



Approach To Myanmar National Building Code 2020

Chapter 2.12

Presented

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At Federation of Myanmar Engineering Society

5 March 2023

2.12 GREEN BUILDING

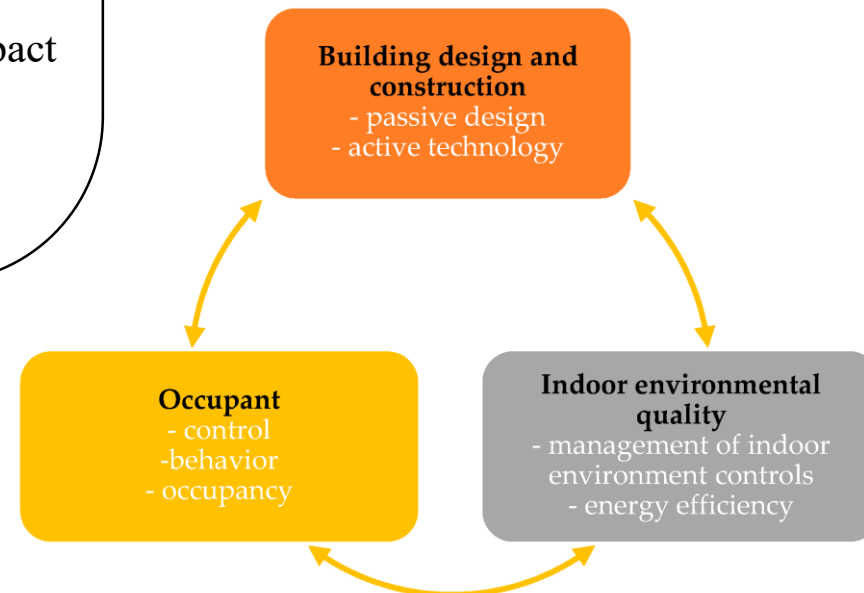
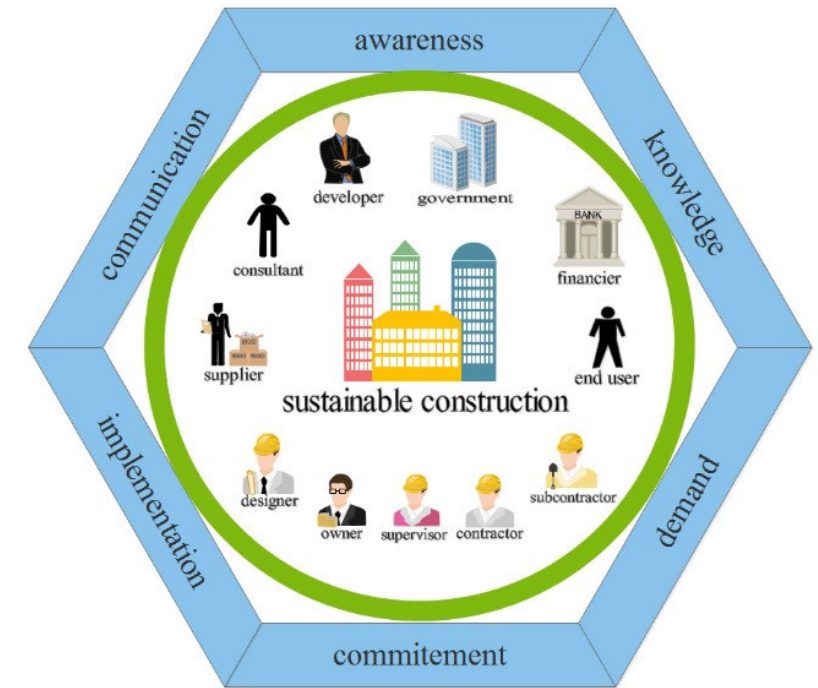
2.12 Green Building

2.12.1 Introduction

Green building and sustainable building both refer to the design and construction of buildings that have minimal impact on the environment. The purpose of Chapter 12 is to provide **minimum design requirements** that will promote all phases of **design, materials selection, and construction**, efficient utilization of energy and water resources in buildings.

The requirements are directed toward the design of building envelopes with adequate thermal resistance and low air leakage, and toward the design and selection of mechanical, water heating, electrical and illumination systems that promote effective use of finite energy resources.

A green building is designed and constructed to **reduce the overall impact of the built environment on human health and the natural environment** for the following criteria.



2.12.2 Criteria for Green Buildings in Myanmar

As an art of creating and shaping living environment for the community in general and each person in particular, architecture is currently largely influenced by urbanization, industrialization and also global climate change.

In order to design a sustainable built environment for the people, this chapter would like to highlight the community and especially the architects and engineers to strive for the future development of green buildings and as a tool for the implementation process, this chapter would like to promulgate its own Criteria for Green Buildings in Myanmar.

2.12.2.1. Aims

2.12.2.1.2. Criteria for Green Buildings in Myanmar specify the contents and requirements for architecture and planning in order to shape and promote sustainable built environment and landscape, to ensure living quality for indoor environment, to use energy and natural resources towards efficiency and to develop social sustainability towards communities and modern architecture based on identity with a futuristic vision.

2.12.2.1.3. The criteria to be established aim to:

- conduct research and development/design activities in principles of green building;
- offer training courses on green building for architects, engineers and the community;
- promote and introduce green building;
- offer consultancy and social critiques in principles of green building;
- evaluate green building designs and honour architects, engineers and developers who design and develop green building respectively.

2.12.2.2. Objectives, Scope and Requirement for Application

2.12.2.2.1. Criteria for green buildings shall apply to:

- Buildings and urban areas which can be constructed, renovated, upgraded or redeveloped/rehabilitated.
- Architectural design and urban/rural planning projects that have been approved by competent organizations, already completed or still under construction.
- The code will later include the compliance method for determining the level of environmental performance of a building development.

2.12.2.3. Five Criteria

- (1) Sustainable Site
- (2) Efficient Consumption of Energy, Water and Natural Resources Management
- (3) Indoor Environment and Materials
- (4) Innovative Architecture and Identity
- (5) Social Sustainability and Humanities for Community



2.12.2.3.1. Criterion One: Sustainable Site

Objectives: to shape a harmonious and sustainable landscape, to minimize the negative impacts of a building on the surrounding area and to make full use of all favourable conditions of the nature for the living environment of human beings.

2.12.2.3.1.1. Construction Site Should Be in Accordance with the Current Planning

- The site should be located within an area where the spatial planning has been approved, and the land area for building purpose needs to be appropriate to the existing building(s) in terms of function and also in consideration of the future development.
- The site should be convenient for transport and access, power and water supply, as well as communication.
- The site should comply with the regulations in planning management, protection and buffer zones applicable to buildings as required in Myanmar National Building Code and relevant planning management policies.



Green mode of transportation



CONSIDER FIRST



1. PEDESTRIANS



2. CYCLISTS



3. PUBLIC TRANSPORT



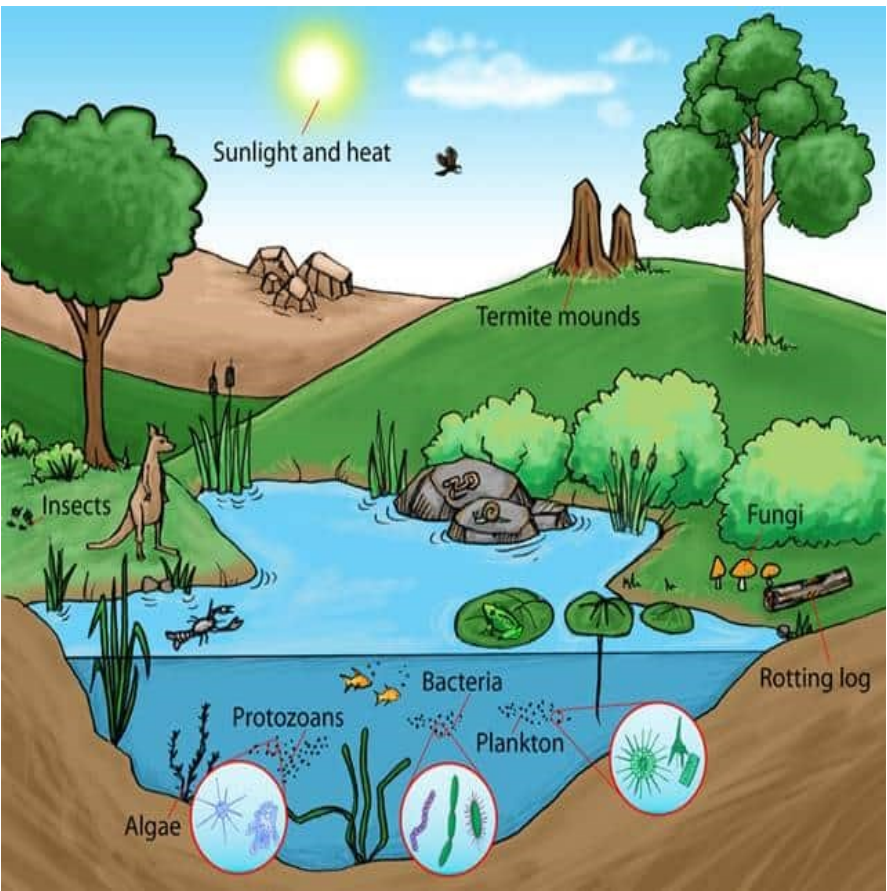
4. PRIVATE MOTOR VEHICLES

CONSIDER LAST



Paris is planning to become a '15-minute city'

Adopting a 15-minute city strategy means striving for an urban model that allows everyone, in every neighbourhood, to **meet most of their daily needs within a short walk or bike ride of their home**. It creates a **'human-scale' city** composed of vibrant, people-friendly, 'complete' neighbourhoods, connected by quality public transport and cycling infrastructure for the longer trips that residents want or need to make. It means **decentralising city life and services** and injecting more life into local areas across the city.



