



Green Building & Sustainable Construction (TCM 5330)

Introduction to Green and Sustainable Construction



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What is the definition of sustainable design?

Sustainable design, refers to the practice of creating products, buildings, and systems that have minimal negative impact on the environment, people, and economy.



Sustainable Design

[sə-'stā-nə-bəl di-'zīn]

A design approach that seeks to minimize negative environmental, social, and economic impacts.

Watch the video

Design principles of sustainable design

- Link:

https://www.youtube.com/watch?v=UKs3EpQzQ6s&ab_channel=FibreGuard

(you may also click on the YouTube Logo)



What is the goal of sustainable design?

The goal of sustainable design is to meet present needs without compromising the ability of future generations to meet their own needs.



What does sustainable design involve?

It involves integrating principles of environmental responsibility, social equity, and economic viability into the design and decision-making processes.





What are some of the equivalent terms used for sustainable design?

- eco-friendly design
- green design

Watch the video principles of sustainable design | Sustainable Building Design Techniques and Principles

- Link:

https://www.youtube.com/watch?v=Ho5VHpg24R8&ab_channel=CivilInsight

(you may also click on the YouTube Logo below)



What are the key elements of sustainable design? *(Slide 1 of 2)*

Environmental Considerations

- Sustainable design aims to minimize the depletion of natural resources, reduce pollution, and limit the overall environmental footprint of a product, building, or system.

Resource Efficiency

- Efficient use of resources, including energy, water, and materials, is a core aspect of sustainable design. This often involves optimizing processes to reduce waste and increase the lifespan of products.

Life Cycle Assessment

- Sustainable design considers the entire life cycle of a product or building, from raw material extraction to manufacturing, use, and end-of-life disposal. This holistic approach helps identify opportunities for improvement at every stage.

Renewable Energy

- Incorporating renewable energy sources, such as solar or wind power, is a common practice in sustainable design to reduce reliance on non-renewable resources and decrease greenhouse gas emissions.

Social Equity

- Sustainable design takes into account the well-being of communities and individuals, aiming for designs that are inclusive, safe, and supportive of human health and quality of life.

What are the key elements of sustainable design? *(Slide 2 of 2)*

Biodiversity

- Designs that support and enhance local ecosystems, promoting biodiversity and preserving natural habitats, are consistent with the principles of sustainable design.

Adaptability and Resilience

- Sustainable designs often incorporate features that make them adaptable to changing conditions, including climate change, and resilient in the face of environmental challenges.

Innovation and Technology

- Sustainable design embraces technological advancements and innovative solutions to address environmental and social challenges, seeking continuous improvement in design practices.

Cradle-to-Cradle Design

- This concept promotes the idea that products should be designed with the intention that all materials can be reused or safely returned to the environment at the end of their life cycle, eliminating the concept of waste.

