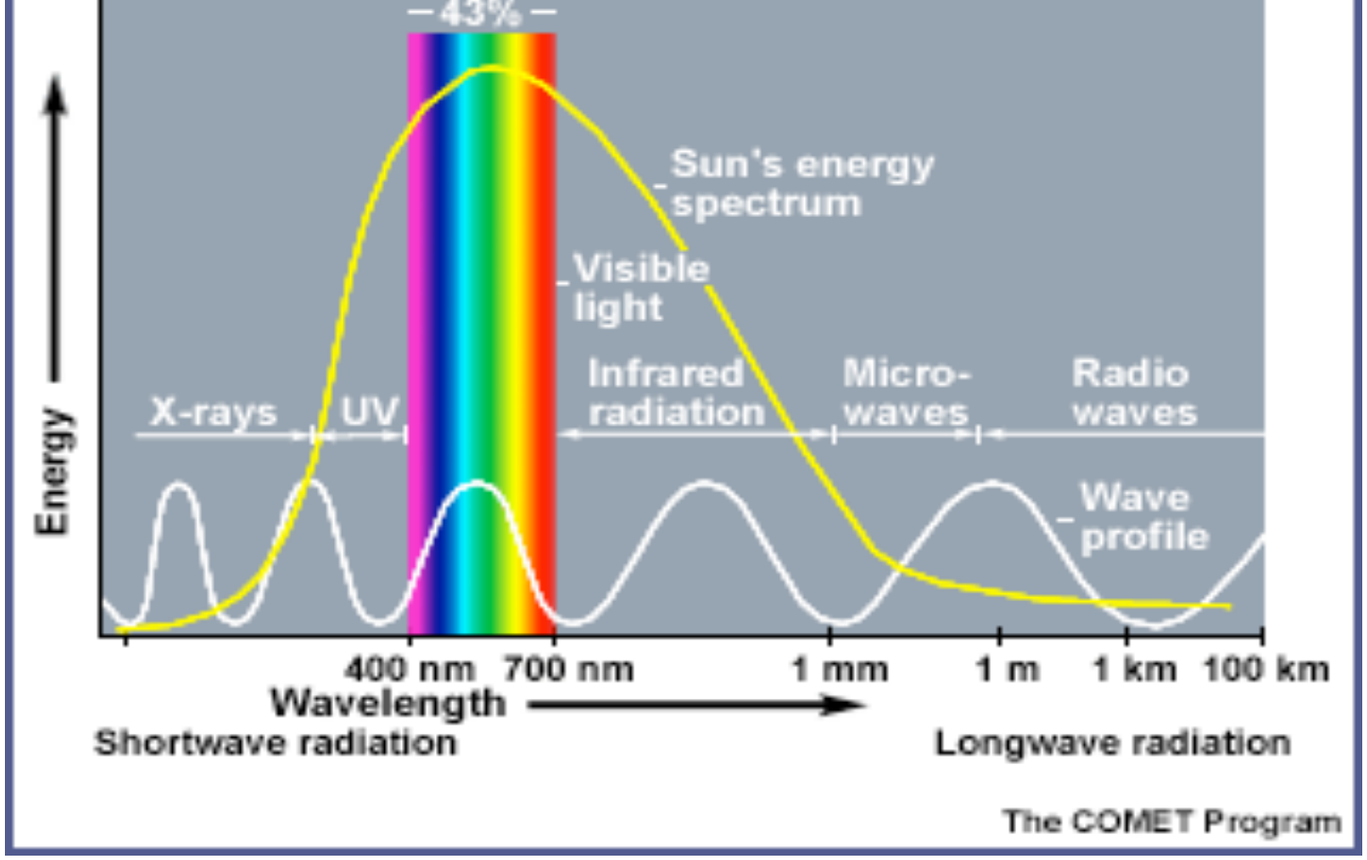
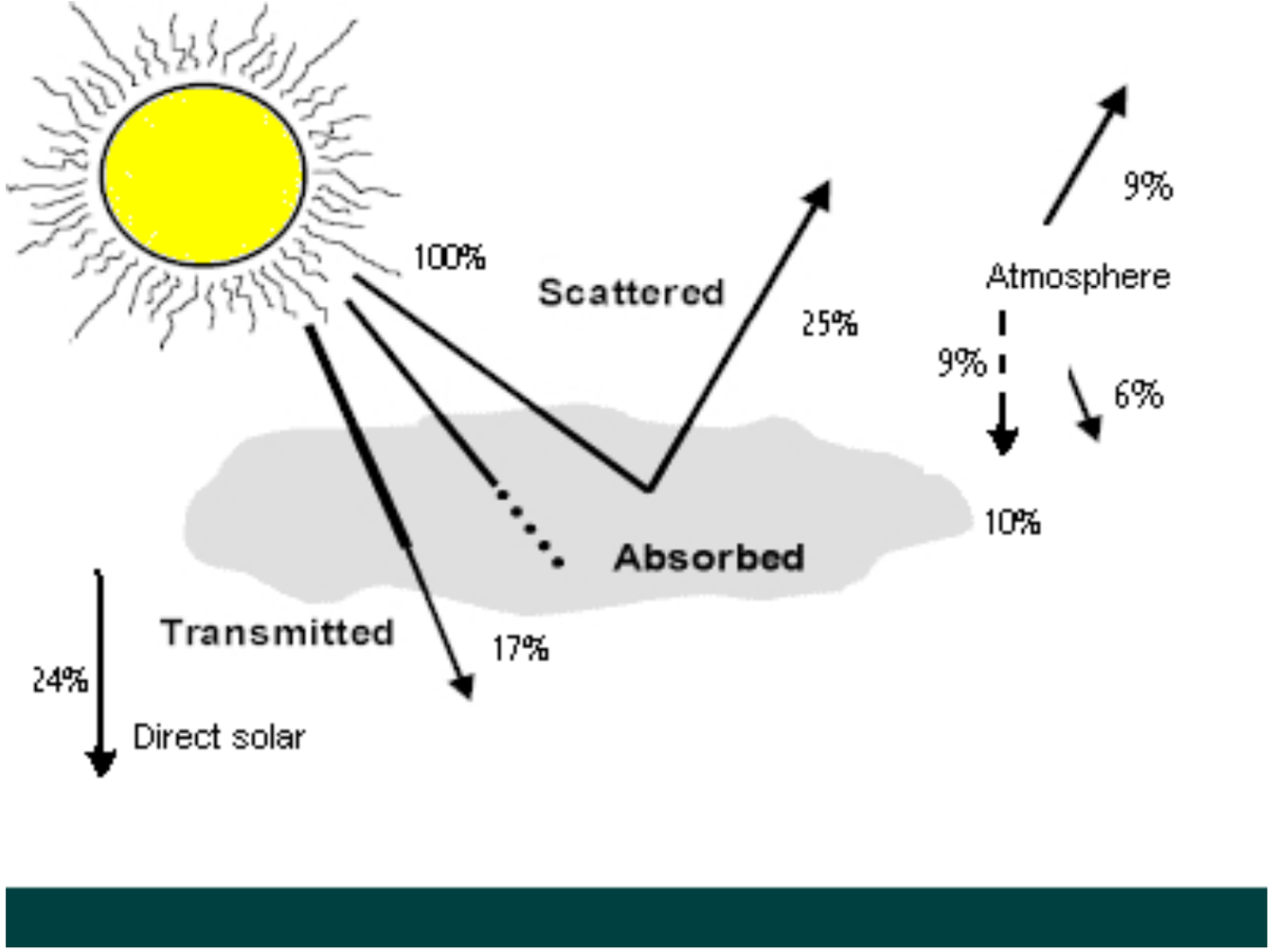
Eco
건축

Energy Efficient Why

태양

- 모든 에너지의 근원
- 47% 만이 지구에 도달
- 30일간의 태양빛 = 전지구의 화석연료와 같음
- 에너지 밀도가 낮음





Light

The Pillars of the Earth
Ken Follett, 1989
12th century, Kingsbridge, England

A cathedral it's god's anteroom,
it's half way to heaven,
and the light,
the light is everything. - Tom Builder

교회는 신이 머무는 곳으로 기도하는 장소이다. - Gaudi

건축은 최고의 조형예술이다.
왜냐하면 조각과 회화도 건축을 필요로 하기 때문이다.건축의 탁월성은 모두 빛에서 나온다. 건축은 빛의 질서이다. 이에 반해 조각은 빛의 유희이고, 회화는 색채에의한 빛의 재현이다. 색채는 빛의 분석이다. - Gaudi

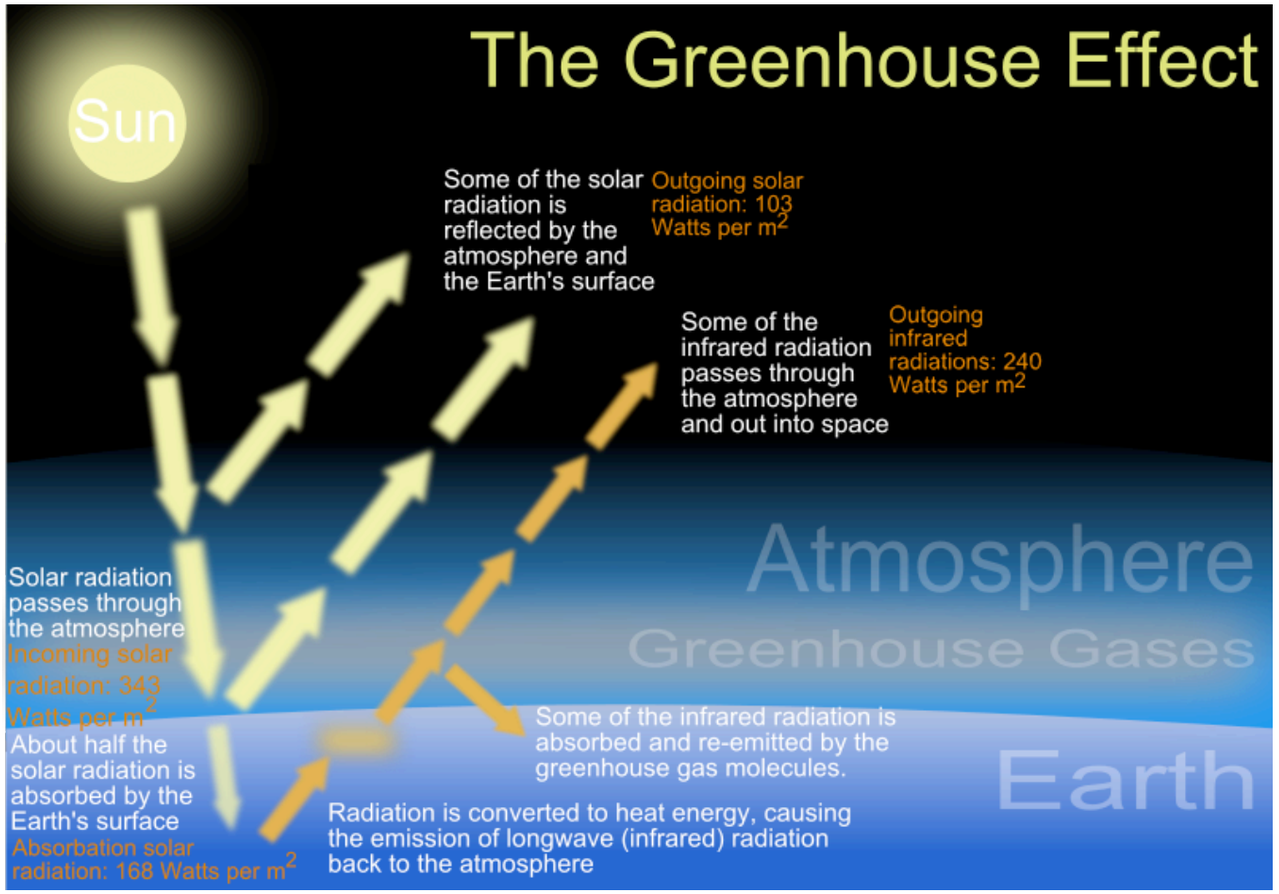
Energy?

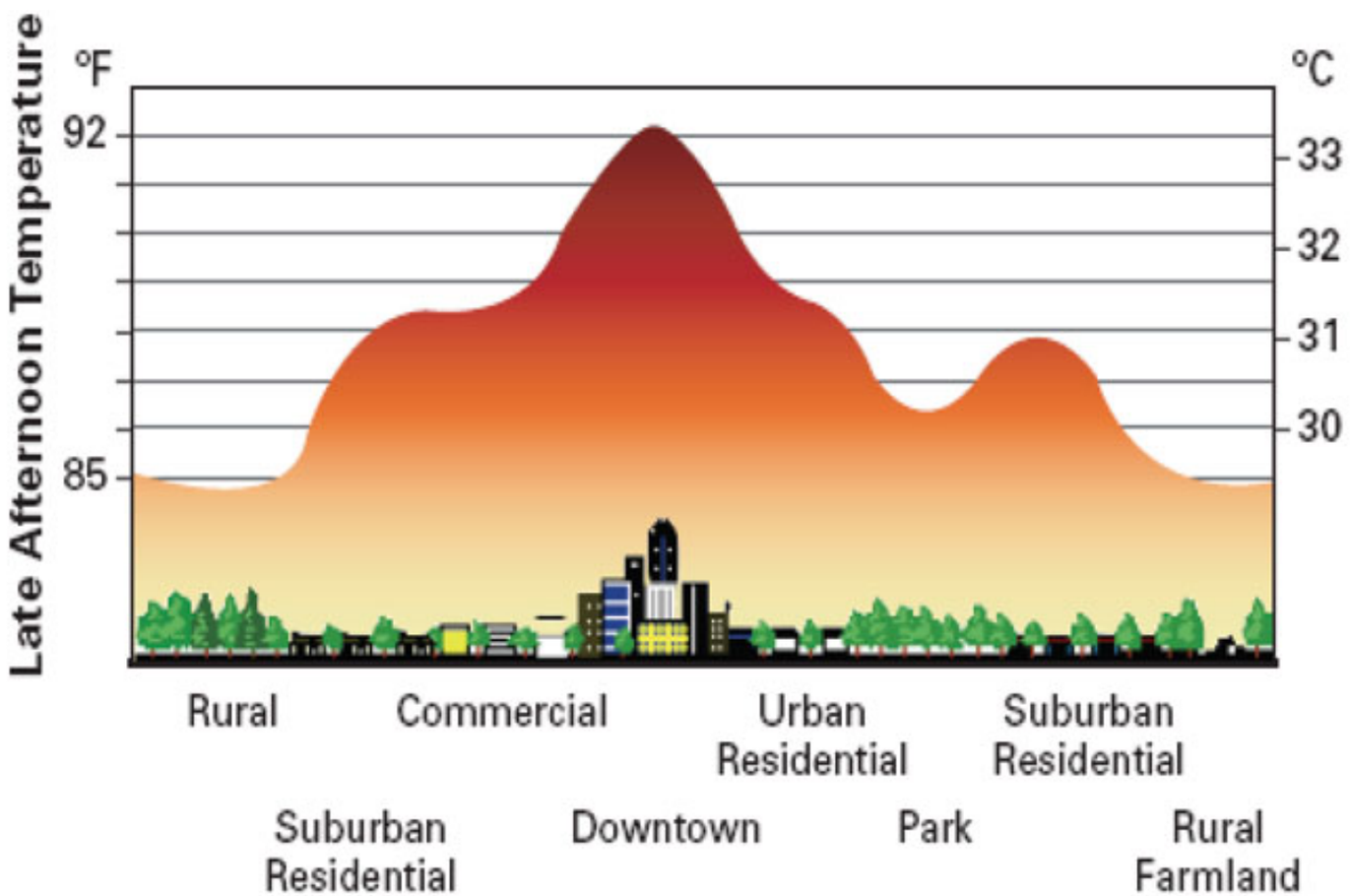
Energy is Lighting 빛
Energy is Heat 열
Energy is Things Grow 성장
Energy Makes Things Move 이동
Energy Runs Machines 작동
Energy Doesn't Disappear

NEED

온실가스 기후변화

- 전체 배출량 29,693천CO2 톤, 이산화탄소가 86% 차지
- 건물에서 43.2%, 수송부문이 40.3%, 폐기물이 12.5% 차지
- 서울의 평균기온은 지난 100년간 약 2℃ 증가(지구평균의 3배)
- 도시 전체 열섬현상 심화





Basic

Tree houses built by the Korowai people in Papua, New Guinea

http://www.papuatrekking.com/Korowai_Kombai.html

Vernacular Architecture

Teepee Tent

There is nothing new under the sun.

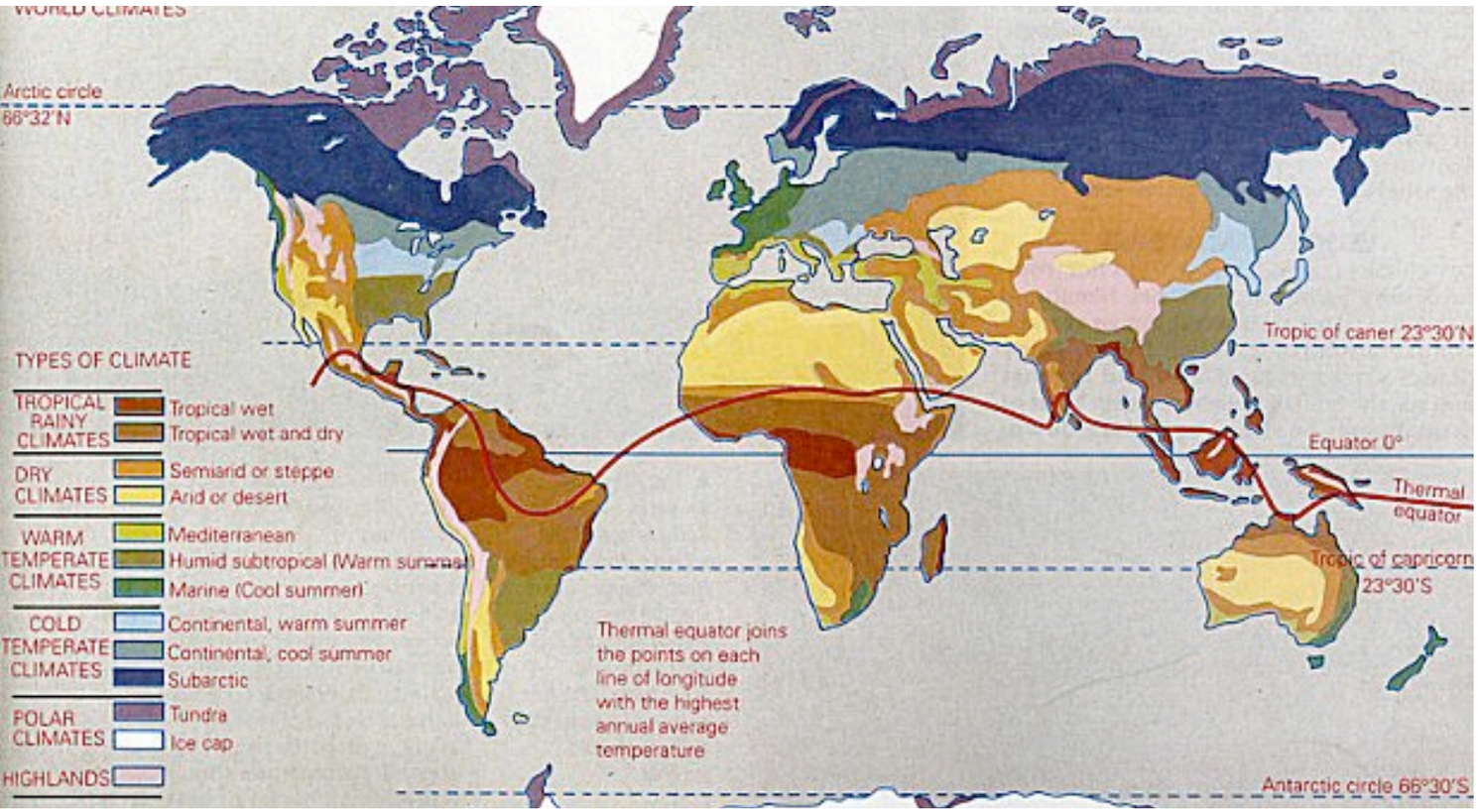
서양속담

미성숙한 시인들은 모방하고, 성숙
한 시인들은 훔친다.

