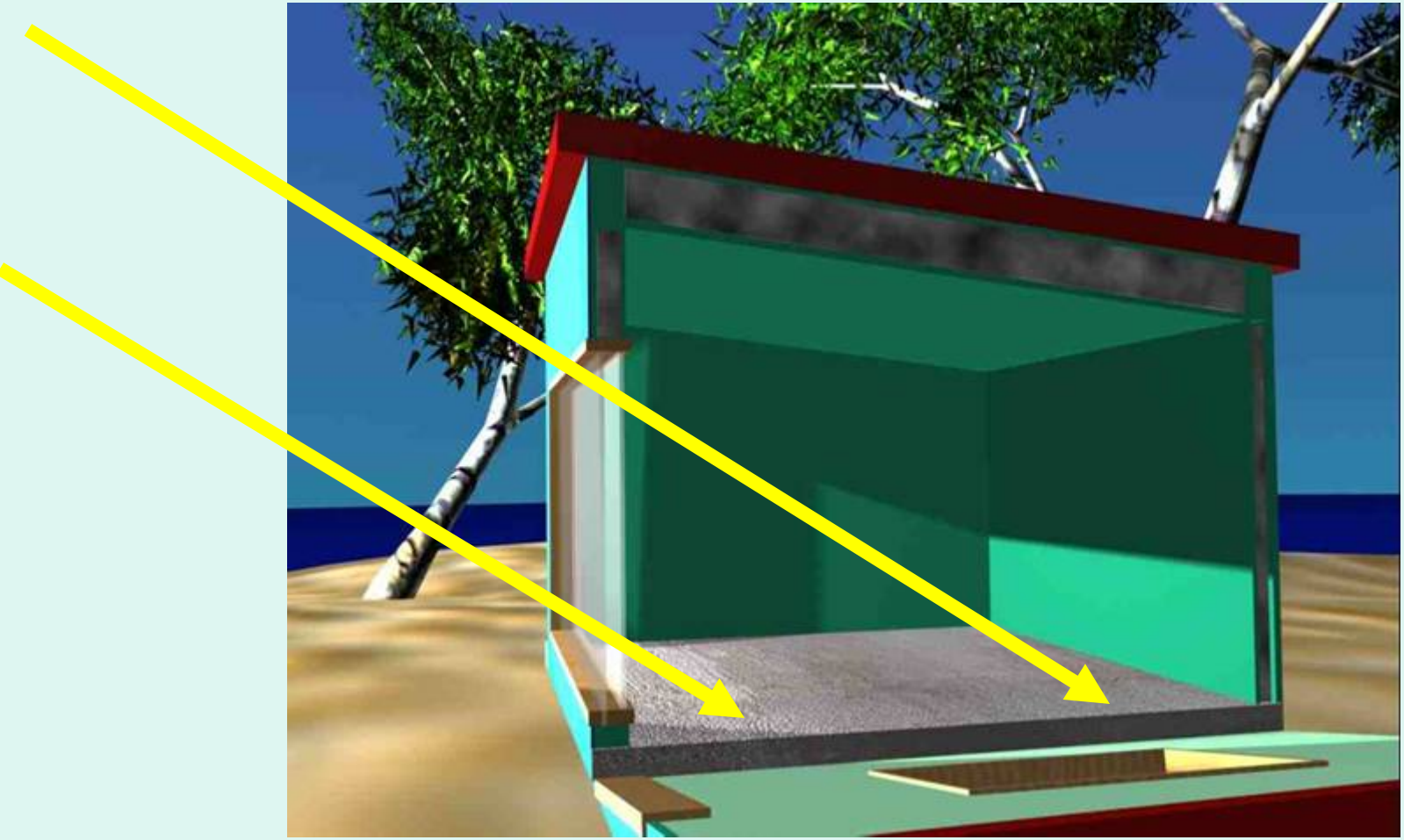
5. **Use daylighting to save energy**

#1: Use Sunlight: Orientation



Direct Gain:

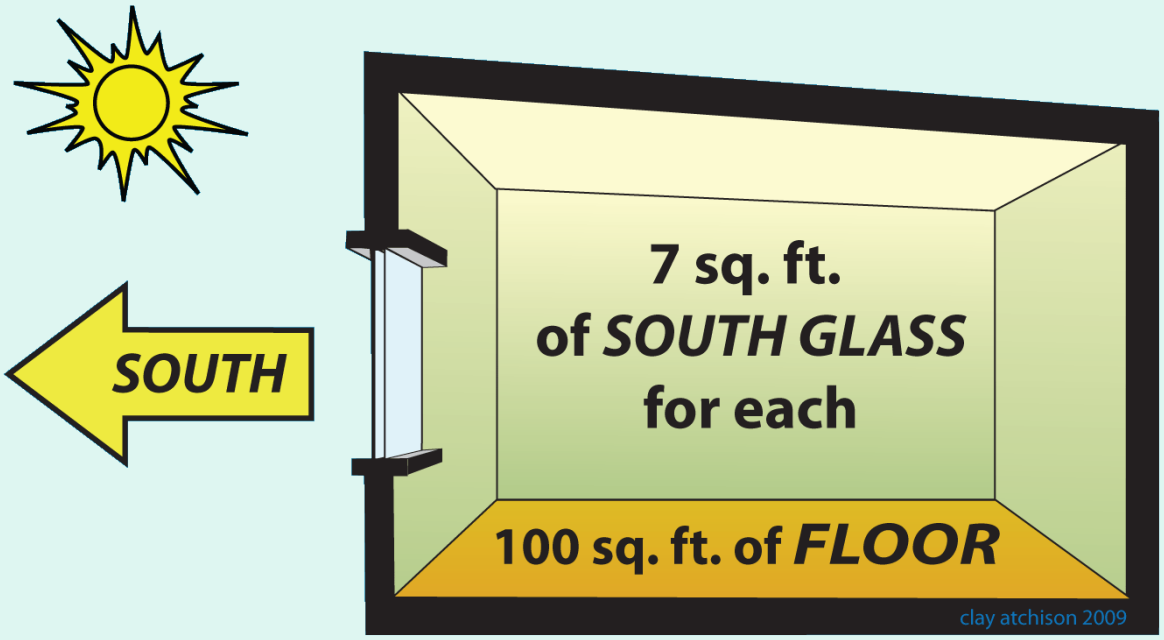
Glass: the magic solar heating technology



Window to Floor Ratios

(Suggested for SF Bay Area)

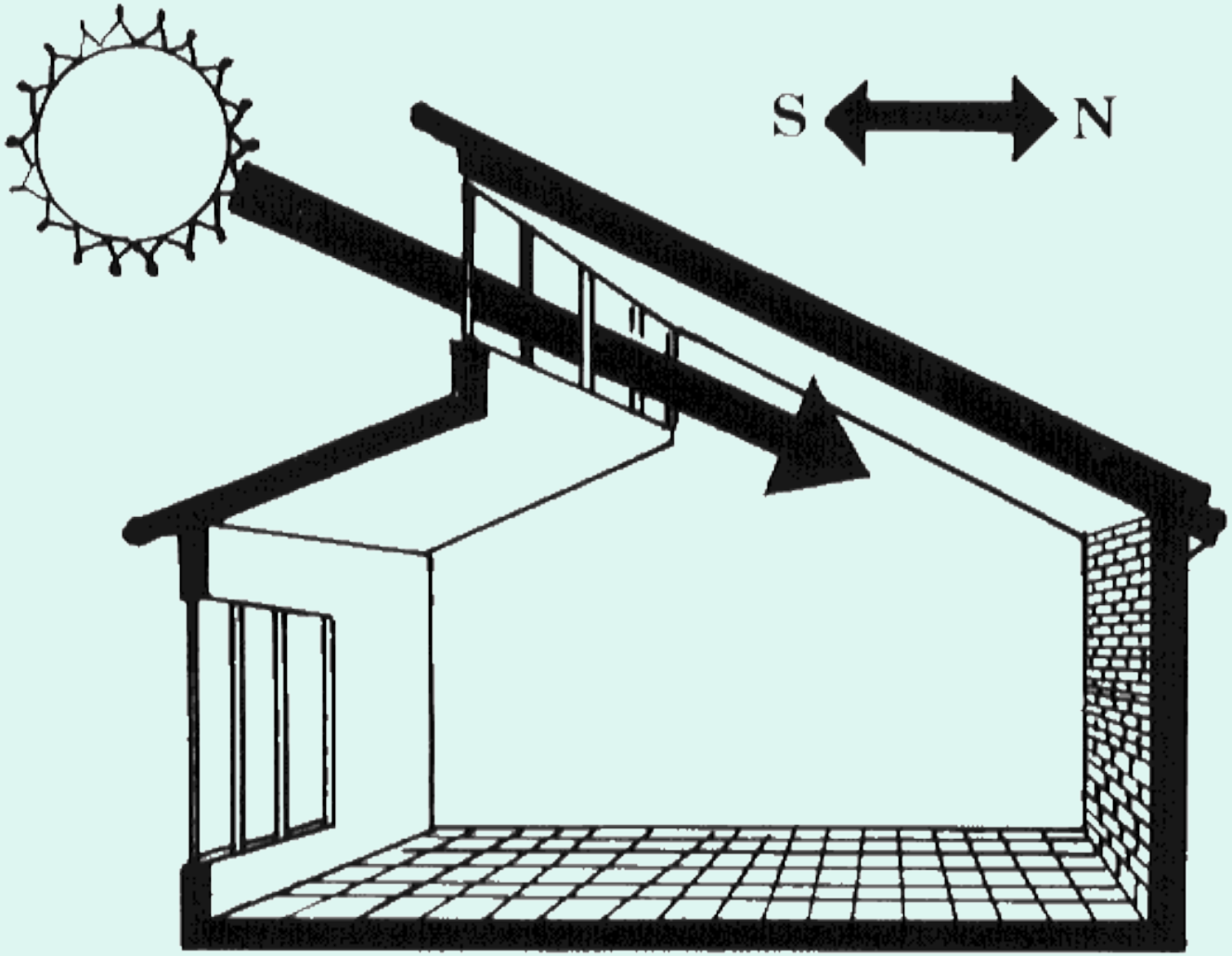
7:100 (without Thermal Mass)



