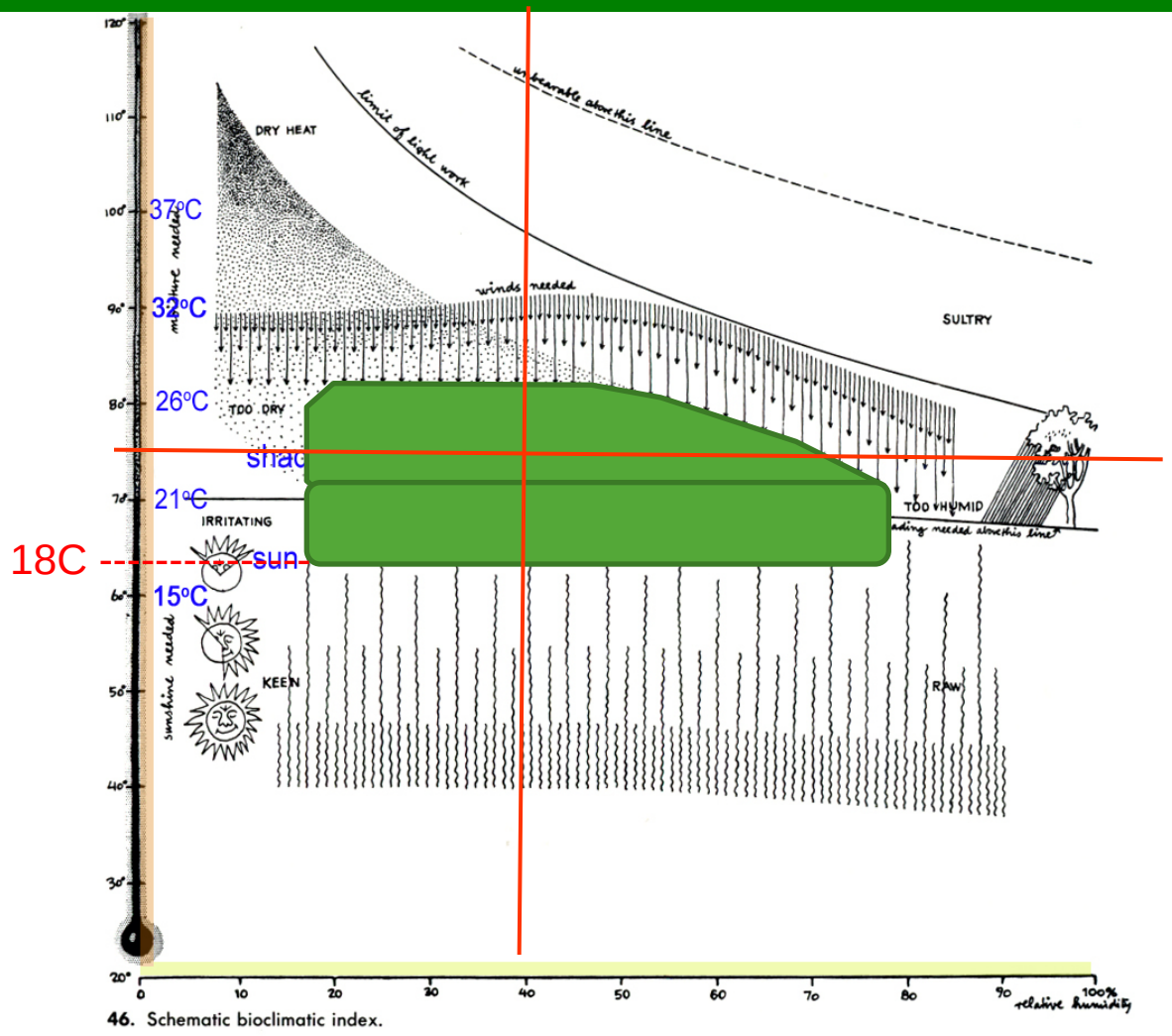
Radical POTENTIAL!!

COMFORT ZONE

WHAT IS IT?

WHAT DOES IT HAVE TO DO WITH GREEN BUILDING + ZERO CARBON?

Where is your Comfort Zone?



46. Schematic bioclimatic index.

This famous illustration is taken from “Design with Climate”, by Victor Olgyay, published in 1963.