ALL LIVING THINGS GET FOOD FROM THE ENVIRONMENT





Ecological value of a site

2.12.2.3.1.2 Protection of Environment and Natural Landscape

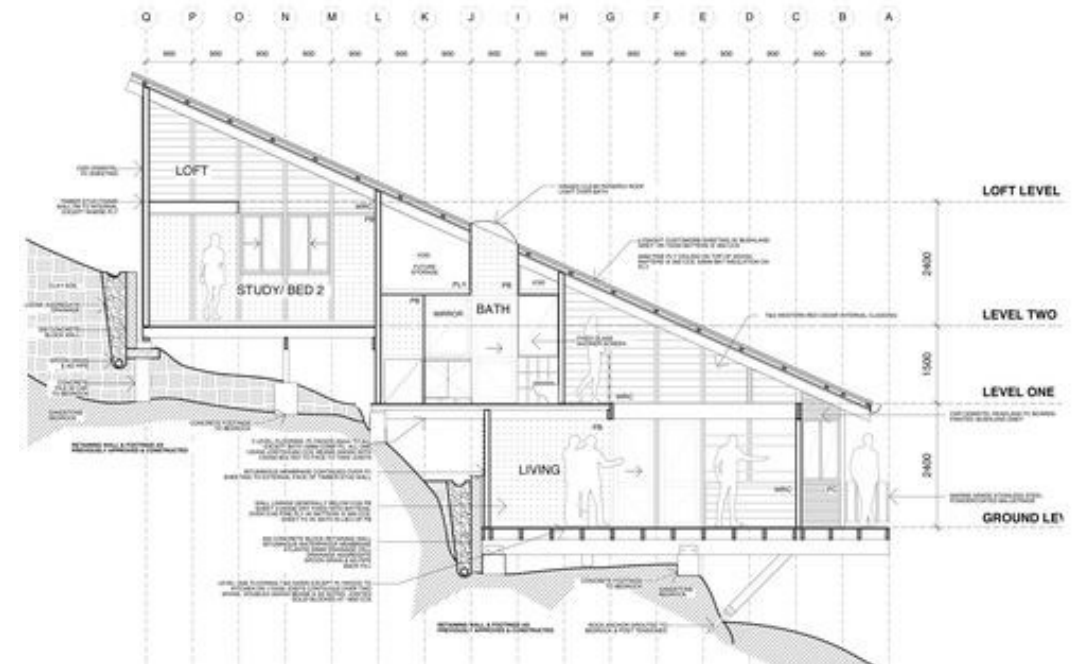
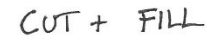
- Protection and conservation of eco-systems and natural landscape:

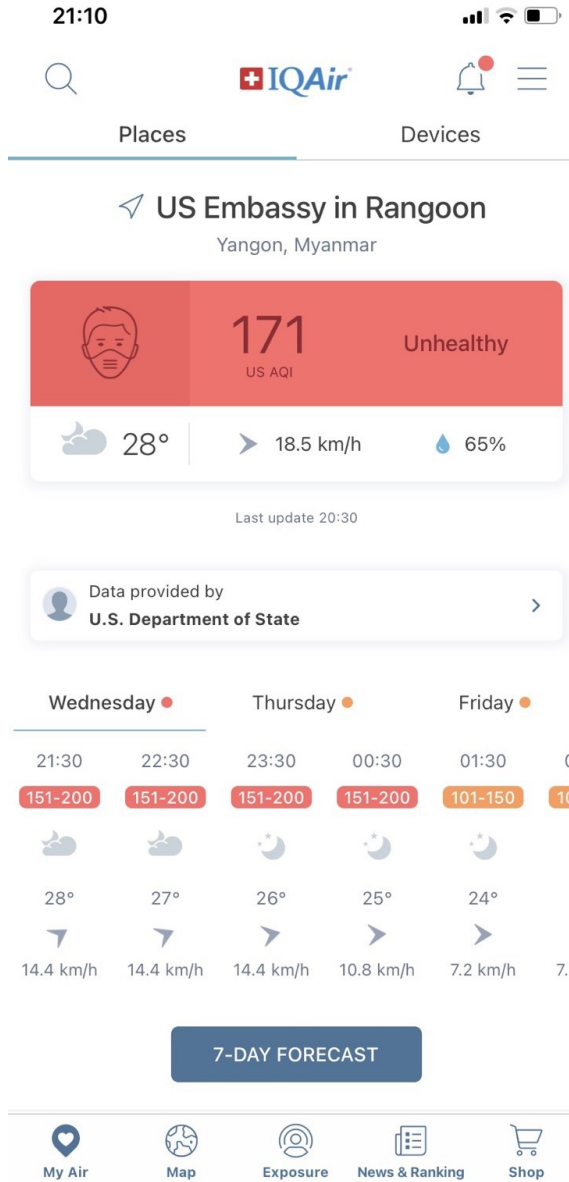
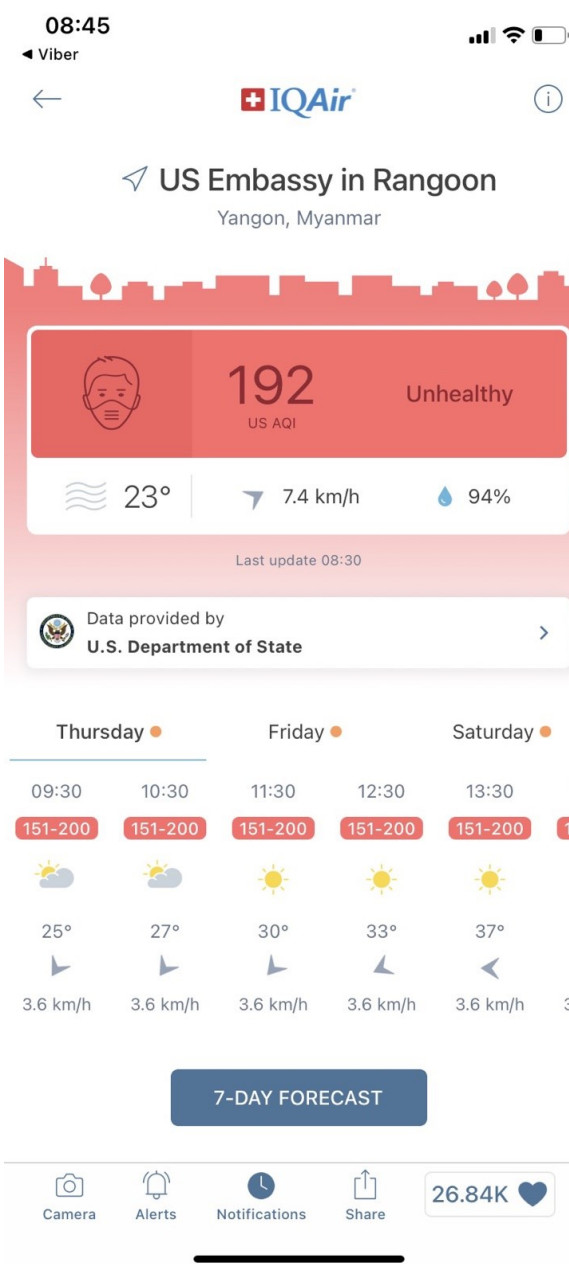
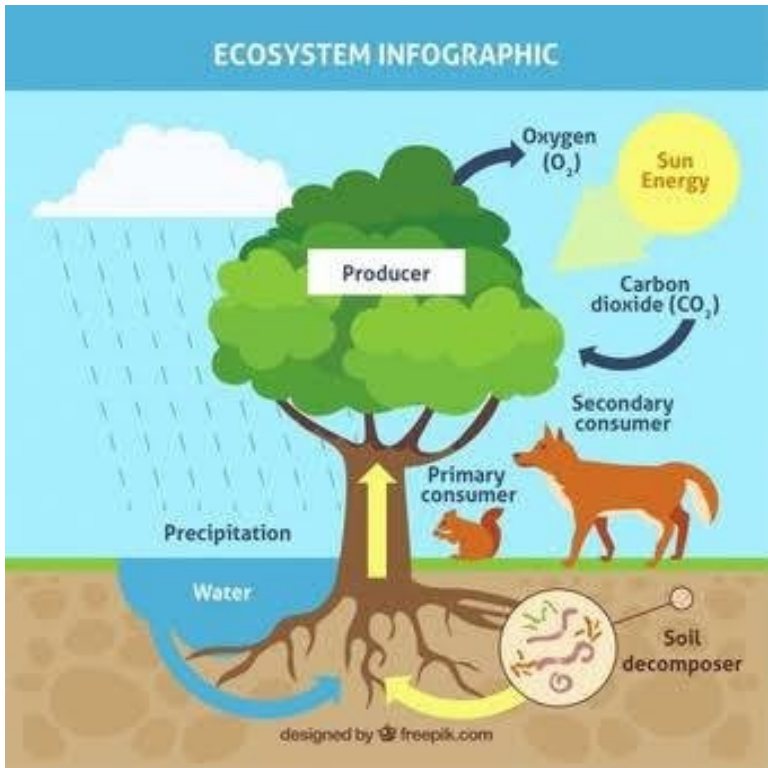
(a) The building(s) will not cause pollution to the environment and neighbouring buildings.