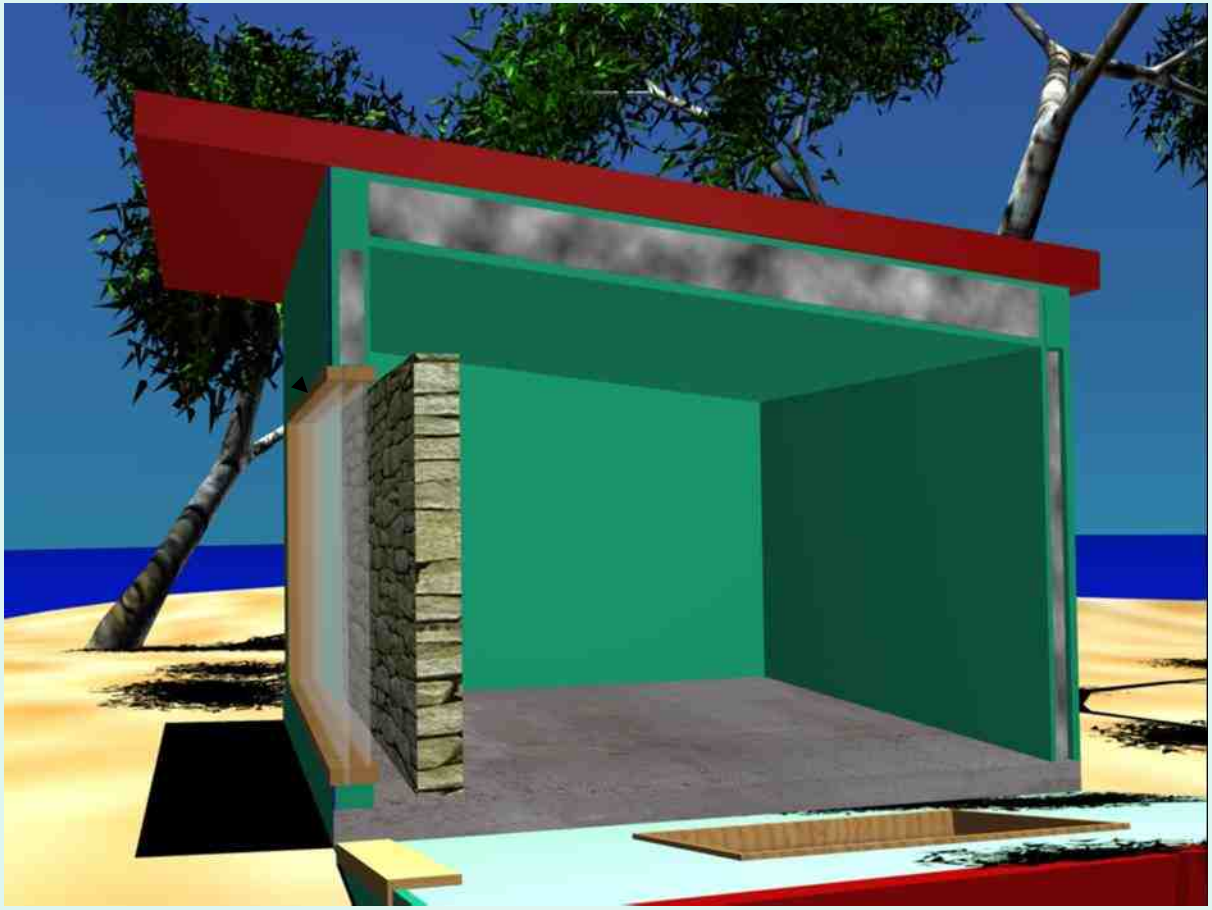
12:100 With Thermal Mass

South Facing Windows

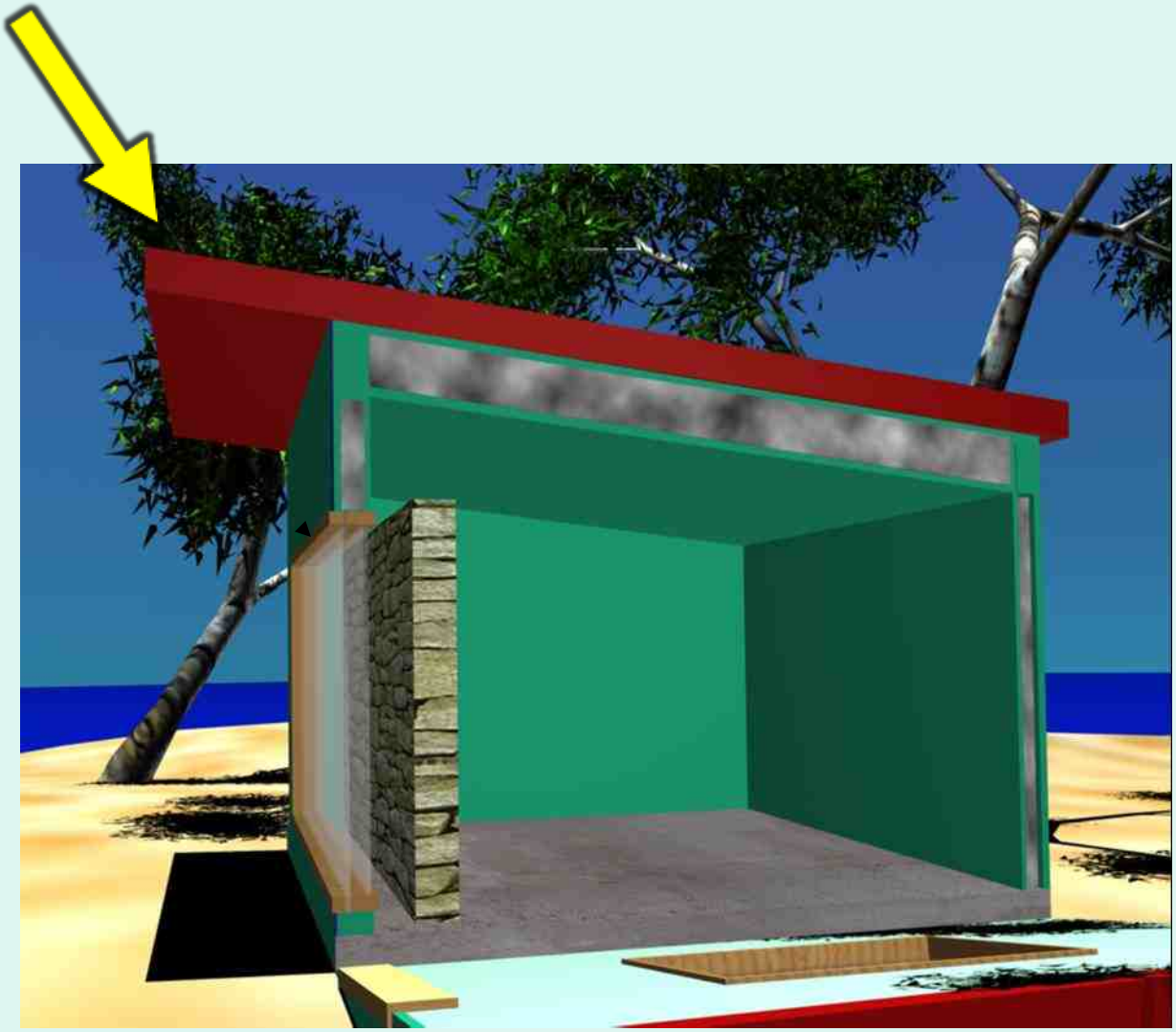
Clerestory Windows



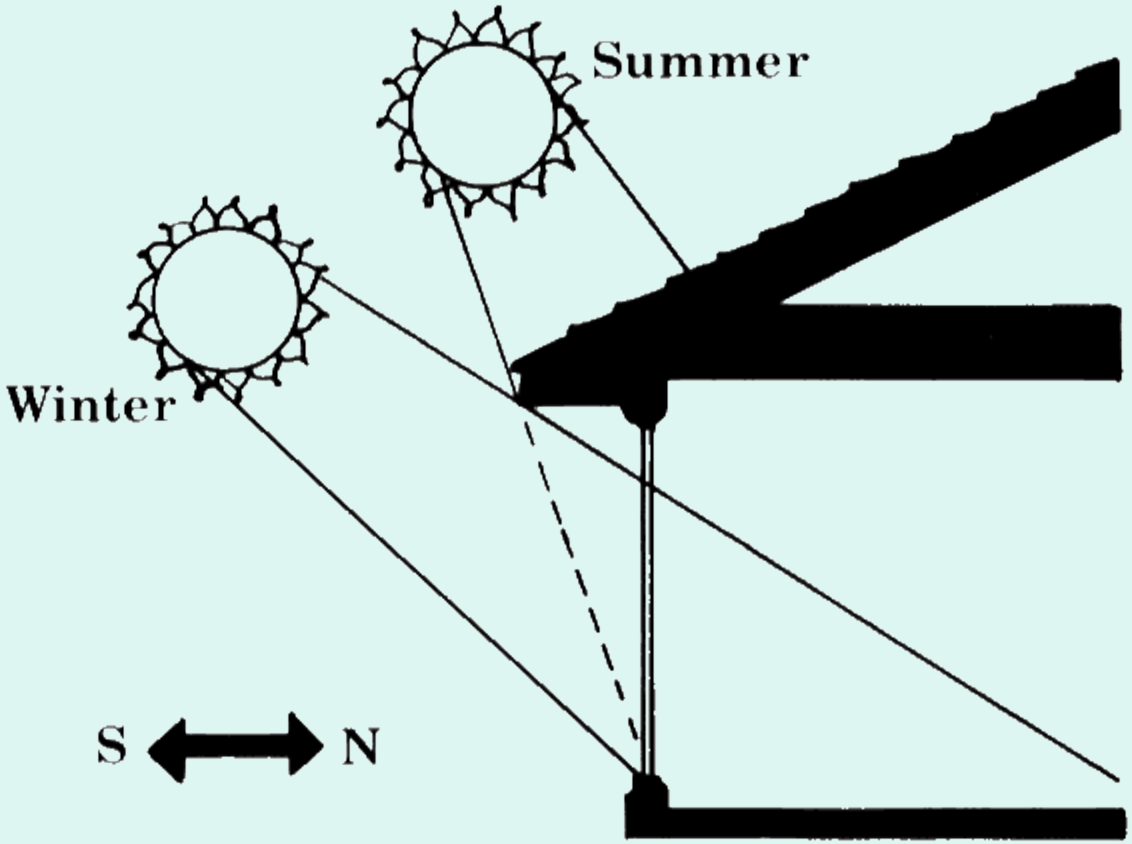
#2. Use shade to stay cool



Overhang shades windows



Block summer sun
Let winter sun in



Sun Angle Key: Vertical Glass

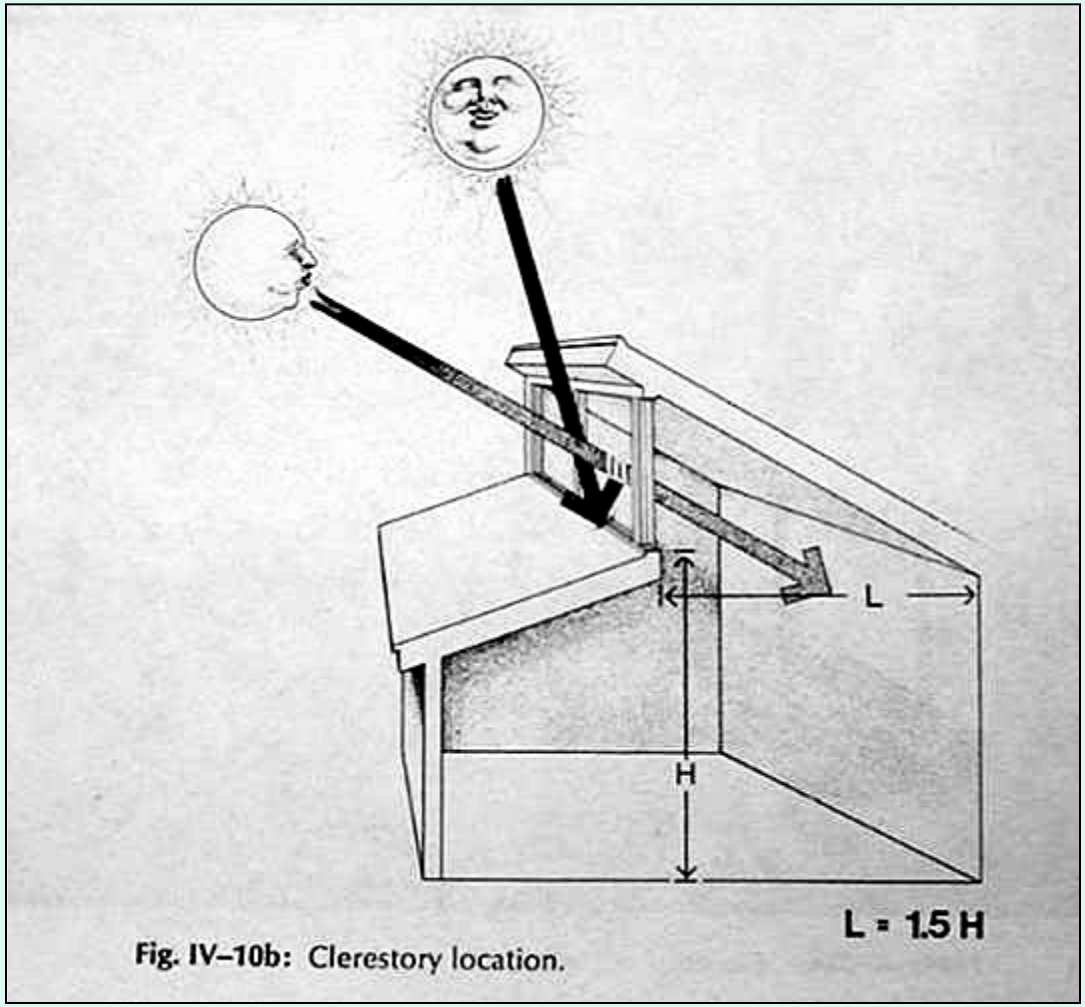
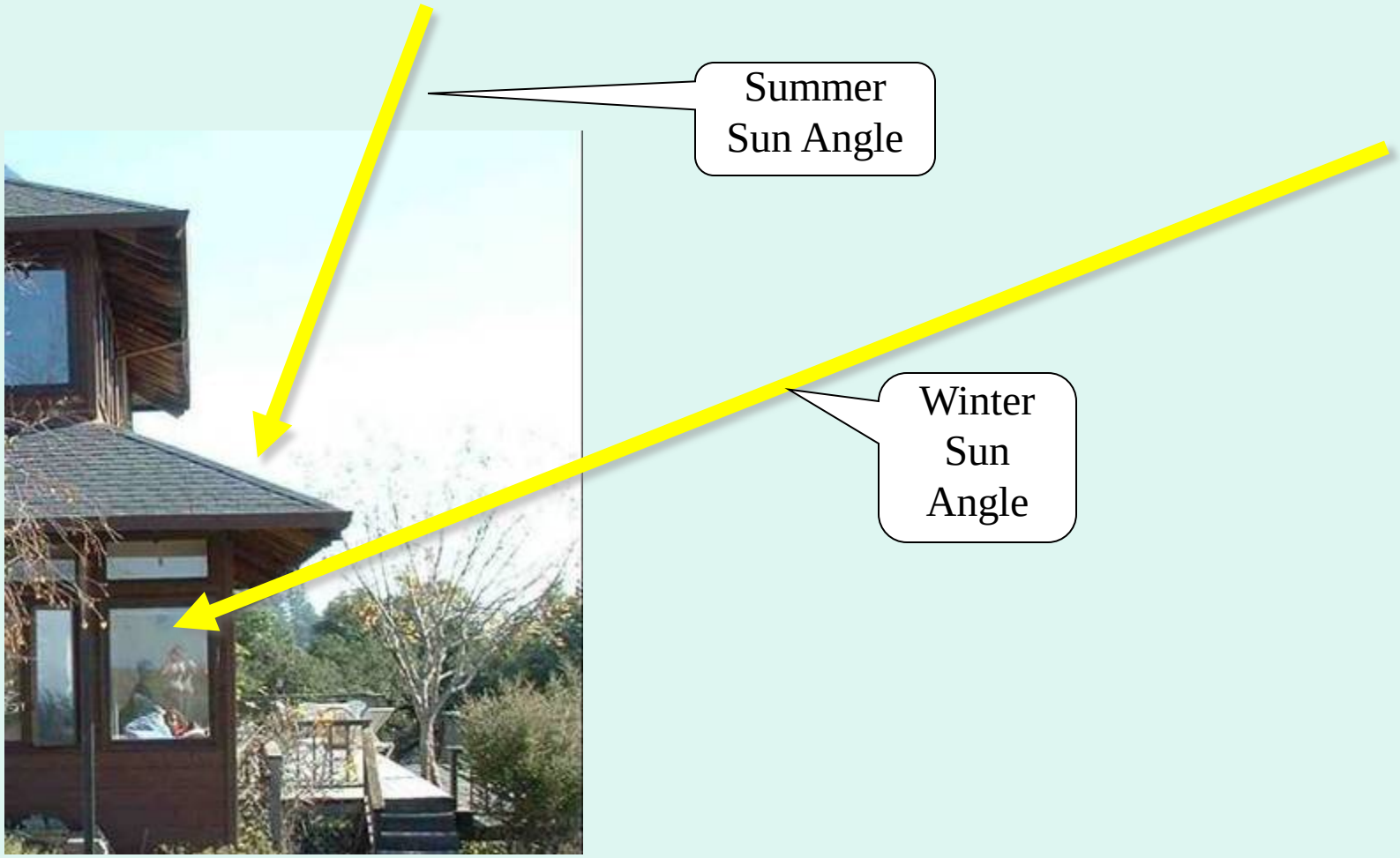


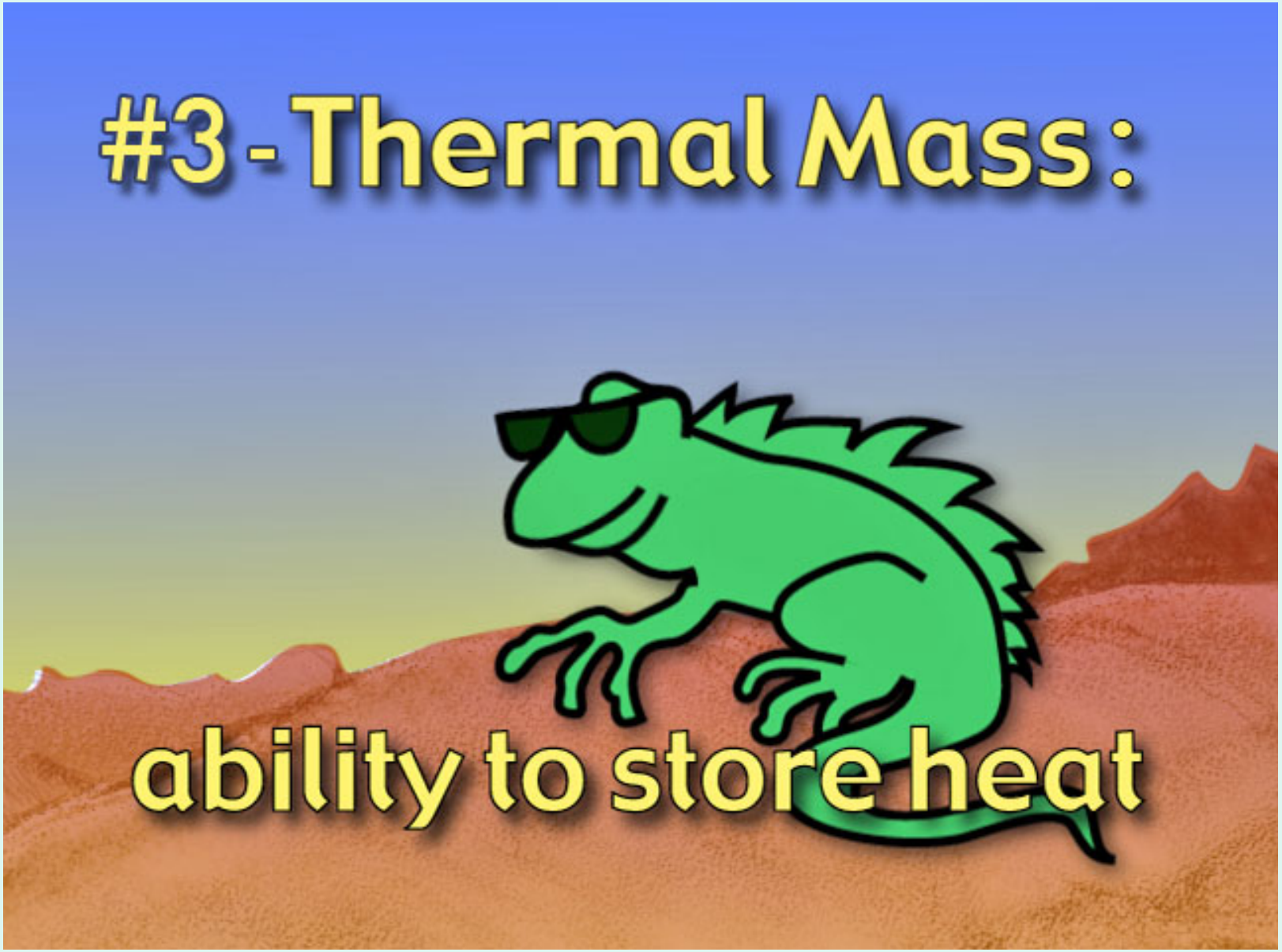
Fig. IV–10b: Clerestory location.