Regulatory Compliance

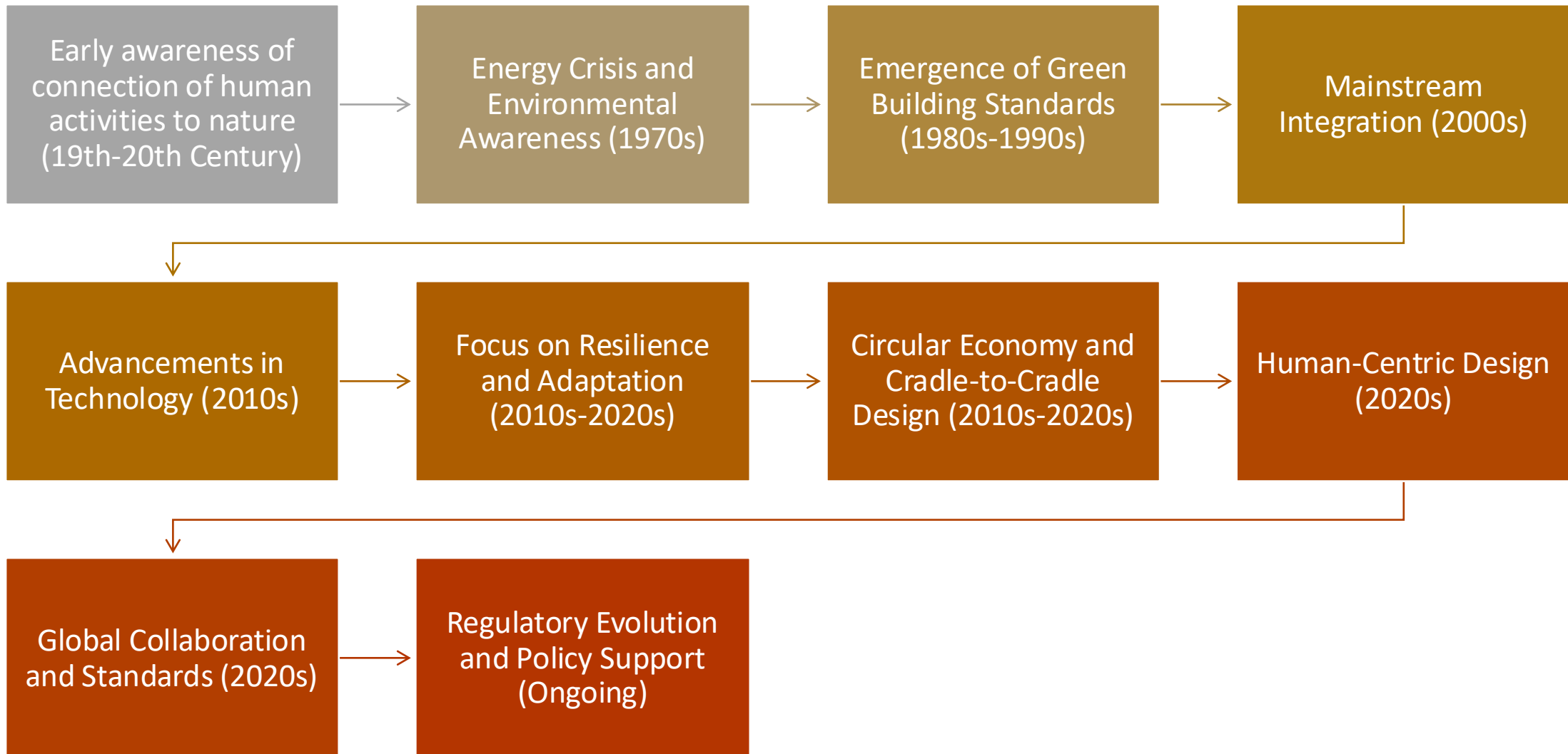
- Sustainable design often aligns with and complies with various environmental and building standards, certifications, and regulations to ensure adherence to best practices and recognized benchmarks.

How has sustainable design evolved?

- Sustainable design has evolved significantly over the years, driven by a growing awareness of environmental issues, a desire for resource efficiency, and a recognition of the impact of human activities on the planet.



What are the key stages in the evolution of sustainable design?



Watch the video Triple Bottom Line (Profit, People, Planet) | From A Business Professor

- Link:

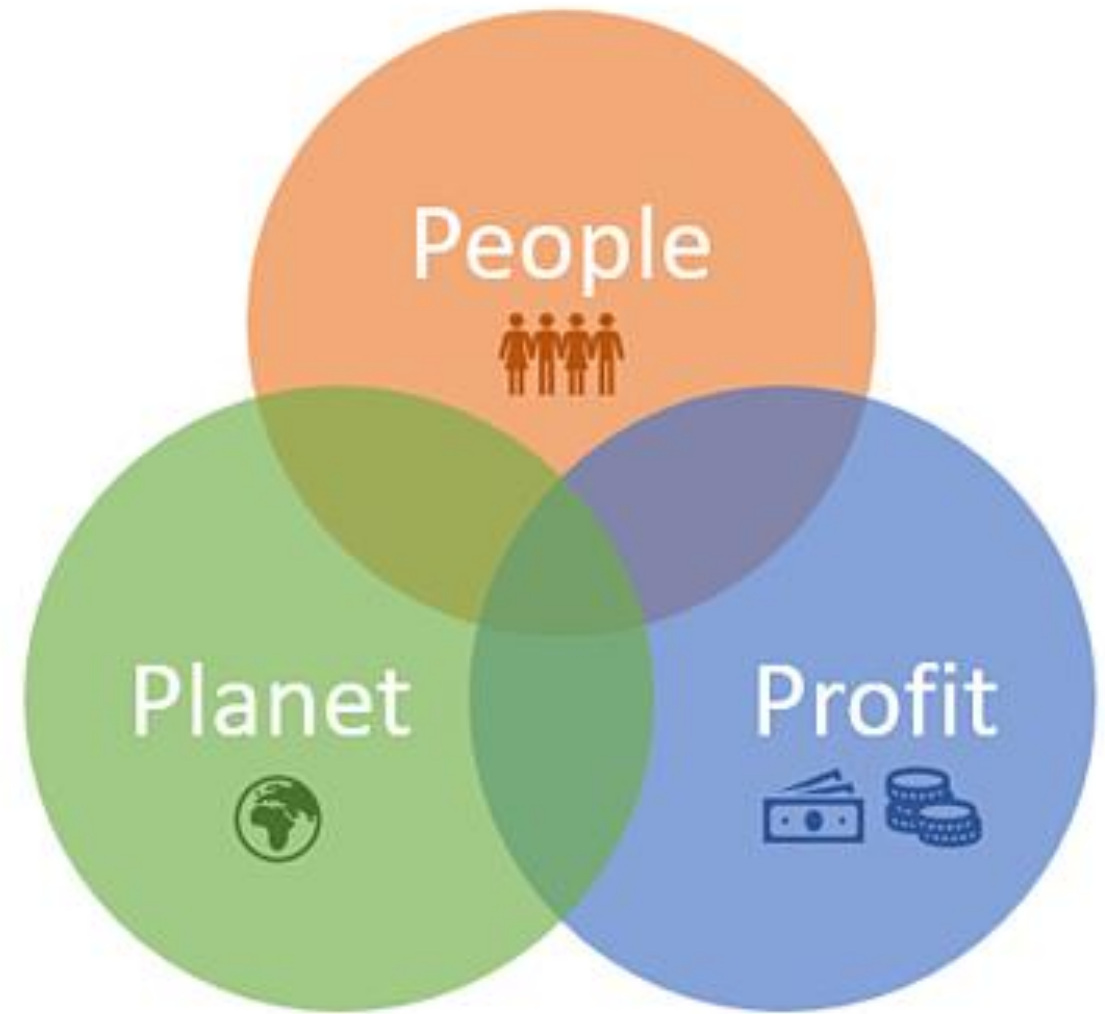
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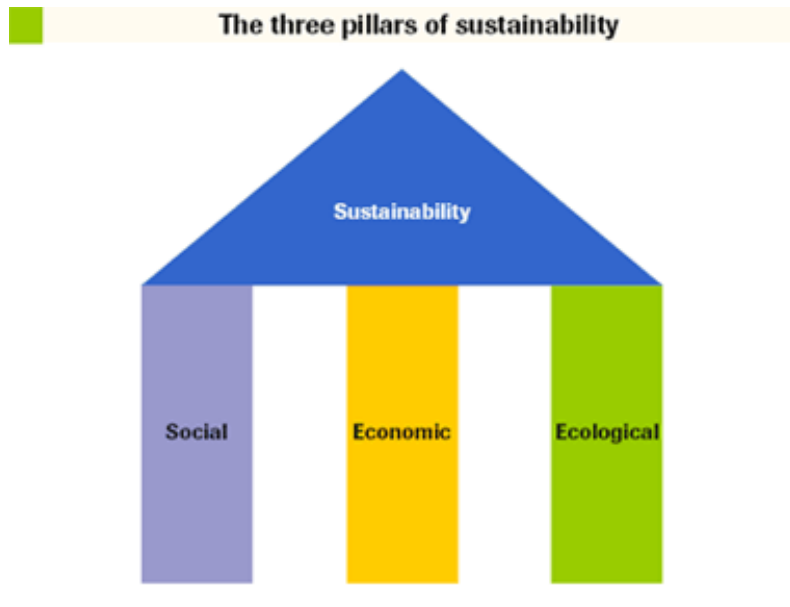
What are the triple bottom lines of sustainability?