(b) The building(s) will not change so much to the typology of the site, the terrain, eco-systems and natural landscape.

- During the construction of the building(s), the monitoring and control of pollution or contamination caused by the construction work to the surrounding area are strongly recommended.

Conserving Eco system





2.12.3.3 Environmental Protection

• Greenery

Green spaces are a great benefit to our environment. They filter pollutants and dust from the air, they provide shade and lower temperatures in urban areas, and they even reduce erosion of soil into our waterways.

(Ref: <http://projectevergreen.org>)

Green space (land that is partly or completely covered with grass, trees, shrubs, or other vegetation). Provision of open space/green area and pervious area in Urban areas shall comply to “Section 2.11.3 Urban Densities” of this code.

Objectives

Encourage greater use of greenery and restoration of existing trees to reduce heat island effect.

Applicability

Applicable to building developments with landscaping areas.

Greenery Provision (GnP) is calculated by considering the 3D volume covered by plants using the following Green Area Index (GAI):

Grass GAI = 1 ; Shrubs GAI = 3; Palms Trees GAI = 4; Trees GAI = 6

Greenery Provision (GnP) = total green area / site area

(Ref: <https://www.farminguk.com>)

TOXIC CHEMICALS RELEASED BY PLASTIC BURNING



BENZENE CARBON MONOXIDE
HYDROXYMETHOXYBENZALDEHYDE PHENOL
CYCLOPENTASILOXANEDECAMETHYL
GREENHOUSE GASES DECANE
OCTANE TRICHLOROFLUOROMETHANE
ETHANOL NAPHTHALENE FURANS
TETRACHLOROBENZOFURANE TRICHLOROPHENOL
ALCOOL LEAD CHLOROFORM ETHIL
BENZOIC ACID BENZYL BUTYLPHTHALATE
CAFFEINE DIMETHYLCYCLOPENTANE
ACETONE FORMIC ACID MERCURY
DIOXINS HEXACHLOROBENZENE
PENTACHLOROBIPHENYL XYLENE
CHLOROBENZOIC ACID FLUORENE

BURNING OF PLASTIC IS DANGEROUS FOR YOUR HEALTH

Damage the nervous system

Disrupt endocrine system and
provoke imbalance hormones

Provoke heart disease

Cause and aggravate
respiratory diseases

Cause kidney &
liver disease

Create skin rashes

Affect reproductive system

HEADACHE

STROKE

COUGH

ASTHMA

EMPHYSEMA

ALLERGIES

HEARTH
ATTACK

INFERTILITY



RESIDUAL ASH IS TOXIC

Sources: Thanal, GAIA, WECF, IIRW, WHO, EPA, EduGreen TERI, Carahhealth.com



Modify DNA

Develop cancers

Affect immune system

STOP BURNING GARBAGE!

Burning garbage produces toxic pollutants that
can harm public health and the environment.



OPEN BURNING OF GARBAGE IS AGAINST THE LAW!

RA 9003: ECOLOGICAL SOLID WASTE MANAGEMENT ACT OF 2000

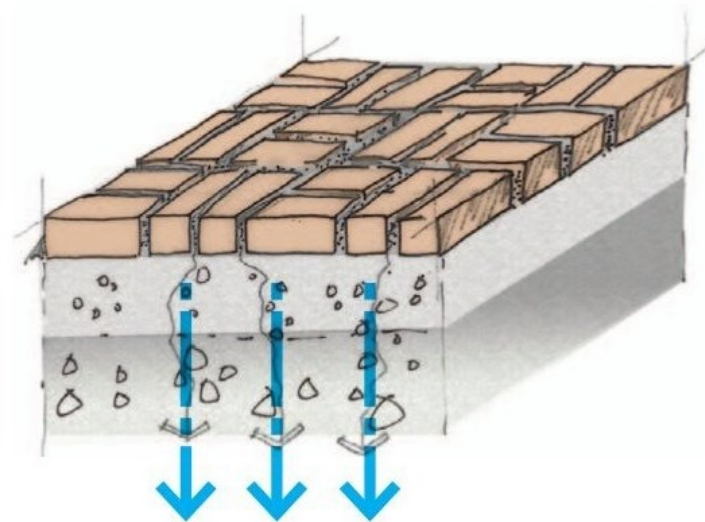
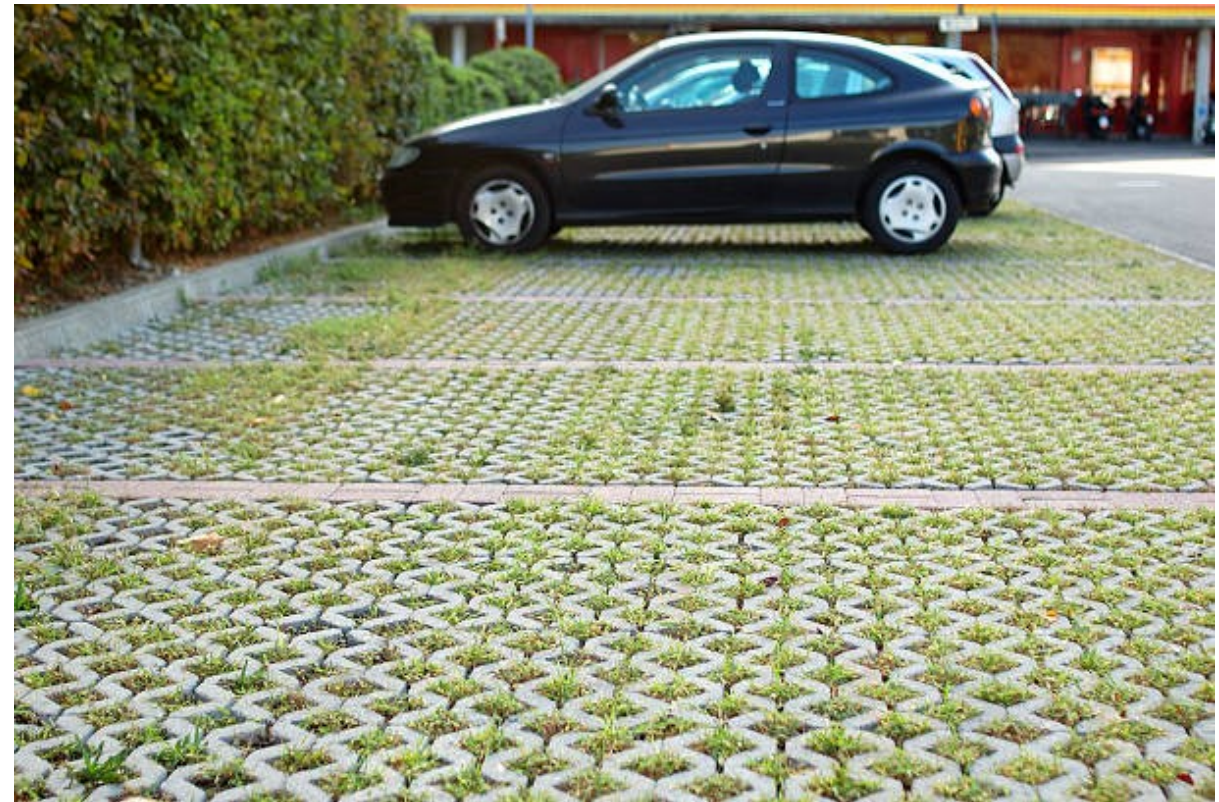
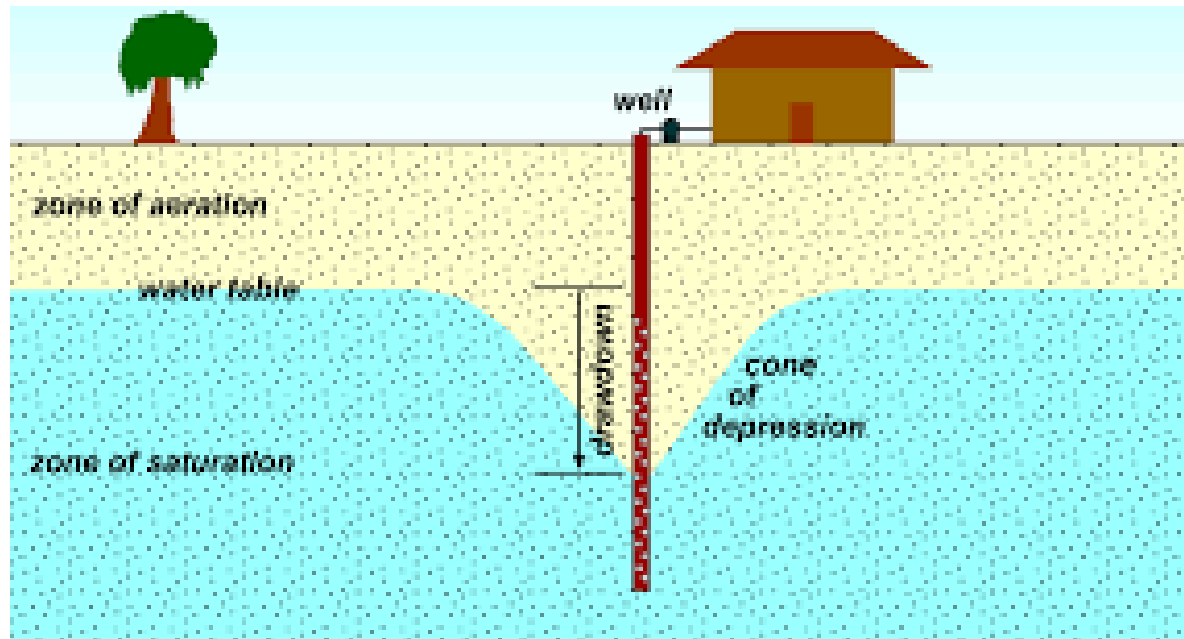
"ANY PERSON WHO VIOLATES SEC. 48, PARS. 2 & 3 SHALL, UPON CONVICTION BE PUNISHED
WITH A FINE OF P300.00 TO P1,000.00, OR IMPRISONMENT OF 1 TO 15 DAYS, OR BOTH."



