



Building Green Together
Digital Platform for Green Construction Learning



Erasmus+

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Sustainable Construction & Green Certificates

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**What do you think is the most
influential factor in bioclimatic design?**



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Sustainable Architecture Concept

Content:

1.1 Bioclimatic Principles

Description of the 10 key bioclimatic principles for a project

1.2 Green Certifications

Building Energy Certification, VERDE Certification, BREEAM Certification, LEED Certification, Passivhaus Standard

1.3 Bioclimatic Design Exercise

Practical exercise for applying bioclimatic design principles to a project

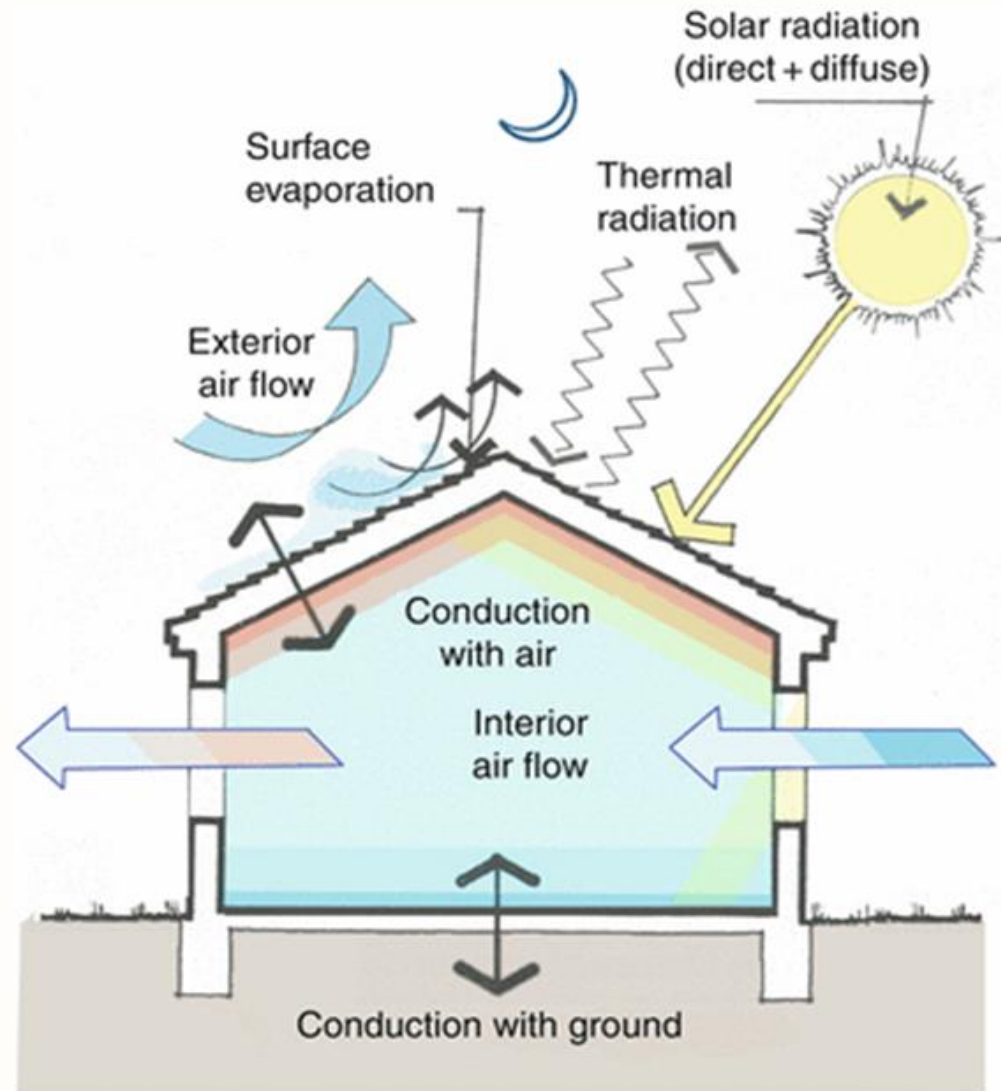


1.1 Bioclimatic Principles

Bioclimatic design seeks to achieve a harmonious balance between the built environment and the natural environment, maximizing efficiency while minimizing environmental impact.