Eaves Keep Summer Sun Out
Let Winter Sun In



Porches, shade zones, strategically planted trees


Angled Slats in
Shade Structure


#3 - Thermal Mass:
ability to store heat

#3: Use Thermal Mass to store warmth & coolth

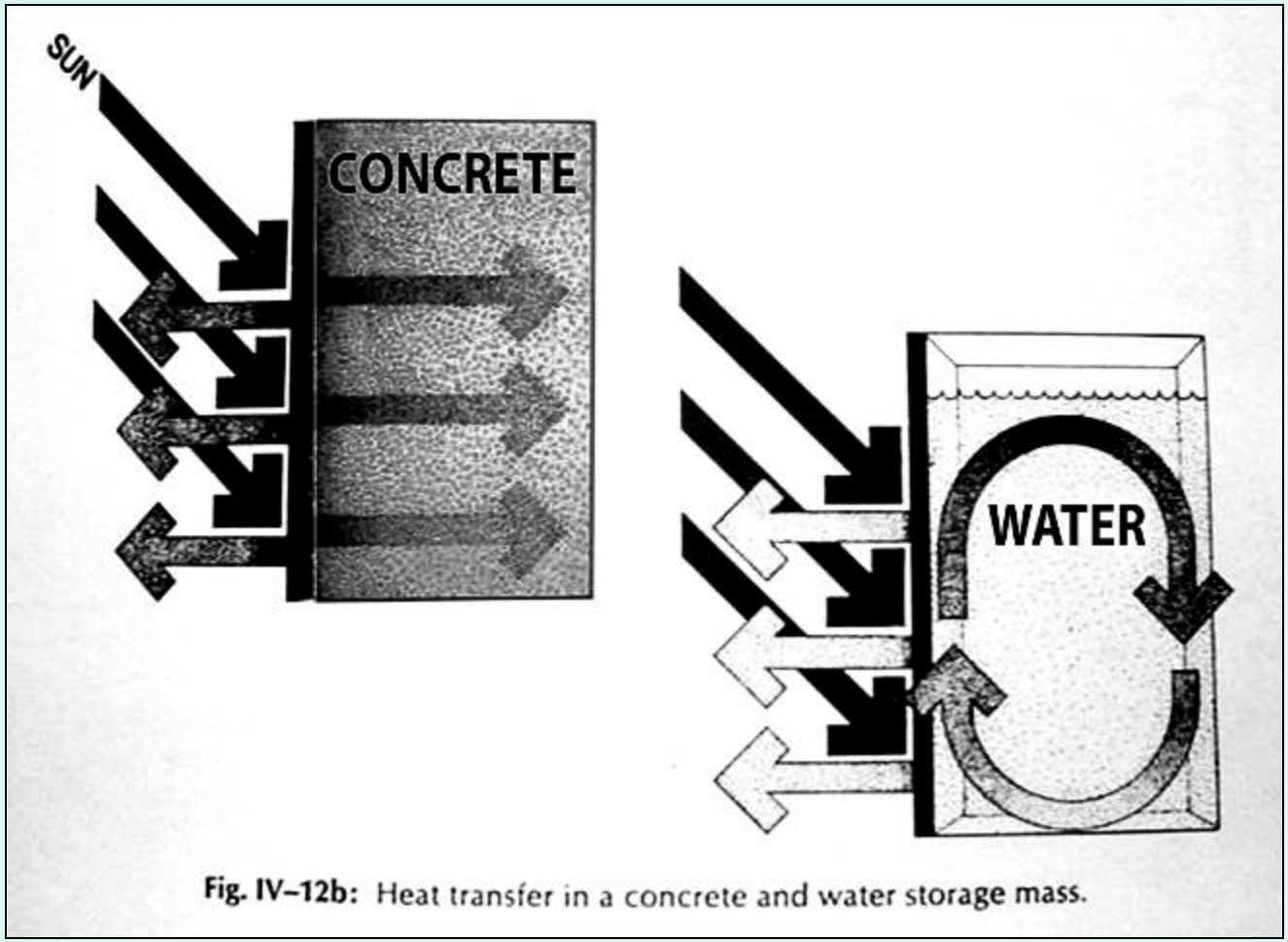
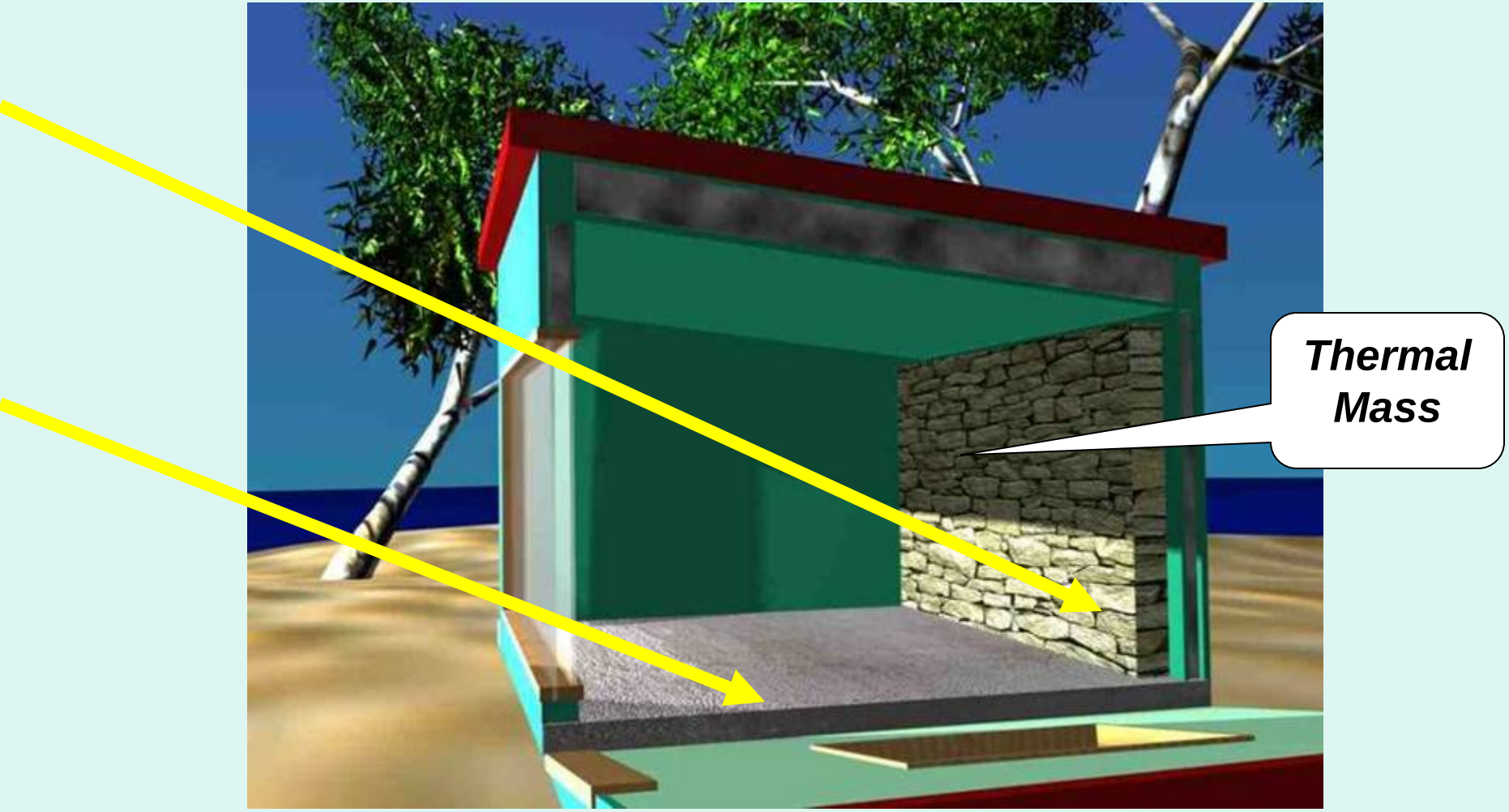


Fig. IV–12b: Heat transfer in a concrete and water storage mass.

Direct Gain with Thermal Mass

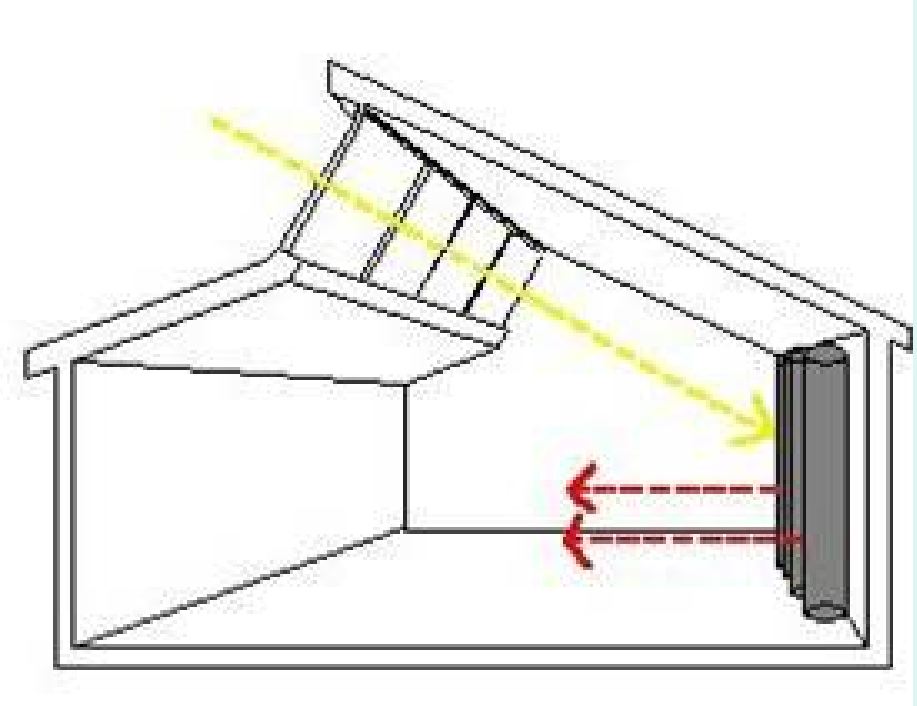
12:100 South Glass to Floor Area (Berkeley)



Thick Plaster Wall

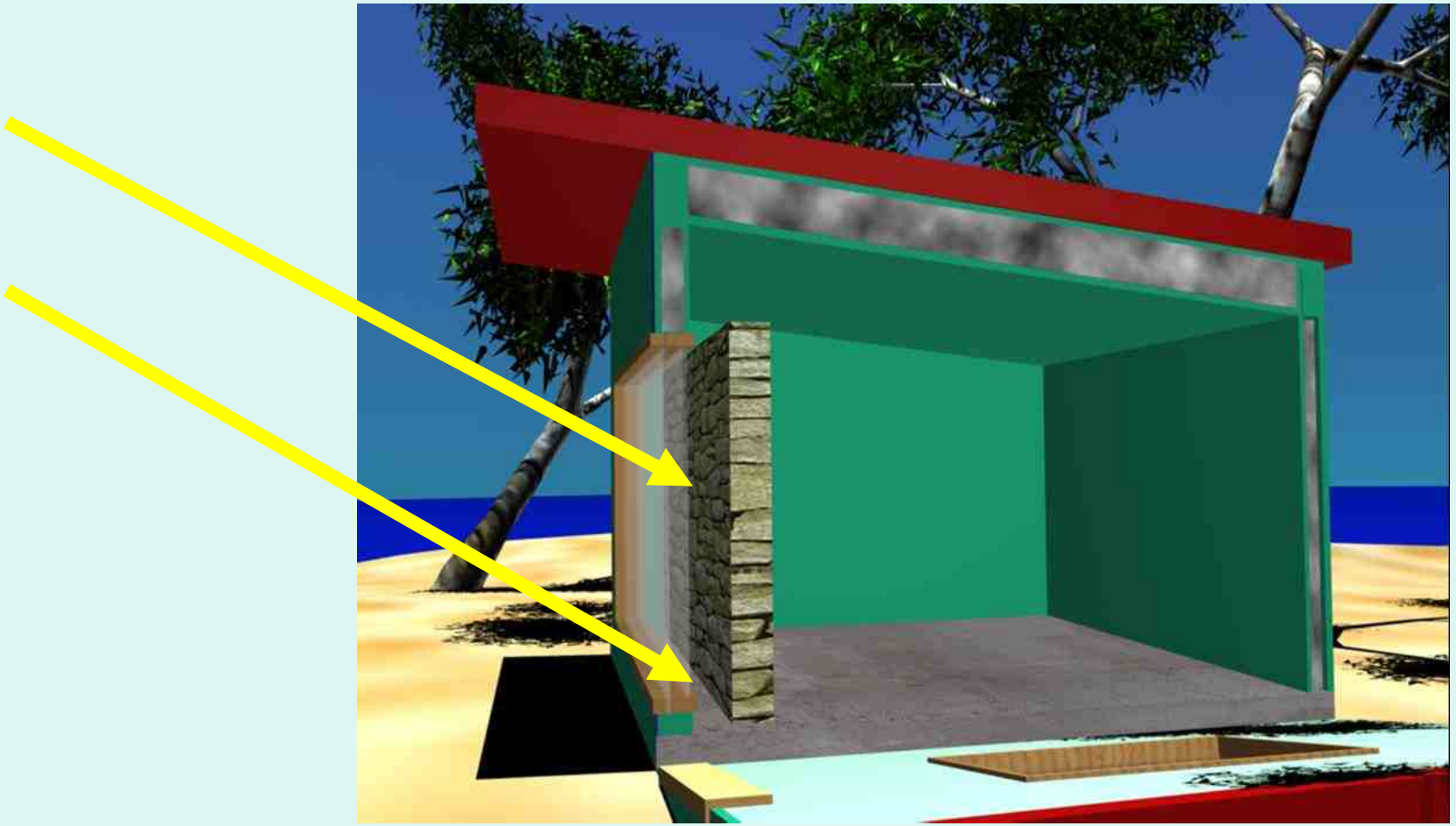
- Thermal mass not in direct sun light:70% as efficient.
- Notice another Solar Home Feature?

Thermal Mass: Water Tubes



Trombe Wall:

Block Glare, Thermal Storage, Heat Control



Trombe Wall

Added to building in Wales

Trombe Wall with Windows

Windows let direct gain & daylight in

Wall absorbs & releases heat
in a controlled way

#4: Use insulation to keep heat in or out

Neat Installation is more effective

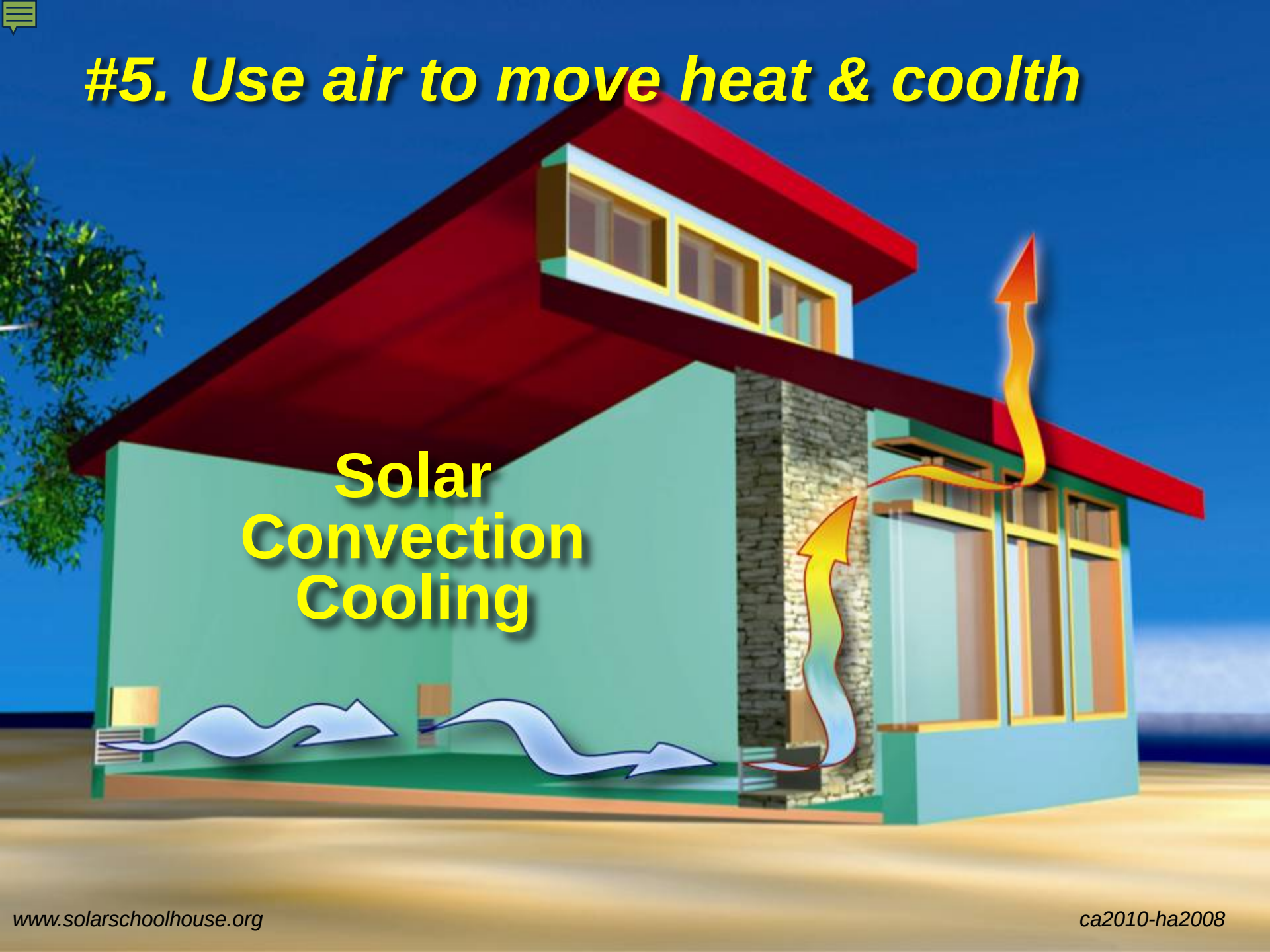
Straw Bale: waste material: R35

(needs less energy for heating and cooling)