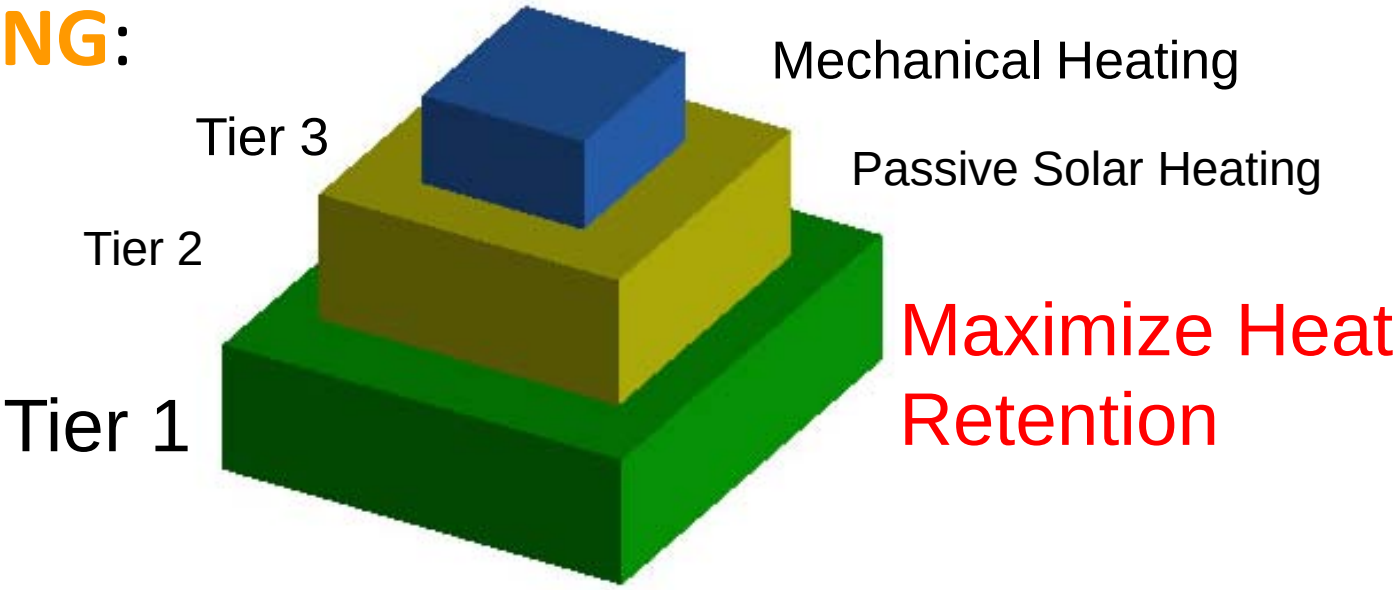
This is the finite point of expected comfort for 100% mechanical heating and cooling.

To lower our energy consumption, we must work within the broader area.

AND move this line DOWN to 18C (point of heating or cooling in degree day calculations.

PASSIVE Strategies - HEATING

The tiered approach to reducing carbon for **HEATING**:



First reduce the overall energy required, then maximize the amount of energy required for mechanical heating that comes from renewable sources.

•**Source:** Lechner. Heating, Cooling, Lighting.

PASSIVE Strategies - HEATING

MAXIMIZE HEAT RETENTION:

1. Super insulated envelope (*as high as **double** current standards*)
2. Tight envelope / controlled air changes
3. Provide thermal mass **inside** of thermal insulation to store heat (COMPLETE OPPOSITE OF REGULAR WOOD FRAME CONSTRUCTION!)
4. Top quality windows with high R-values – up to **triple glazed** with argon fill and low-e coatings on two surfaces

Premise – what you don't "lose" you don't have to create or power…. So make sure that you keep it! *(…NEGAwatts)*

PASSIVE Strategies - HEATING

PASSIVE SOLAR HEATING:

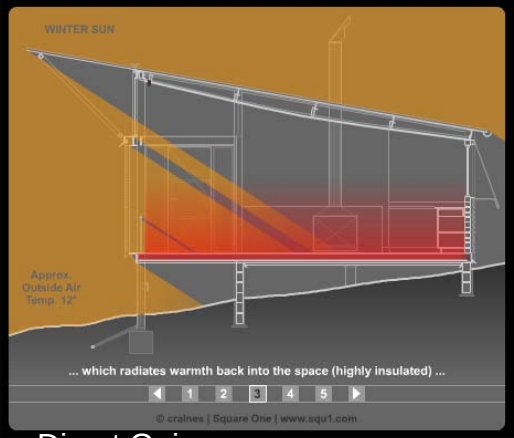
1. primarily south facing windows
2. proportion windows to suit thermal mass and size of room(s)