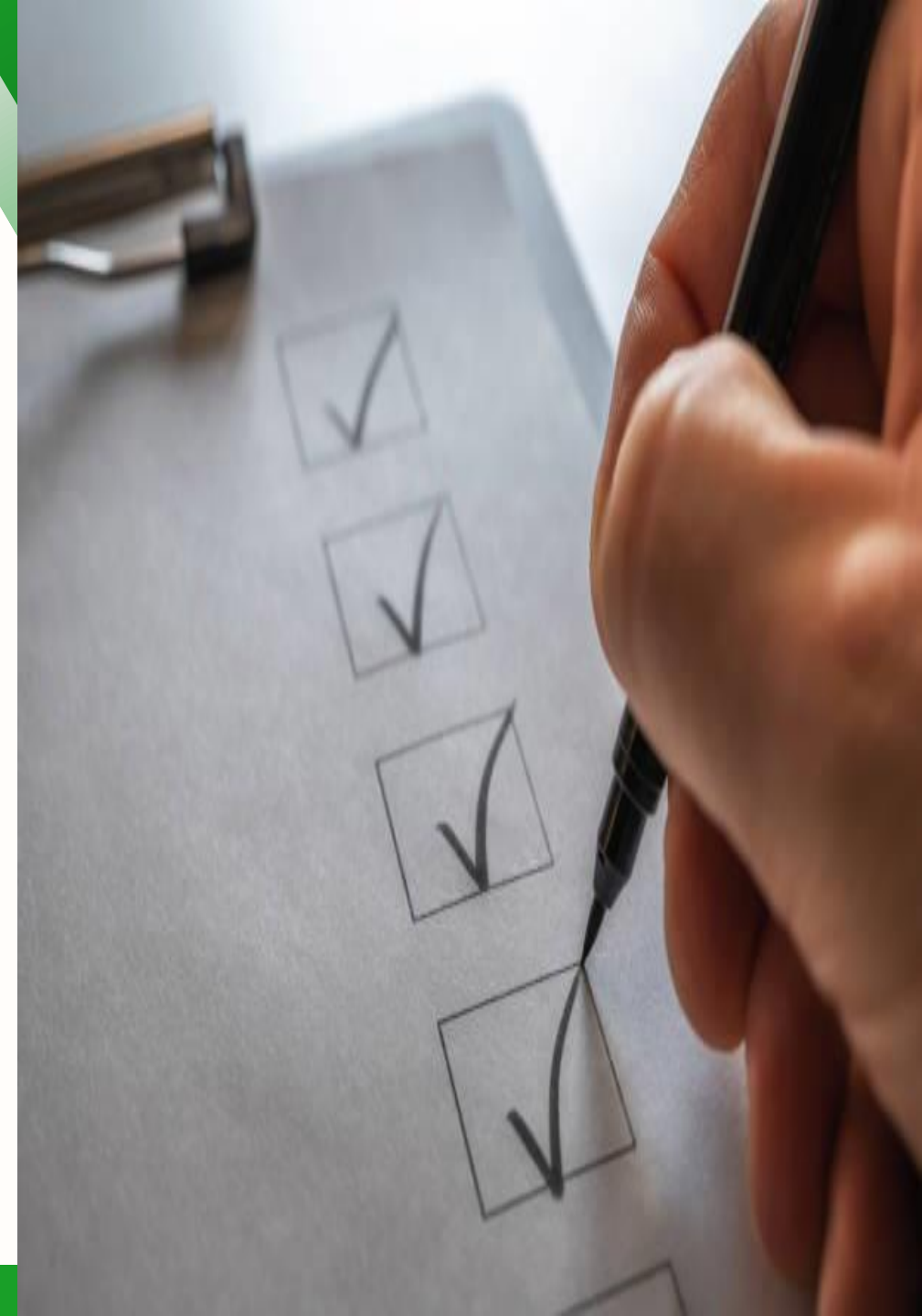
Using natural resources and harness with local climatic conditions, creates an efficient and environmentally friendly built environment.

Good bioclimatic design is based on several essential principles that allow the project to be analyzed in terms of efficient areas for improved development.