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Ground water conservation



2.12.2.3.1.3 Prevention and mitigation of natural disasters and adaptation to climate change

Solutions in planning, architecture and technology should be developed in response to climate change and help minimize the devastation/damage of natural disasters (such as flood, land slide, storm, earthquake and whirlwind).

2.12.2.3.1.4 Harmony with natural landscape

Solutions in spatial planning and architectural design should not only be in harmony with natural landscape, but also enhance the quality of such natural landscape.

2.12.2.3.1.5 Restoration and Improvement of Environment and Landscape

Landscape design solutions applicable to green areas, water bodies, architecture and building technology will help restore and improve microclimatic conditions and enhance the beauty of the local natural landscape.

2.12.2.3.2. Criterion Two: Efficient Consumption of Energy, Water and Natural Resources Management

Objectives: To enhance the efficiency and help save both energy and natural resources; to reduce negative impacts on the natural environment and minimize the greenhouse effect in using natural resources, such as land, water, energy, materials, etc. for green building.

2.12.2.3.2.1 Land saving in building

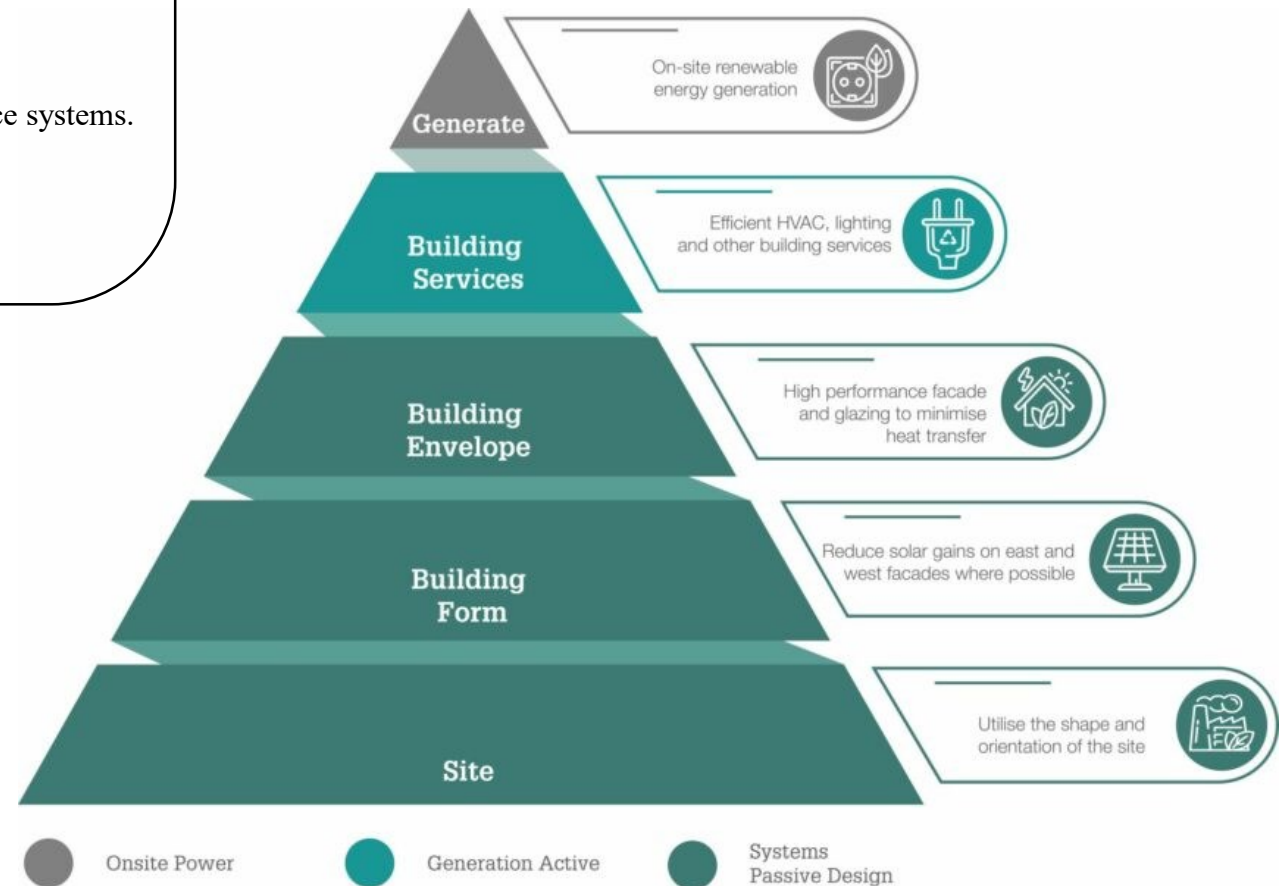
- Building density and land use ratio should be in accordance with the properties And purposes of use of building(s), as well as the landscape requirements for the area.
- Use uncultivated or uninhabited land, not agricultural land, for building purpose and try to conserve eco-systems.
- Develop solutions to create green areas and underground spaces, and economize land use for building purpose.



Ecological value of a site

2.12.2.3.2 Energy Saving and Efficient Energy Use

- Solutions in planning, architecture, use of building materials, application of technology and installation of equipment should ensure efficient energy use and save as much energy as possible.
- It is strongly advised to exploit energy sources locally available, particularly renewable energy, in compliance with the relevant standards currently applied.
- Controlling, monitoring and/or managing systems should be properly used towards the minimization of energy consumption of building service systems.