3 MAIN STRATEGIES:

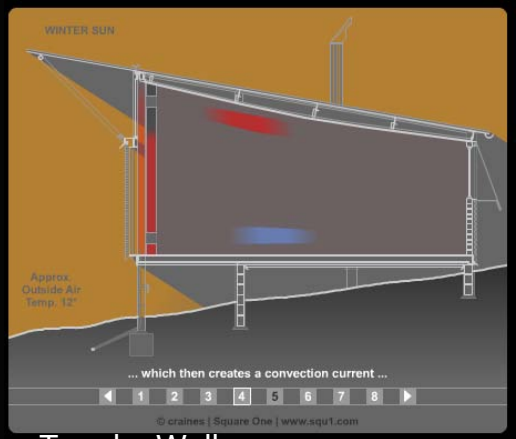
Direct Gain

Thermal Storage Wall

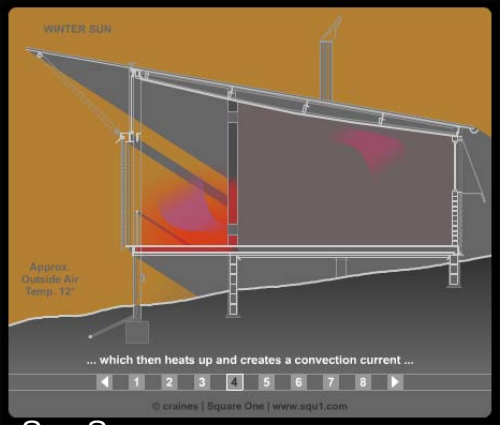
Sunspace



Direct Gain



Trombe Wall



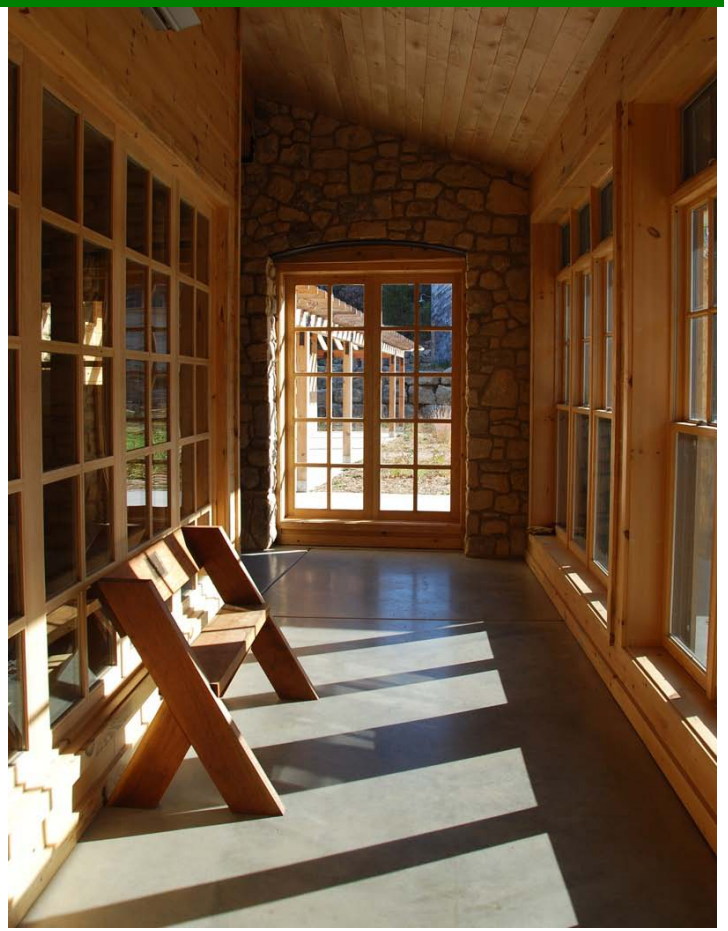
Sun Space

Source: Square One Archives (http://squ1.com/archive/)

Thermal Mass is Critical

- To ensure comfort to the occupants….
- People are 80% water so if they are the only thermal sink in the room, they will be the target.