10 Fundamental Bioclimatic Principles

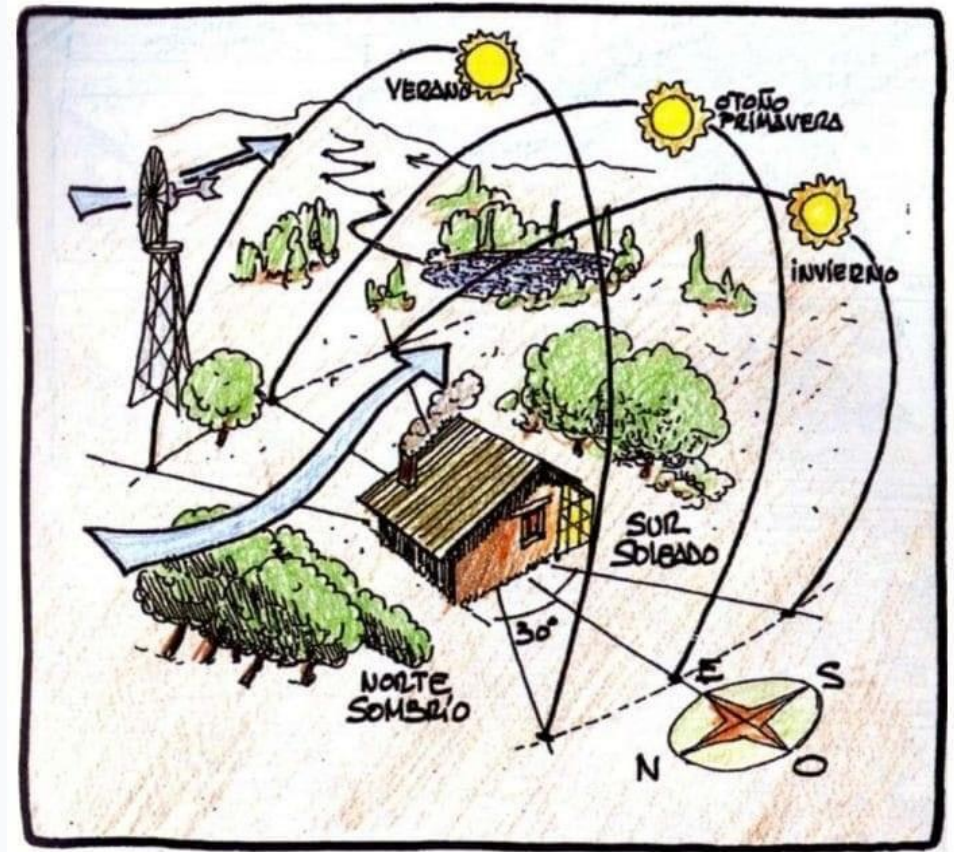
- ✓ 1. Orientation and Location
- ✓ 2. Thermal Insulation & Air tightness
- ✓ 3. Natural Ventilation Strategies
- ✓ 4. Thermal Mass
- ✓ 5. Solar Shading
- ✓ 6. Solar Capture
- ✓ 7. Water Management
- ✓ 8. Sustainable Landscaping
- ✓ 9. Sustainable Materials
- ✓ 10. Energy Efficiency



📍 Orientation and Location

Proper building orientation on the site allows for making the most of available natural resources (such as sunlight and prevailing winds) thereby maximizing indoor comfort and minimizing energy consumption.

- ✓ **Solar Path Optimization:** Position living spaces to capture morning and winter solar radiation while minimizing summer glare.
- ✓ **Solar Radiation Control:** Incorporating elements such as eaves, overhangs, and blinds; **especially important in hot climates.**
- ✓ **Prevailing Winds:** Place window openings strategically to harness cross-ventilation for natural cooling.
- ✓ **Microclimate Adaptation:** Leverage natural land contours, hills, and surrounding vegetation for protection against harsh weather.
- ✓ **Site Integration:** Minimize landscape disruption and preserve natural soil permeability.



Thermal Insulation & Airtightness

- ✓ **Continuous Envelope:** High-performance insulation reduces heat loss in winter and heat gain in summer.
- ✓ **Thermal Bridge Elimination:** Eliminating weak thermal junctions prevents cold spots, condensation, and mold.
- ✓ **Building Airtightness:** Prevents unconditioned air infiltration, maintaining a stable indoor climate.
- ✓ **Indoor Air Quality:** Combined with controlled mechanical ventilation to eliminate allergens and pollutants.

Reduction in heating and cooling energy demand through thermal insulation.

GLASS WOOL THERMAL INSULATION

WITH ALUMINUM FOIL FACING



THERMAL
INSULATION



FIRE
RESISTANT



SOUND
ABSORPTION



ENERGY
SAVING

High quality glass wool blanket with aluminum foil facing, offering excellent thermal insulation, heat reflection and energy saving.