T.S 엘리엇

Nothing is complete unless you
put it in final shape.

Korea



기후

- 아열대 /대륙성기후/ 해양성기후
- 계절풍/뚜렷한 사계절

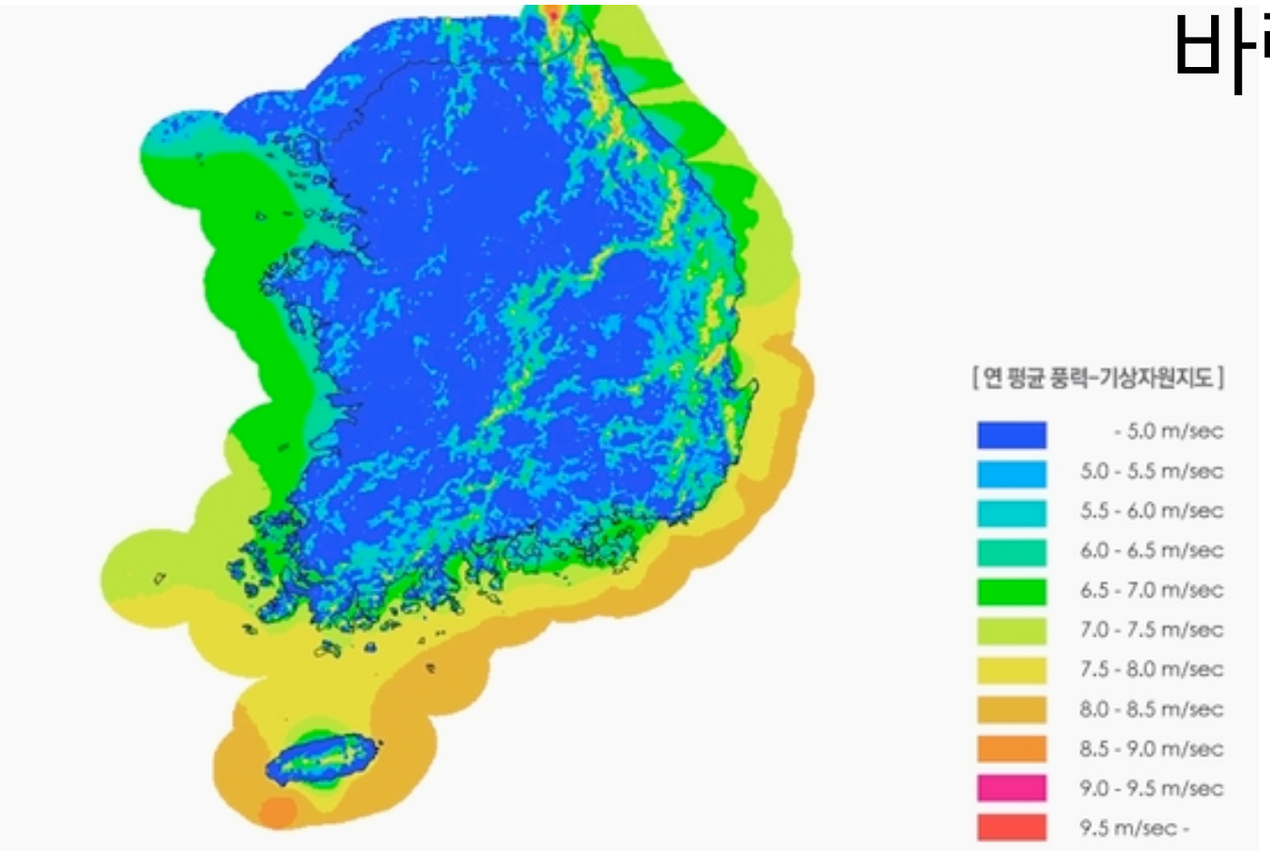
여름철

- 많은강수량/높은 상대습도
- 강한일조와 일사

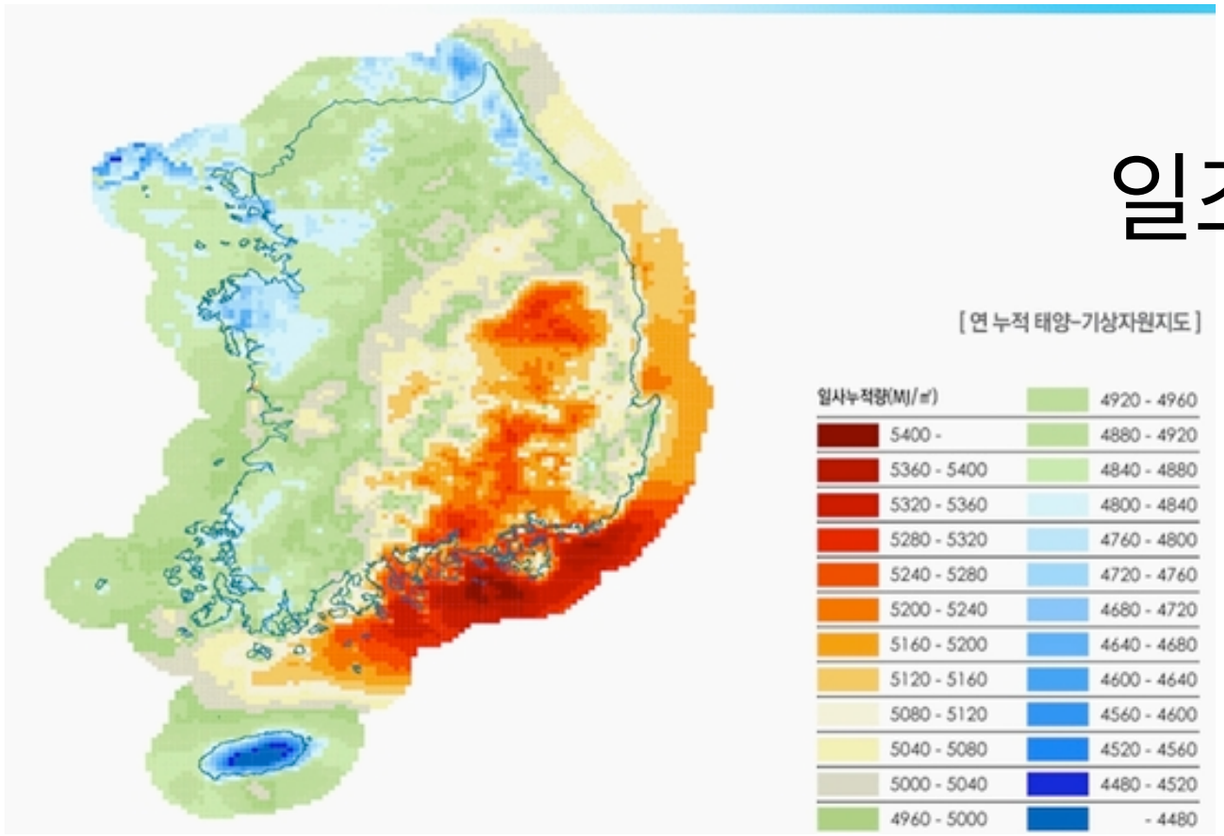
겨울철

- 추위
- 북서풍차단 / 일사활용

바람


[연 평균 풍력-기상자원지도]
- 5.0 m/sec
5.0 - 5.5 m/sec
5.5 - 6.0 m/sec
6.0 - 6.5 m/sec
6.5 - 7.0 m/sec
7.0 - 7.5 m/sec
7.5 - 8.0 m/sec
8.0 - 8.5 m/sec
8.5 - 9.0 m/sec
9.0 - 9.5 m/sec
9.5 m/sec -

일조량


[연 누적 태양-기상자원지도]
일사누적량(MJ/㎡)
5400 -
5360 - 5400
5320 - 5360
5280 - 5320
5240 - 5280
5200 - 5240
5160 - 5200
5120 - 5160
5080 - 5120
5040 - 5080
5000 - 5040
4960 - 5000
4920 - 4960
4880 - 4920
4840 - 4880
4800 - 4840
4760 - 4800
4720 - 4760
4680 - 4720
4640 - 4680
4600 - 4640
4560 - 4600
4520 - 4560
4480 - 4520
- 4480


SPAIN
FRANCE
Santander
San Sebastian
Bilbao
Santiago de Compostela
Vigo
Girona
Zaragoza
Barcelona
Salamanca
Avila
Madrid
Balearic Sea
PORTUGAL
Toledo
Menorca
Mallorca
Valencia
Ibiza
Badajoz
Benidorm
Alicante
Cordoba
Seville
Granada
Mediterranean Sea
Jerez de la Frontera
Malaga
Almeria
Marbella
Torremolinos
Atlantic Ocean
ALGERIA
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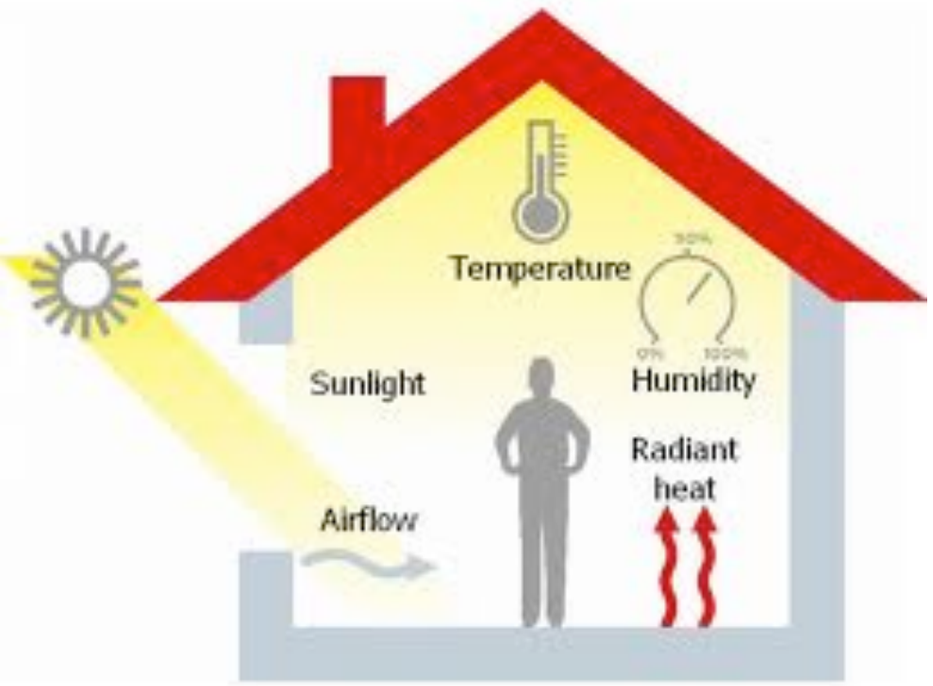
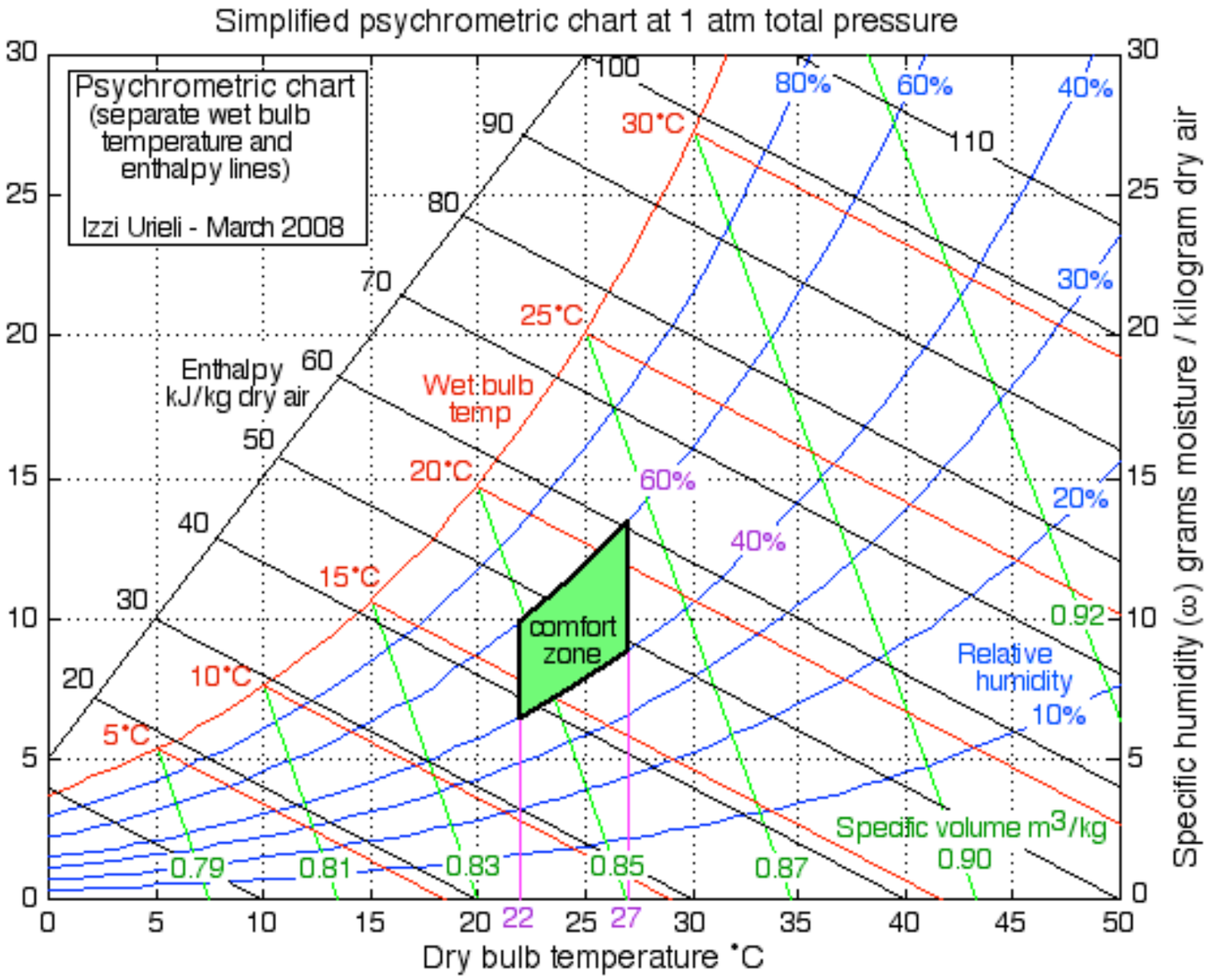


쾌적

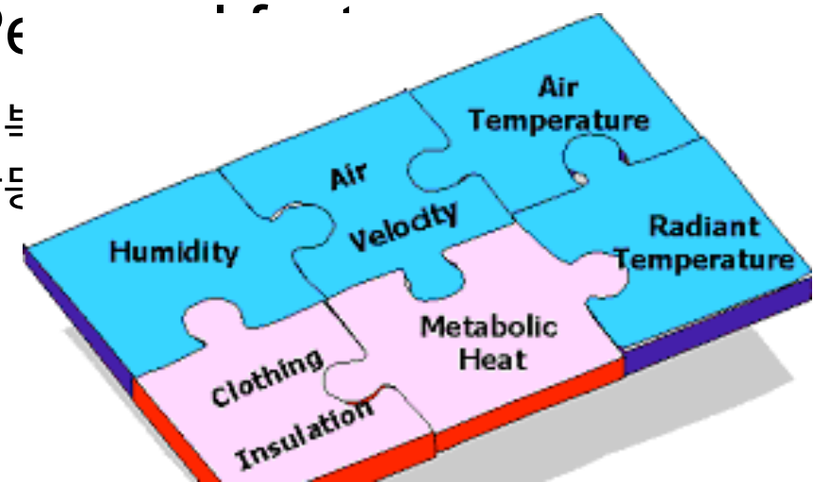


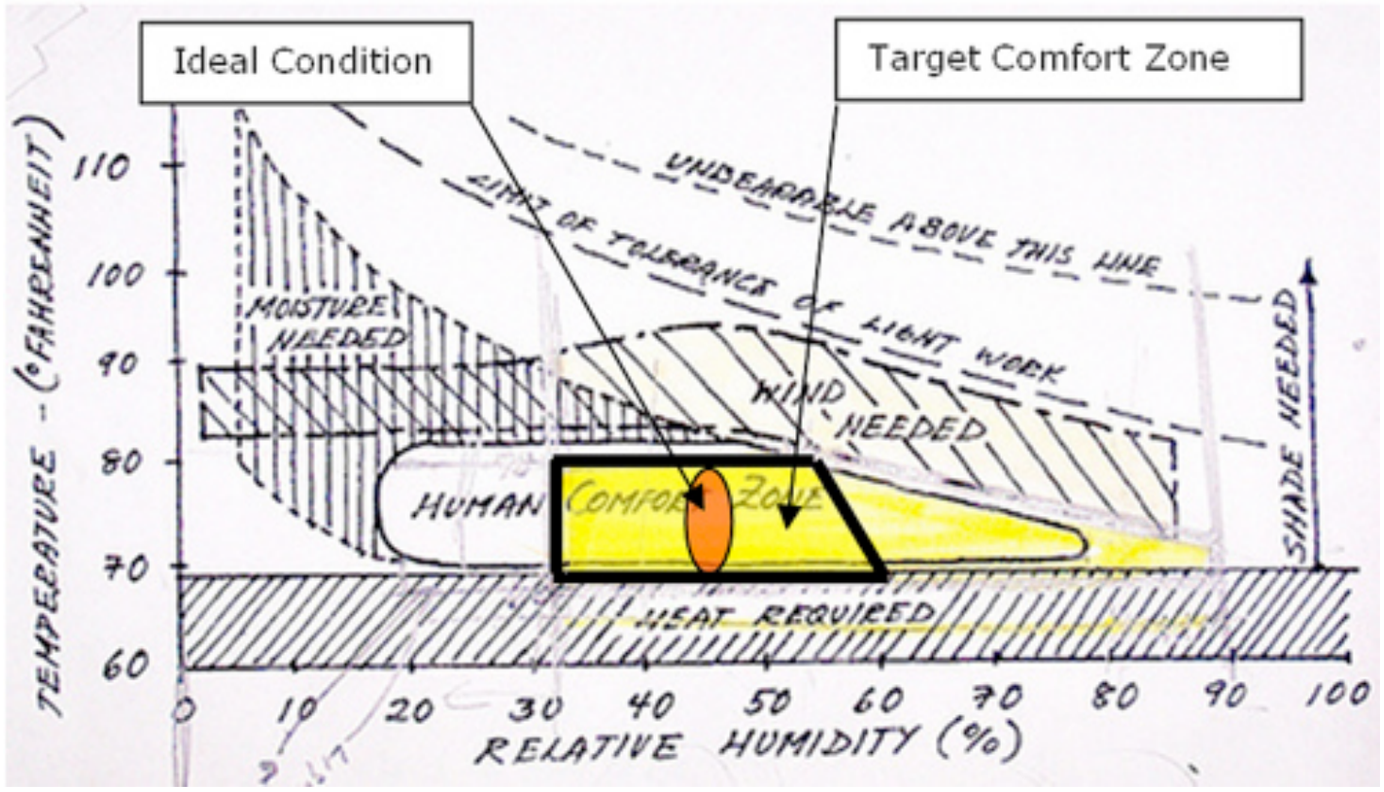
Environmental factors:

1. 온도 Air temperature
2. 복사열 Radiant temperature
3. 기류속도 Air velocity
4. 습도 Humidity

Pe

1. 의
2. 활





테스트

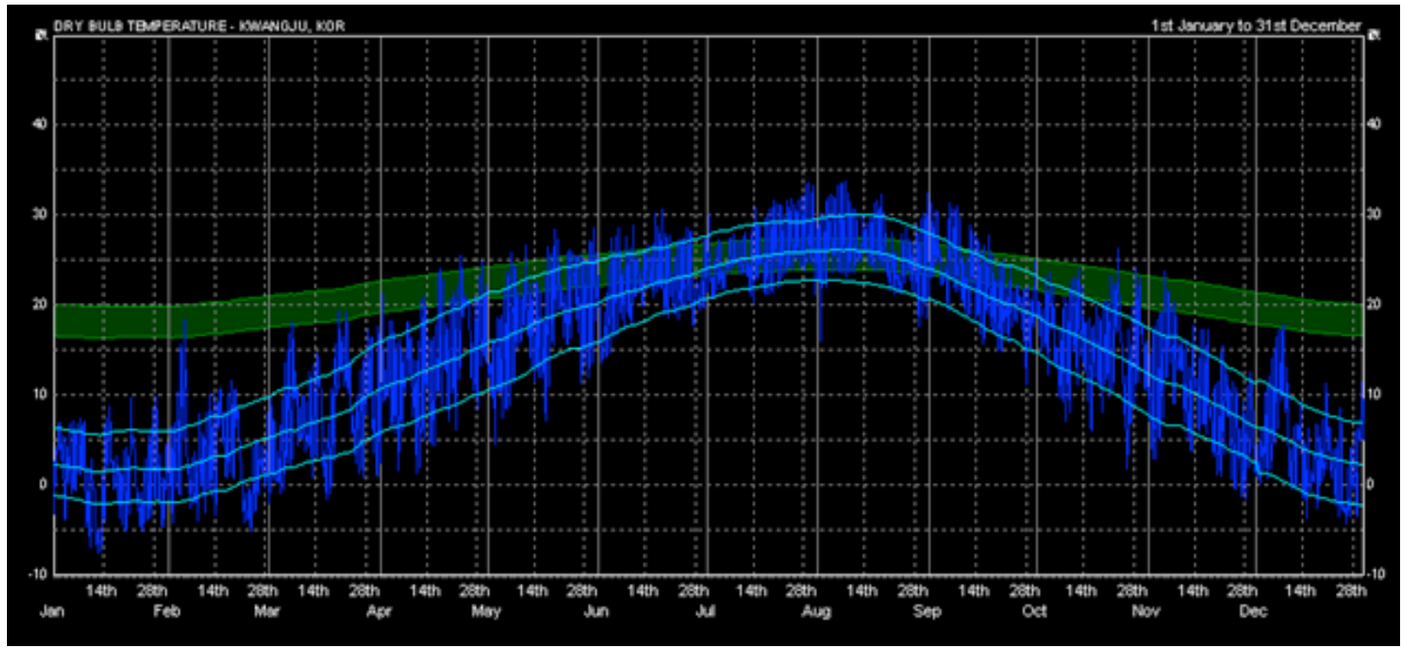
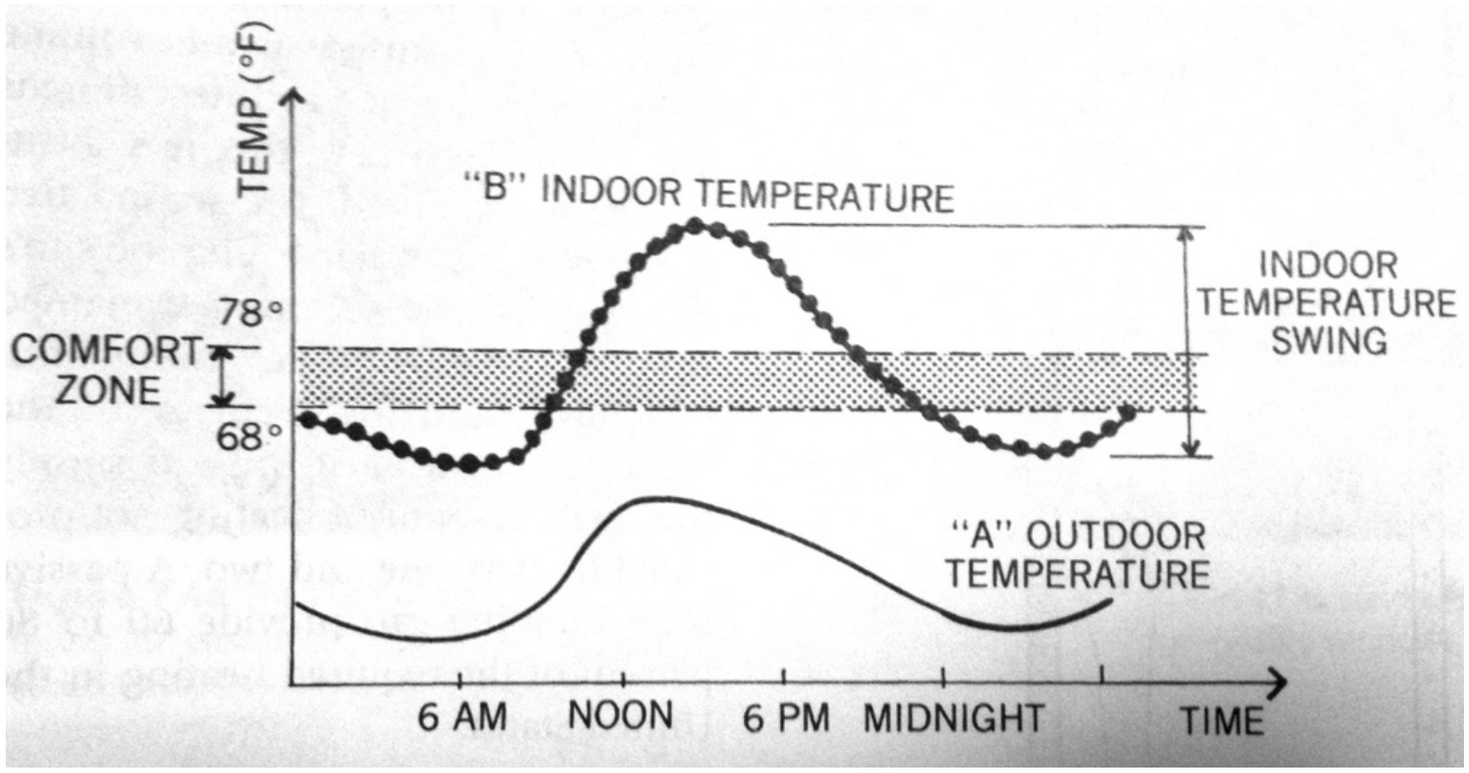
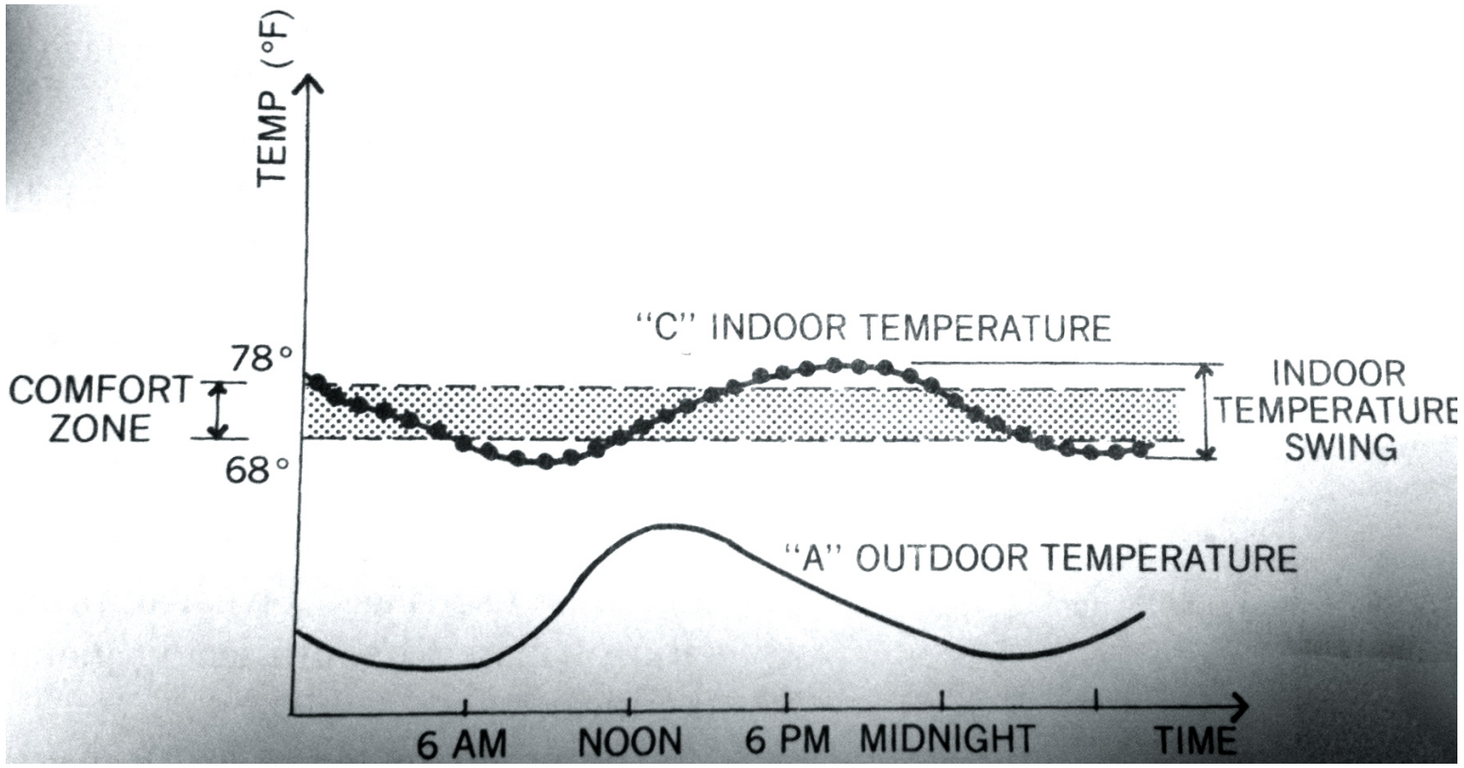


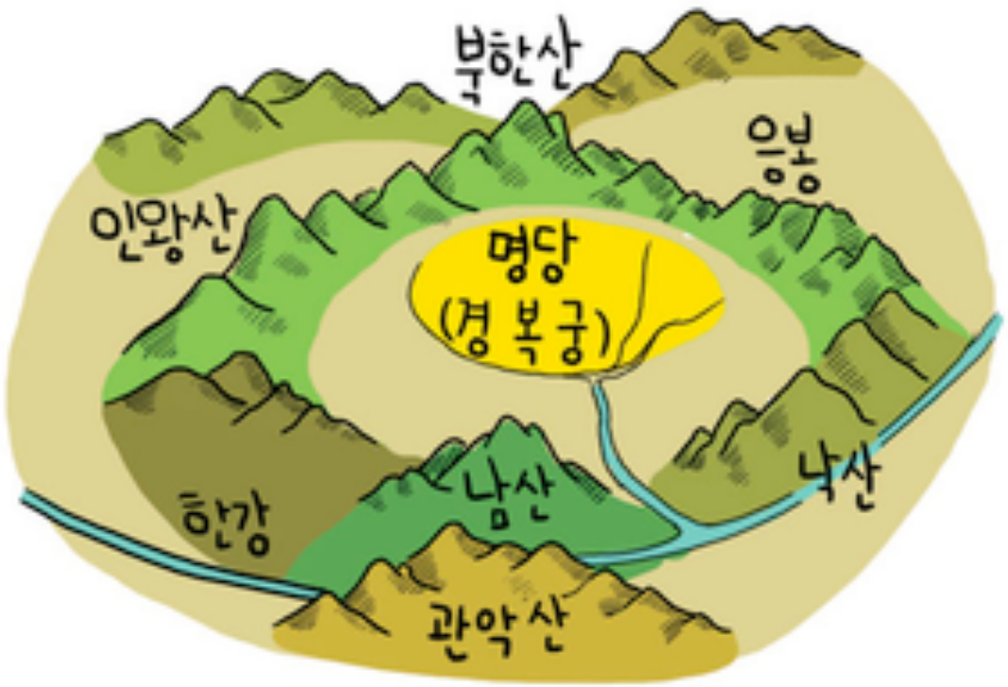
Table 4.3 Body Heat Production as a Function of Activity

	Activity	Heat Produced (Btu/h)		Watts
	Sleeping	340		100
	Light work	680		200
	Walking	1020		300
	Jogging	2720		800

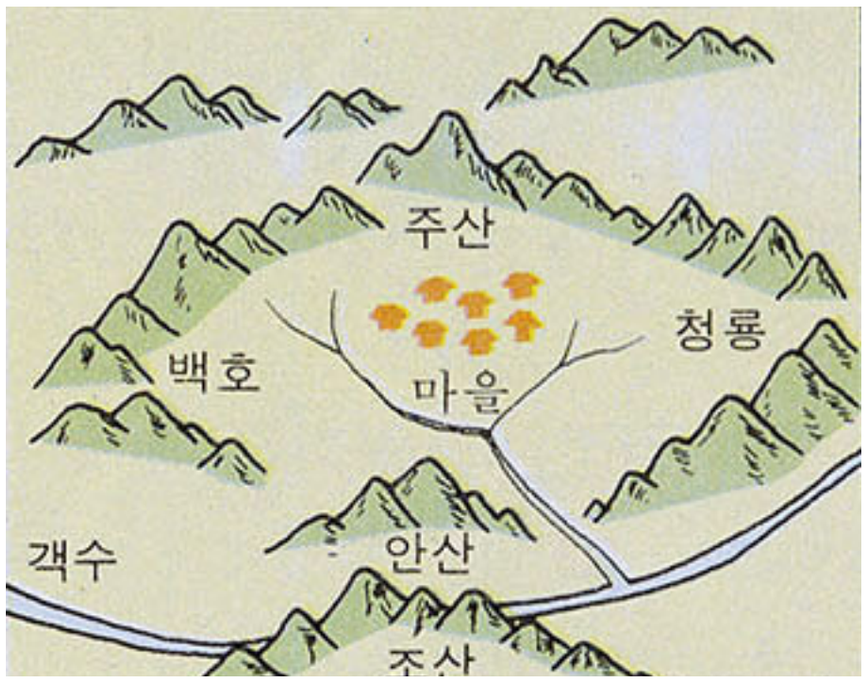




외기 온도 변화에 영향을 받지 않은 쾌적대 유지



장풍득수
藏風得水



배산임수背山臨水

- 일조와 이사취득 용이
- 계절풍에 유리-밤에 저지대에 형성되는 냉기층과 산정부근의 바람으로부터격리
- **삼대**가 적선을 해야 **남향집**에 산다.

Climate기후 - 오랜기간의 평균 기상

Weather기상- **기상이란 대기의 다양한 상태를 말함.**

- **Weather** is the state of the atmosphere, to the degree that it is hot or cold, wet or dry, calm or stormy, clear or cloudy.

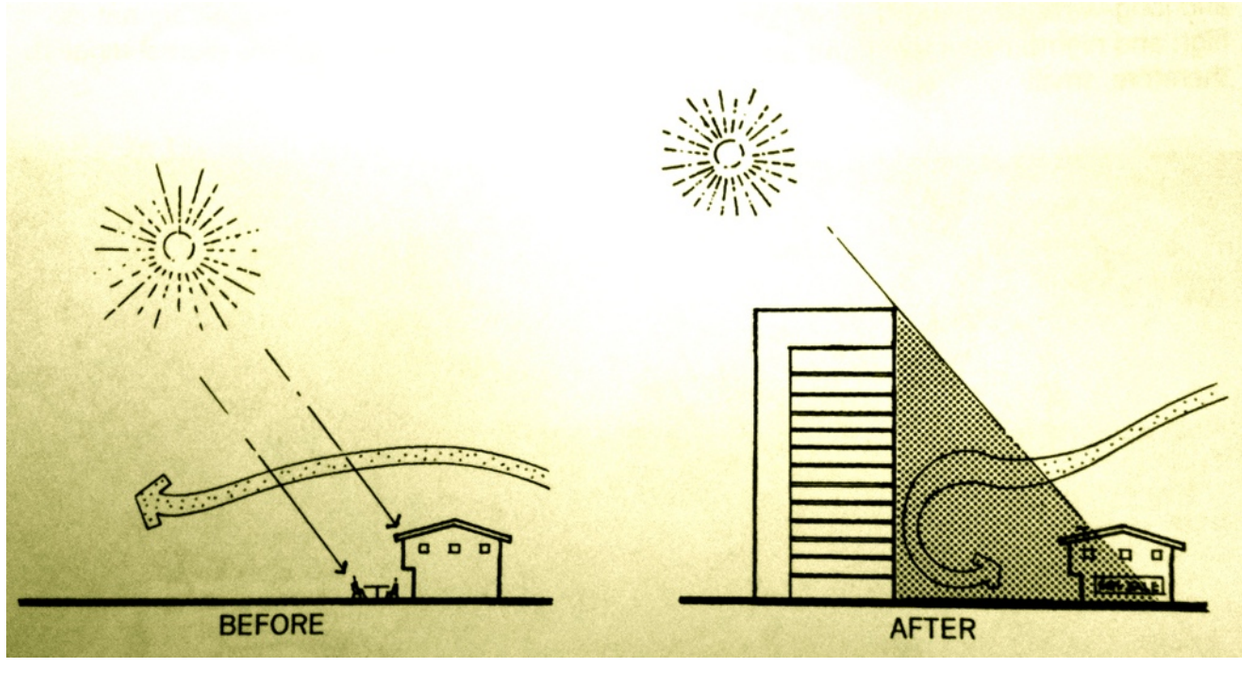
Micro Climate미기후-대기의 물리적 상태로, 건물, 실개천, 빗물 침투시설 및 숲의 존재 등에 영향을 받아 생활주변에서 나타나는 아주 작은 지역기후특성을 말함.(친환경 주택의 건설기준 및 성능)

- A **microclimate** is a local atmospheric zone where the climate differs from the surrounding area. 대지 및 주변

Macro Climate지역기후

- 건물 주변

기후
Climate



Microclimate

기후요소
Climatic elements

- 온도 Temperature - dry-bulb temperature.
- 습도 Humidity - expressed as relative humidity or absolute humidity, or the web-bulb temperature or dew-point temperature may be stated, from which the humidity can be deduced.
- 기류 Air movement - both wind speed and direction are indicated.
- 강수량 Precipitation - the total amount of rain, hail, snow, dew, measured in rain gauges and expressed in mm per unit time (day, month, year).
- 운량 Cloud cover - based on visual observation and expressed as a fraction of the sky hemisphere (tenths, or 'octas' = eights) covered by clouds.
- 일조시간 Sunshine duration - the period of clear sunshine (when a sharp shadow is cast), measured by a sunshine recorder which burns a trace on a paper strip, expressed as hours per day or month.
- 태양복사 Solar radiation - measured by a pyranometer, on an unobstructed horizontal surface and recorded either as the continuously varying irradiance (W/m^2), or through an electronic integrator as irradiance over the hour or day.