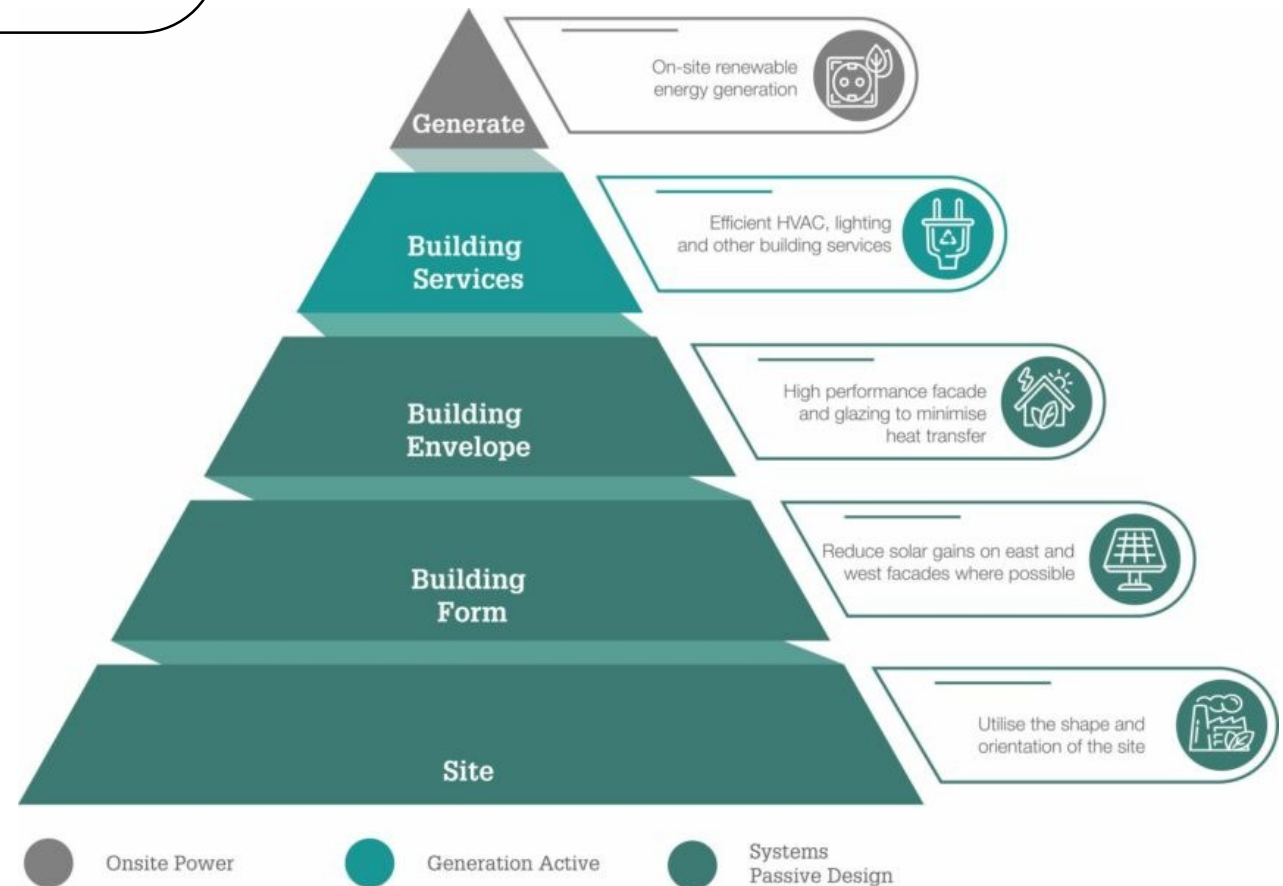


- **Energy Efficient Features**

In the near future, energy efficiency is potentially the most important and cost-effective means for mitigating greenhouse gas emissions from industry.

(ref:<https://link.springer.com>)

Energy efficient features in place of conventional fixtures should be applied in building projects



2.12.2.3.2.3 Utilization and Efficient Use of Air Circulation and Daylight

Solutions in planning, architecture, use of building materials, application of technology and installation of equipment should ensure efficient use of air circulation and daylight which are of course good for building occupants' health. By doing so it is possible to minimize air-conditioning and artificial lighting.

2.12.2.3.2.4 Efficient use of water

- Save clean water as a valuable natural resource and comply with relevant standards currently applied.
- Develop water-saving solutions and minimize water leakage.
- Rain water and wastewater should be collected, treated and reused.
- Ensure that water sources are safe and will not have any harmful effects on human health and living environment.

2.12.3.2 Safeguarding Water, Water Efficiency and Pollution Control

Water efficiency is reducing water wastage by measuring the amount of water required for a particular purpose and the amount of water used or delivered. Water efficiency differs from water conservation in that it focuses on reducing waste, not restricting use. (Ref:

<https://en.wikipedia.org>)

Important factors to be considered for safeguarding water are:

- Water efficient fittings
- Water usage monitoring
- Water discharge system
- Rain water harvesting system
- Irrigation system

2.12.2.3.2.5 Use of environment-friendly materials

- Materials to be used for the building(s) must be free of hazardous substances and emissions (radioactive materials, chemicals, volatile organic compounds, etc.).
- Use of local materials should be encouraged, so that the natural resources will not become exhausted, and can even be reused or recycled.

2.12.2.3.3.3 Materials for Interior Design

Use of materials for interior design, such as paints, gypsum, wood and plastic, must be free of emissions of greenhouse gases or hazardous substances that have negative effects on the health and physio-psychological state of building occupants.

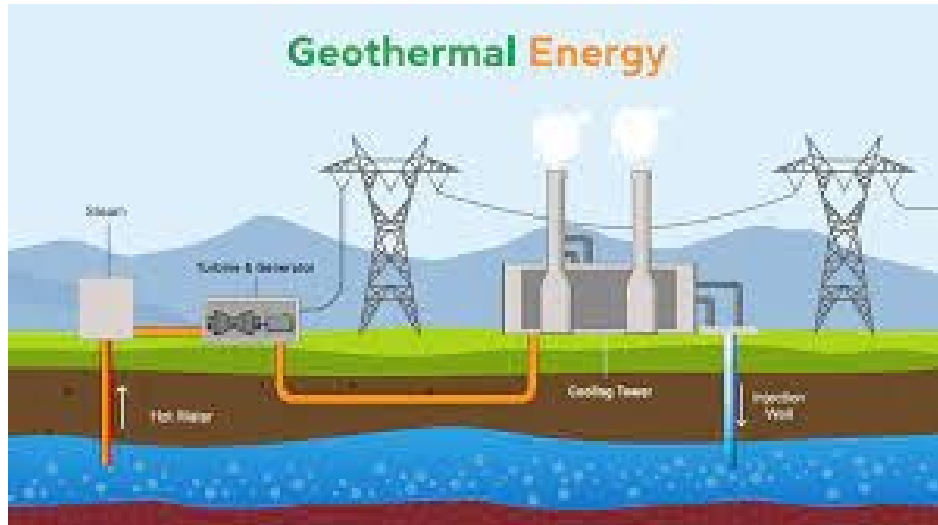


2.12.2.3.2.6 Application of green technologies

Application of innovative and intelligent solutions in engineering, technology and equipment for design and construction of **buildings and/ or on a larger scale**, a whole urban area will help minimize loss of energy, costs and environmental pollution.

- **Renewable Energy**

Renewable energy is energy that is collected from **renewable resources**, which are **naturally replenished on a human timescale**, such as **sunlight, wind, rain, tides, waves, and geothermal heat**. Renewable energy often provides energy in four important areas: electricity generation, air and water heating/cooling, transportation, and rural (off-grid) energy services. (Ref: <https://en.wikipedia.org>) Some of the examples are solar energy, wind energy, biomass,



2.12.2.3.2.7 Efficient Management in use of buildings as well as urban areas

- Application of waste sorting and treatment without causing pollution.
- Application of reuse and recycling solutions to deal with building waste and try to minimize the amount of waste transported to waste disposal sites and recycle the amount of waste arising throughout the life cycle of a building.
- Management of use of energy, water and materials must meet the requirements towards saving and efficiency according to relevant standards of competent organization.
- Management and operation of building(s) and urban area(s) must ensure that CO2 emissions and waste substances will not exceed the amounts required in standards.



Solid Waste Management System

Solid waste management is a term that is used to refer to the process of collecting and treating solid wastes. It also offers solutions for recycling Items that do not belong to garbage or trash. As long as people have been living in settlements and residential areas, garbage or solid waste has been an issue.

Waste management is all about how solid waste can be changed and used as a valuable resource. Solid waste management should be embraced by each and every household including the business owners across the world.

Industrialization has brought a lot of good things and bad things as well. One of the negative effects of industrialization is the creation of solid waste.

(Ref: <https://www.conserve-energy-future.com>)



Environmental Management System

Environmental management system (EMS) refers to the management of an organization's environmental programs in a comprehensive, systematic, planned and documented manner. It includes the organizational structure, planning and resources for developing, implementing and maintaining policy for environmental protection.

Operational Controls, Procedures, and Practices. To implement an effective environmental management system, an organization must identify those operations and activities that are associated with the identified significant environmental aspects in line with its policy, objectives and targets.