THERMAL INSULATION

Reduces heat transfer and improves energy efficiency.



HEAT REFLECTION

Aluminum foil facing reflects radiant heat effectively.



SOUND ABSORPTION

Fiber structure helps reduce noise transmission.



MOISTURE RESISTANT

Aluminum foil facing acts as a vapor barrier.



WIDE APPLICATION



HVAC DUCTS



ROOF INSULATION



WALL INSULATION



INDUSTRIAL EQUIPMENT



SAFE & RELIABLE



TCO FRIENDLY



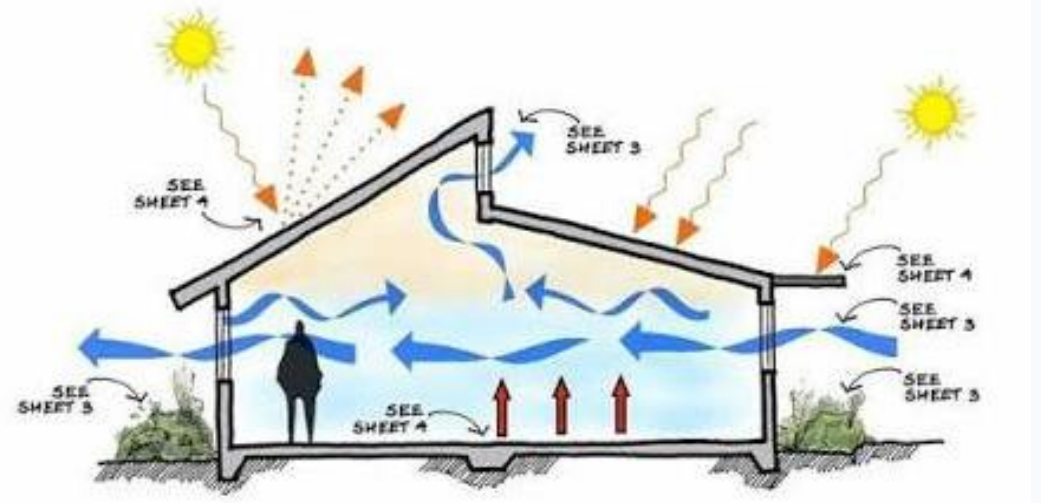
EASY TO INSTALL



WIDE APPLICATION

⇒ Natural Ventilation Strategies

Natural ventilation harnesses natural resources available in the environment, such as prevailing winds and pressure differences, to promote indoor air circulation without the need for mechanical or electrical devices.



Cross Ventilation

Opposite window openings allow breeze pathways that flush warm air out and introduce fresh outdoor air naturally.



Stack Effect

Exploits buoyancy where warm air rises and escapes through high openings, drawing cooler air from lower levels.



Night Flushing

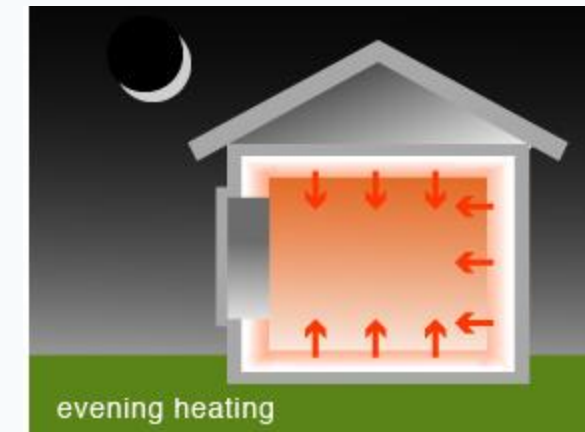
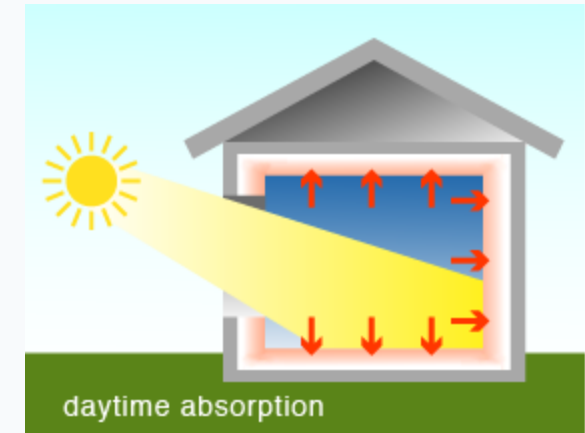
Utilizes cool nighttime temperatures to dissipate heat absorbed by structural elements during hot summer days.