As the four environmental variables directly affecting thermal comfort are temperature, humidity, solar radiation and air movement, these are the four constituents of climate most important for the purposes of building design. Rainfall data may sometimes be needed, such as for designing drainage systems and assessing the level of percipitation.

기후분석
Climate Analysis

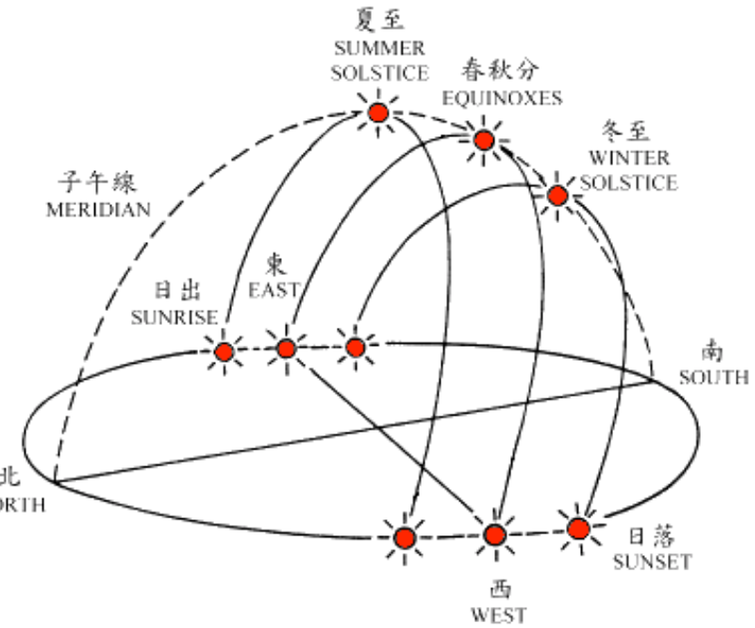
Different design situations will require different weather data for the study.
Climate analysis carried out at initial design stage may be used for:

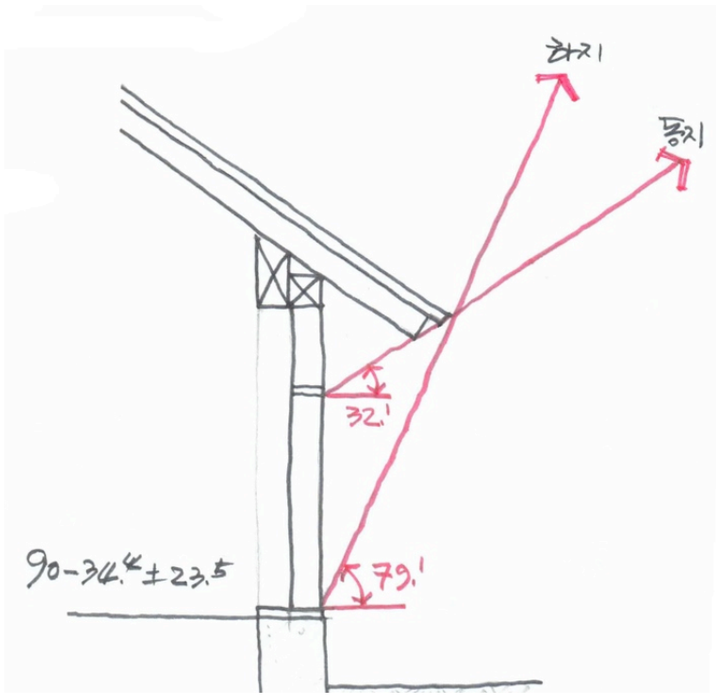
- develop design strategies
- check condensation problems in some cases
- optimisation of insulation

Climate Analysis

Load and energy calculation carried out at outline and detail design stages will require weather data for:

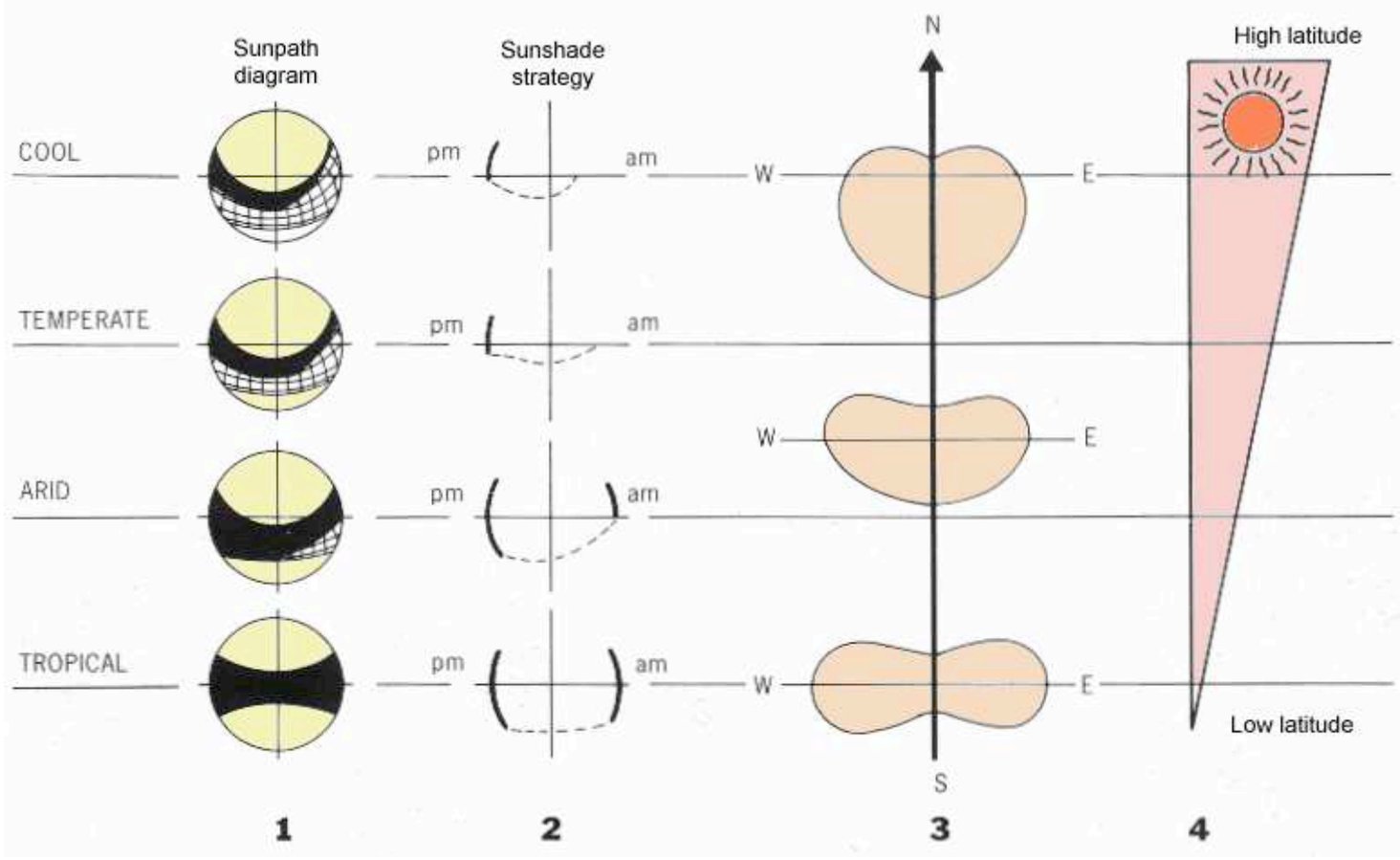
- calculation of cooling and heating requirements
- design of heating, ventilating and air-conditioning (HVAC) systems
- energy estimation of buildings





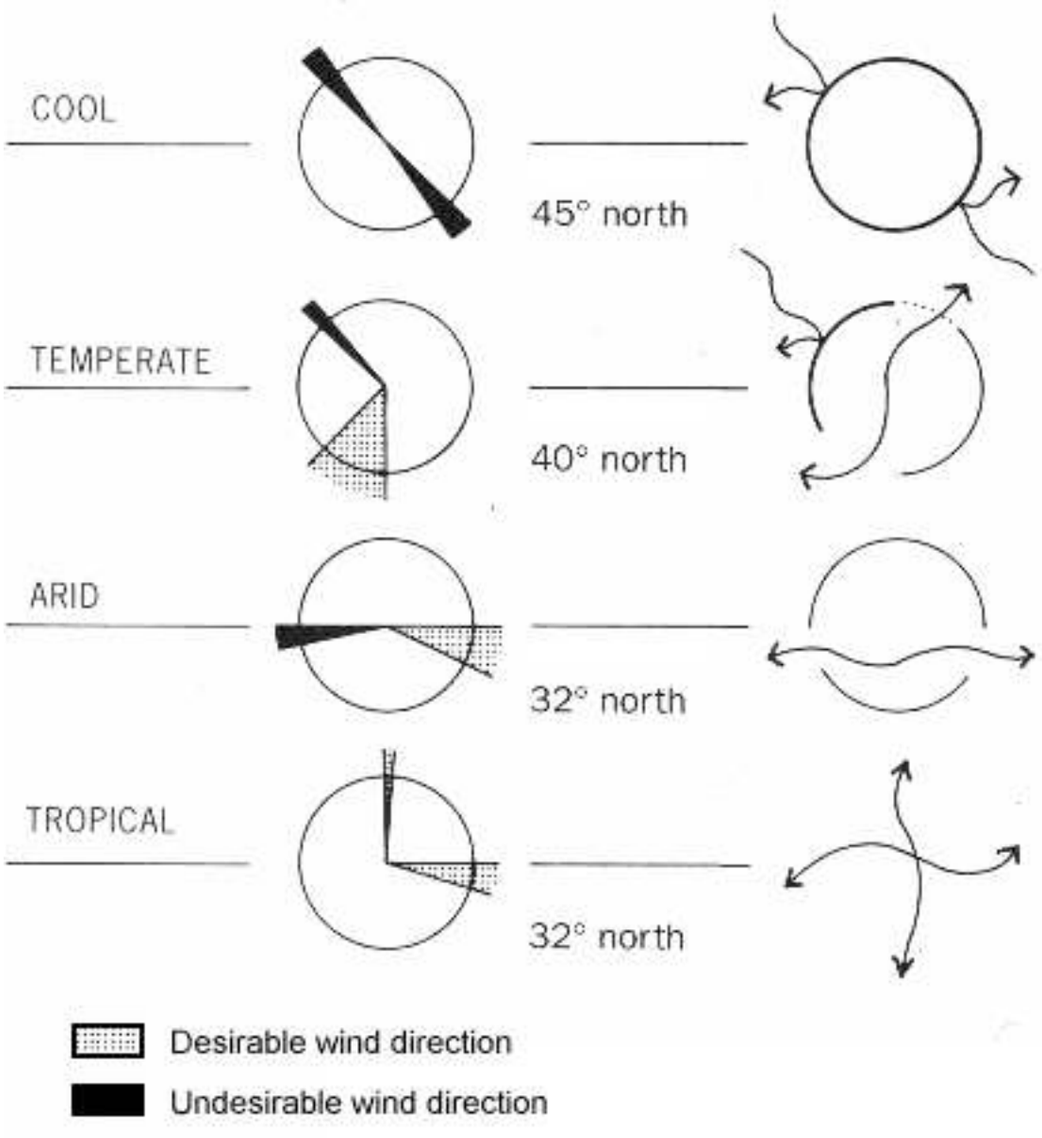
태양고도를 고려한 창대위치결정

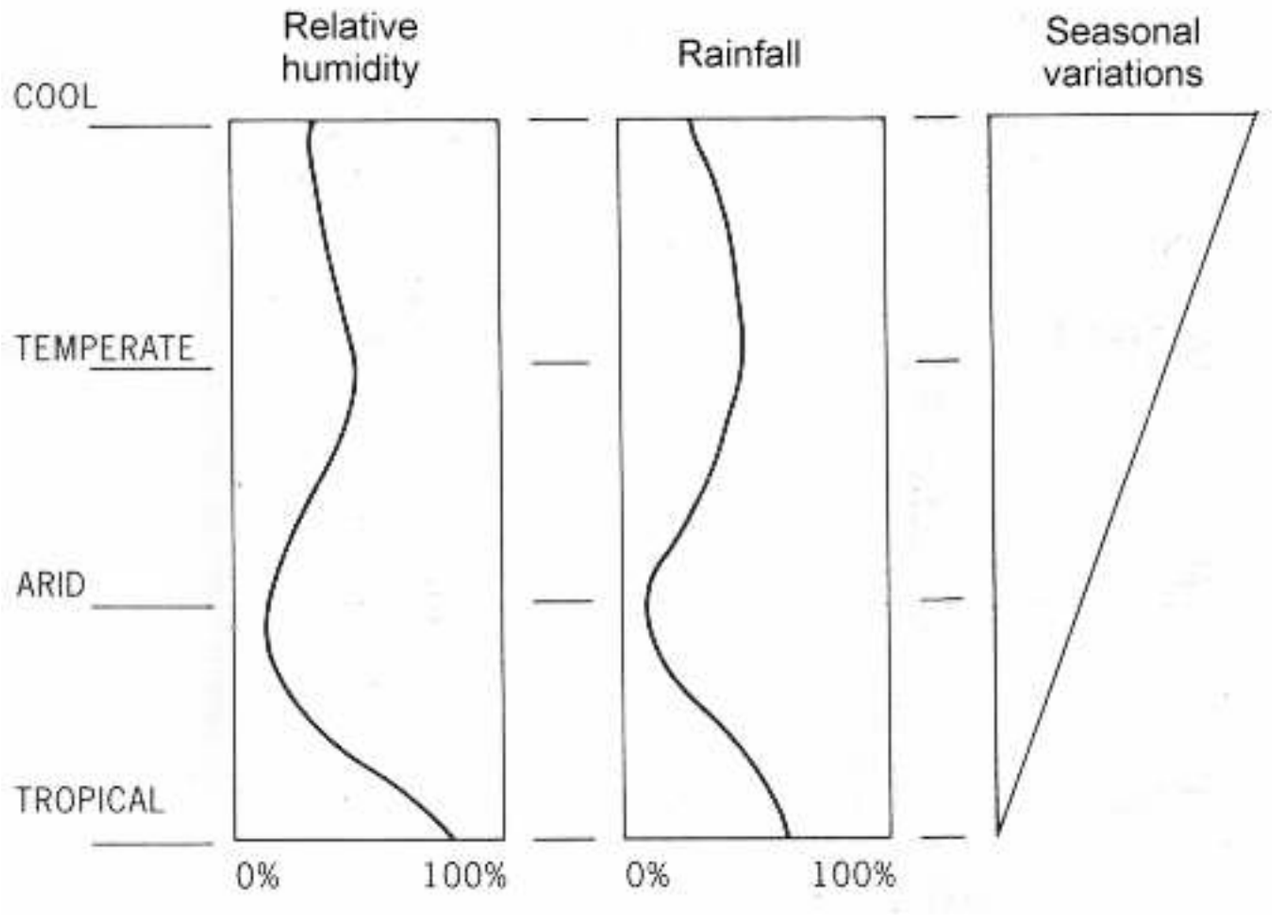
Sunshade Analysis



- Solar paths requiring shade
- Sunshade analysis(vertical and horizontal)
- Insolation
- Sun requirements during winter

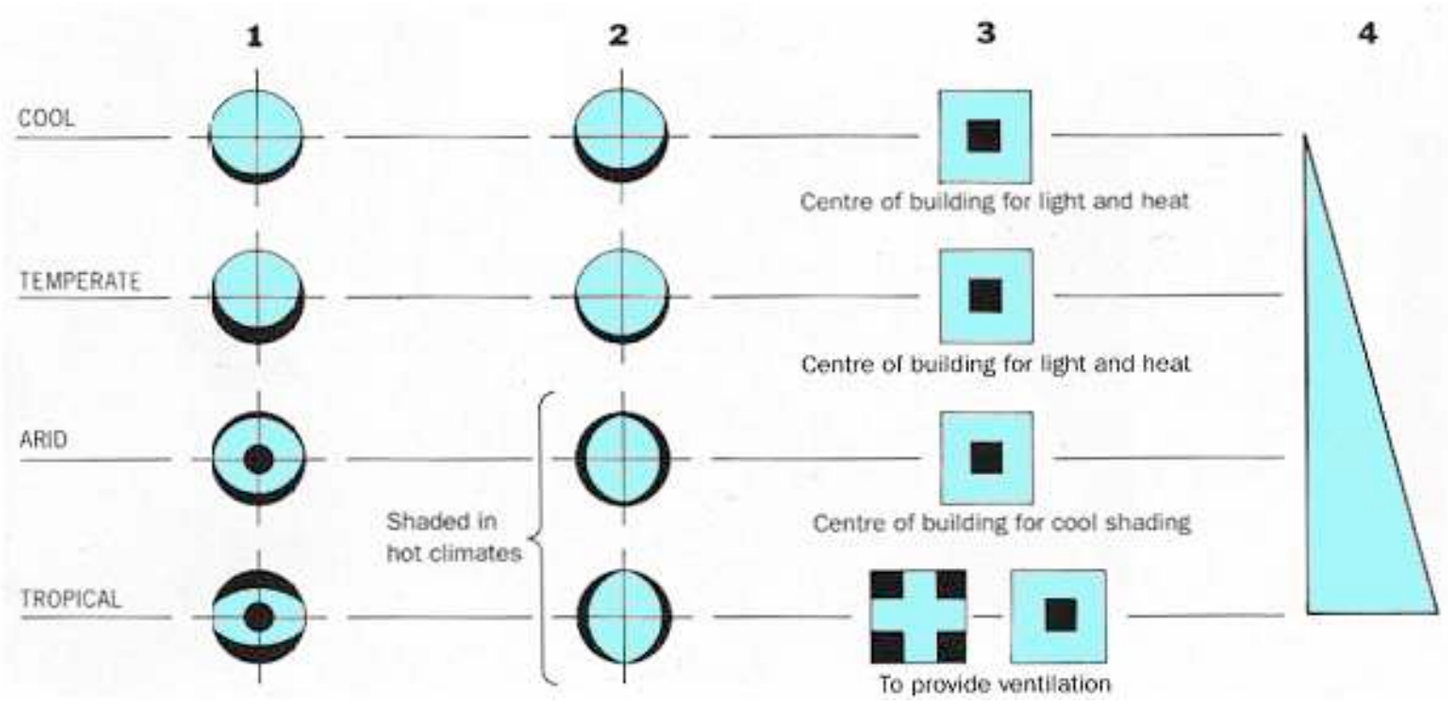
Wind Analysis



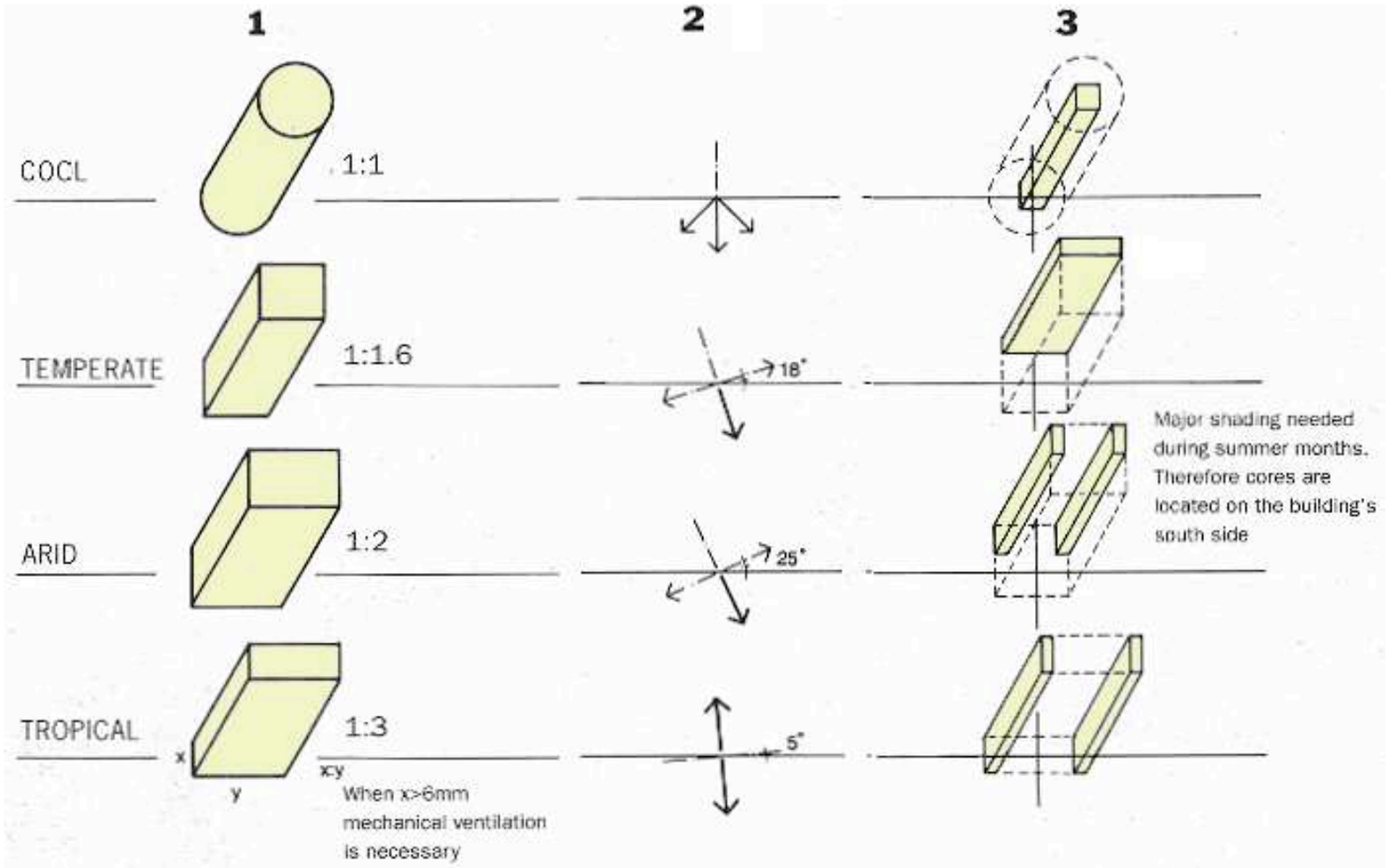


Humidity, Rainfall and Seasonal Variations

- Annual average relative humidity
- Annual average rainfall
- Annual seasonal variations