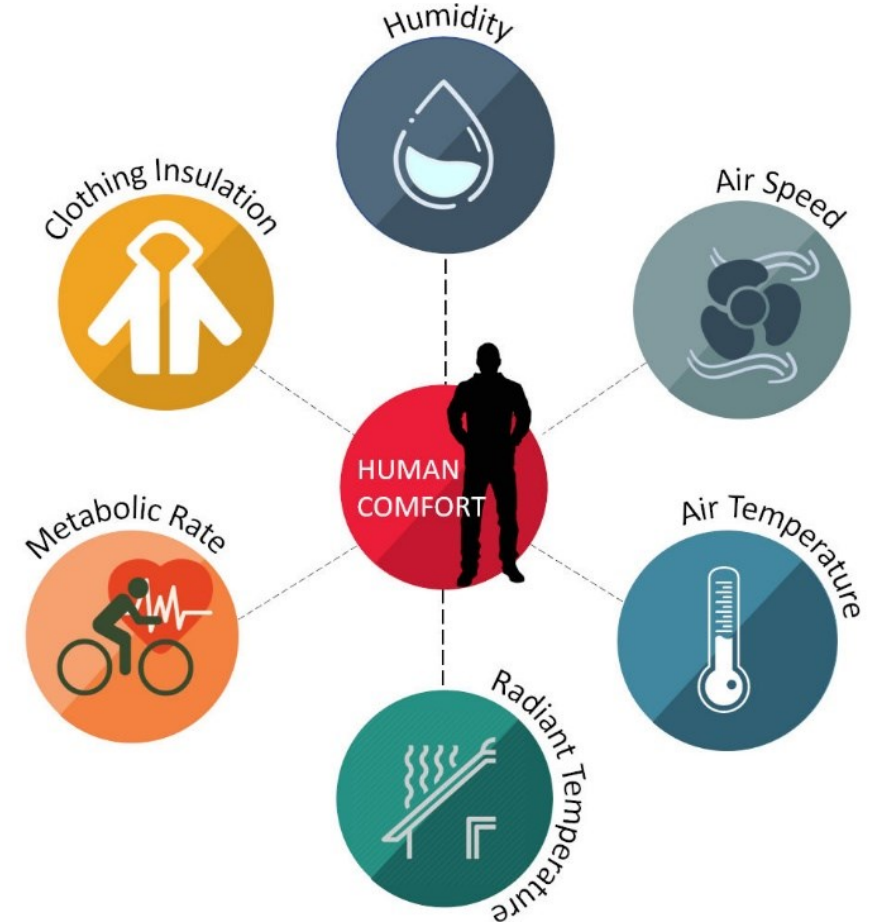


2.12.2.3.3 Criterion Three: Indoor Environment and Materials

Objective: To create **safe, hygiene and comfortable** to building occupants while the building(s) can still be effectively used.

2.12.2.3.3.1 Room Design

- Rooms should be designed in accordance with **specific purposes of use and the needs of building occupants, physio-psychologically** considered.
- Rooms specially reserved for and used by **disabled people** must be designed as required.
- Room design must meet the needs of building occupants for **social communication and welfare**.



2.12.3.4 Indoor Environmental Quality

Indoor environmental quality (IEQ) refers to the quality of a building's environment in relation to the **health and wellbeing** of those who occupy space within it.

IEQ is determined by many factors, including lighting, air quality, and damp conditions.

(Ref: www.cdc.gov/niosh/topics/indoorenv/default.html)



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• Indoor Air Quality (IAQ)

Indoor air quality (IAQ) is the purity of the air in a specified area. It is determined by the level of dust, suspended particles and pollutants that are present. The quality of indoor air can affect the health and wellness of those who are breathing it.

(Ref: www.safeopedia.com)

2.12.2.3.3.4 Indoor Air Quality

- Indoor air must satisfy the hygiene conditions and ensure good health for building occupants and the air quality meet the standards of competent organizations.
- Natural ventilation: Make full use of cool wind in terms of providing fresh air for building occupants; Minimize and avoid, if possible, cold/hot wind that may have negative effects on human health.
- Mechanical ventilation:
 - (a) Ensure that air quality, room temperature; humidity, indoor wind speed, etc. are adequate to meet the requirements for comfort and well-being of building occupants;
 - (b) Minimize the use of energy-intensive equipment and appliances for heating and cooling in residential buildings
- Air pollution must be controlled and should not exceed the maximum level allowed in the standards.



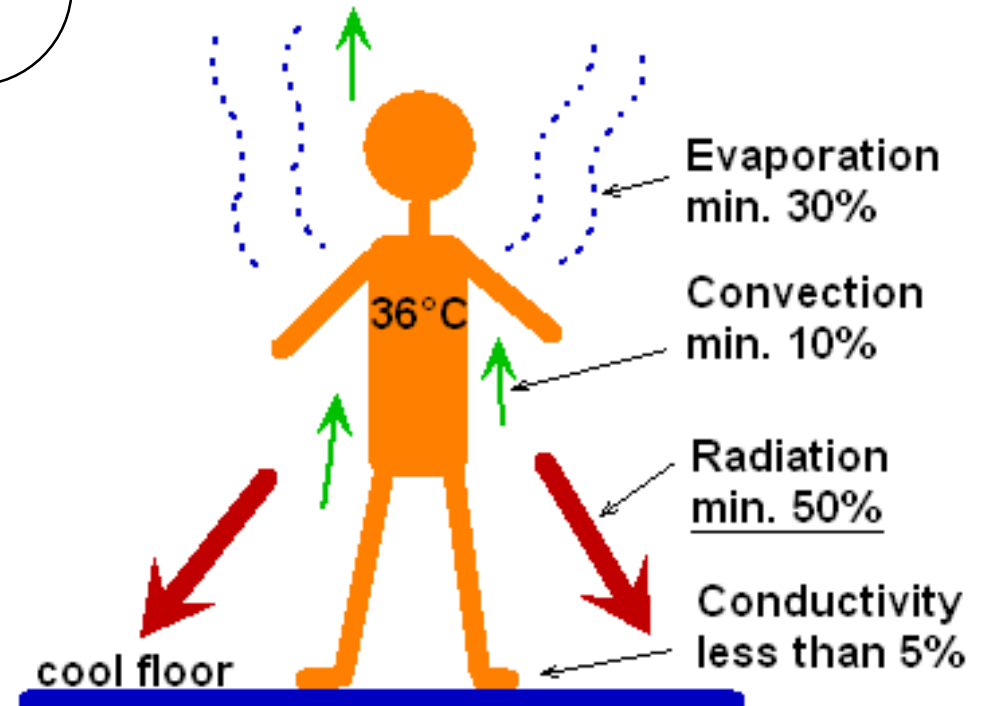
Thermal Comfort

Thermal comfort is the condition of mind that expresses satisfaction with the thermal environment. The temperature is an indication of the physical environment. Good indoor thermal comfort improves productivity at workplace.

Thermal comfort results from a combination of environmental factors and personal factors. Environmental factors influencing thermal comfort are:

Air temperature

- The temperature of the air that a person is in contact with, measured by the dry bulb temperature (DBT).



Radiant temperature

- The temperature of a person's surroundings (including surfaces, heat generating equipment, the sun and the sky). This is generally expressed as mean radiant temperature (MRT, a weighted average of the temperature of the surfaces surrounding a person, which can be approximated by globe thermometer) and any strong mono-directional radiation such as radiation from the sun.