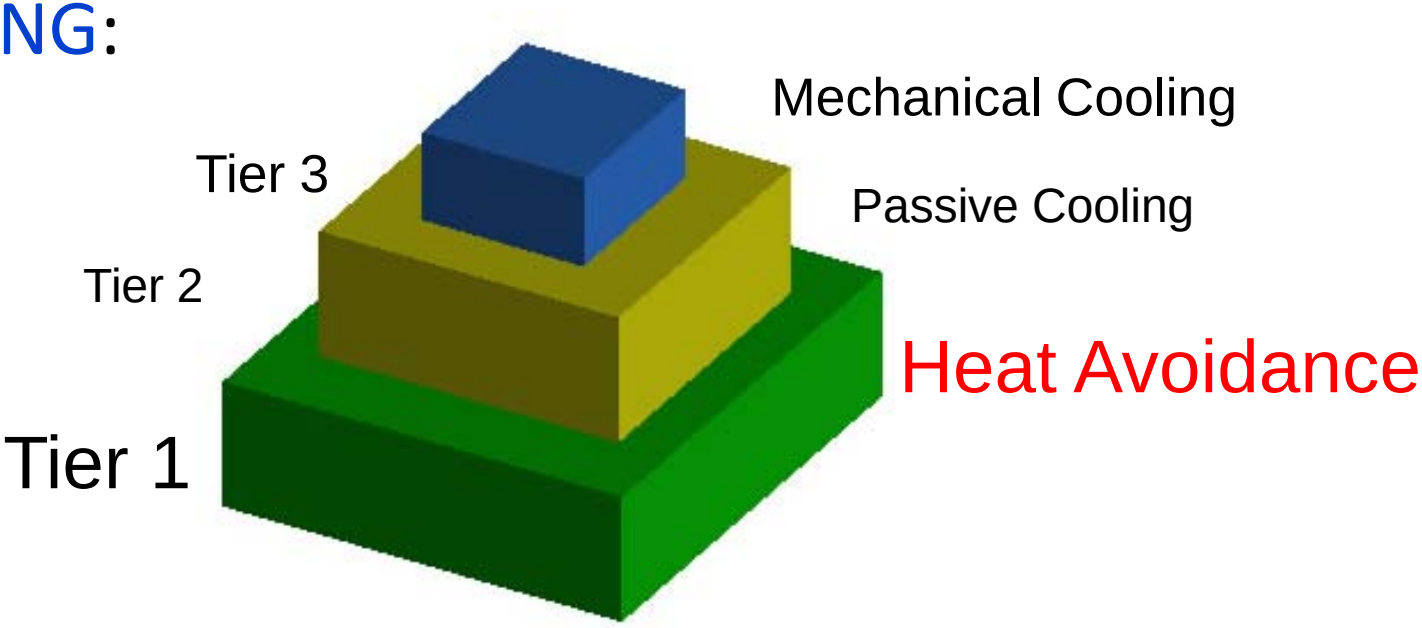
- And to store the FREE energy for slow release distribution….



Aldo Leopold Legacy Center: Concrete floors complement the insulative wood walls

PASSIVE Strategies - COOLING

The tiered approach to reducing carbon for COOLING:



•Maximize the amount of energy required for mechanical cooling that comes from renewable sources.

•**Source:** Lechner. Heating, Cooling, Lighting.

PASSIVE Strategies - COOLING

HEAT AVOIDANCE:

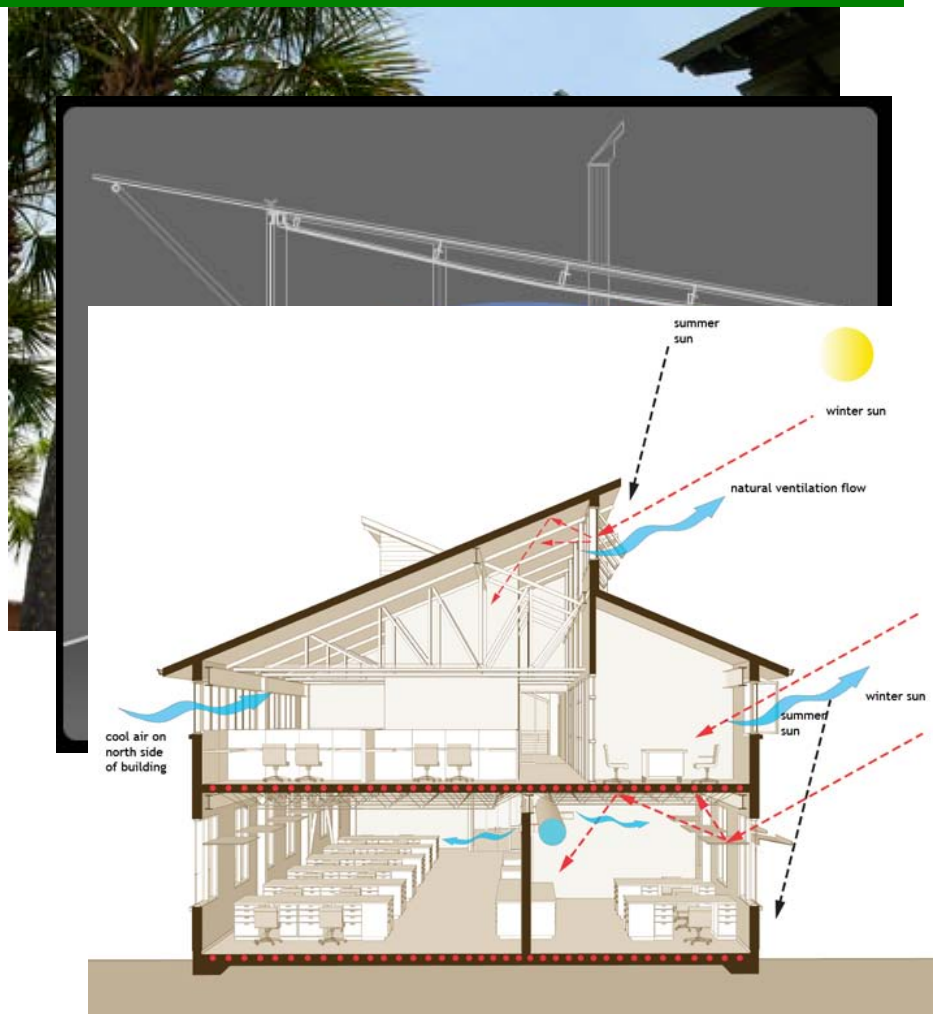
1. shade windows from the sun during hot months
2. design materials and plantings to cool the local microclimate
3. locate trees and trellis' to shade east and west façades during morning and afternoon low sun