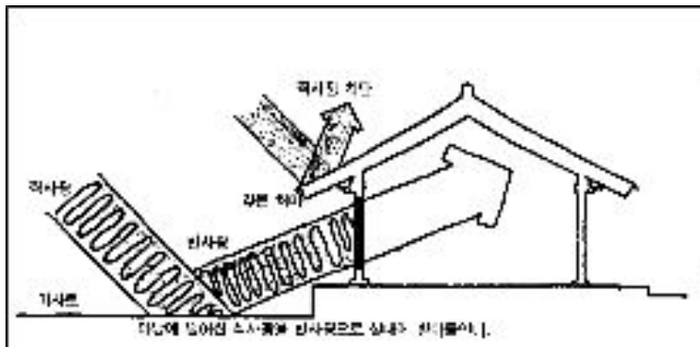


Influence on built form

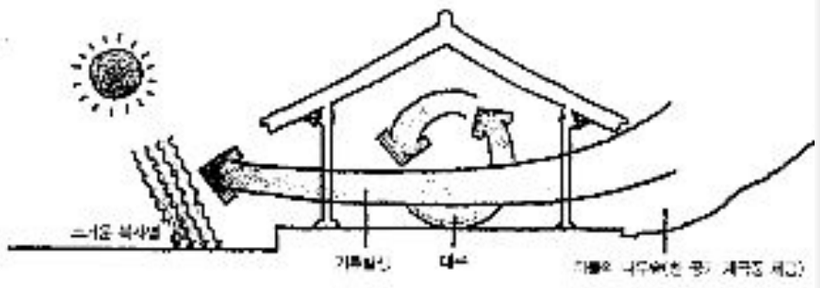


- Zone for transitional space
- Zone for solar gain
- Use of atrium
- Potential of roof/ground floor as useable exterior space

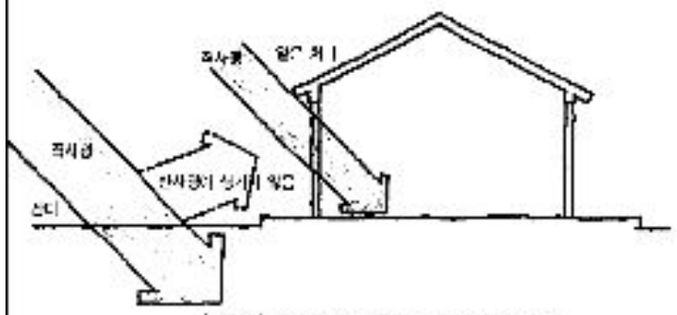
- Form
- Orientation



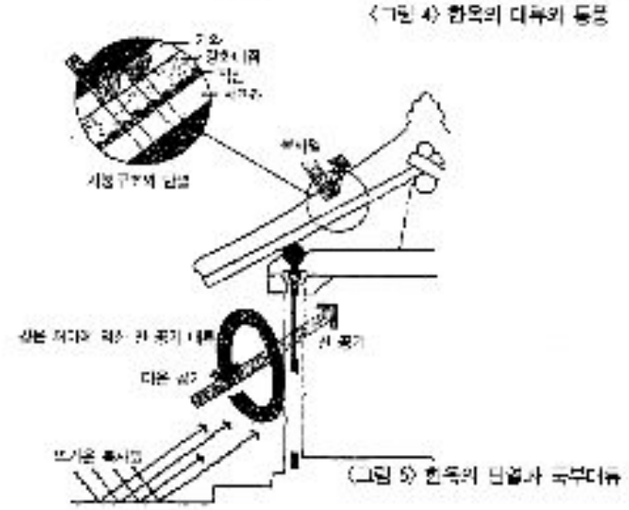
〈그림 2〉 반사광을 이용하는 한옥의 일조계획



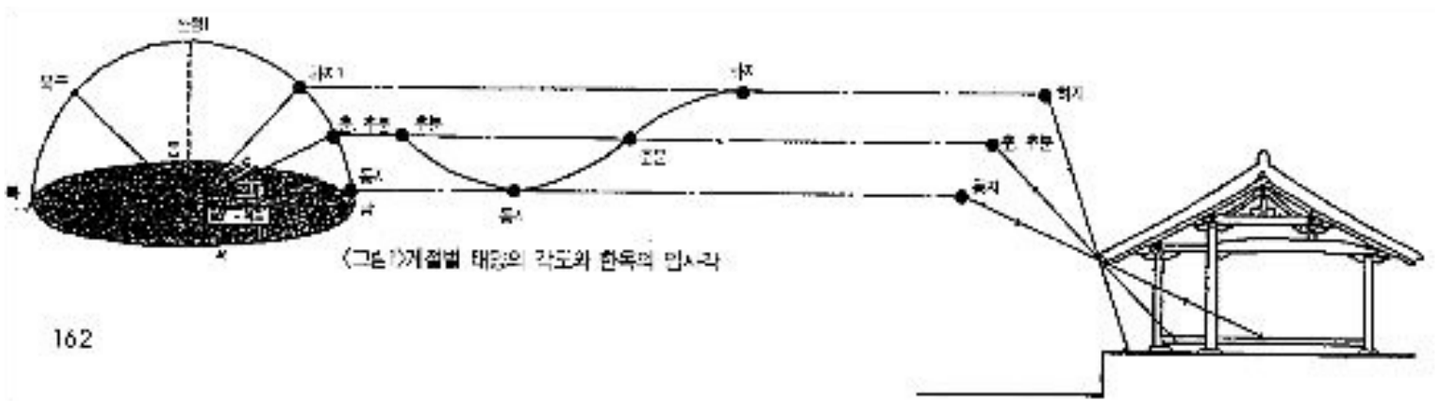
〈그림 4〉 한옥의 대부와 동향



〈그림 3〉 조사광을 이용하는 현대의 설비식



〈그림 5〉 한옥의 입출사 특부대



〈그림〉계절별 태양의 각도와 한옥의 입사각

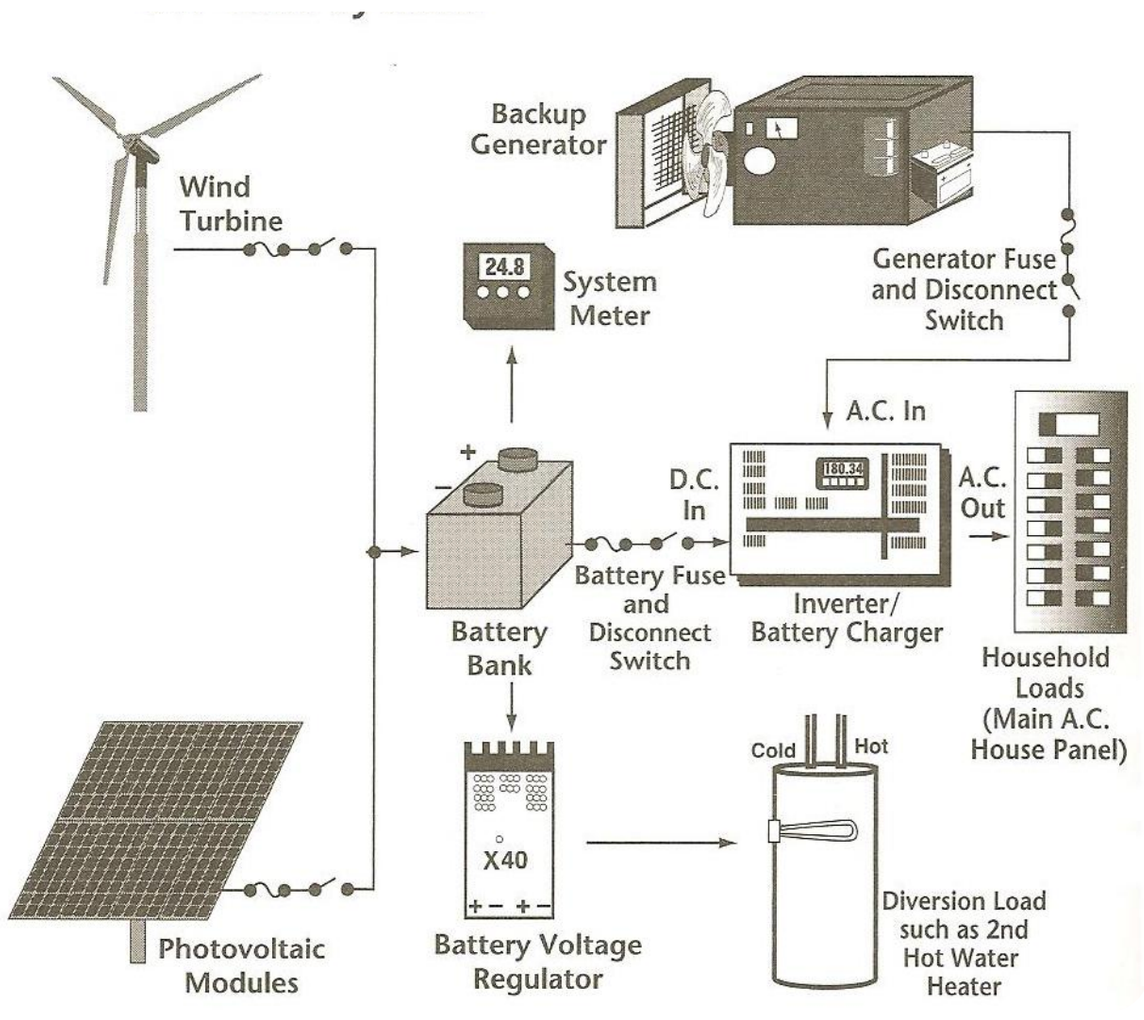
Temperate Climate

- 더운여름, 추운겨울-어려운 환경계획
- 건물방위 및 형상(S/V용적에 대한 표면적비), 자연에너지 이용(태양열, 바람, 축열)
- 차양, 창호계획
- 외피재료의 단열 및 축열 고려

Design Principles

		전도	대류	복사	기화
겨울	획득촉진			태양열 획득 촉진	
	손실억제	전도에 의한 열류의 최소화	외부열류의 극소화		
여름	획득억제	전도에 의한 열류의 극소화		태양열 획득의 극소화	
	손실촉진	주기적인 열류의 지연	환기촉진	복사냉방의 촉진	기화냉방의 촉진

Off-Grid System



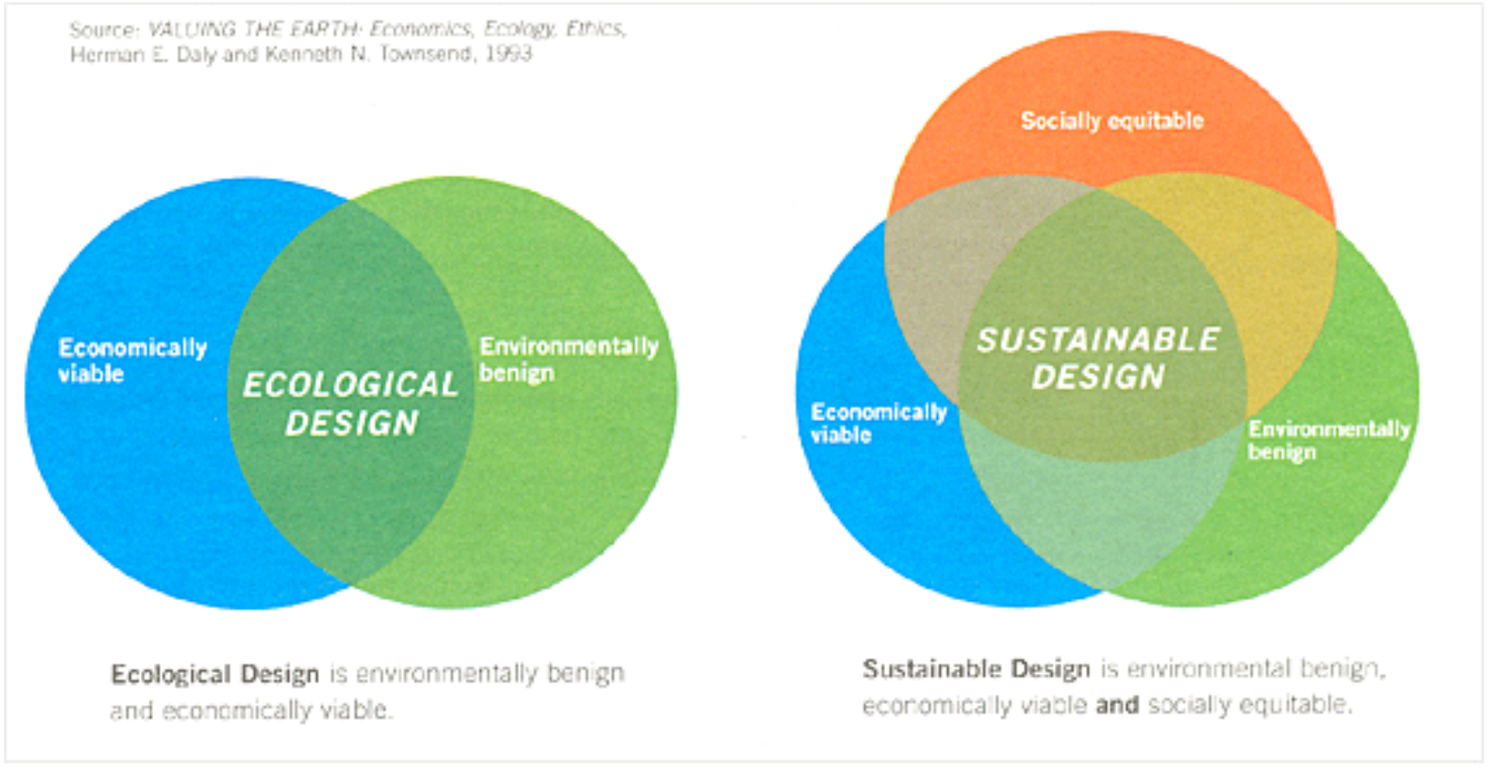


도표2 Source: Okala ecological design, IDSA, 01 March 2004, Portland, OR, USA

지속가능한 건축 Sustainable Architecture

정의

- 지역적 특성이나 건물유형에 따라 약간의 차이는 있으나 국제적으로 통용되는 가장 일반적인 정의는 WECD의 지속가능한 개발 (Sustainable Development)에 대한 목표와 연계하여
- "에너지절약건축(Energy Use)",
- "자원절약건축(Materials and Water)",
- "건강한 실내환경건축(Health and Well-being)",
- "자연친화건축(Ecology and LandUse)" 등을 합리적으로 통합한 건축을 의미한다.

The Top Ten Green Architecture Projects of 2011

AIA Committee On Environment

Cherokee Studios

These urban infill, mixed-use, market-rate apartments are designed with energy efficiency in mind -- they utilize passive cooling strategy like cross-ventilation and thermal convection to make the most of their sunny southern California location. Cherokee Studios is currently awaiting LEED Platinum certification and it also features an owner-controlled, double facade system with operable metal shade screens.

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AIA Committee On Environment

First Unitarian Society Meeting House

The First Unitarian Society needed to expand their facilities to accommodate their growing congregation, however they wished to preserve the integrity of the Frank Lloyd Wright-designed National Historic Landmark Meeting House. The 20,000 sq ft addition provides space for expanded daily needs, exemplifies the congregation's deeply held environmental values, and reflects Wright's philosophy of organic architecture.

The Top Ten Green Architecture Projects of 2011

AIA Committee On Environment

Kiowa County K-12 Schools

After a devastating tornado tore through Greensburg, Kansas, the town was all but destroyed and in need of many new facilities, including a new school. This K-12 facility utilizes a highly flexible, sustainable approach that focuses on students and is targeting LEED Platinum certification.

The Top Ten Green Architecture Projects of 2011

AIA Committee On Environment

High Tech High Chula Vista

This public charter school places a strong focus on community, project-based learning, and fostering students' individual interests. HTH's main principles are small class sizes, openness and transparency, and sustainable design.

The Top Ten Green Architecture Projects of 2011

AIA Committee On Environment

LiveStrong Foundation

This adaptive reuse project of a former paper factory in Austin is now the headquarters for Lance Armstrong's LiveStrong Foundation. Reclaimed materials, creative office spaces and natural daylighting make this a beautiful project.

The Top Ten Green Architecture Projects of 2011

AIA Committee On Environment

LOTT Clean Water Alliance

The LOTT Clean Water Alliance celebrated the essential resource by placing its water reclamation plant right out in the open and revitalizing an older facility. The office, education and technology center provides wastewater treatment services to 85,000 people in four local communities and emphasizes water conservation through a strong community outreach program.

The Top Ten Green Architecture Projects of 2011

AIA Committee On Environment

OS House

This LEED Platinum-certified urban home features a compact design on a narrow infill lot and eliminates extraneous closet space, bathrooms and parking spaces in order to maximize floor space. The high-performance home features energy-efficient passive solar design as well as a rainscreen and a tight building envelope.