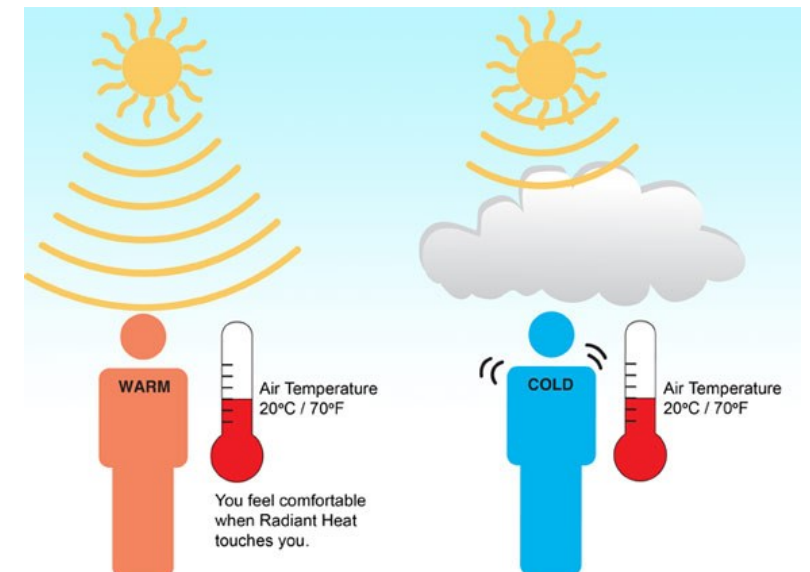
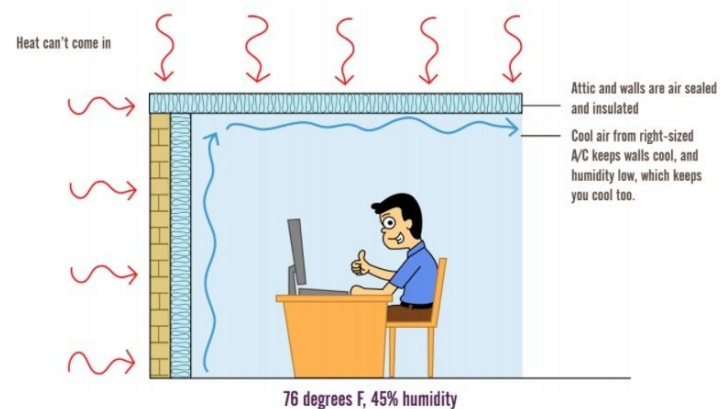
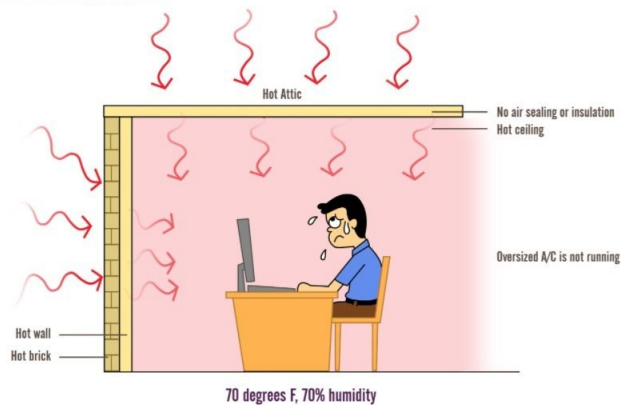
Relative humidity (RH)

- The ratio between the actual amount of water vapour in the air and the maximum amount of water vapour that the air can hold at that air temperature, expressed as a percentage. The higher the relative humidity, the more difficult it is to lose heat through the evaporation of sweat.

(Ref: <https://www.designingbuildings.com>)



Mean Radiant Temperature (MRT)



Air velocity

- The velocity of the air that a person is in contact with (measured in m/s). The faster the air is moving, the greater the exchange of heat between the person and the air (for example, draughts generally make us feel colder).

- **Air Change Rate**

Air changes per hour, or air change rate, abbreviated ACH or ac/h, is a measure of the air volume added to or removed from a space (normally a room or house) divided by the volume of the space. If the air in the space is either uniform or perfectly mixed, air changes per hour is a measure of how many times the air within a defined space is replaced. (Ref: <https://en.wikipedia.org>)

2.12.3 Environmental Sustainability Standard

2.12.3.1 Energy Efficiency and Renewable Energy

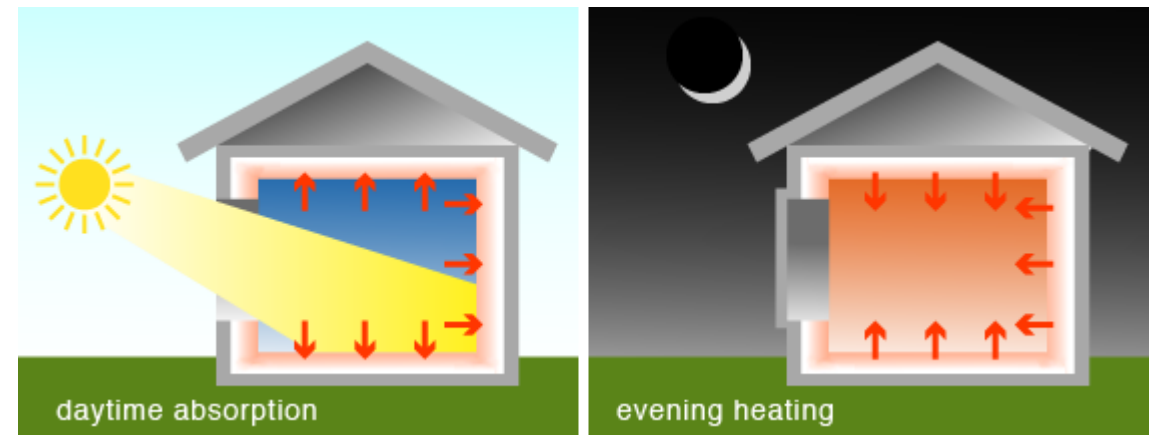
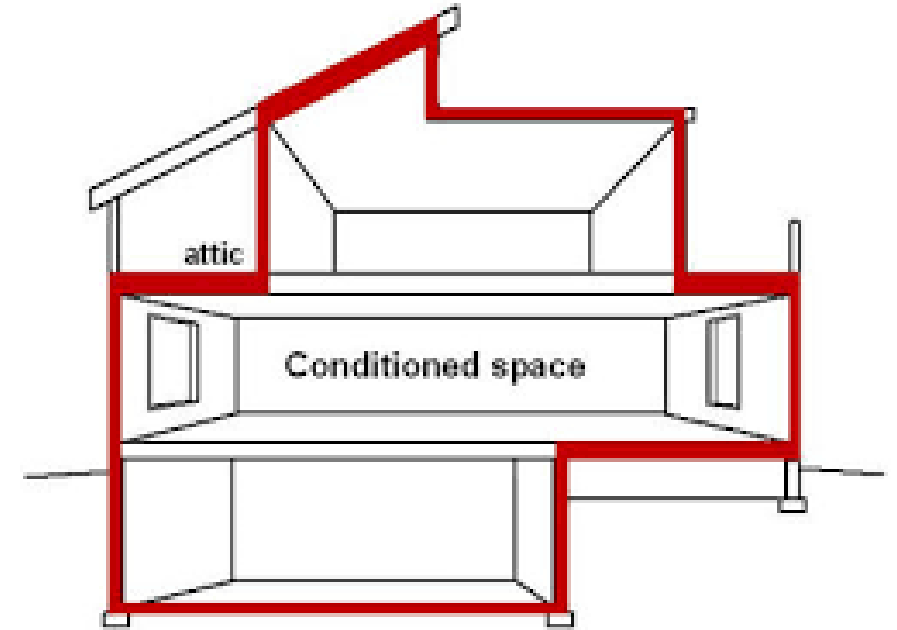
- **Building Envelope**

Heat gain or loss in buildings is due to heat transfer through walls, roof, ceiling, floor, and glass etc., i.e., the building fabric or envelope.

The load due to such heat transfer is often referred to as the envelope heat gain or loss. In this connection, it is to be considered whether a particular wall or roof is exposed (normal or severe exposure) to the sun or not. In the case of a sunlit wall or roof, the heat gain of the room will be more in comparison to a shaded one, as the outside surface temperature of the wall or roof will increase above the outside air temperature due to the incident solar radiation.

(Ref: shodhganga.inflibnet.ac.in)

The control of the overall thermal performance of building envelope will contribute to minimize heat gain thus reducing the overall cooling load requirement.

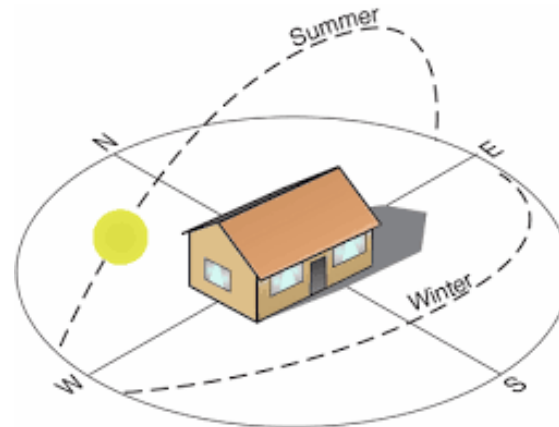


2.12.2.3.3.2 Building Envelope

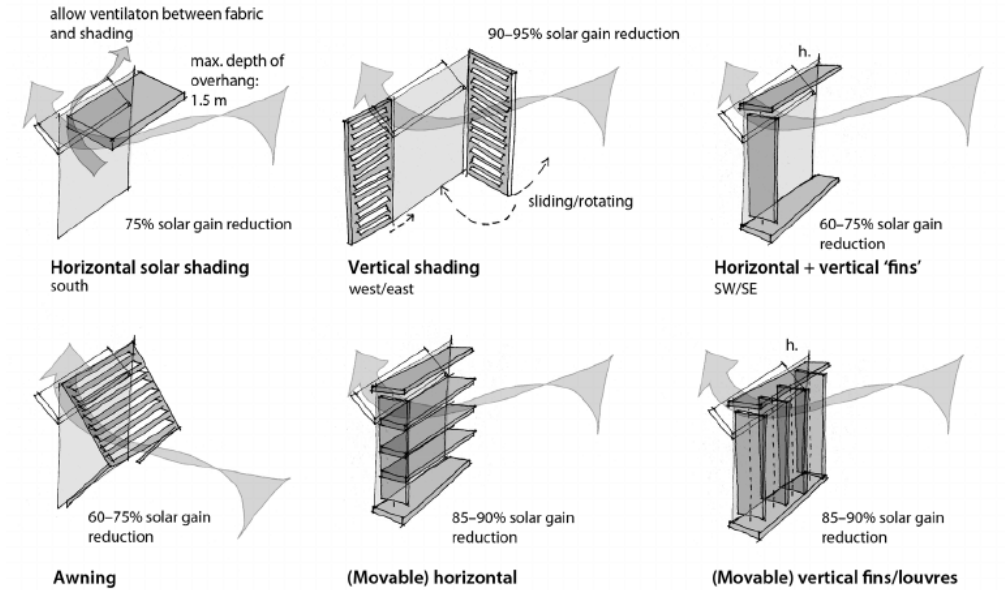
- Building design, including built forms, spatial planning, structural design and selection of building envelope, must meet the requirements for the prevention and mitigation of the negative impacts of both natural and artificial factors, such as solar radiation, light and lighting, wind and rain.