If you don't invite the heat in, you don't have to get rid of it…..

PASSIVE Strategies - COOLING

NATURAL VENTILATION:

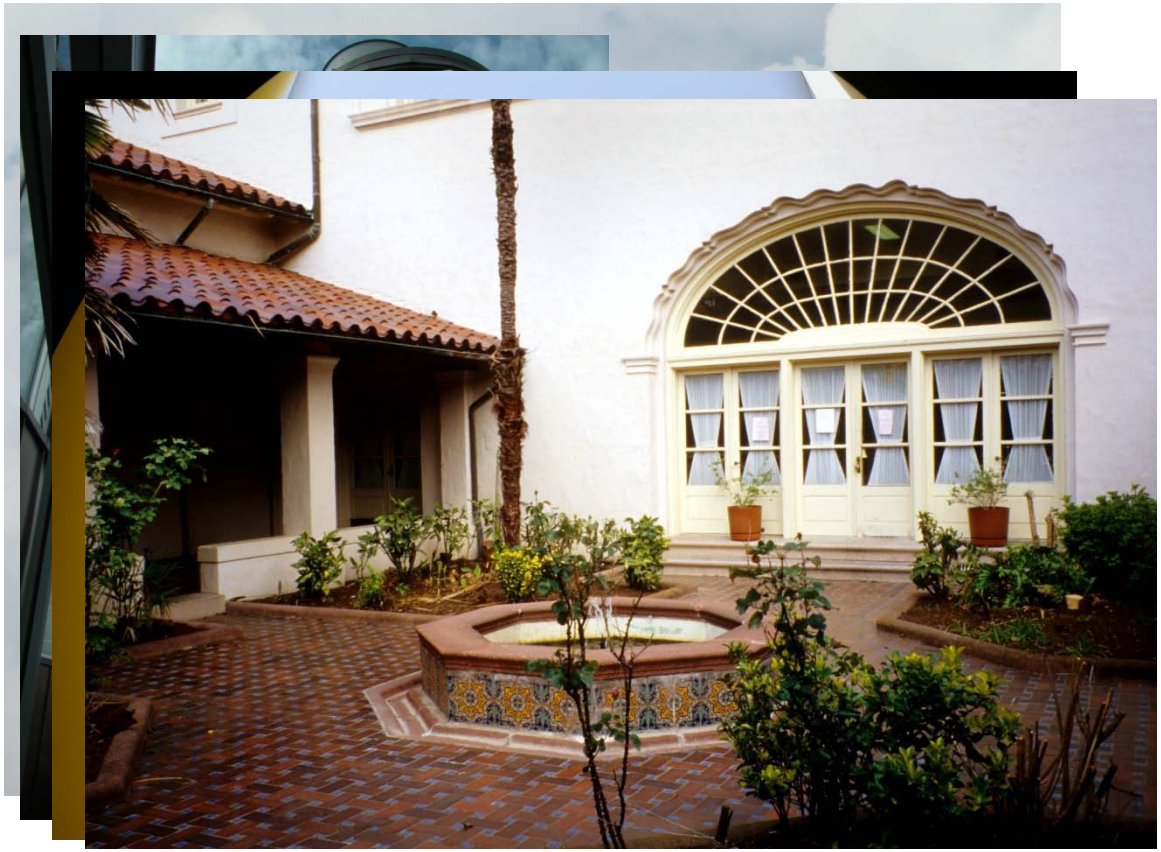
1. design for maximum ventilation
2. keep plans as open as possible for unrestricted air flow
3. use easily operable windows at low levels with high level clerestory windows to induce stack effect cooling