Thermal Mass

The concept of "thermal mass" refers to the capacity of certain materials to absorb, store, and release heat in response to temperature changes in the surrounding environment.

The aim is to leverage its characteristics to reduce reliance on mechanical heating and cooling systems, thereby lowering energy consumption and greenhouse effect

- ✓ **Thermal Inertia:** High-density materials (concrete, stone, brick, ceramic) absorb heat during the day and release it gradually at night.



Solar Shading

Before designing shading elements, it is useful to conduct a solar analysis of the site using a sun path diagram or software, making it possible to identify the areas requiring the greatest protection from radiation.

- ✓ **Passive Shading:** Overhangs, pergolas, and louvers block high summer sun rays while admitting lower winter solar heat.
- ✓ **Vegetative Shading:** Deciduous trees offer summer shade while dropping leaves in winter to allow light access.
- ✓ **Adjustable Blinds:** Flexible exterior shading enables real-time adaptation to daily weather shifts.



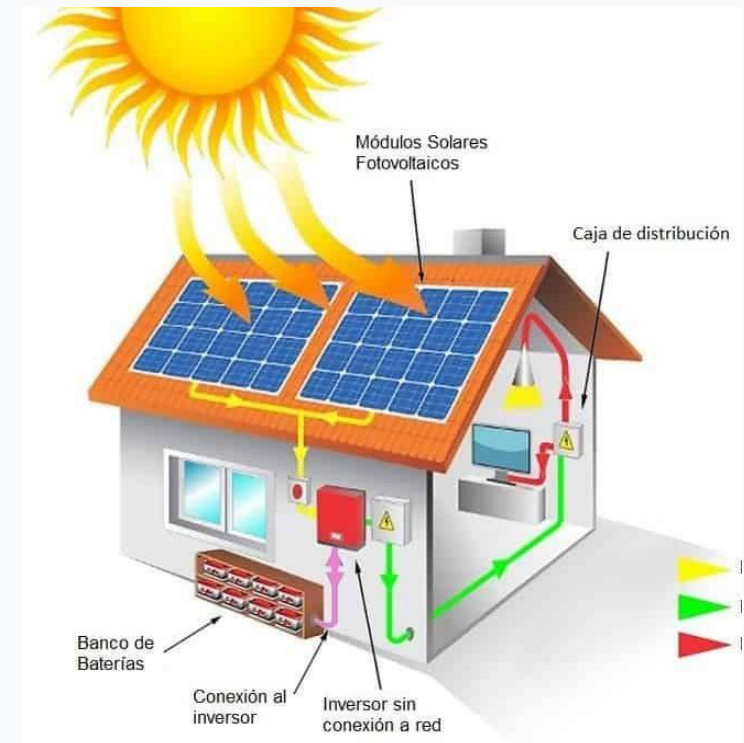
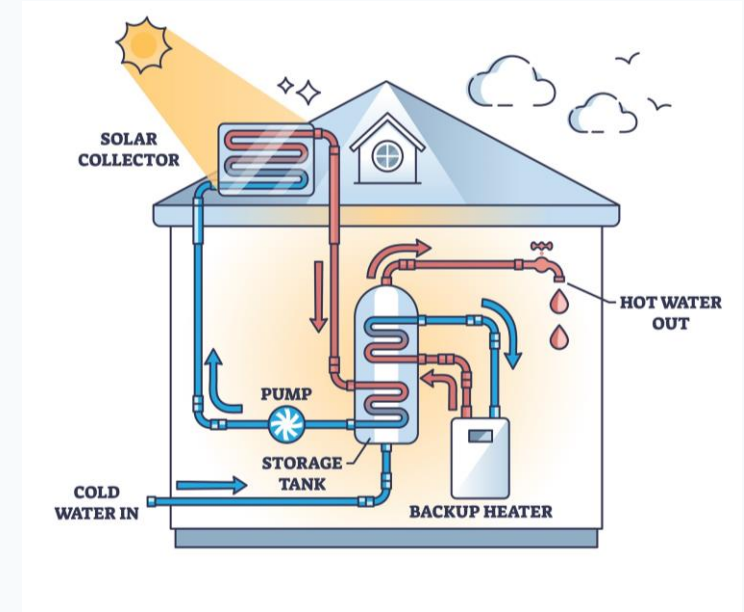
*In the **Northern Hemisphere** generally, south and southeast-facing orientations are recommended for living rooms and bedrooms to take advantage of the warming effect of morning light while avoiding exposure to the intense light of midday and afternoon.*