Other requirements include: thermal insulation, sun shading, ventilation, reflection, illumination, noise control, elimination of the condensation of humidity as well as the diffusion of toxins.

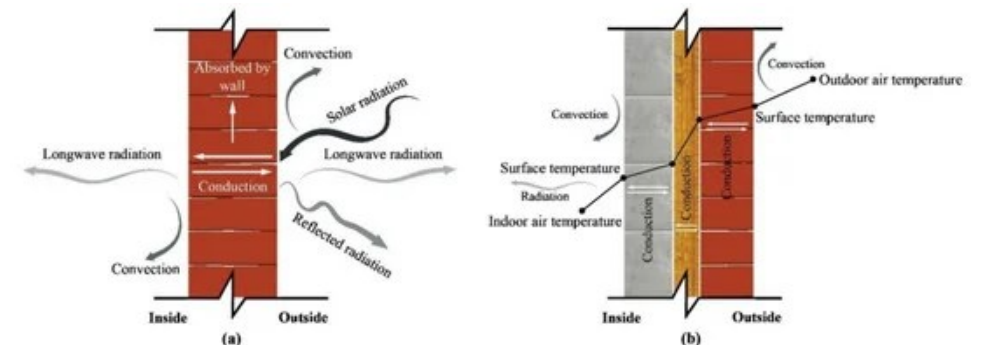
- Use of materials for the building envelope must take the advantage of the natural environment towards energy saving and efficiency.



Most effective shading



Bottom three shading devices are suitable for all orientations if movable shading fins. They are effective solar shading, but reduce daylighting and winter solar gain so use with care. Design sliding/inward-opening windows, which do not impede natural ventilation. Design top inward-opening 'hopper' windows for night cooling (h.).



Heat transmission through building envelope

Comparison of Overall Heat Transfer Value standards

Sl.	Country	Year	Status	OTTV (Walls)	OTTV (Roof)
1	Singapore 1° 20' N	1979	Mandatory	45W/m ²	45W/m ²
2	Malaysia 3° 7' N	1989	Voluntary	45W/m ²	25W/m ²
3	Thailand 13° 41' N	1992	Mandatory	45W/m ²	25W/m ²
4	Philippines 14° 35' N	1993	Voluntary	48W/m ²	---
5	Jamica 17° 56' N	1992	Mandatory	55.1-67.7W/m ²	20W/m ²
6	Hong Kong 22° 18' N	1995	Mandatory	Tower: 35 W/m ² Podium: 80 W/m ²	

- **Natural Ventilation in Common Area**

A building's natural ventilation can be based on a variety of different ventilation principles. A ventilation principle shows how natural ventilation works based on the design of the building, internal thermal loads and the positioning of openings (typically windows). All natural ventilation principles are based on the principle of ensuring healthy and comfortable indoor climate through minimal energy consumption and at minimal cost. (Ref: <https://www.windowmaster.com>)

Common area such as stairs, toilets, lifts, lobby, walkways, passage ways are advised to be naturally ventilated as much as possible rather than using air-conditioning system readily.



2.12.2.3.3.6 Lighting

Ensure the following factors/conditions: illuminance, lighting indicator, visual effect and minimization of energy consumption. Solutions to control and manage lighting/illumination towards energy saving and efficiency should be applied and easy/convenient to use.

- **Lighting**

Daylight is the combination of all direct and indirect sunlight during the daytime. This includes direct sunlight, diffuse sky radiation, and (often) both of these reflected by the Earth and terrestrial objects, like landforms and buildings. Sunlight scattered or reflected by objects in outer space (that is, beyond the Earth's atmosphere) is generally not considered daylight. Thus, daylight excludes moonlight, despite it being indirect sunlight. Daytime is the period of time each day when daylight occurs. Daylight happens as Earth rotates, and either side on which the Sun shines is considered daylight. (Ref: <https://en.wikipedia.org>) Building works must be designed to integrate natural lighting wherever applicable to reduce the need of the electrical energy.

2.12.2.3.3.5 Noise

Noise must be controlled and should not exceed the maximum level allowed in the standards.

Noise Pollution Control

A form and level of environmental sound that is generally considered likely to **annoy, distract or even harm other people**. Most industrial plants operated by a business located near a residential area will need to be respectful of others residing within earshot regarding their production of **noise pollution**.

(Ref:<https://www.merriam-webster.com>)

Any sound which is unnecessary, excessive, unnatural, annoying, prolonged, or unusually loud in relation to its time, place and use effect.

2.12.2.3.4. Criterion 4: Innovative Architecture and Identity

Objective: To develop innovative architecture on the basis of the continuity and respect of traditional values and an emphasis on vernacular or local architecture.

2.12.2.3.4.1 Planning and Architecture

Solutions should be compatible/ appropriate to the needs of people living and working in a modern society and help them understand much better as well as respect/appreciate the cultural values of a society.

2.12.2.3.4.2 Conservation, Continuation and Promotion of Cultural Values and Traditional Architectural Styles; which are highly characteristic for each region, nation and ethnic group.

2.12.2.3.4.3 Application of Advanced Science and Innovative/Climate Responsive Technology; which is expected to bring socio-economic benefits to the community.

2.12.2.3.5 Criterion 5:

Social Sustainability and Humanities for Community

Objective: To connect architectural development with the goals in establishing, protecting
And nurturing social environment and humanities towards stability
and sustainability.

2.12.2.3.5.1 Ensure Harmony with Social Environment and Humanities for Community

The harmony with humanities for the communities, such as cultural tradition, history, religion, lifestyle, etc. should be emphasized and highlighted.

2.12.2.3.5.2 Meet the Material, Cultural and Spiritual Needs of Individuals, Communities and Nations

It is important to respect the rights and needs of communities in order to avoid conflicts of interest and to ensure the integration of disabled people into the society as well as to help marginalized groups (low-income residents).

2.12.2.3.5.3 Respect, Conserve and Promote the Values of Cultural Heritage

- Respect, conserve and promote all the values of cultural heritage, both tangible and intangible one.
- Explore and discover new heritage and propose solutions to conserve the heritage and put it into a closer relationship with the local socio-economic activities.

2.12.2.3.5.4 Ensure a Stable Socio-Economic Context

- Ensure a harmony of interests among different groups of the local community without causing any negative problems, hereby it is possible to establish and secure a stable and sustainable socio-economic development for the local community.
- Ensure an efficient management concept by respecting and encouraging the public participation in the design process, investment in construction, use and operation of building(s) as well as urban area(s)

CERTIFICATION

	HPI	BREEAM	LEED	EDGE	nZEB	Passivhaus	LEVEL(s)*
Energy Efficiency Energy use + CO ₂ emissions	●	●	●	●	●	●	●
Energy Savings	●	●	●	●	●	●	●
Indoor Air Quality Ventilation, VoCs, Radon	●	●	●	●	○	○	●
Water Efficiency Water quality + Testing	●	●	●	●	○	●	●
Daylight Levels Health + Wellbeing	●	●	●	●	●	○	●
Acoustic Comfort Wellbeing + Comfort	●	●	●	●	●	●	●
Embodied Carbon	●	●	●	●	●	●	●
Improving Biodiversity	●	●	●	●	●	●	○
Universal Design Lifetime Homes	●	●	●	●	●	●	○
Connected Location Transport links, facilities, amenities	●	●	●	●	●	●	●
Lifecycle Analysis	●	●	●	●	●	●	●
Circular Economy Design for reuse	●	●	●	●	●	●	●
Nationally Adapted Data fed back into national policy	●	●	●	●	●	●	○

● Fully considered
 ○ Partially considered
 ● Not considered

* An EU framework from the European Commission. More information at https://ec.europa.eu/environment/topics/circular-economy/levels_en

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