The Top Ten Green Architecture Projects of 2011

AIA Committee On Environment

Research Support Facility

With NREL behind the helm, it's no surprise that the Research Support Facility building is the largest net-zero-energy commercial office structure in the US. Beyond serving as an example for new construction and a living laboratory, the facility also supports NREL's mission to transform innovative research in renewable energy and energy efficiency into market-viable technologies and practices.

The Top Ten Green Architecture Projects of 2011

AIA Committee On Environment

Step Up on 5th

This mixed-use project provides permanent affordable housing and support services for the homeless and mentally disabled population in the heart of downtown Santa Monica. Density and a transit-oriented location are mixed with natural daylighting, passive solar design and access to community resources.

The Top Ten Green Architecture Projects of 2011

AIA Committee On Environment

Vancouver Convention Centre West

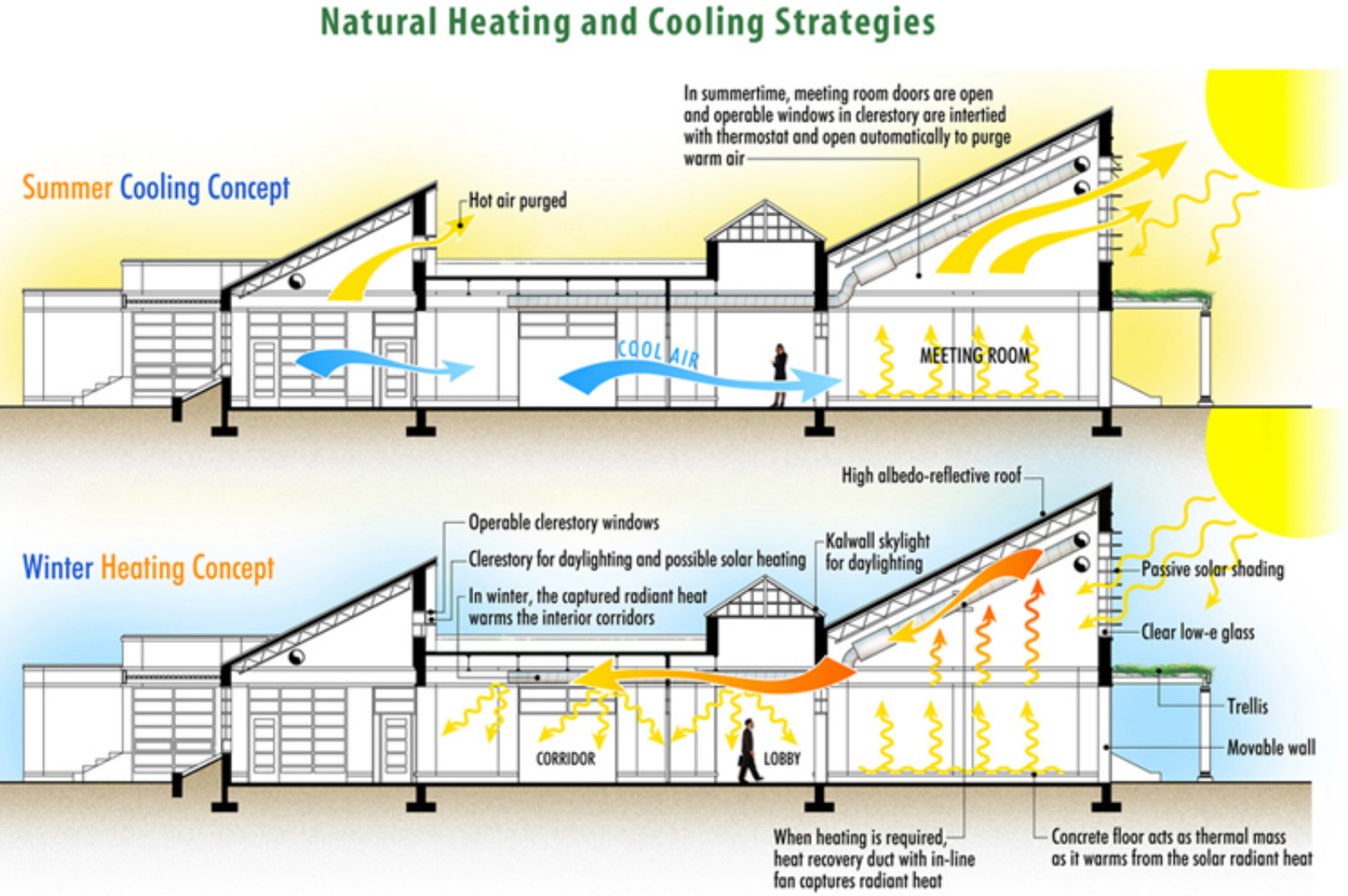
The LEED Platinum Vancouver Convention Centre is well-known for its large green roof, but it also deserves major props for its commitment to energy efficiency, the community, and the area's waterways and salmon. The project includes an artificial reef to guide salmon around the perimeter of the development.

High Contact, Low Impact

지속가능한 건축 7원칙

- 저감 Reduce
- 재사용 Reuse
- 재활용 Recycle
- 자연보호 Protect nature
- 독성제거 Eliminate toxics
- 생애비용 Life cycle costing
- 품질 Quality

친환경건축



- Environment friendly building
- 친환경 건축-생태건축
- Zero-Energy Building(ZEB)
- 제로에너지 건물
- 탄소제로 건물
- 저에너지 건축

Green Building

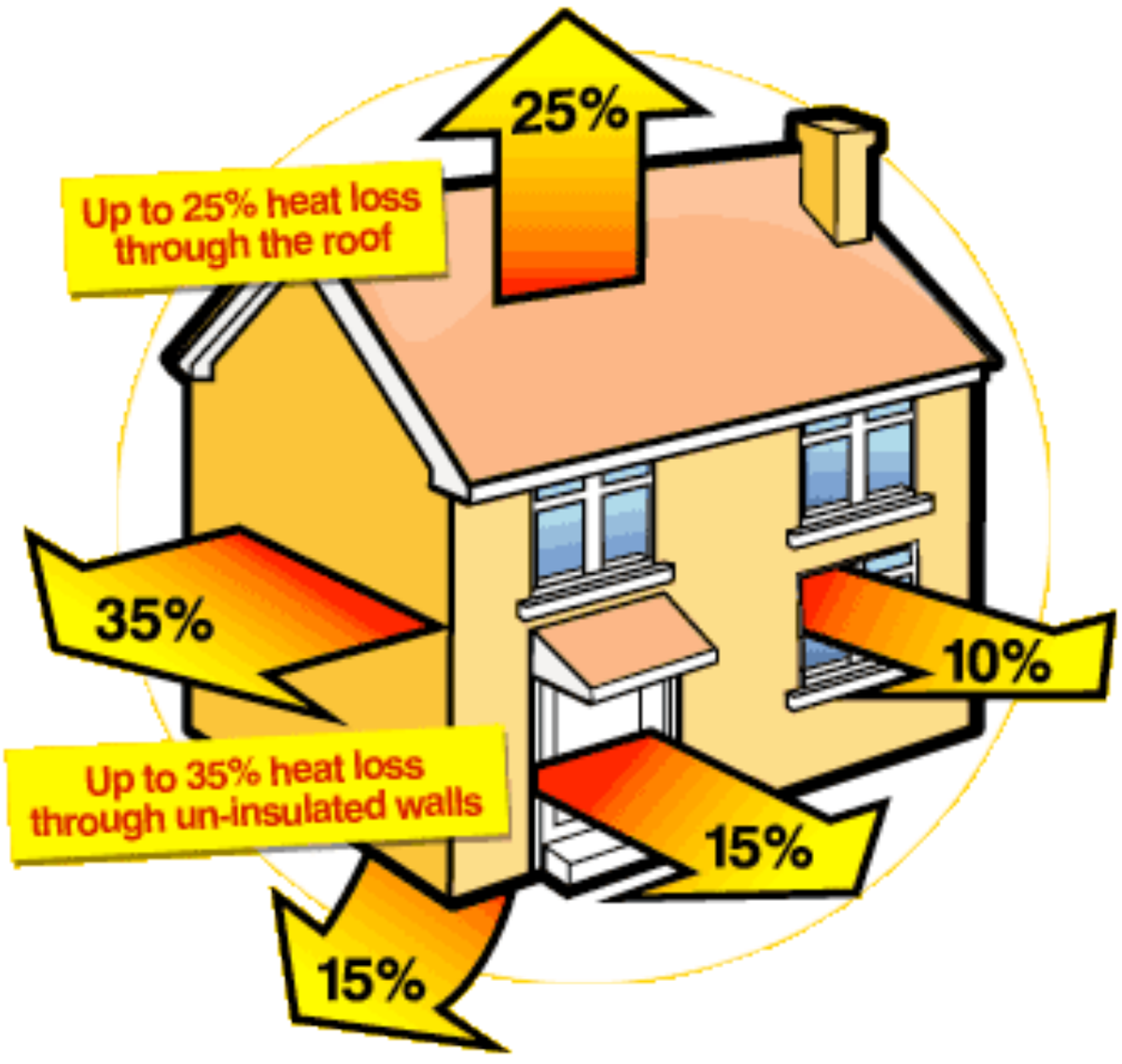
- Ökologisches Bauen-독일 생태건축 -자연환경과 조화되며 자원과 에너지를 생태학적 관점에서 최대한 효율적으로 이용하여 건강한 주생활 또는 업무가 가능한 건축
- 環境共生住宅-일본 환경공생건축
- Green Architecture
- Bioclimatic Architecture-기후순응형 건축
- Alternatives Bauen-대안건축
- Sustainable Building-지속가능한 건축

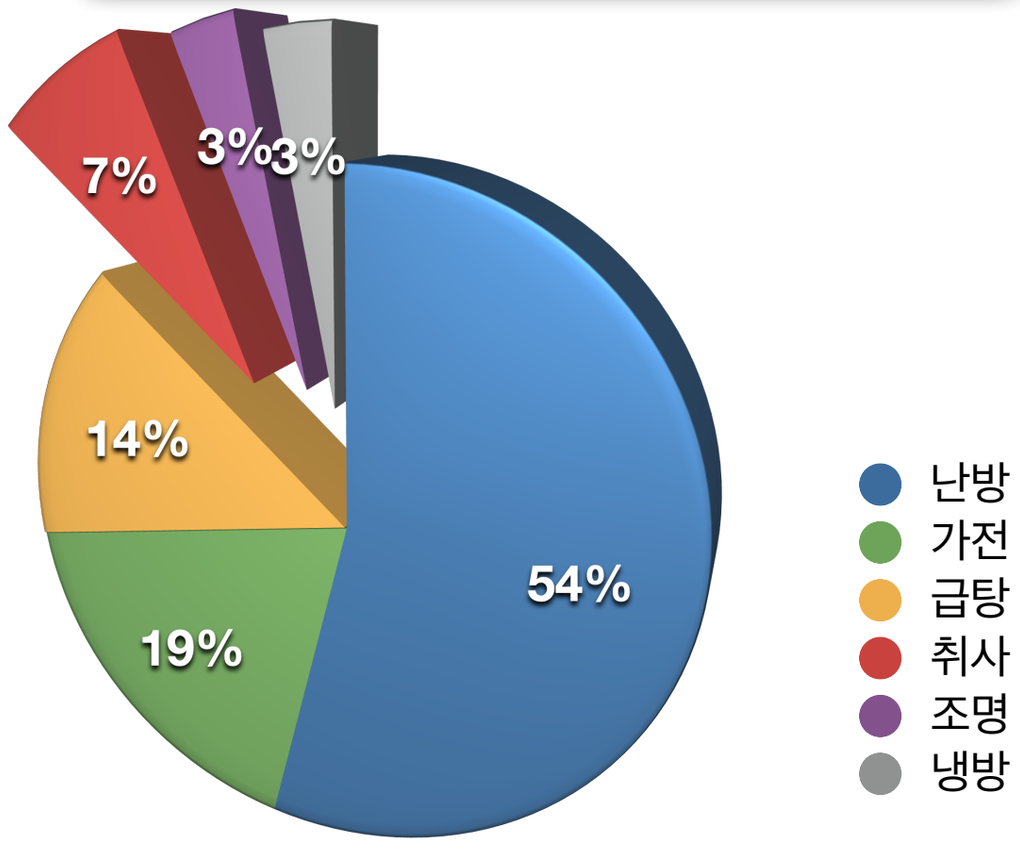
- 지구와 우리의 환경에 대한 피해가 최소화 되도록 설계, 건설, 유지, 관리되는 건물
  - 에너지 효율에 관한 기술
  - 지속가능성에 관한 기술
    - 에너지 부하 저감기술
    - 설비효율향상기술
    - 공해저감기술
    - 자원 재활용 기술
- 영국 BREEAM
- 카나다 BEPAC
- 미국 LEED
- 일본 CASBEE

토사하土佐派의 뛰어난 주택 체크리스트

1. 지역의 집들과 어울리는가
2. 지역의 재료를 사용하는가
3. 생활의 상처를 치유할 수 있는가
4. 100년을 버틸수 있는가.
5. 리모델링이 쉬운가.
6. 부수부품을 구할 수 있는가.
7. 유류파동에 버틸 수 있는 공법인가.
8. 다른 생물을 해치지 않는가.
9. 지구 온난화를 억제할 수 있는가.
10. 희소자원을 소비하지 않는가.
11. 독물에 의존하지 않는가.
12. 오래 되고도 여전히 아름다운가.

주택
에너지





주거용 건물 에너지 용도별 사용 현황

에너지 절약

Appliances & Electronics

- Buying Efficient Products
- Estimating Energy Use
- Turning Off Computers

Designing & Remodeling

- Passive Solar
- Whole-House Design
- Zero-Energy Homes
- Log Homes
- Manufactured Homes
- Earth-Sheltered Homes
- Financing an Efficient Home

Electricity

- Reducing Electricity Use
- Buying Clean Electricity
- Making Clean Electricity
- Reading Electric Meters

Heating & Cooling

- Selecting & Replacing Your System
- Cooling Systems
- Heating Systems
- Heat Pumps
- Thermostats, Ducts, & Meters

Insulation & Air Sealing

- Weatherstripping & Caulking
- Insulation
- Controlling Moisture
- Ventilation

Landscaping

- For Your Climate
- For Your Microclimate
- Shading
- Using Windbreaks
- Conserving Water & Xeriscaping

Lighting & Daylighting

- Artificial Lighting
- Types of Lighting
- Turning Off Lights
- Natural Lighting

Water Heating

- Selecting a Water Heater
- Solar Water Heaters
- Demand (Tankless) Water Heaters
- Reducing Water Heating Bills
- Swimming Pool Heating

Windows, Doors & Skylights

- Energy Performance Ratings
- Selecting Windows
- Selecting Exterior Doors
- Selecting Skylights

Connect with Energy Savers

- Energy Savers Blog
- Facebook

신재생에너지
○ 재생에너지
태양광, 태양열, 바이오, 풍력, 수력, 해양, 폐기물, 지열의 8개 분야
○ 신에너지
연료전지, 석탄액화가스화 및 중질산유 가스화, 수소에너지

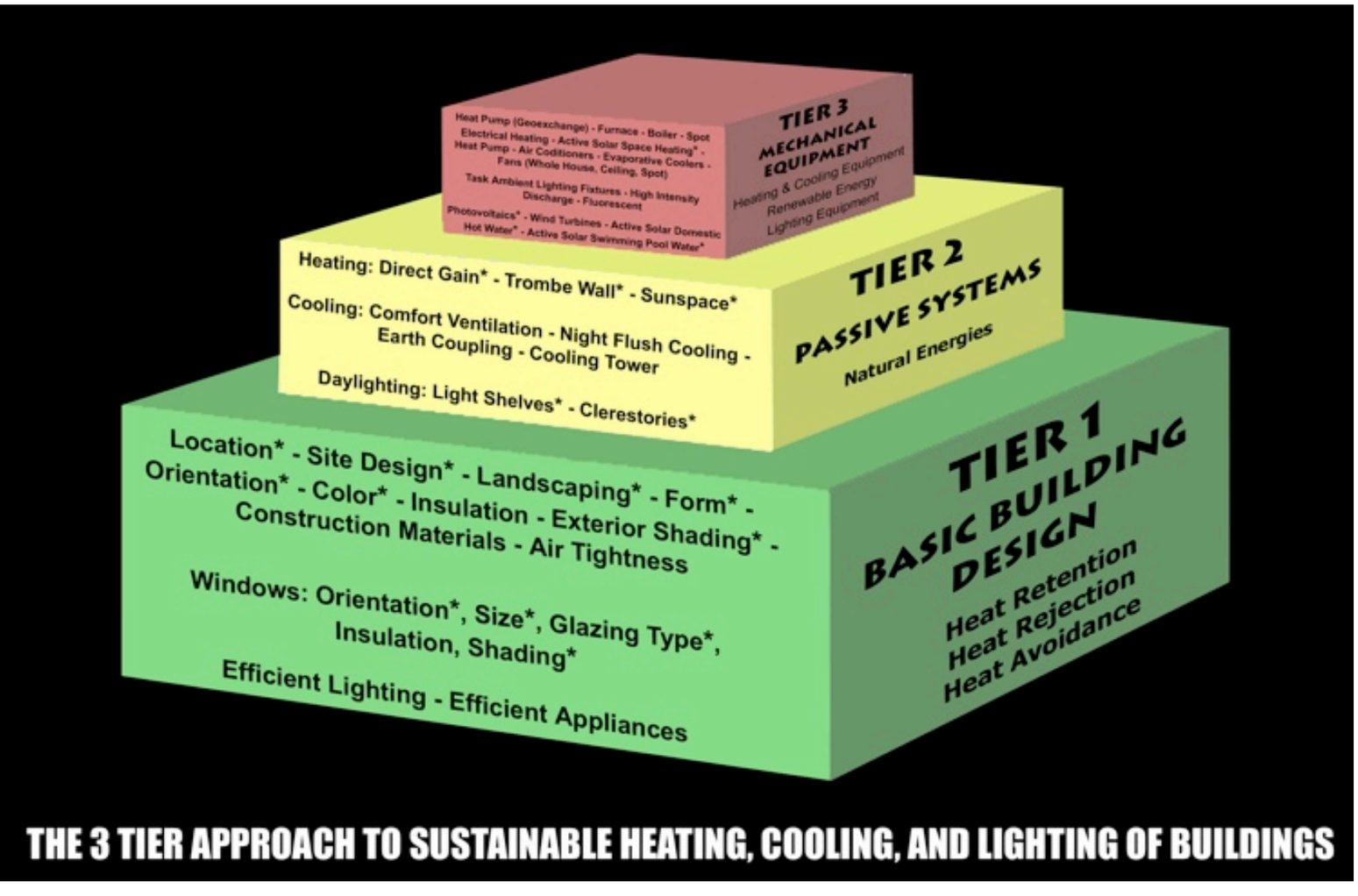
- 클린 전기 구매 Buy Clean Electricity
  - 바이오매스 Biomass
  - 지열 Geothermal
  - 소수력 Hydropower
  - 태양광 Photovoltaics (Solar)
  - 풍력 Wind.
- 신재생에너지 생산 Make Your Own Clean Electricity
  - Small solar electric systems
  - Small wind electric systems
  - Microhydropower systems
  - Small hybrid electric systems (solar and wind).
- 전기 절약 Reduce Your Electricity Use
  - 전기기기Appliances and electronics
  - 조명 Lighting
  - 전기 난방 Electric water heating

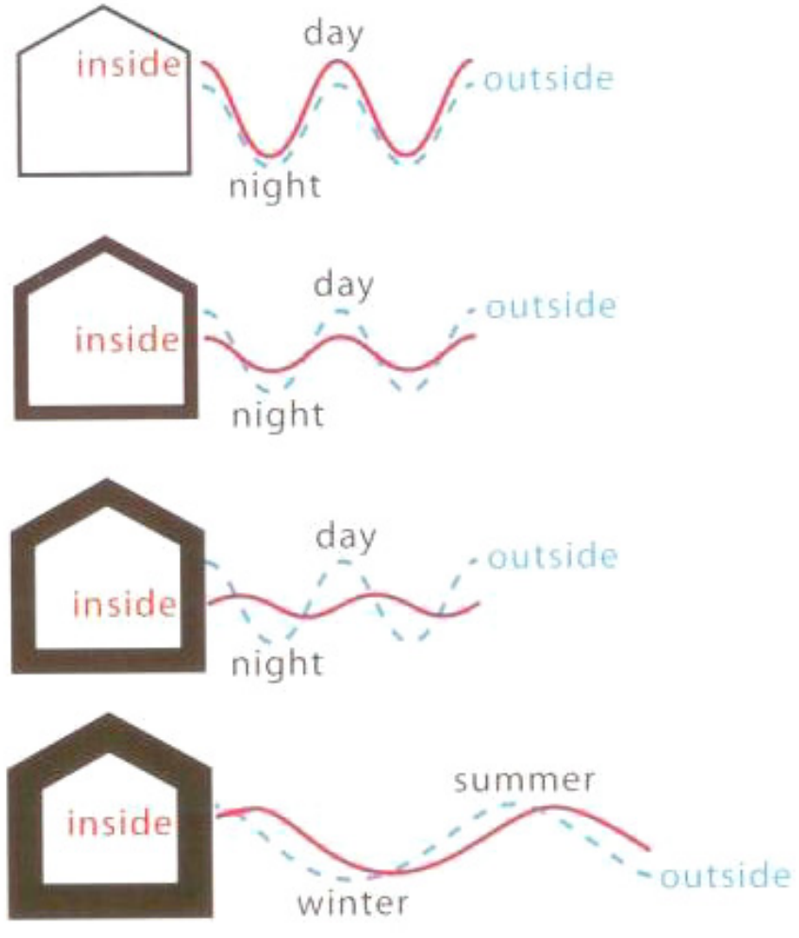
주택설계
리모델링

- **지중건물 Earth-sheltered Homes**
- **목조 주택 Log Homes**
- Use wooden logs to provide structure and insulation.
  - The R-Value of Wood
  - Minimizing Air Leakage
  - Controlling Moisture
  - Building Energy Code Compliance
- **Passive Solar Homes**
- Take advantage of climatic conditions, especially the sun, for heating in the winter and cooling in the summer.
- **초가집 Straw Bale Homes**
- **Zero Energy Homes**
- **Climate-specific design**
  - Passive solar heating and cooling
  - Energy-efficient construction
  - Energy-efficient appliances and lighting
  - Solar water heating system
  - Small solar electric system.