- The triple bottom line (TBL) is a framework that considers three key dimensions of sustainability, often referred to as the "three Ps": People, Planet, and Profit.
- The triple bottom line provides a holistic approach to decision-making, emphasizing the interconnectedness of social, environmental, and economic considerations.



Explain “People” as one of the triple bottom lines of sustainability

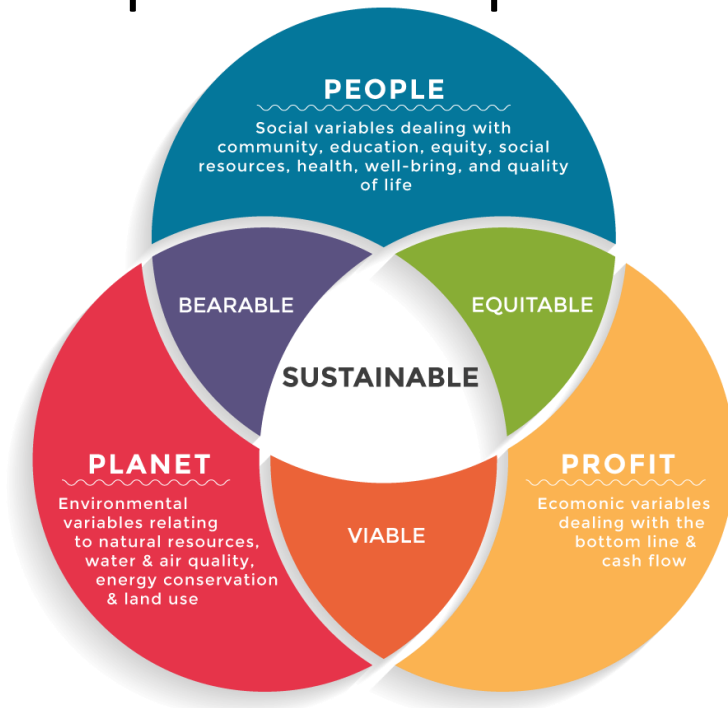
- This dimension focuses on social equity and human well-being.
- It involves considerations for the welfare of individuals, communities, and society at large. Key elements include:



- Social justice and inclusivity.
- Community development and empowerment.
- Health and well-being of individuals.
- Labor rights and fair working conditions.