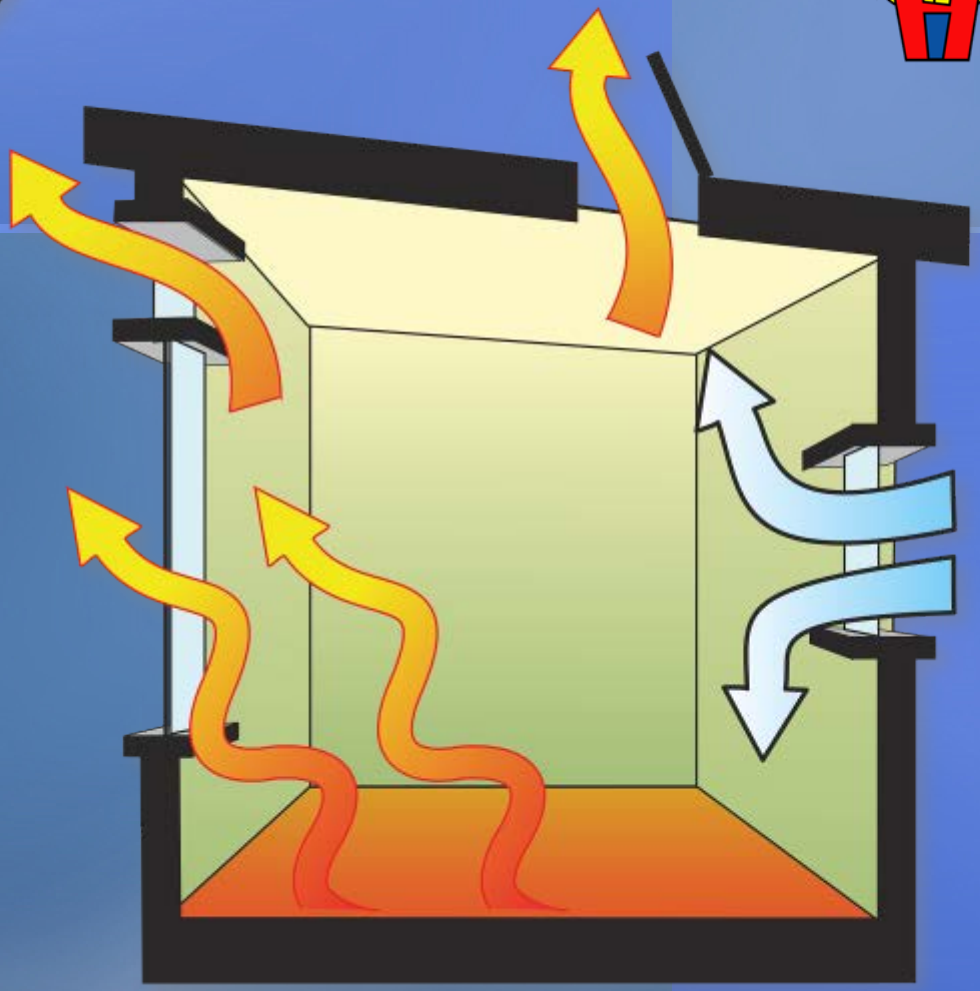
Straw Bale: 2 feet thick:

Keeps heat in during winter & out in summer

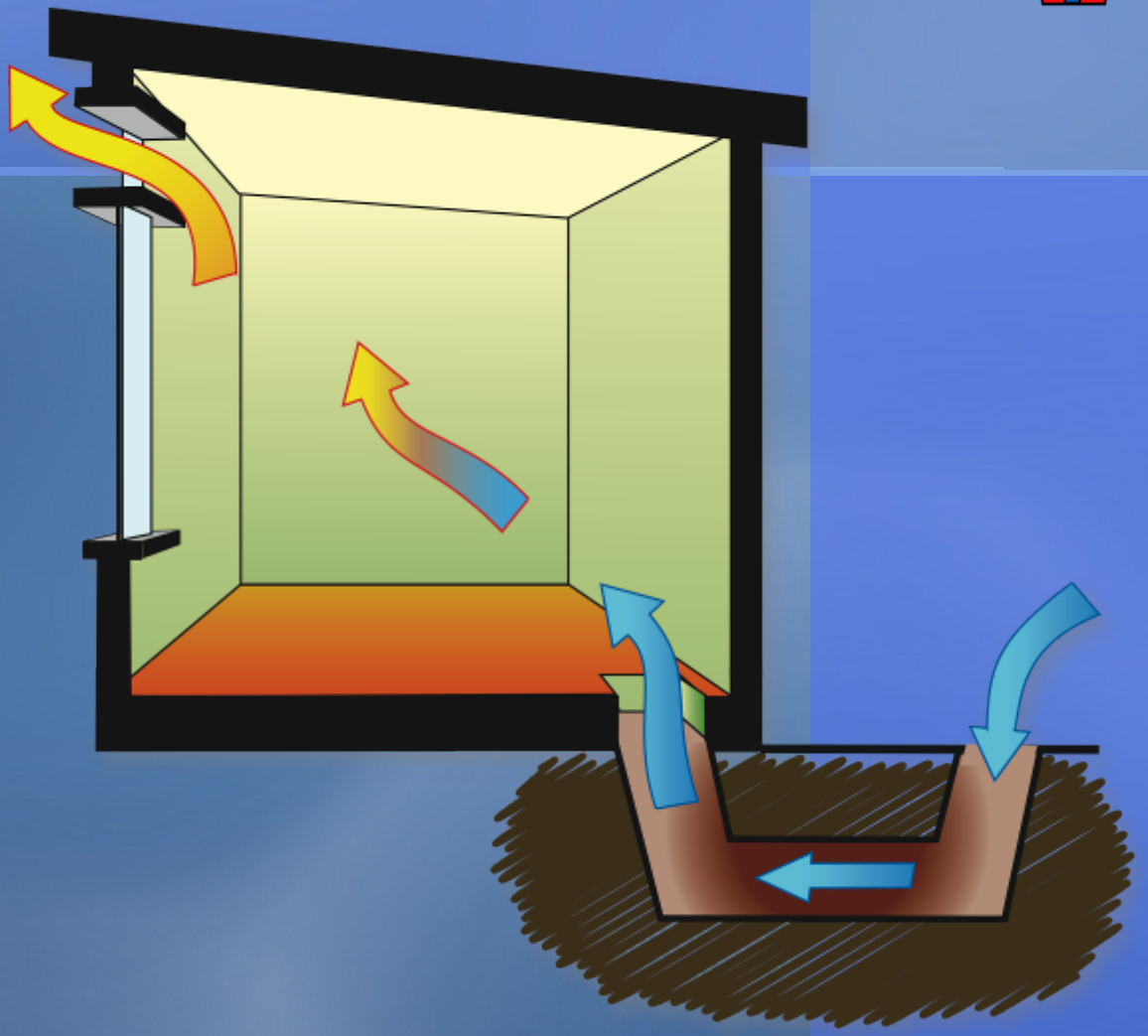
#5. Use air to move heat & coolth



Night Convection Cooling

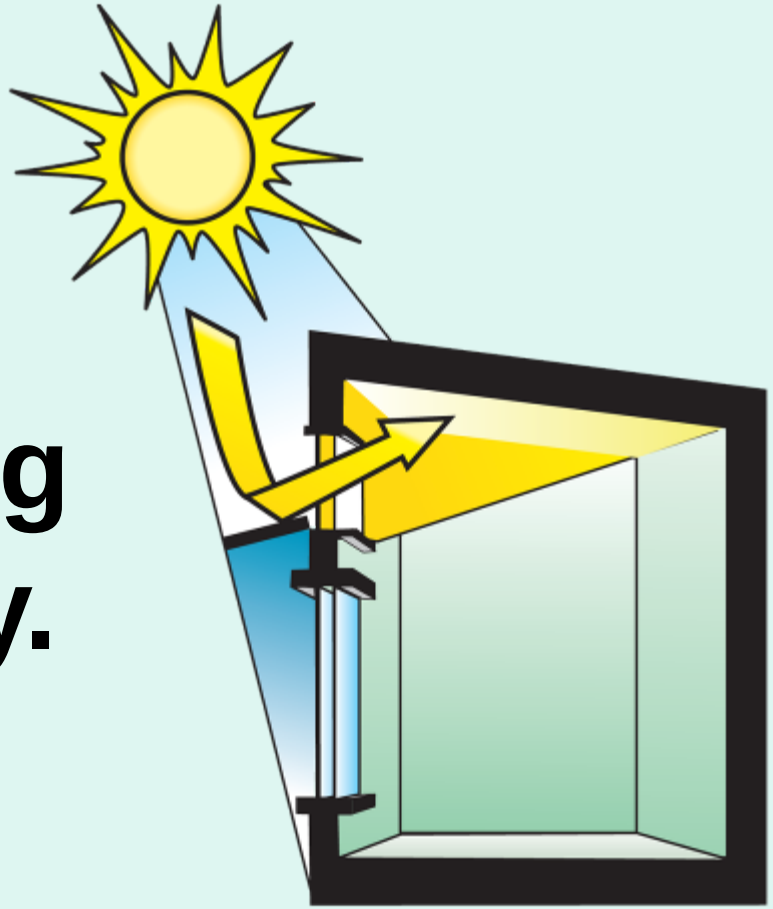


Earth Cooling



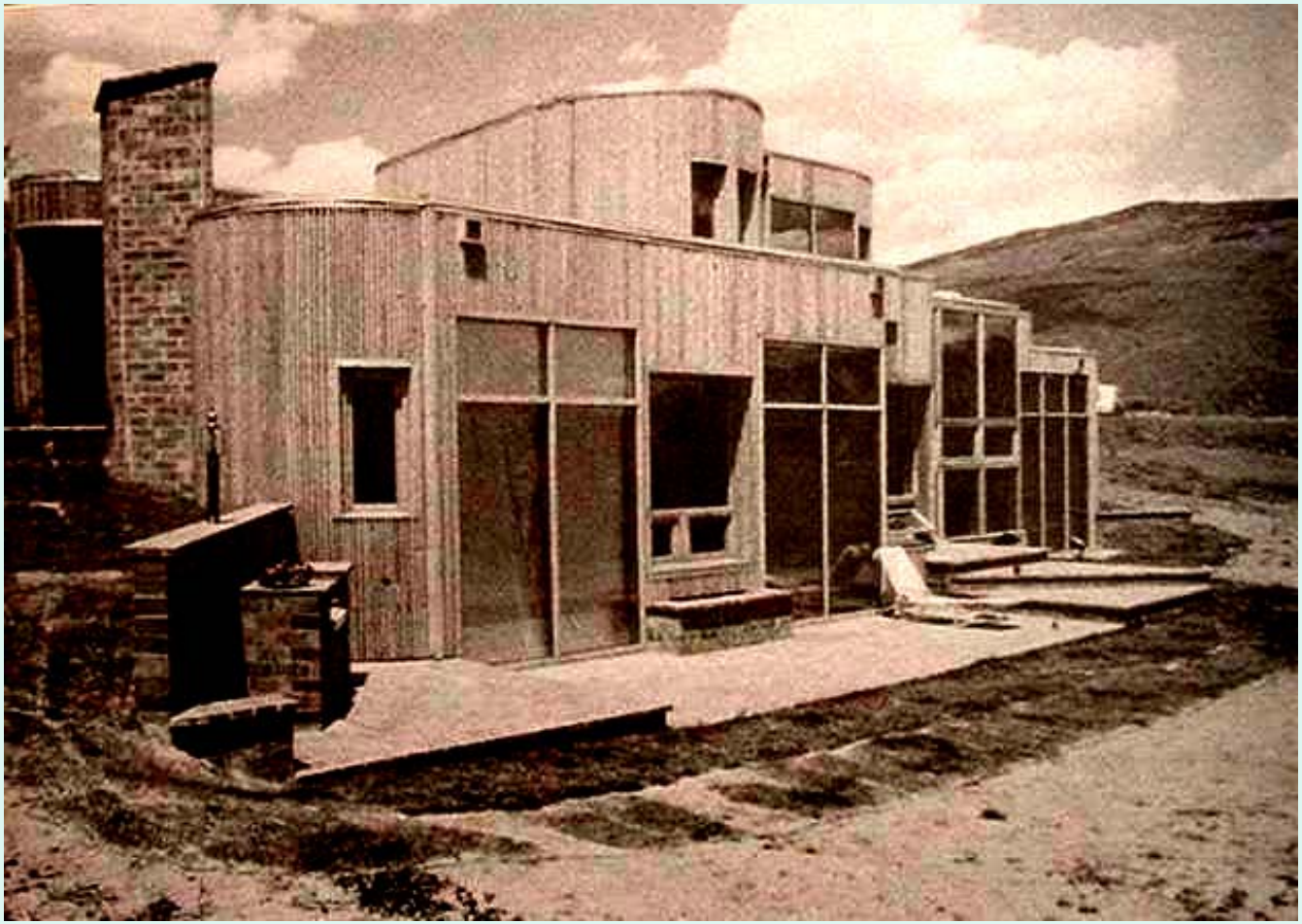
6.

Use daylighting to save energy.



Solar Design Features?

Anything missing?



Solar Design Features?

Earthships

Earthships

ca2010-ha2008


Earthships

Inside an Earthship

Solar Design Features?


Solar Decathlon
ca2010-ha2008

Solar Design Features?

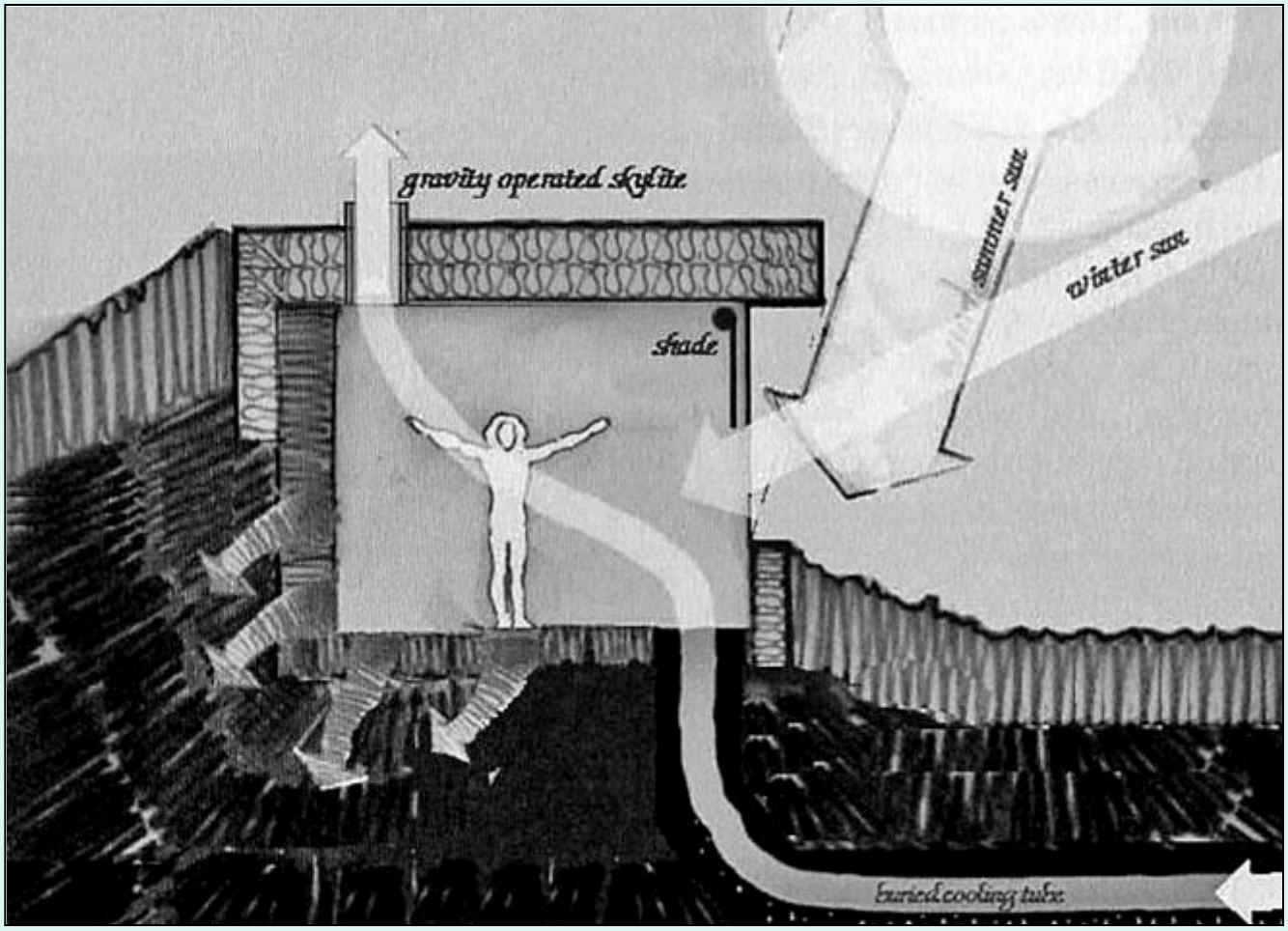
Anything missing?