PASSIVE Strategies - COOLING

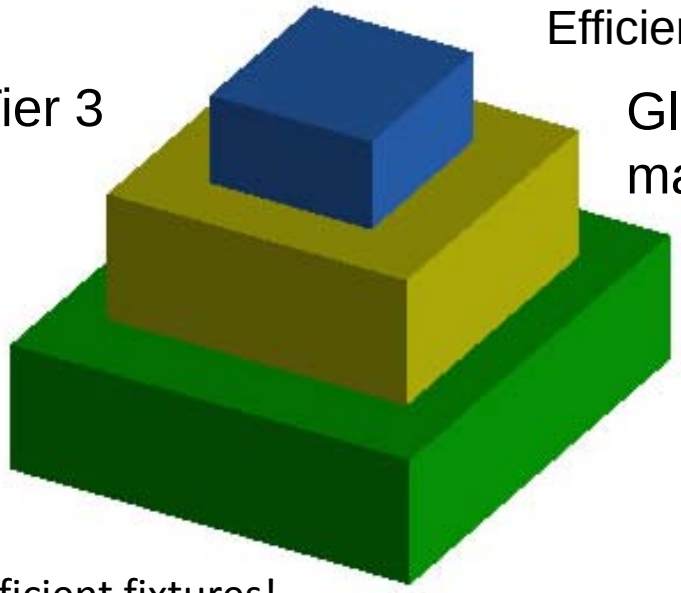
INNOVATION:

1. wind cowls
2. solar chimneys
3. water features



PASSIVE Strategies - DAYLIGHTING

The tiered approach to reducing carbon with **DAYLIGHTING**:



Tier 3

Efficient artificial Lighting w/ sensors

Tier 2

Glare, color, reflectivity and material concerns

Tier 1

Orientation and planning of building to allow light to reach maximum no. of spaces

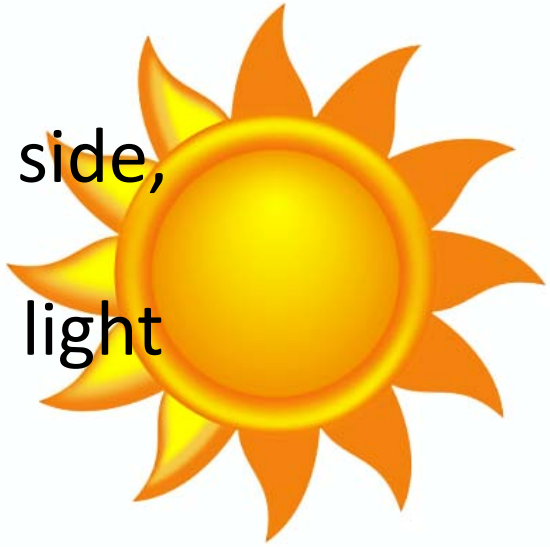
Use energy efficient fixtures!

Maximize the amount of energy/electricity required for artificial lighting that comes from renewable sources.

Source: Lechner. Heating, Cooling, Lighting.