Explain “Planet” as one of the triple bottom lines of sustainability

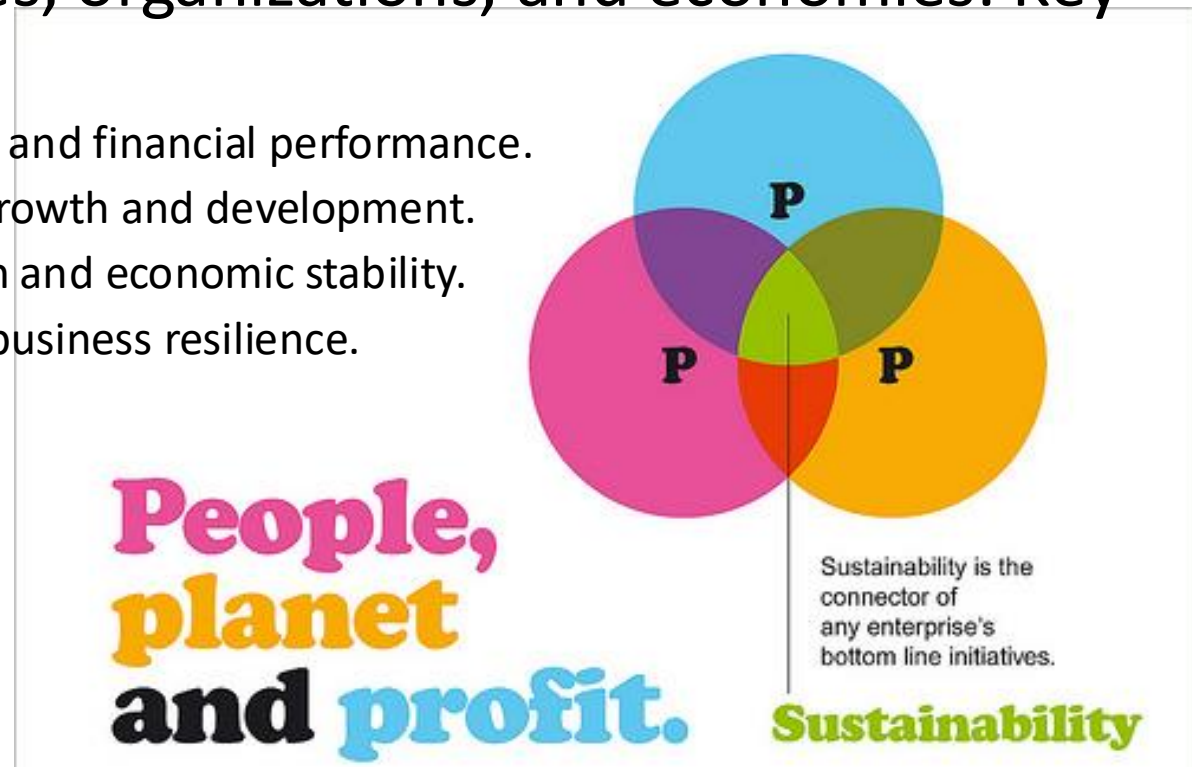
- The "Planet" dimension addresses environmental sustainability and the impact of human activities on the natural world. It involves practices that promote ecological health and minimize resource depletion and pollution. Key elements include:



- Conservation of natural resources.
- Biodiversity preservation.
- Climate change mitigation.
- Sustainable land use and ecosystems.

Explain “Profit” as one of the triple bottom lines of sustainability

- The economic dimension of the triple bottom line focuses on financial viability and profitability. It recognizes the importance of economic sustainability for businesses, organizations, and economies. Key elements include:
 - Profitability and financial performance.
 - Economic growth and development.
 - Job creation and economic stability.
 - Long-term business resilience.



What does the triple bottom line framework try to encourage?

- The triple bottom line framework encourages businesses, organizations, and decision-makers to evaluate their actions and policies based on a broader set of criteria beyond traditional economic measures.
- By considering the social, environmental, and economic impacts of decisions, the triple bottom line seeks to promote sustainable practices that benefit not only the bottom line but also people and the planet.



Watch the video

Environmental impact assessments: identifying relevant issues and concerns from the beginning

- Link:

https://www.youtube.com/watch?v=RWtT0EfHNsE&ab_channel=Inter-AmericanDevelopmentBank

(you may also click on the YouTube Logo below)



What do we mean by environmental impact assessment?

- Environmental Impact Assessment (EIA) is a systematic process used to identify, predict, evaluate, and mitigate the potential environmental effects of proposed projects, plans, or policies.
- The goal of EIA is to ensure that decision-makers have comprehensive information about the environmental consequences of their actions, allowing them to make informed and environmentally responsible choices.
- The process involves assessing the likely impacts of a proposed project on the environment and, where possible, identifying measures to avoid, minimize, or mitigate adverse effects.



What are the key components of Environmental Impact Assessment? *(slide 1 of 2)*

Identification of Environmental Impacts

- Systematic identification of potential environmental impacts associated with a proposed project, considering both direct and indirect effects.

Baseline Data Collection

- Gathering baseline information about the current state of the environment in the project area. This serves as a reference point for assessing changes that may occur due to the project.