Passive House

기본과 패시브 디자인만으로 에너지 소비의 80%이상을 줄일수 있다.





냉난방부하 - 연간 15 kWh/m² yr 이하, 최대 10W/m² 이하

난방, 온수, 전기 부하 연간 **120 kWh/m²이하**

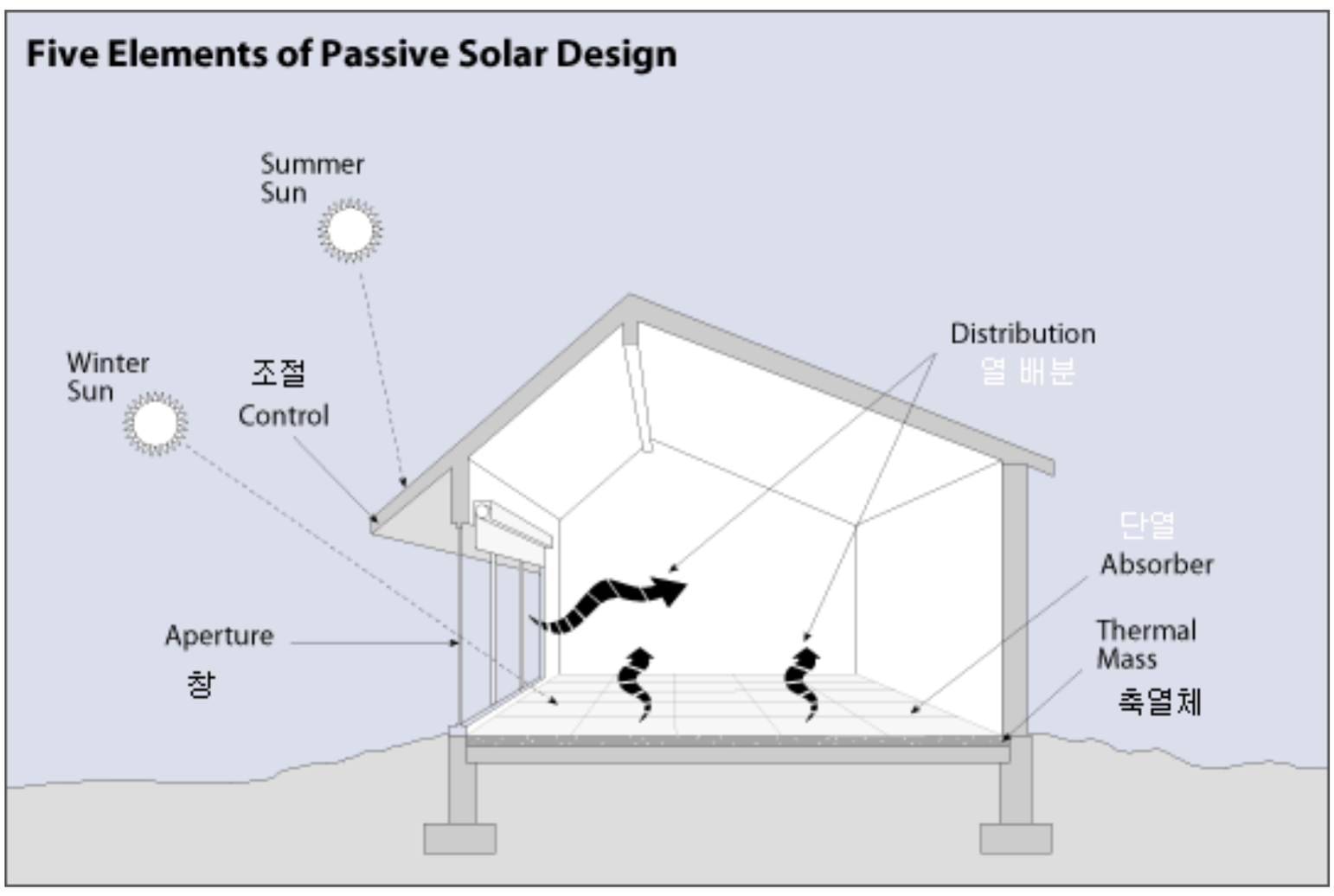
시간당 0.6 이하의 환기 (n_{50} ≤ 0.6 / hour) at 50 Pa (N/m²)

태양열 난방부하의 40%

분류	난방부하kWh/m²
Low-Energy-Building	40-79
Three Liter House	16-39
Passive House	15
Zero Energy House	0
Plus Energy House	

- Superinsulation/초단열
- Advanced window technology
- Airtightness
- Ventilation
- Space heating
- Lighting and electrical appliances

Passive House



The 5 Principles

- 단열 Insulation
- 기밀 Air Tightness
- 태양열 획득 Solar Gain
- 열교환 Heat Exchange
- 열교 최소화 Thermal Bridging minimised

우리나라 주택 냉난방 에너지 평균20 liters=184,000Kcal=210kWh/m²

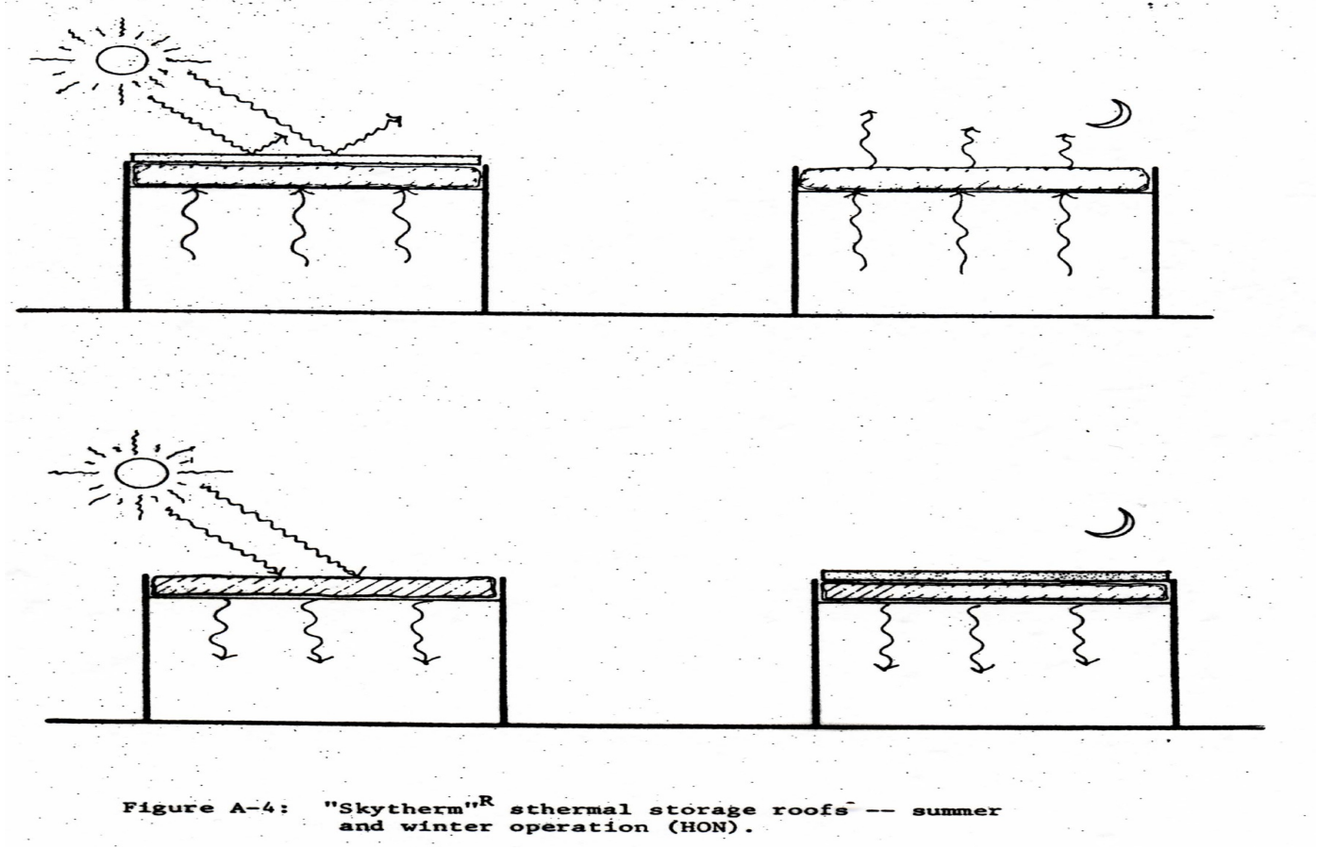
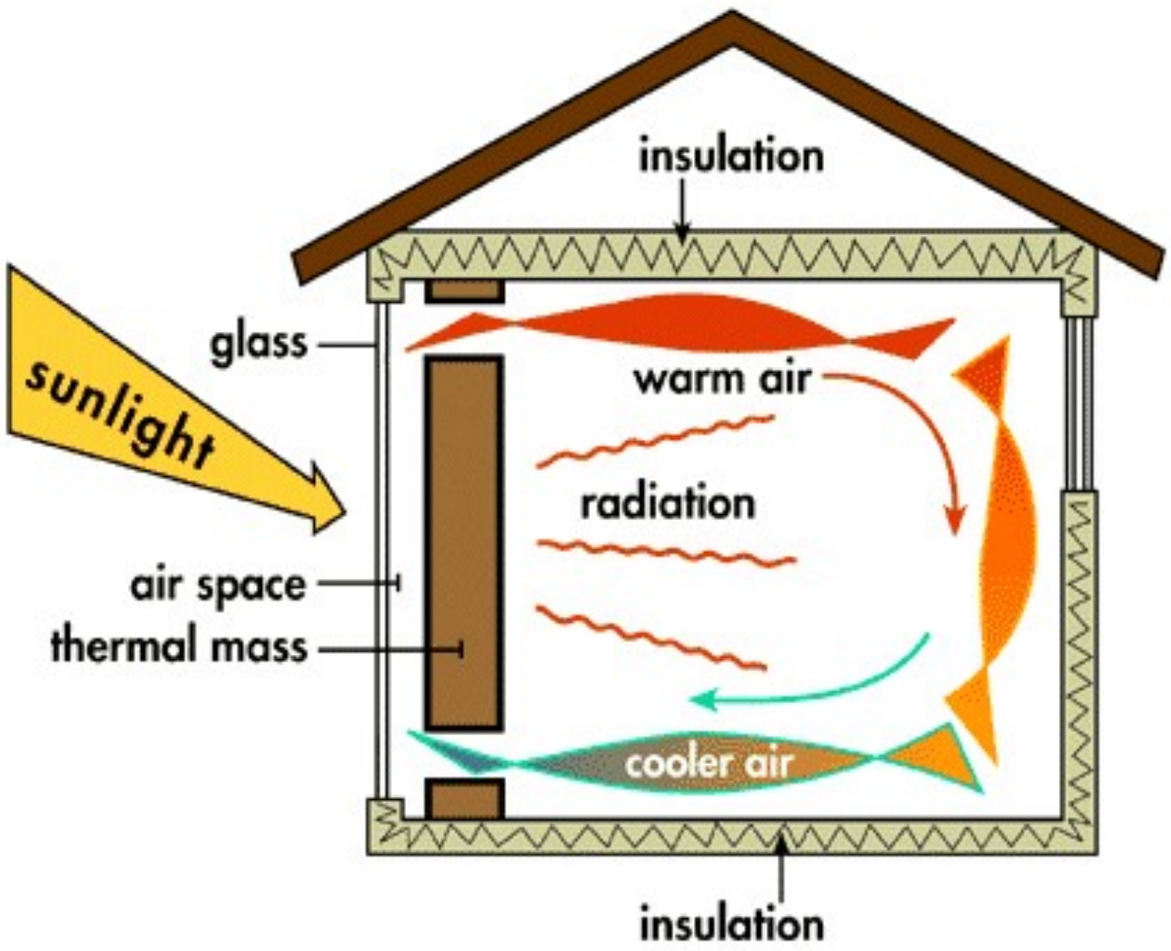


Figure A-4: "Skytherm"R sthermal storage roofs -- summer and winter operation (HON).

Trombe Wall with Vents



Passive House는 새로운 것이 아니다.

Sunlighthouse

Pressbaum, Austria, 2010

2010 년 오스트리아 건축상 환경과

에너지테크놀리지 부분 특별상

오스트리아 최초의 CO2-neutral 단독주택

HEIN-TROY Architekten

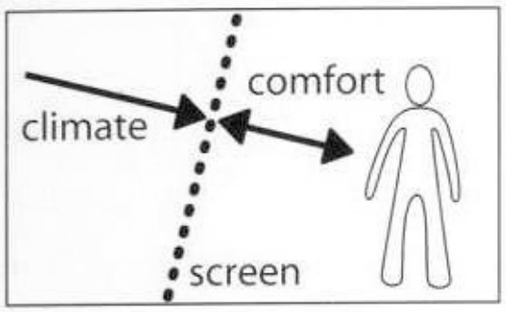
http://www.hein-troy.at

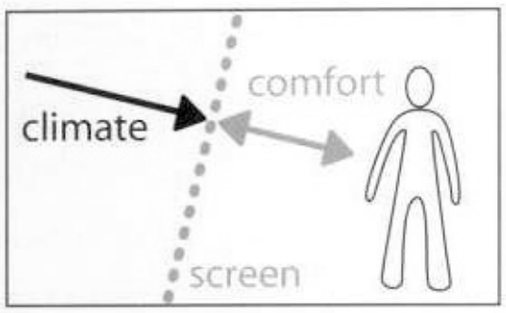
2012 Austria Korea Future Building Solutions Architecture Exhibition

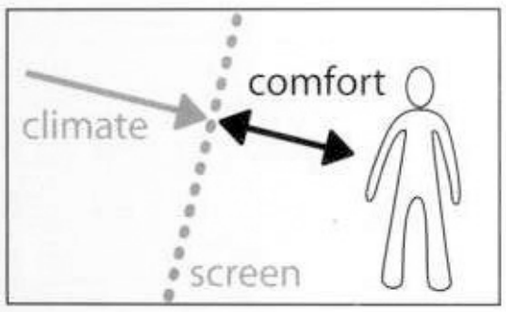
Passive

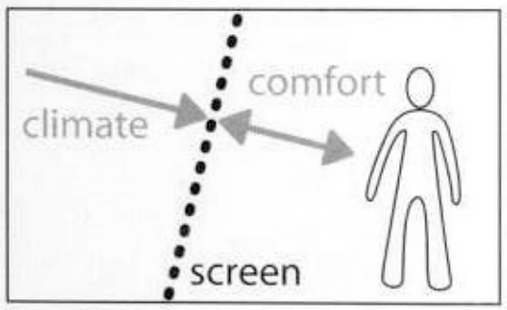
단열

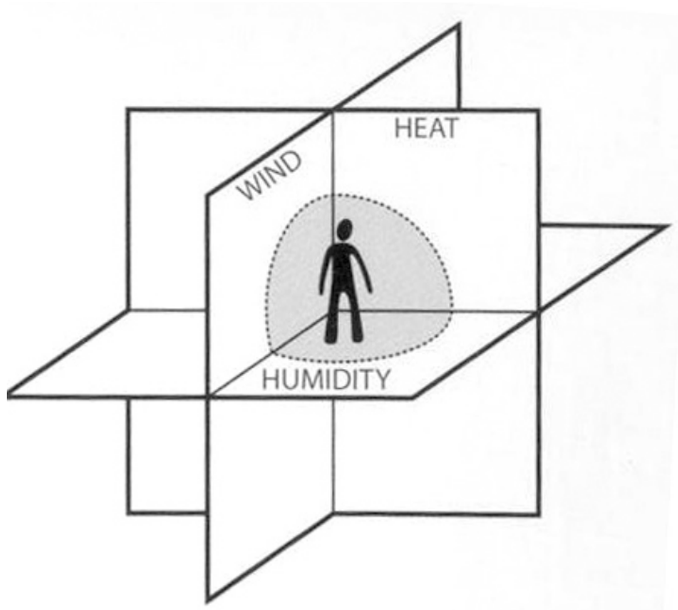
- Air sealing
  - Detecting Air Leaks
  - Air Barriers
- 단열 Insulation
  - 열전도율(Kcal/m.h°C)
- Moisture control
  - Attics
  - Foundation
    - Basement
    - Crawl space
    - Slab-on-grade floors
  - Walls
- Ventilation.