Solar Design Features?

Architect: Craig Henritzy

Contemporary Design:

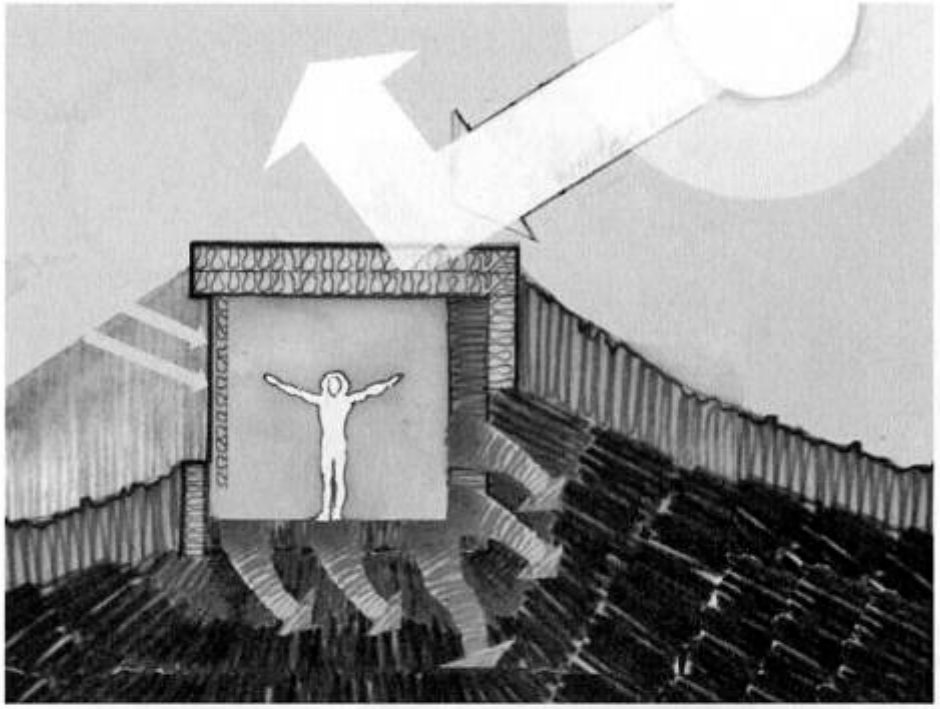
Taking advantage of 58 degree earth temperature



From: Comfort in Any Climate, by Michael Reynolds,

Extremely Hot Climate

1. Build into the earth
2. Reflective Roof
3. Use ***NORTH*** facing windows



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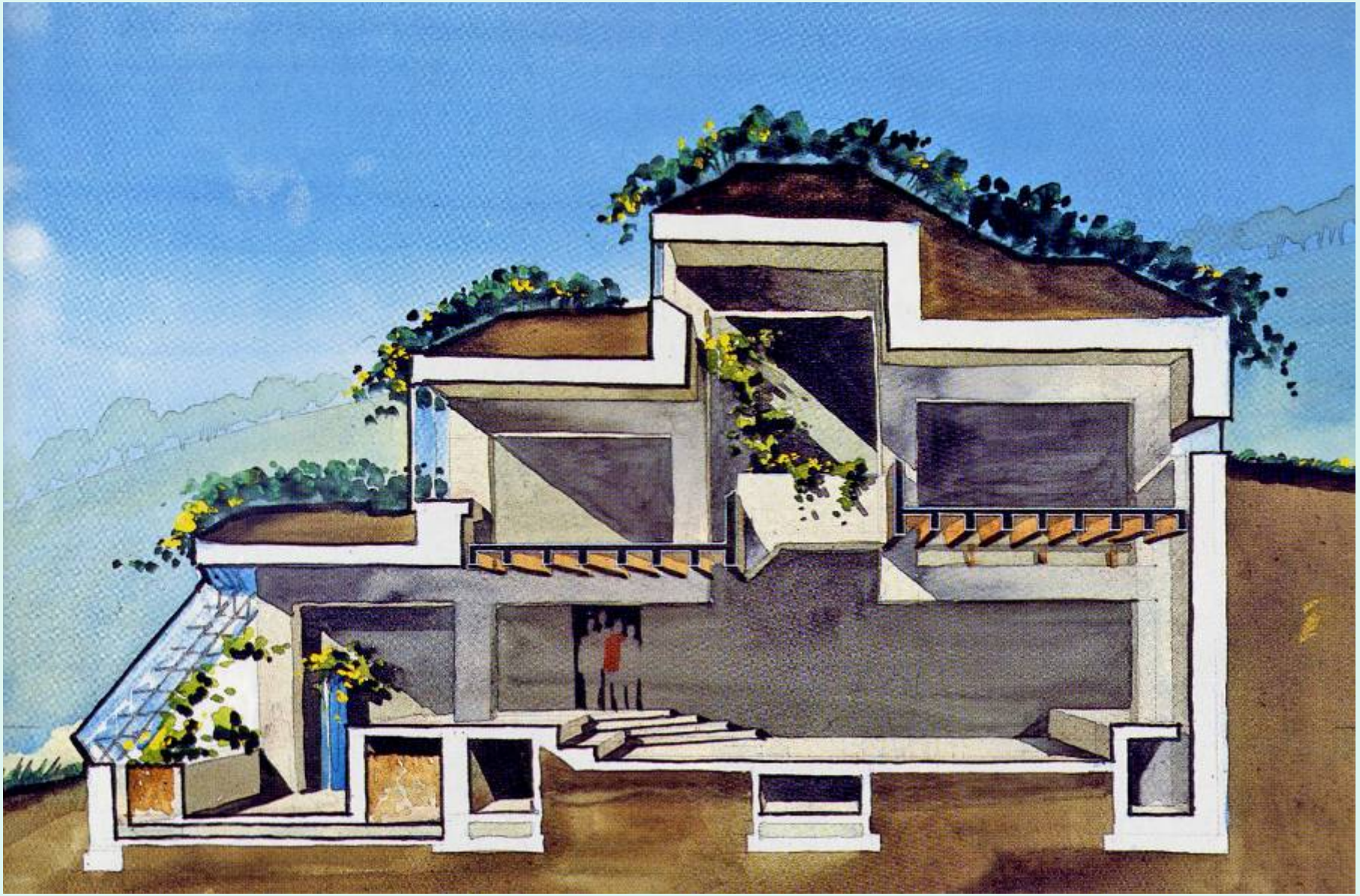

From: The Earth-Sheltered House, by Malcolm Wells

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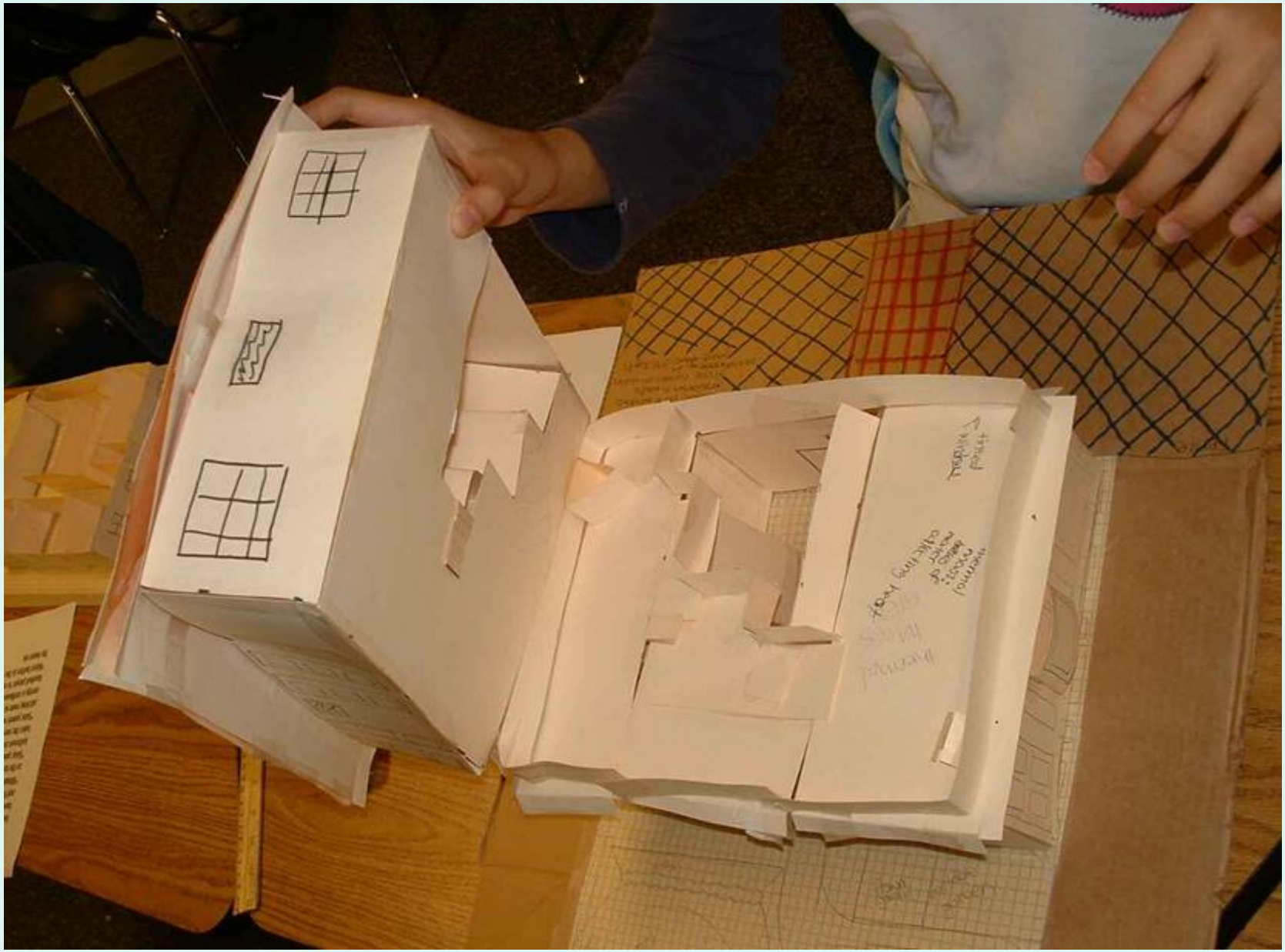
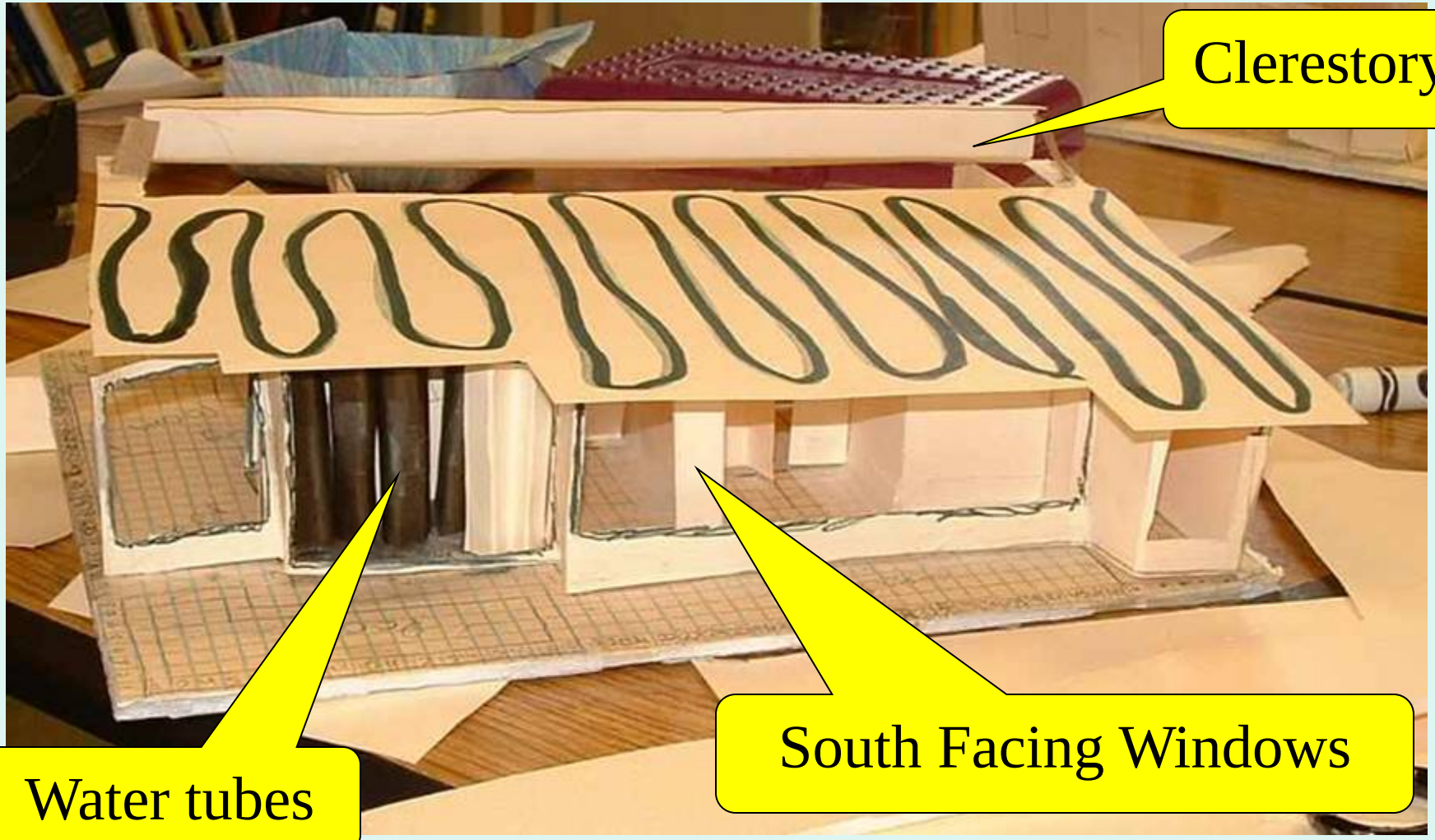
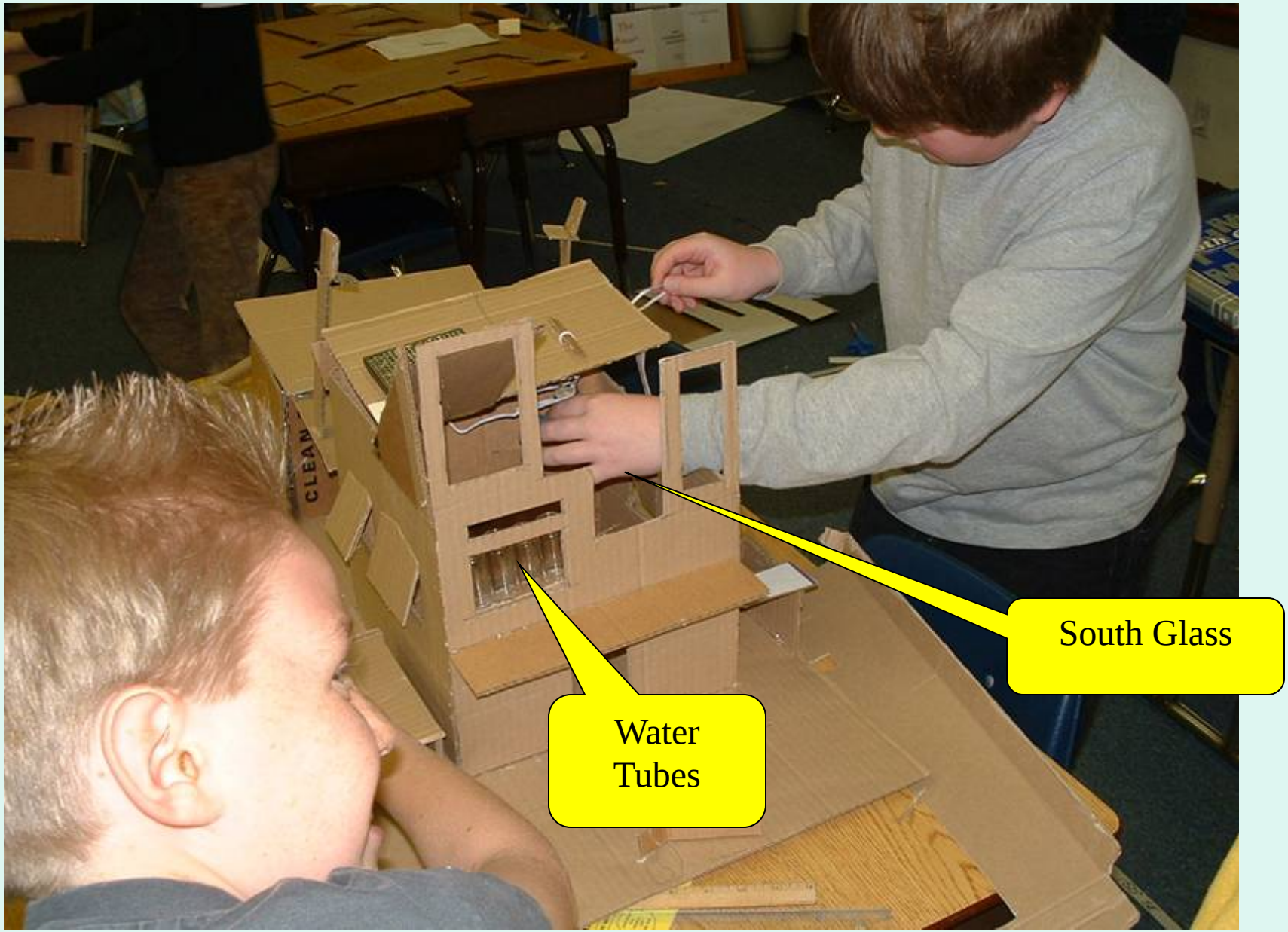
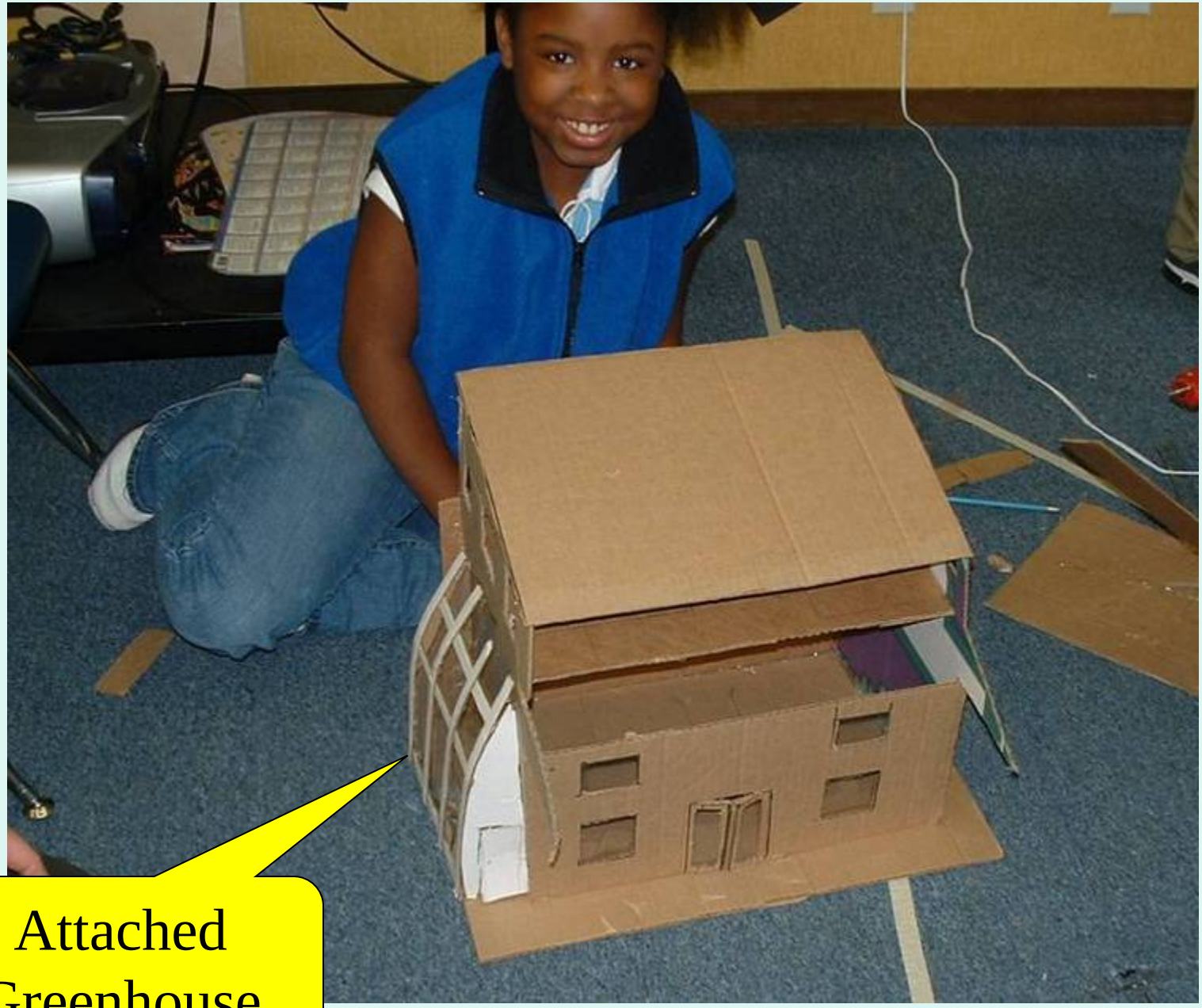
Solar Home Model