Solar Capture

Passive solar design harnesses the sun's energy to naturally regulate the temperature of interior spaces through proper building orientation, the strategic design of openings, the use of shading, and the selection of materials with appropriate thermal properties to maximize solar gain in winter and minimize it in summer.

Solar Thermal & PV Energy

Photovoltaic panels produce clean electricity while thermal collectors supply domestic hot water and support space heating, drastically lowering grid dependency.

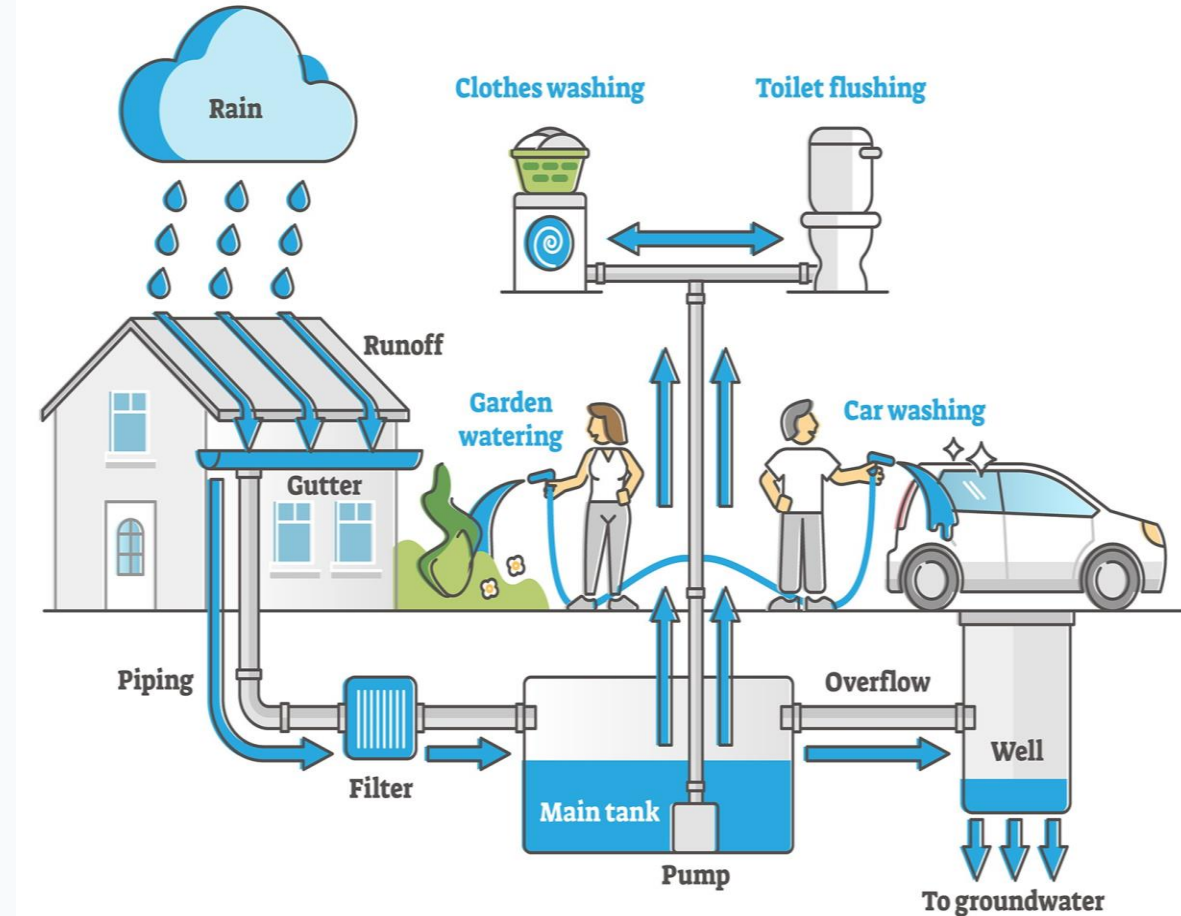


Water Management

Water reuse aims to maximize the use of available water resources in the region and minimize potable water consumption, thereby contributing to environmental conservation and the reduction of the buildings' water footprint.