Impact Prediction and Assessment

- Evaluating the potential impacts of the project on various environmental components, such as air and water quality, biodiversity, soil, and human health.

Alternatives Analysis

- Considering and comparing different project alternatives to identify options that may have fewer adverse environmental effects.

Public Participation

- Involving the public, stakeholders, and local communities in the decision-making process to ensure that diverse perspectives are considered and concerns are addressed.

What are the key components of Environmental Impact Assessment? *(slide 2 of 2)*

Mitigation Measures

- Identifying and recommending measures to prevent, minimize, or offset adverse environmental impacts. These may include changes in project design, technology, or operational practices.

Monitoring and Management Plans

- Developing plans for monitoring the project's environmental performance during and after implementation, as well as establishing mechanisms for adaptive management.

Regulatory Compliance

- Ensuring that the proposed project complies with applicable environmental laws, regulations, and standards.

Interdisciplinary Approach

- Involving experts from various disciplines, such as ecology, hydrology, geology, and social sciences, to comprehensively assess the project's potential impacts.

Decision-Making Support

- Providing decision-makers with comprehensive information about the environmental implications of the project, allowing them to make informed and responsible decisions.

Watch the video

The principles of Life Cycle Assessment (LCA)

- Link:

https://www.youtube.com/watch?v=r0ucT1KRiO4&ab_channel=Spark-sx

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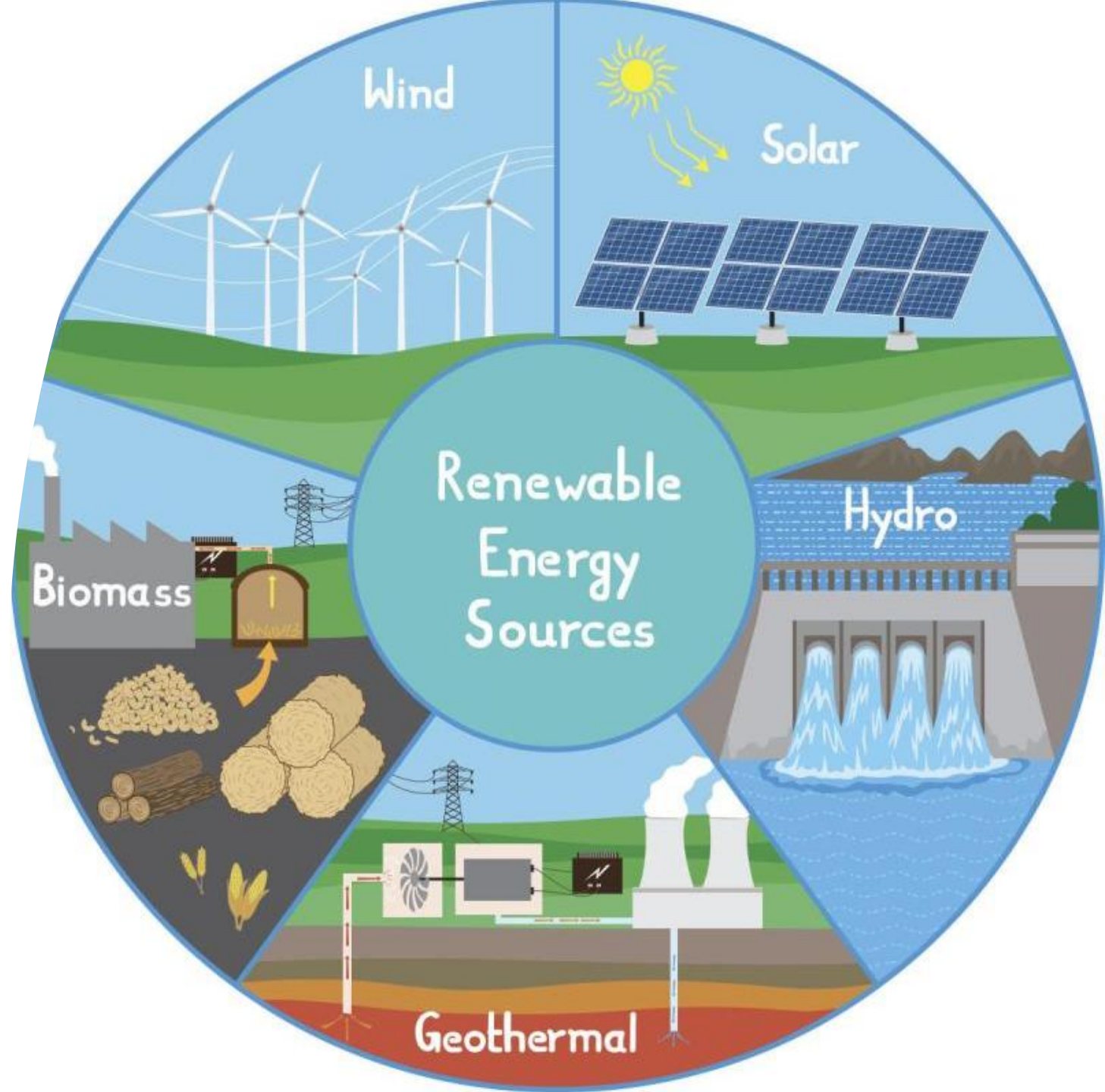
What do we mean by Life Cycle Analysis (LCA)?