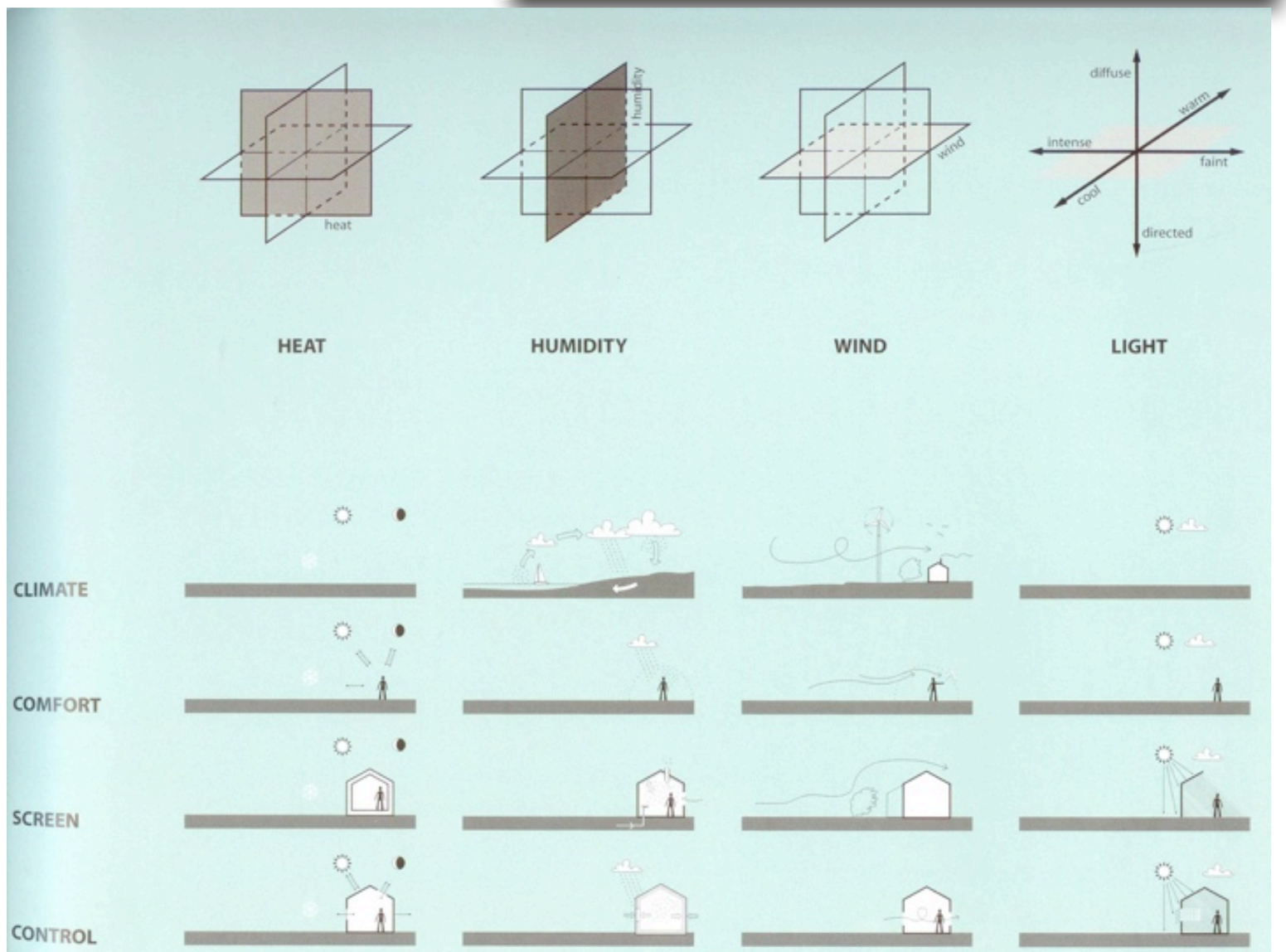

climate
comfort
screen


climate
comfort
screen


climate
comfort
screen

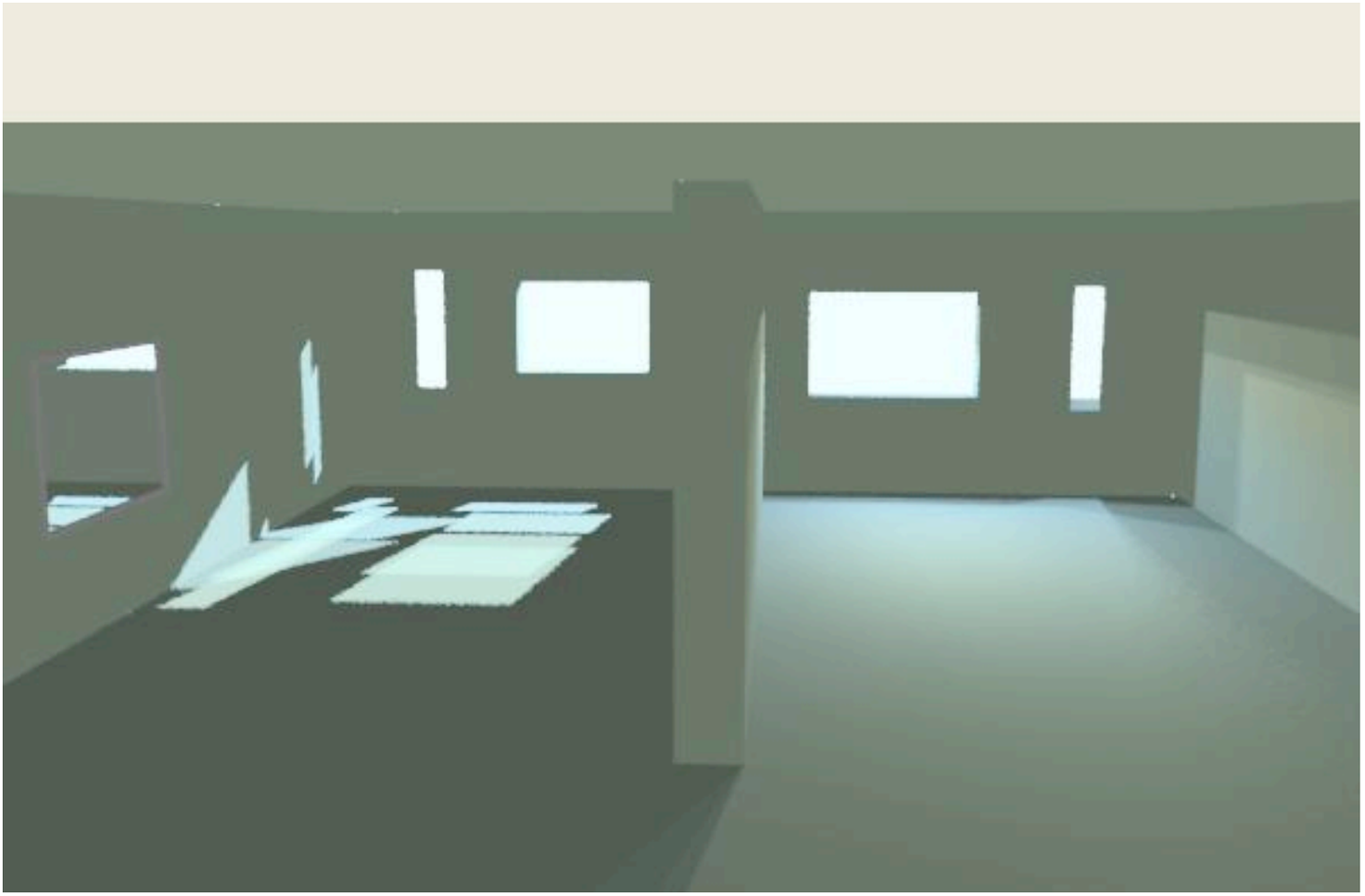

climate
comfort
screen


HEAT
WIND
HUMIDITY


heat
humidity
wind
diffuse
warm
intense
faint
cool
directed
HEAT
HUMIDITY
WIND
LIGHT
CLIMATE
COMFORT
SCREEN
CONTROL

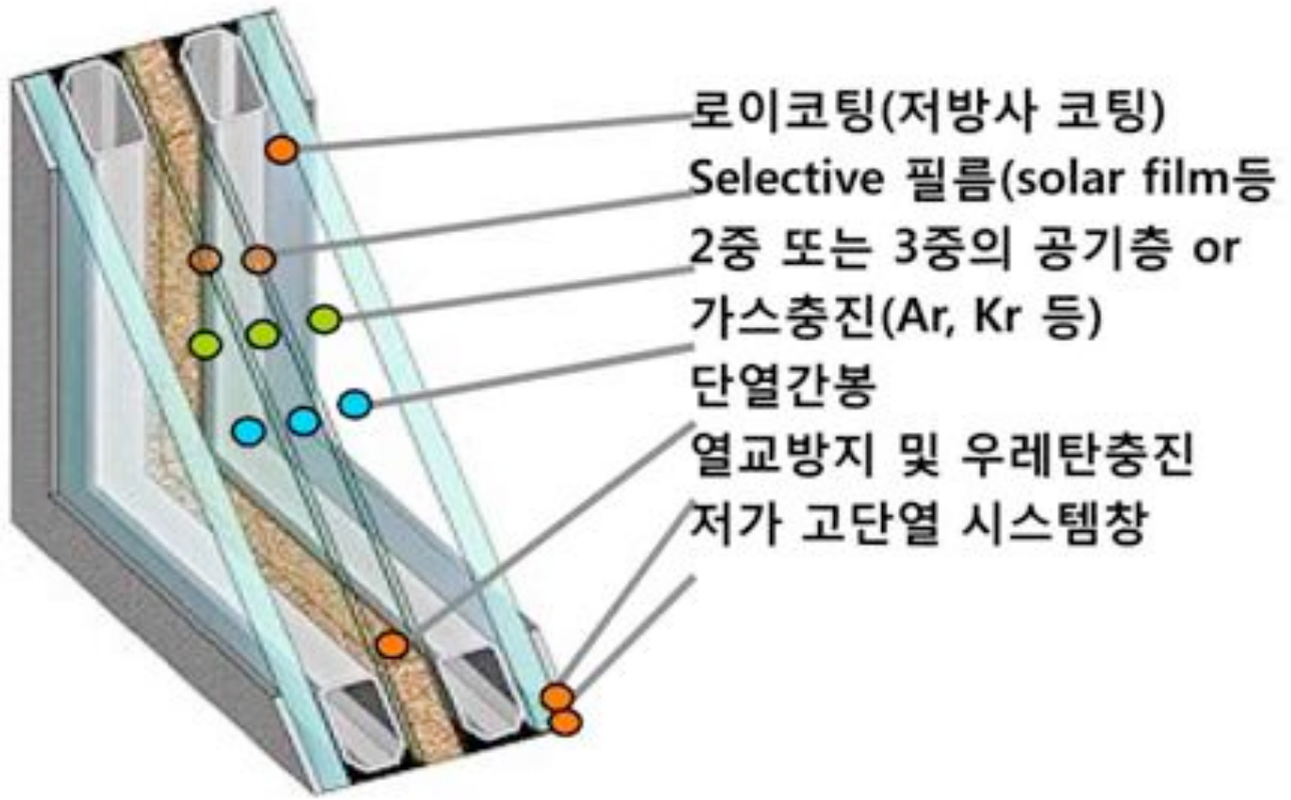
조경

- Climate
- Microclimate
- Shading
- Windbreaks
- Water conservation

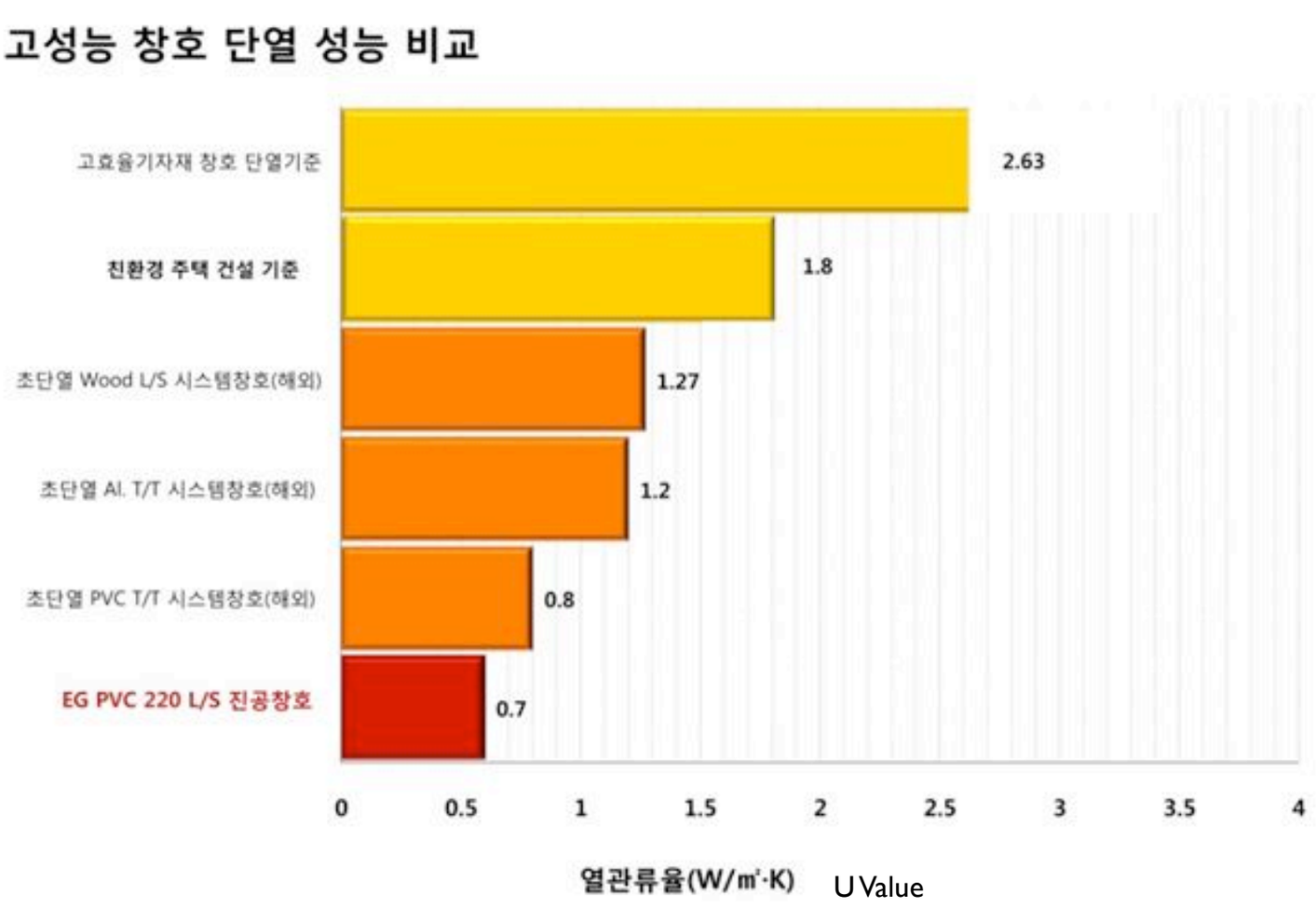


조명

- 조명 Lighting
- Learn how to reduce artificial lighting energy use while maintaining its quality and quantity.
- 주광 Daylighting
- Maximize the use of natural daylight in your home to further reduce the need for artificial lighting.



창호 주광



- 외부문 Exterior Doors
  - Select energy-efficient doors or improve the energy efficiency of existing ones.
- 주광 Skylights
  - Select energy-efficient skylights.
- 창 Windows
  - Select energy-efficient windows or improve the energy efficiency of existing ones.

Examples

Vals, Switzerland

지중건물

장점
- 외부 온도와 무관
- 유지보수 쉬움
- 자연방음
- 지상건물보다 보다 자연 친화적

단점
- 지상건물보다 20% 비싸다
- 습기제어
- 건축조건이 까다롭다

Vacation Home in Vals, Switzerlan

Christian Müll

Loir-et-Cher (France)

Kandovan (Iran)

Interior of a cave inMatmata (Tunisia)

Hôtel Sididriss in Matmata(Tunisia)

Cave house inRochemémier (France)

Granada (Spain)

Condition

- Climate and Topography
  온도 높고 습도 낮음
- Soil
  모래, 자갈 이상적
- Groundwater level
  지하수위
- Slope
  적절한 경사
  남측 창

통나무집

Use wooden logs to provide structure and insulation.

- The R-Value of Wood
- Minimizing Air Leakage
- Controlling Moisture
- Building Energy Code Compliance

2010 Design Winner: Log Home Plan | Montclaire Custom Wood Home

한옥

통나무주택?

전통한옥양식으로 지어진 나의 작은 오두막은 이 곳 산사에서 가장 **웃풍**이 심한 곳이다. 그래서 방안에 들어와도 겉옷을 쉽게 벗지 않는다. 원래 한옥은 방바닥은 따뜻하고 공기는 차가운 것이 특징이라고 한다. 예전에는 윗목에 떠놓은 냉수가 얼어버리는 일도 자주 있었다고 한다. 그래서 겨울을 맞으며 창호와 벽, 기둥의 틈새를 잘 메워 보온에 나름대로 신경을 썼는데도 그리 좋아지지는 않는다.

웃풍심한 방-주경스님-2009.1.15.

우풍, 웃풍
not 外風
바늘구멍으로 황소바람 들어온다

'우풍'이라는 말이 있다. 방구들을 데우는 우리 온돌방에 있는 현상이다. '난로'(스토브, 파이어플레이스, 페치카, 히터)를 쓰는 다른 나라에는 없다. 방바닥의 다스운 기운을 흩뜨리지 않고 모아 두려고 이불 따위로 덮는다. 그러면 그 위 방 안 공간에는 다스운 기운이 막혀 찬 기운이 돈다. 지붕이나 벽이 얇으면 그런 데서 찬기운이 스며들어 우풍이 더해진다. 그런데 우리 사전들은 이 '우풍'을 인정하지 않는다. 대개 '외풍'이라는 한자말을 만들어, 그 말의 잘못이라고 다루고 있다. 있는 말이 없는 말의 잘못이란다. 그런 중에서 문세영 <조선어사전>(1938)만은 견해가 다르다. 어정쩡하나마 '웃바람'이라고 해 놓고, 그 풀이를 "겨울에 방 속 천장·벽 들에서 나오는 찬 바람"이라고 했다. 거의 맞는데, 풀이 끝의 '바람'만 틀렸다. '우풍'의 '풍'을 '風'으로 잘못 알고 '바람'이라고 한 것인데, '바람'이 아니고 천장·벽에서 나오는 찬 '기운'이다. 그것을 뒷받침해 주는 낱말이 있다. '두르풍'이다. 사전들에 그 풀이를 "흔히 노인들이 방 안에서 추위를 막느라고 어깨에 둘러 입는 웃옷"이라고 했다. 그러면서 올림말에 '두르風'이라고 '風'자를 넣는다. 어째서 '웃옷'이 '風'이냐. '풍'을 '風'으로 잘못 알고, '기운'을 '바람'이라고 하는 것이나, '웃옷'을 '風'이라고 하는 것이나, 우리말을 무시하는 짓들이다. '風'에는 "가르침·경치·기세·떨어짐·문둥병·바람·버릇·분부·빠름·소리·쐼·암내·중풍·충고·품성·풍악·풍채·학질" 따위 뜻은 있으나 '기운'이나 '웃옷'이란 뜻은 없다. 어디에 '외풍'(바깥바람)이라는 말이 있더라도 '우풍'이라는 우리말을 개개지 말자.

정재도/한말글연구회 회장 한계례 2005.5.1.

Straw bale House

Bath University

This straw bale house plastered withloam is located in Swalmen, in the southeastern Netherlands

단열성능이 뛰어나다
벽이 두꺼워진다
시공비가 낮다
습도

경남 산천 신안면 민들레학교

Thatching House

This straw bale house plastered withloam is located in Swalmen, in the southeastern Netherlands

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다용도

Pfarre St.Franziskus
Wels, OÖ, Austria, 2005
패시브하우스 교회 증축
Luger & Maul Architekten
http://luger-maul.syreta.com

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Schiestlhaus

Hochschwab, Steiermark, Austria, 2005

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