Water Reuse & Harvesting

Rainwater collection systems combined with greywater recycling (from showers and sinks) significantly reduce potable water consumption for irrigation and flushing.



Sustainable Landscaping

Good landscape and garden design contributes to improving energy efficiency, promoting biodiversity, and reducing the environmental impact of built environments

Native plant selection minimizes irrigation and maintenance while boosting biodiversity. Green roofs and living walls enhance thermal insulation and combat the urban heat island effect.



Sustainable Materials

Selecting environmentally friendly materials is fundamental to creating buildings that are sustainable, energy-efficient, and healthy for their occupants. It is important to consider the **entire lifecycle** of these materials, from extraction to final disposal.

It is recommended to use **local materials** that minimize environmental impact during both production and eventual disposal, thereby keeping transportation costs to a minimum and significantly reducing the carbon footprint.

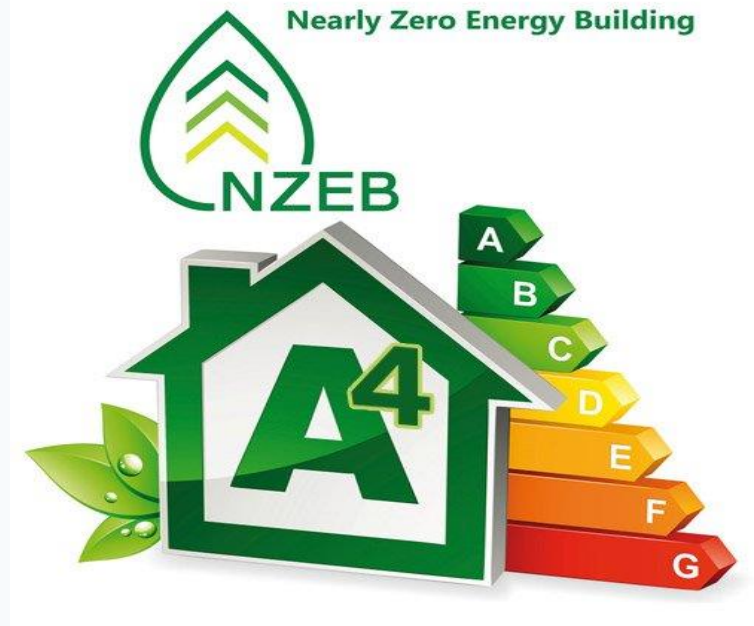
Eco-Friendly Design

Prioritizing local, certified, recycled, or low-embodied-carbon building materials (e.g., FSC timber, adobe, cork) ensures minimal lifecycle ecological footprint.



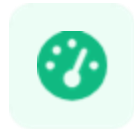
⚡ Energy Efficiency Core Pillars

In good bioclimatic design, it is essential to integrate technologies and practices that reduce energy consumption, such as energy-efficient lighting, energy management systems, and efficient appliances.



Passive First

Maximize natural heating, cooling, and daylighting before relying on mechanical systems.



Efficient Systems

Implement LED lighting, heat recovery HVAC, and smart energy management automation.



Renewable Generation

Integrate onsite renewable energy to achieve Nearly Zero Energy Buildings (NZEB).

Sustainable Urban Mobility

- ✓ **Compact City Planning:** High-density, mixed-use neighborhoods reduce transit distances and urban sprawl.
- ✓ **Active Mobility:** Dedicated cycling networks and pedestrian corridors promote healthy, zero-emission travel.
- ✓ **Clean Public Transit:** Electric buses, light rails, and shared mobility fleets minimize carbon footprints.
- ✓ **Urban Resilience:** Green infrastructure manages stormwater runoff and strengthens climate adaptation.



Review Questions



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1.2 Green Certifications



There are certifications established and managed by various initiatives aimed at providing external auditing and advisory services regarding sustainability and energy consumption; achieving a high rating adds prestige to any project. These certifications involve an evaluator assessing the project (at the client's request) across a range of areas, from actual energy consumption to material quality, water management, and emissions from the building's mechanical systems.