Student Projects

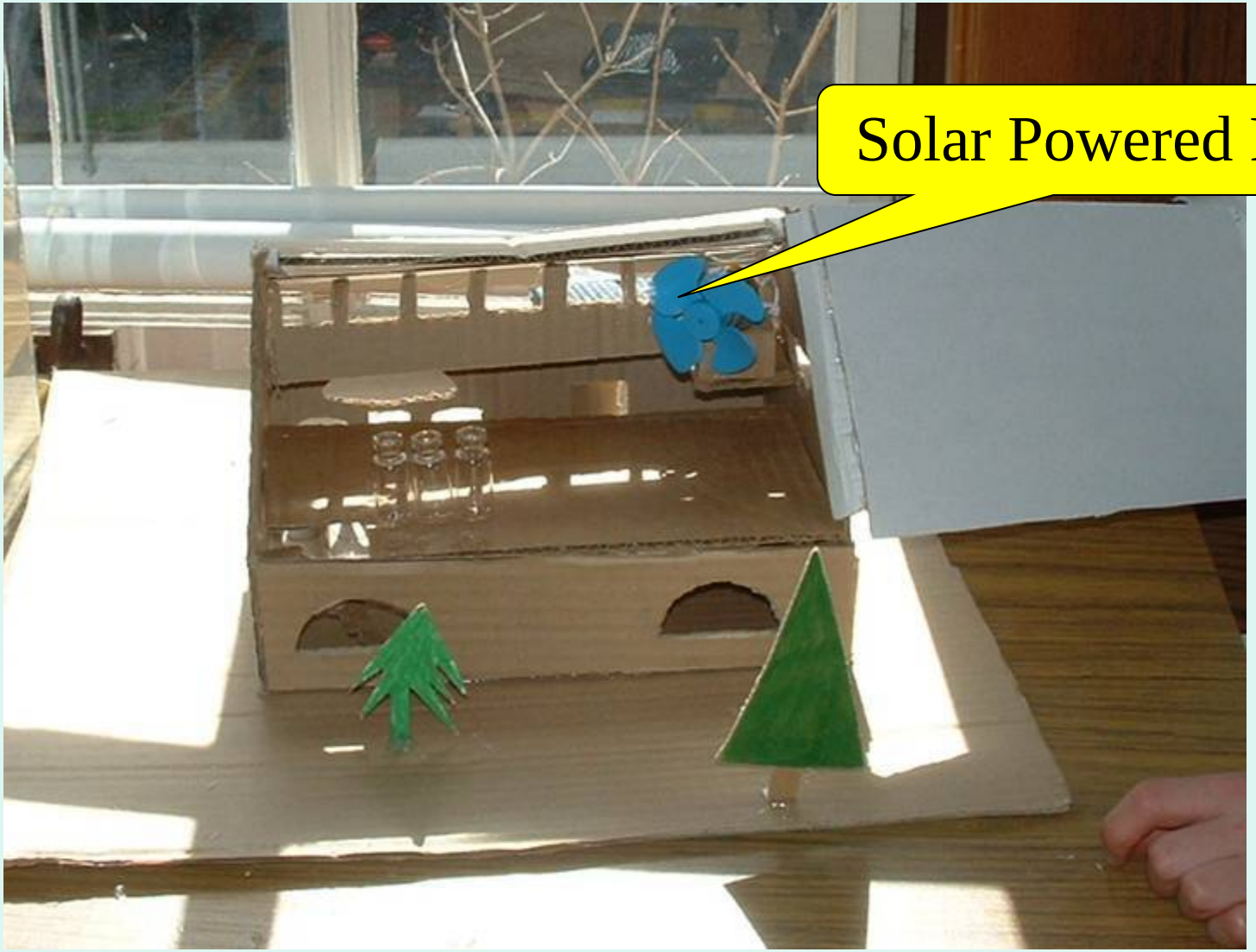



Clerestory
Water tubes
South Facing Windows


South Glass
Water
Tubes


Attached
Greenhouse

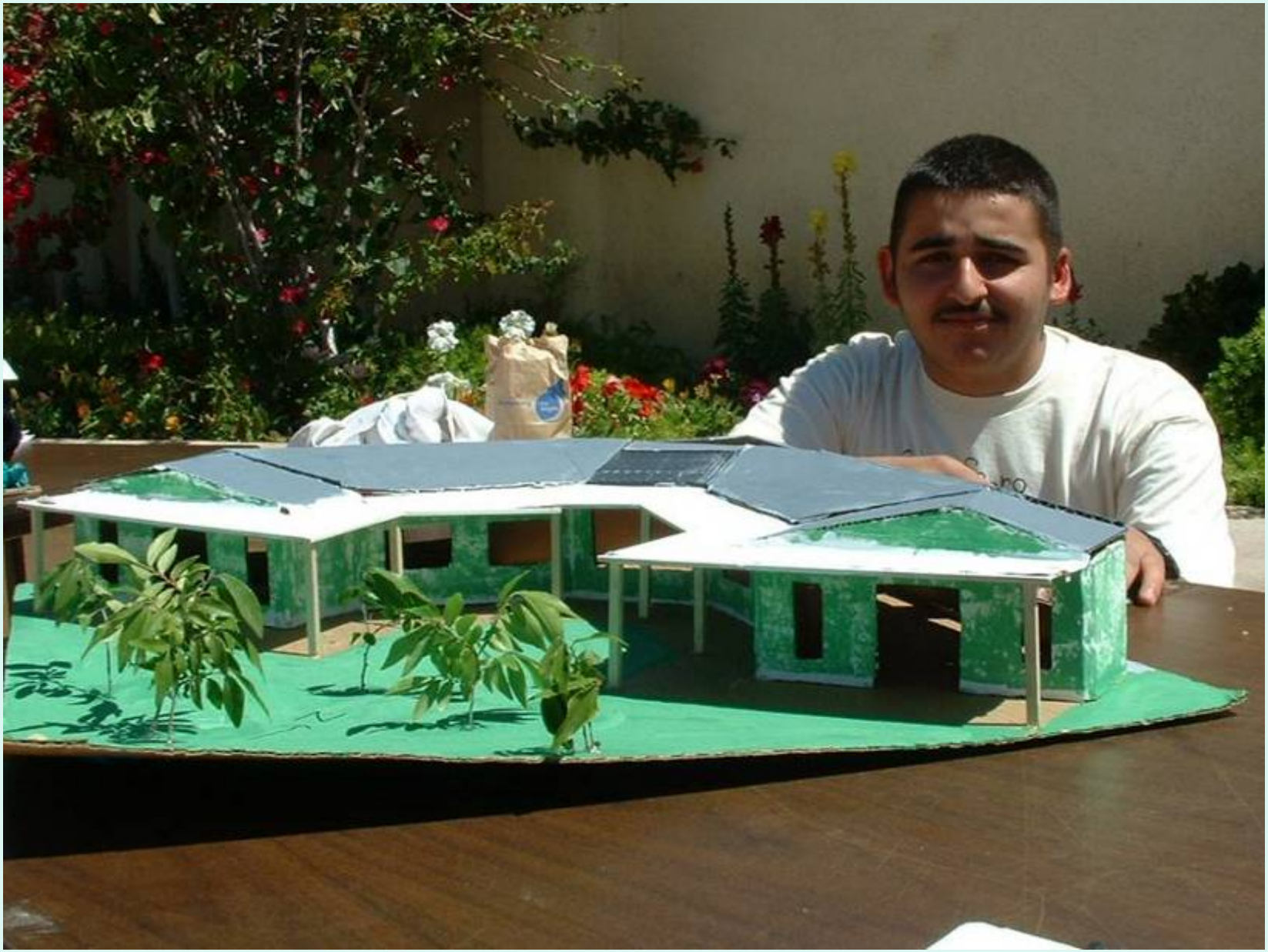
Landscaping & Solar Electricity



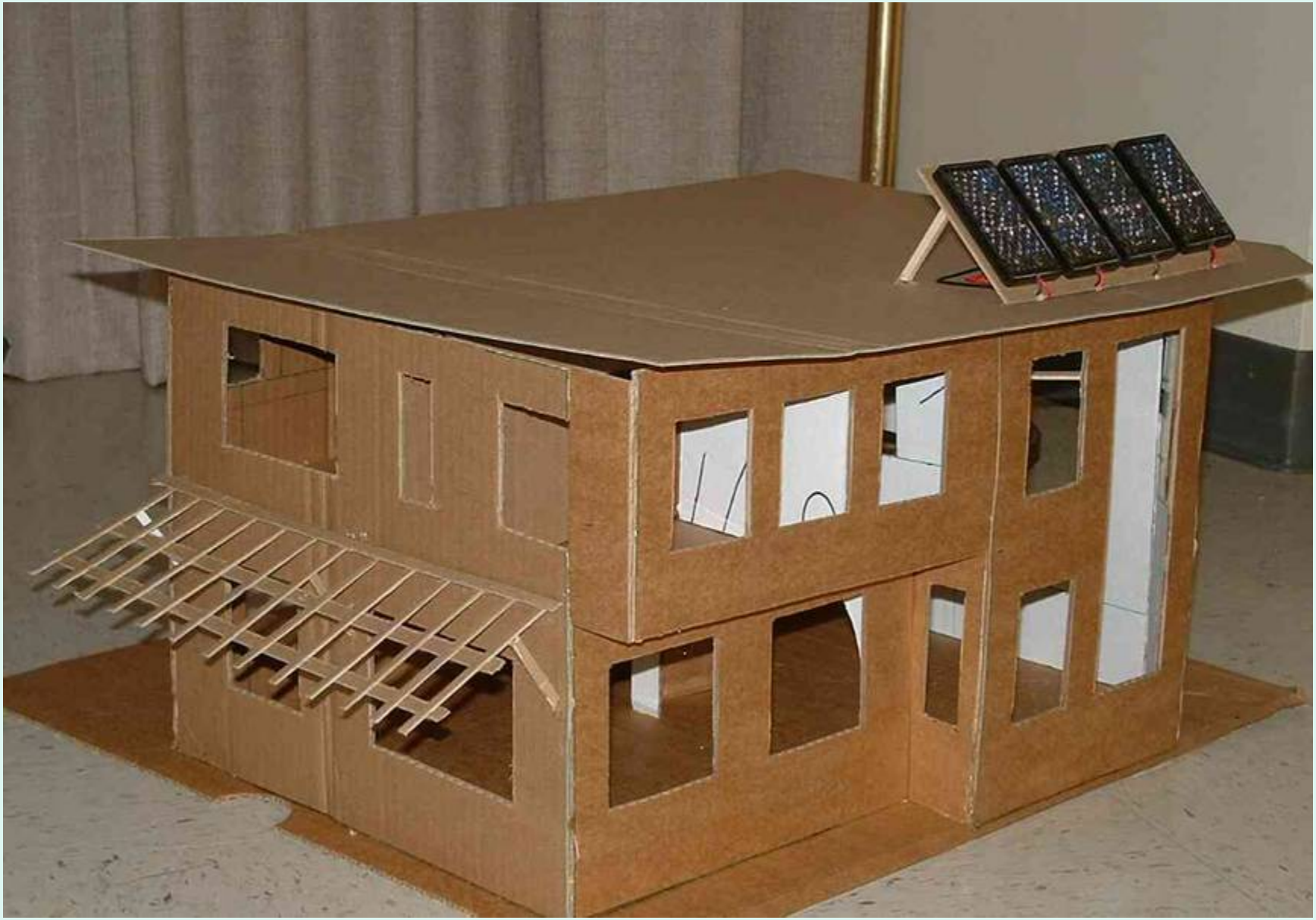
Brawley High School Students' Berm House