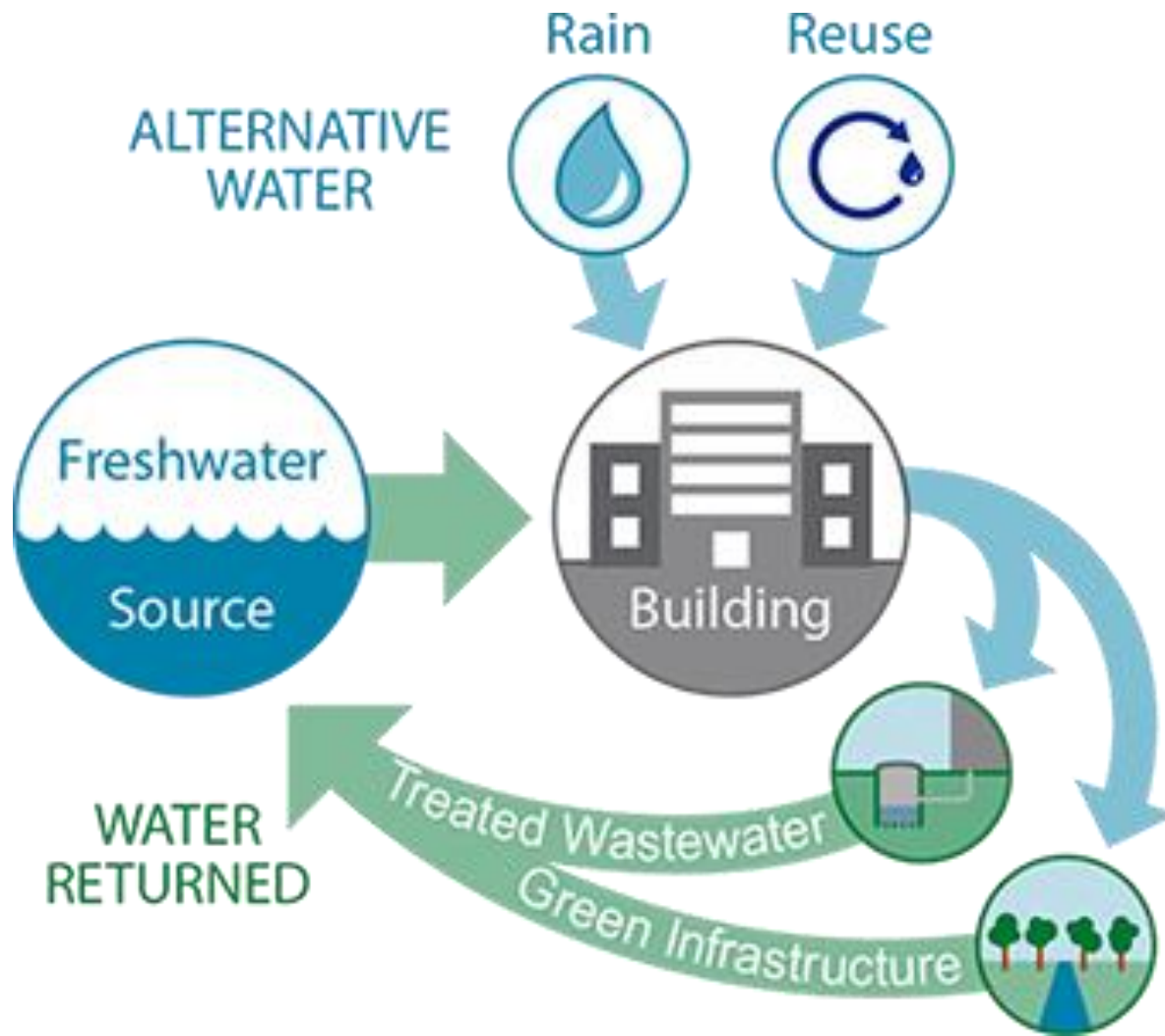
- Life Cycle Analysis (LCA), also known as Life Cycle Assessment, is a systematic and comprehensive method used to evaluate the environmental impacts of a product, process, or system throughout its entire life cycle.
- The life cycle typically includes the stages of raw material extraction, manufacturing, transportation, use, and end-of-life disposal or recycling.
- LCA aims to quantify the environmental burdens associated with each stage of the life cycle and assess the overall sustainability performance of the subject under study.