- ✓ **VERDE Certification**
- ✓ **BREEAM**
- ✓ **LEED**
- ✓ **Passivhaus**

🌱 Building Energy Certification

Energy certifications provide useful information about a property's energy consumption but also serve to identify areas for improving the building's energy efficiency.

A to G Rating Scale

Scale A Energy consumption: Less than (38 kWh/m²·year)

CO₂ emissions: Less than (6 kg CO₂/m²·year)

Scale G Energy consumption: More than (290 kWh/m²·year)

CO₂ emissions: More than (50 kg CO₂/m²·year)

- ✓ Mandatory for building sales and rentals.
- ✓ Class A consumes up to 50% less energy than average.
- ✓ Valid for 10 years, driving energy retrofits. (Spain)

CALIFICACIÓN ENERGÉTICA DEL EDIFICIO TERMINADO ETIQUETA

DATOS DEL EDIFICIO

Edificio sujeto a certificación energética:

Polígono catastral:

Tipología edificio:

Dirección:

Municipio:

CP:

C. Autónoma:

ESCALA DE LA CALIFICACIÓN ENERGÉTICA

	Consumo de energía kWh/m ² ·año	Emissiones kg CO ₂ /m ² ·año
A más eficiente		
B		
C	95	
D		32
E		
F		
G menos eficiente		

REGISTRO

14/01/2023

Válida hasta:

ESPAÑA

Directiva 2010/31 / UE

Date of entry into force of **building energy certification**: Bulgaria (2005), Italy (2006), Spain (2013)

VERDE Certification

The VERDE certification system is an initiative developed by the Green Building Council (GBC), adapted to European and Spanish regulations, aimed at promoting sustainability in the building sector.

The sustainability aspects to be evaluated within this green certification process include: energy efficiency, sustainable materials, water management, waste management, indoor environmental quality, accessibility, and innovation and technology.

- ✓ Assesses product sourcing, construction, use, and end-of-life.
- ✓ Focuses on local adaptation and indoor environmental quality.
- ✓ Rated from 0 to 5 Green Leaves, More leaves = greater commitment to the environment.



BREEAM Certification

BREEAM provides a structured and rigorous methodology for assessing and certifying sustainability in architecture, helping to drive the adoption of more sustainable construction practices worldwide.

Science-Based Assessment

Developed in the UK by BRE, BREEAM is the pioneer international environmental assessment method for master planning, infrastructure, and buildings.

- ✓ Categories: Management, Health, Energy, Transport, Water, Materials, Waste, Land Use, Pollution, and Innovation.
- ✓ Ratings: Pass, Good, Very Good, Excellent, Outstanding.
- ✓ Uses weighting factors to calculate a unified percentage score.

BREEAM® ES

Estándar en Construcción Sostenible
www.breem.es
www.breem.com

Certificado Final

Este documento certifica que:

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03008 - Alicante

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BREEAM ES Nueva Construcción 2015

por un Asesor para:

Oficina de Propiedad Intelectual de la Unión Europea (EUIPO)

y ha obtenido una clasificación de 90,11%

Excepcional



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LEED Certification

Global Sustainability Benchmark

Leadership in Energy and Environmental Design (LEED) is the globally recognized green building rating framework developed by the USGBC.

- ✓ 100+ point scale across 7 credit categories.
- ✓ Levels: Certified (40-49), Silver (50-59), Gold (60-79), Platinum (80+).
- ✓ LEED v4.1 covers BD+C, ID+C, O+M, Cities & Residential.



Passivhaus Standard

Ultra-Low Energy Standard

Passivhaus focuses on drastic reductions in heating and cooling energy demands, providing outstanding thermal comfort and indoor air purity.

Key features of a Passivhaus home:

High-quality thermal insulation, high-efficiency windows and doors, airtightness, absence of thermal bridges, ventilation with heat recovery, passive solar design, and renewable energy.

- ✓ Heating & Cooling demand $\leq 15 \text{ kWh/m}^2\cdot\text{year}$.
- ✓ Airtightness: $N50 \leq 0.6$ air changes per hour (Blower Door Test).
- ✓ Verification performed via PHPP (Passive House Planning Package).



1.3 Bioclimatic Design Principles for a Rural Housing Project



Identify which aspects of bioclimatic design could be implemented in a project, considering the given program and the characteristics of the site where it is located.

Goals:

- Develop appropriate implementation processes for bioclimatic principles and analyze their impact on the environment.





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