The Model


The Model



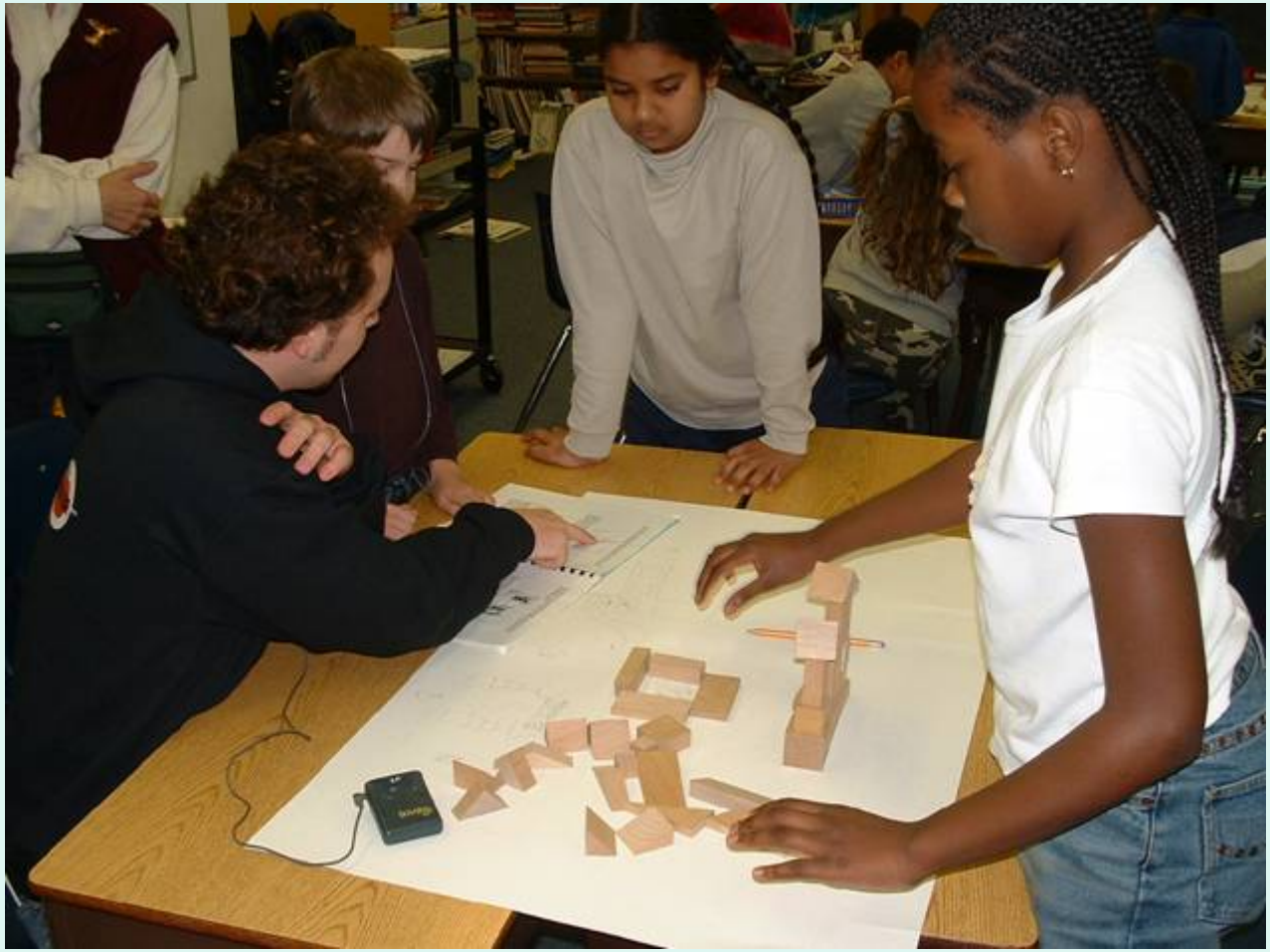
Teacher Projects



Solar Home Village

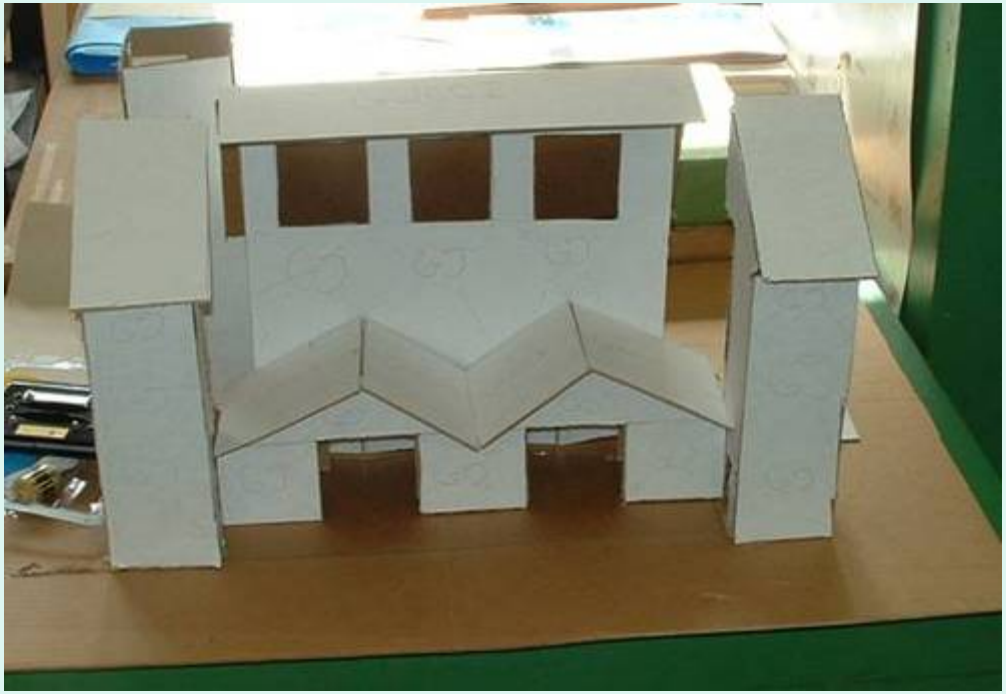
DESIGN AND BUILD

Use Blocks in Design Process

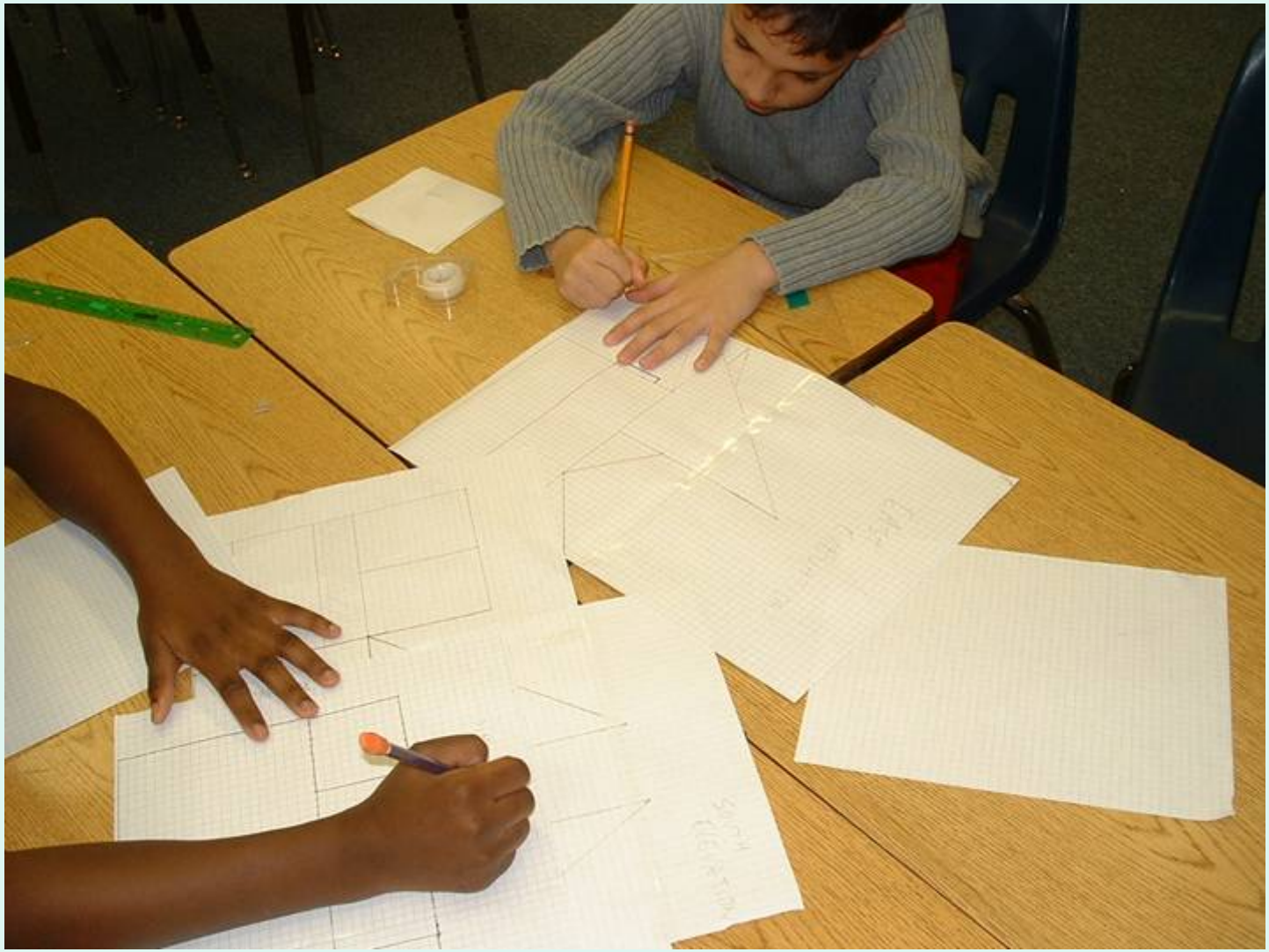


From Blocks…

…To Model



Drawing Plans



***HOUSE PLANS*:**

- Floor plan
- South Elevation
- East Elevation
- North Elevation (optional)

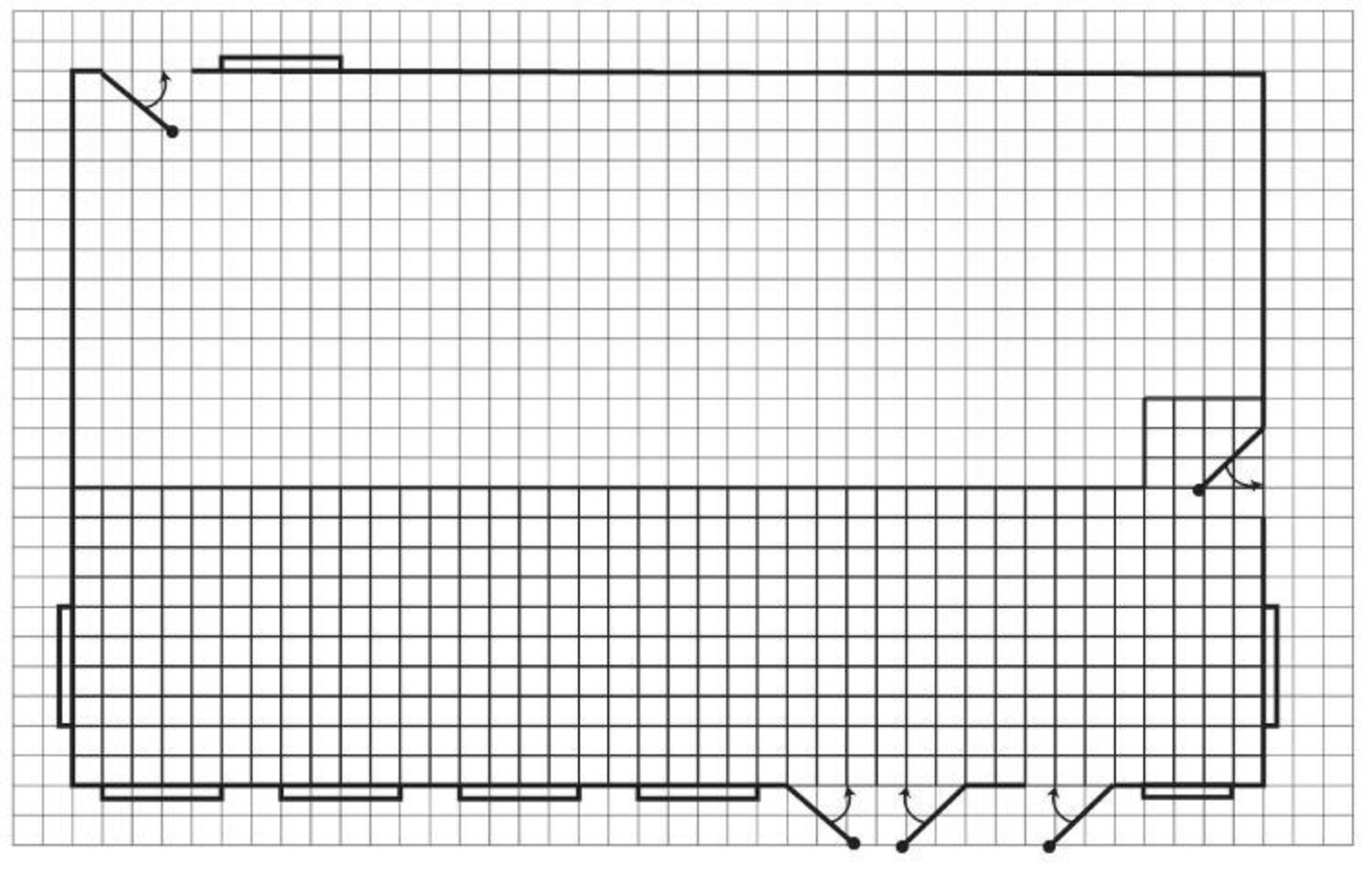
Building to Scale

¼ Inch Scale:

1 square = 1 foot by 1 foot

1 square inch = 4 foot by 4 foot

FLOOR PLAN:



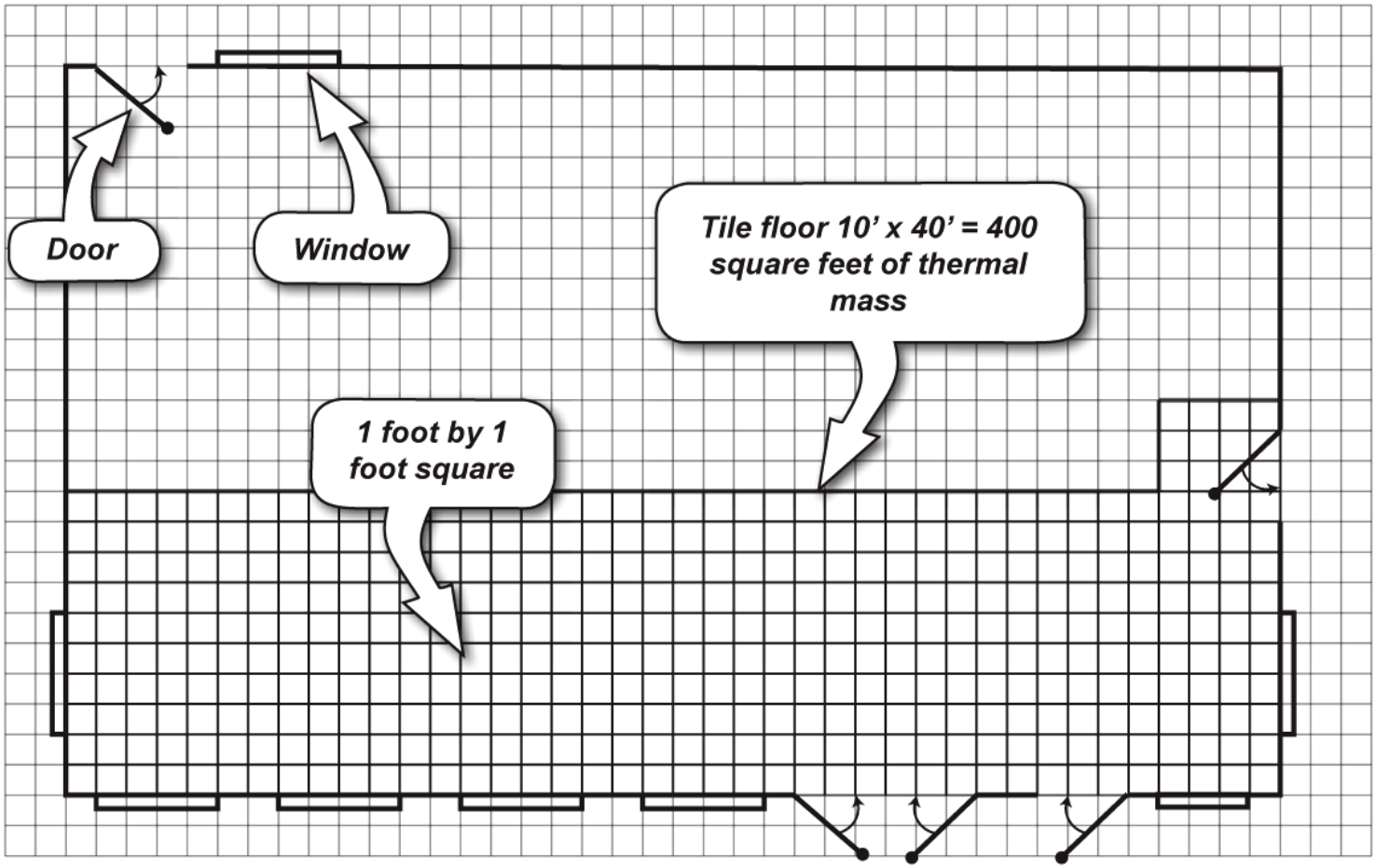
***FLOOR PLAN*:**

- Orientation
- Layout & room type
- Floor materials
- Floor area for window calculations
- Thermal mass and calculation

PLAN VIEW

40 feet long
24 feet wide

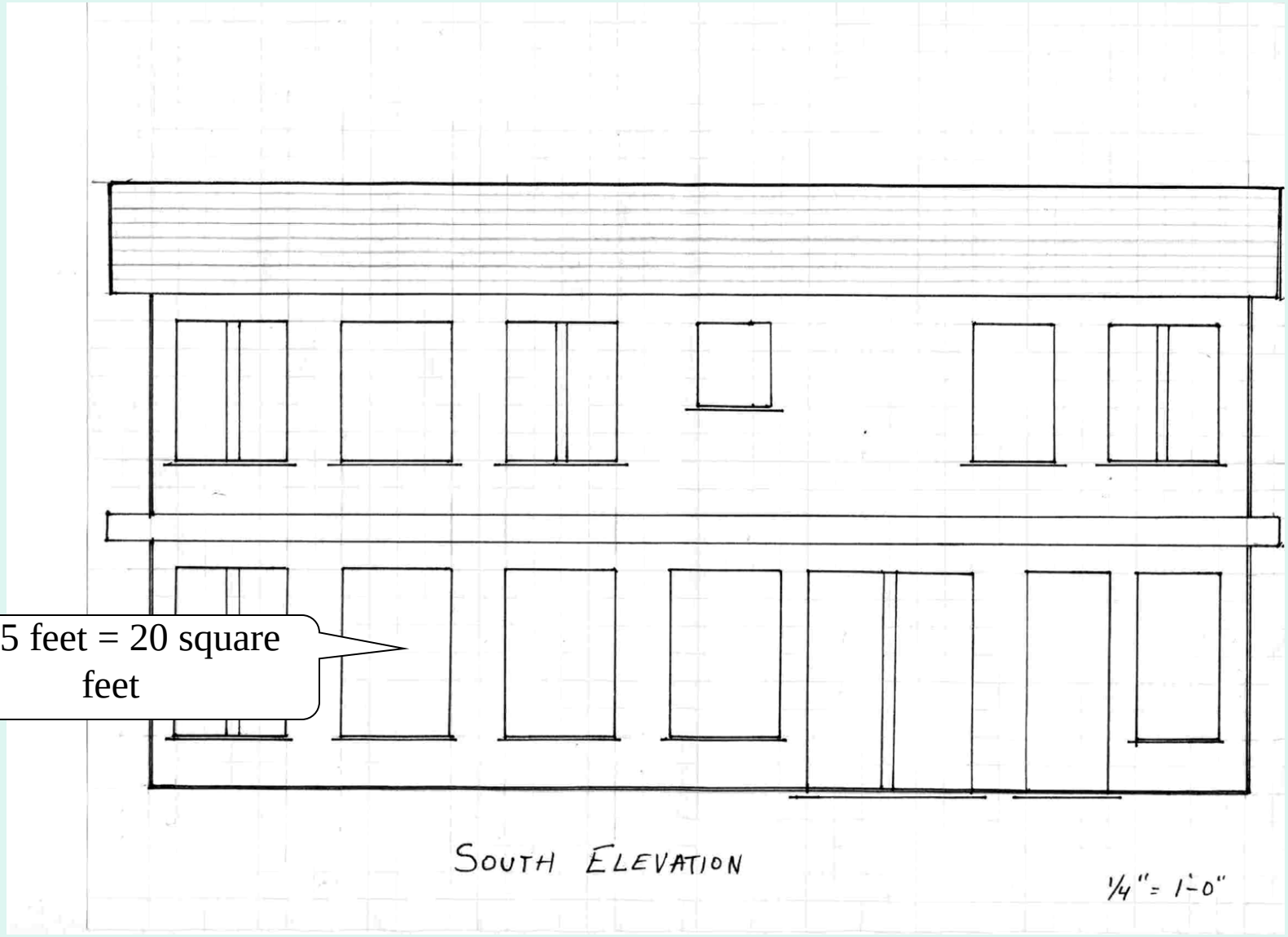
South



Total area of first floor: 24' x 40' = 960 square feet

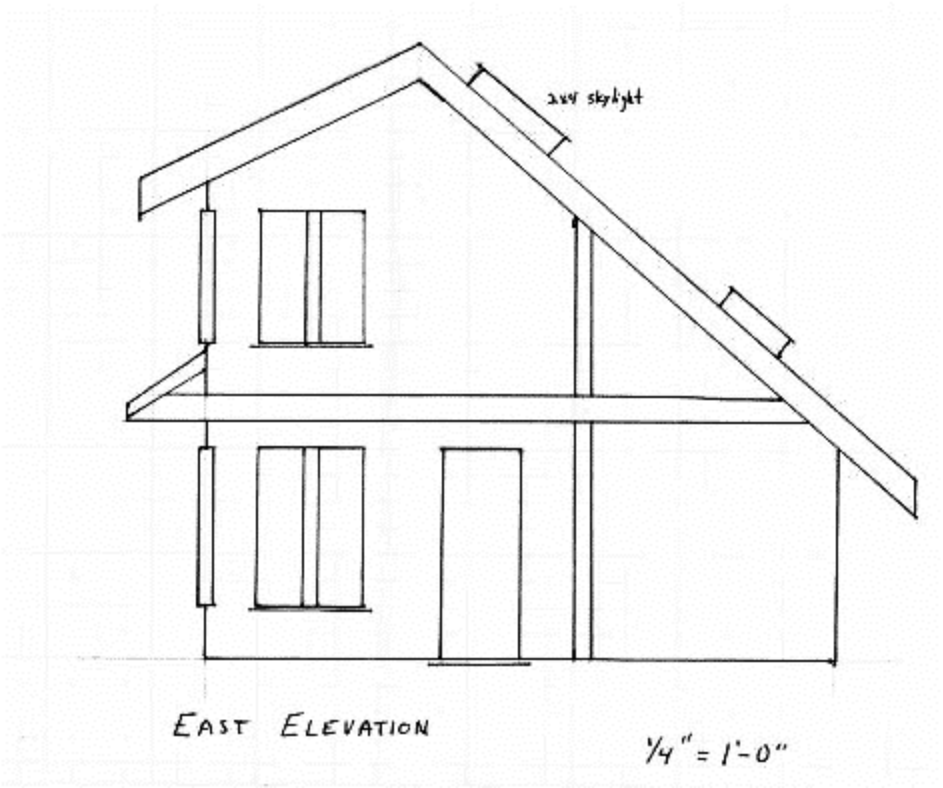
Southern Elevation:

Rule of Thumb:
12 sq ft of glass for every 100 sq ft of floor

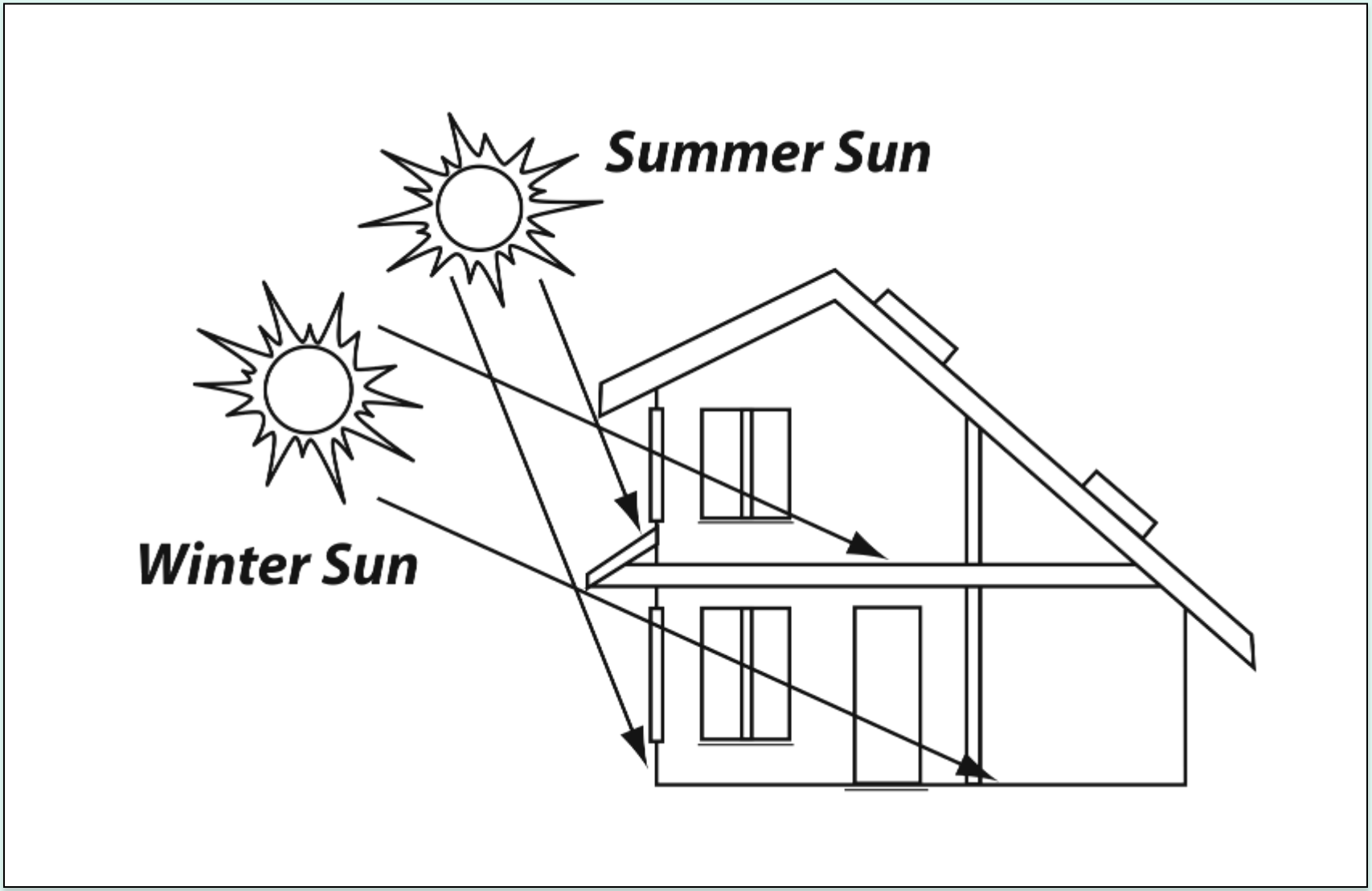

4 x 5 feet = 20 square feet
SOUTH ELEVATION
1/4" = 1'-0"

East Elevation:

To measure eaves:
find winter & summer sun angles

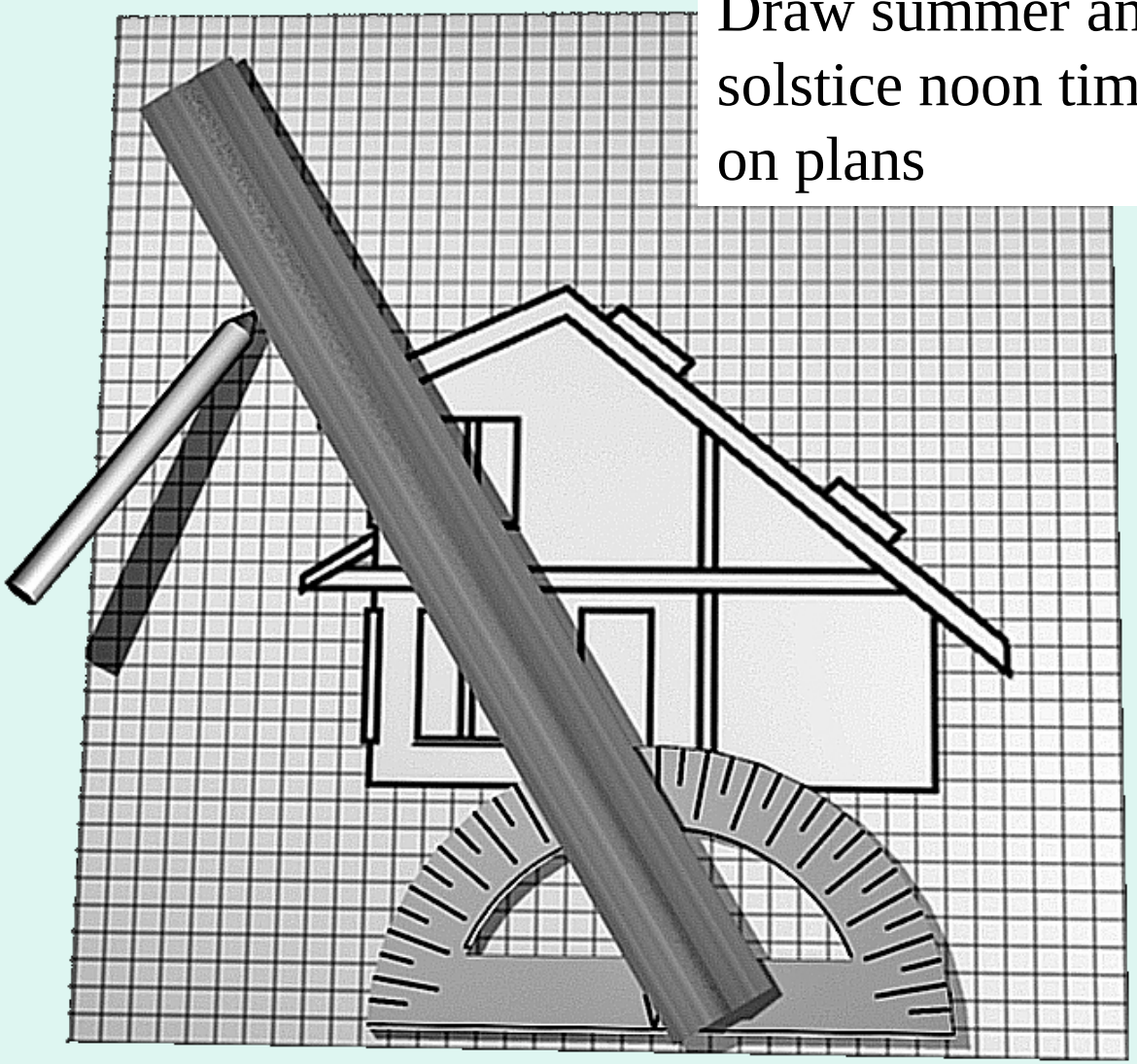


Use Sun Angles to Calculate Overhangs



Use Protractor to Calculate Overhangs

Draw summer and winter solstice noon time angles on plans



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BUILD YOUR MODEL!

Place your home in the Solar Village!

Complete Solar Home Project Plans in The Your Solar Home Guidebook