PASSIVE Strategies - DAYLIGHTING

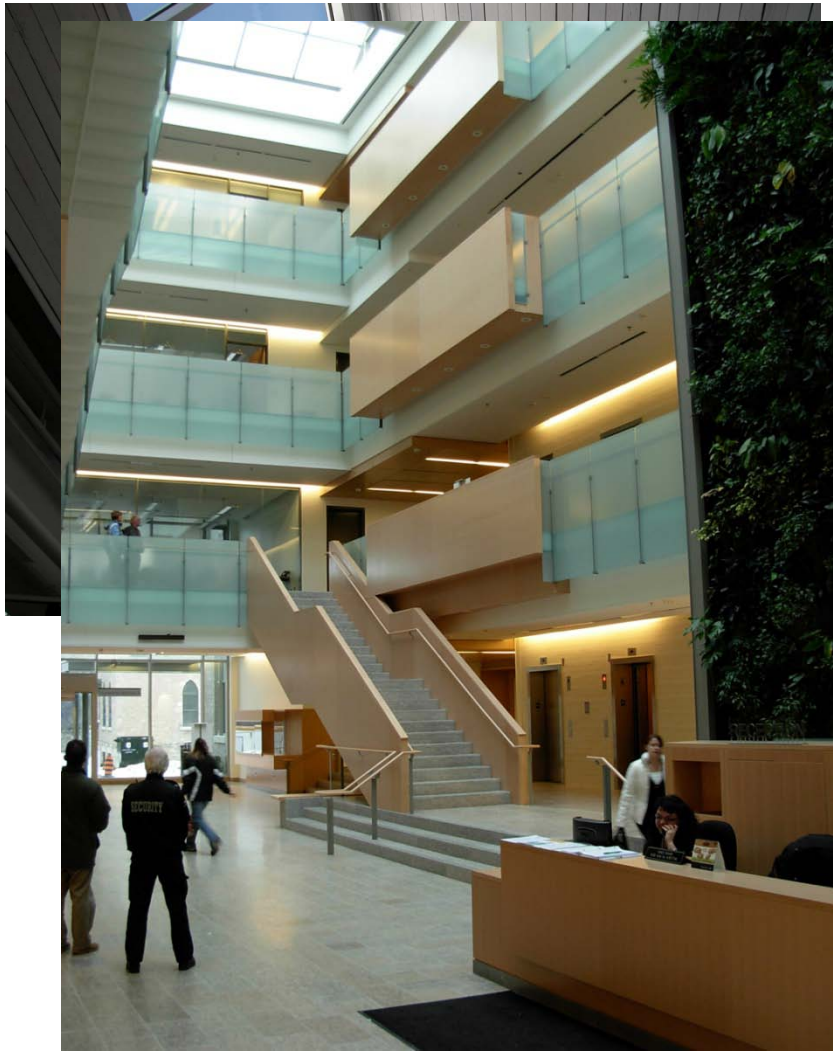
- start with solar geometry
- understand context, sky dome, adjacent buildings and potential overshadowing
- be able to differentiate between sunlight (heat) and daylight (seeing)
- understand occupancy/use requirements
- maximize areas served by daylight
- explore different glazing strategies: side, clerestory, top
- consider light shelves and reflected light



PASSIVE Strategies - DAYLIGHTING

GLARE, COLOUR, REFLECTIVITY, MATERIALS:

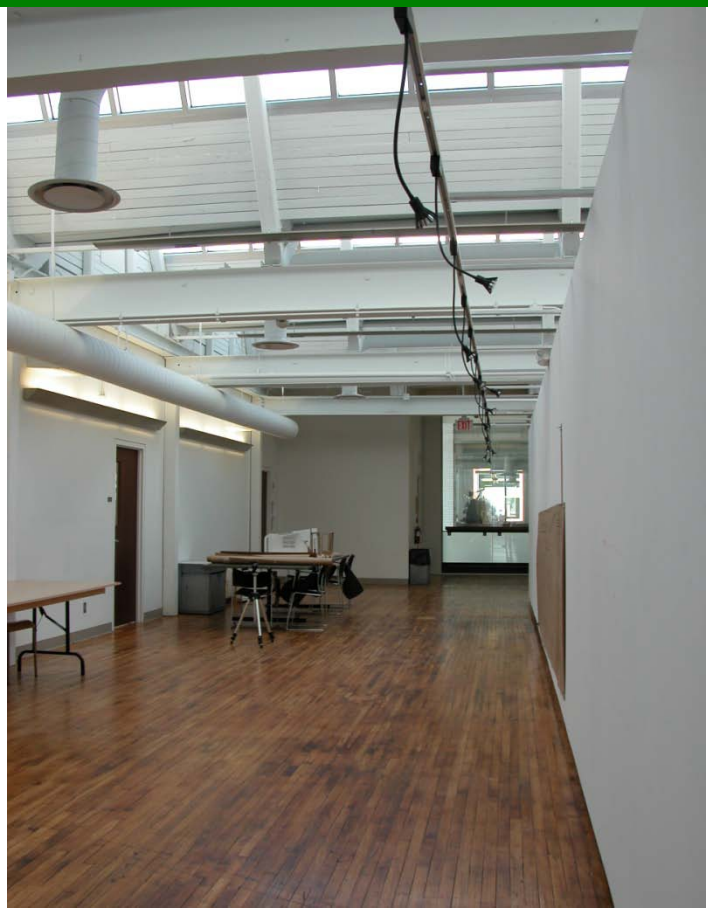
- incorporate light dynamics
- avoid glare
- understand the function of material selection; ie. reflectivity and surface qualities
- balance color and reflectivity with amount of daylight provided



PASSIVE Strategies - DAYLIGHTING

ENERGY EFFICIENCY AND RENEWABLES:

- use energy efficient light fixtures (and effectively!)
- use occupant sensors *combined with light level sensors*
- aim to only have lights switch on only when daylight is insufficient
- provide electricity via renewable means: wind, PV, CHP



Lights on due to occupant sensors when there is adequate daylight – WASTES ENERGY!

Radical RETHINKING:

DESIGN FOR YOUR LOCAL CLIMATE!

ERADICATE

“MacDonald’s Type Architecture”

PASSIVE – BIO CLIMATIC DESIGN

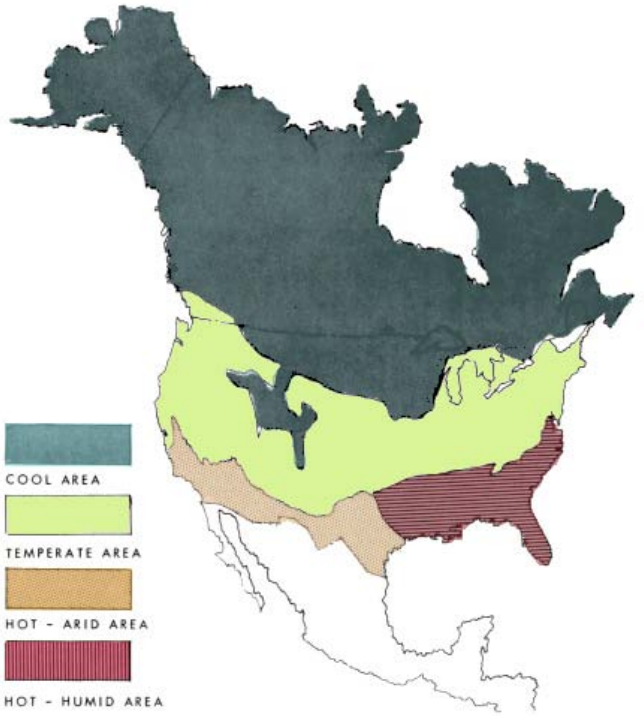
Design must first acknowledge regional, local and microclimate impacts on the building and site.

COLD

TEMPERATE

HOT-ARID

HOT-HUMID



11. Regional climate zones of the North American continent.

Image: 1963 “Design With Climate”, Victor Olgyay.

Bio-climatic Design: COLD

Where **WINTER** is the dominant season and concerns for conserving heat predominate

RULES:

- **First INSULATE**

- *exceed* CODE requirements

-build tight to reduce air changes

- **Then INSOLATE**

- ORIENT AND SITE THE BUILDING PROPERLY FOR THE SUN

- maximize south facing windows for easier control

- fenestrate for DIRECT GAIN PASSIVE

- apply THERMAL MASS to store the FREE SOLAR HEAT

- create a sheltered MICROCLIMATE

YMCA Environmental Learning Centre, Paradise Lake, Ontario

Bio-climatic Design: HOT-ARID

Where **very high summer temperatures** with great fluctuation predominate with **dry conditions** throughout the year.

Traditional House in Egypt

RULES:

- Solar avoidance : keep DIRECT SOLAR GAIN out of the building
- avoid daytime ventilation
- promote nighttime flushing with cool evening air
- achieve daylighting by reflectance and use of LIGHT non-heat absorbing colours
- create a cooler MICROCLIMATE by using light / lightweight materials
- respect the DIURNAL CYCLE
- use heavy mass for walls and DO NOT INSULATE

Bio-climatic Design: HOT-HUMID

Where **warm to hot** stable conditions predominate with **high humidity** throughout the year.

RULES:

- SOLAR AVOIDANCE : large roofs with overhangs that shade walls and to allow windows open at all times
- PROMOTE VENTILATION
- USE LIGHTWEIGHT MATERIALS that do not hold heat
- use STACK EFFECT to ventilate through high spaces
- use of COURTYARDS and semi-enclosed outside spaces
- use WATER FEATURES for cooling

House in Seaside, Florida

Bio-climatic Design: TEMPERATE

The summers are hot and humid, and the winters are cold. In much of the region the topography is generally flat, allowing cold winter winds to come in form the northwest and cool summer breezes to flow in from the southwest. **The four seasons are almost equally long.**

IslandWood Residence, Seattle

RULES:

- BALANCE strategies between COLD and HOT-HUMID
- maximize flexibility in order to be able to modify the envelope
- understand the natural benefits of SOLAR ANGLES that shade during the warm months and allow for heating during the cool months