What do we mean by renewable energy integration?

- Renewable energy integration refers to the incorporation and utilization of renewable energy sources into existing energy systems, infrastructure, and grids.
- This process involves the seamless blending of energy generated from renewable sources, such as solar, wind, hydro, geothermal, and biomass, with conventional energy sources to meet the demand for electricity, heat, or other forms of energy.
- The goal is to reduce reliance on non-renewable and environmentally harmful energy sources while promoting a sustainable and low-carbon energy future.





What is water conservation in design?

- Water conservation in design refers to the intentional planning and implementation of strategies to reduce water consumption, minimize water waste, and optimize water use efficiency in the design of buildings, landscapes, and infrastructure.
- The goal is to create sustainable designs that contribute to the responsible management of water resources and address issues such as water scarcity, drought, and environmental impact.

What are the key aspects of water conservation in design? *(slide 1 of 2)*

Efficient Plumbing Design

- Incorporating water-efficient fixtures, such as low-flow toilets, faucets, and showerheads, to reduce water consumption without compromising functionality.

Graywater Systems

- Designing systems to capture and reuse graywater (wastewater from sinks, showers, and washing machines) for non-potable purposes, such as landscape irrigation or toilet flushing.

Rainwater Harvesting

- Implementing systems to collect and store rainwater for later use, reducing the reliance on traditional water sources for irrigation or non-potable water needs.

Xeriscaping

- Designing landscapes using xeriscaping principles, which involve selecting drought-resistant plants, improving soil quality, and employing water-efficient irrigation practices.

Smart Irrigation Systems

- Integrating technology, such as soil moisture sensors and weather-based controllers, into irrigation systems to optimize watering schedules based on actual plant needs and weather conditions.

What are the key aspects of water conservation in design? *(slide 2 of 2)*

Permeable Surfaces

- Designing surfaces, such as pavements or driveways, that allow water to penetrate the ground, reducing runoff and promoting groundwater recharge.

Water-Efficient Appliances

- Specifying and incorporating water-efficient appliances and equipment in the design, such as Energy Star-rated washing machines and dishwashers.

Drip Irrigation

- Utilizing drip irrigation systems that deliver water directly to the root zones of plants, minimizing water loss through evaporation and runoff.

Stormwater Management

- Implementing sustainable stormwater management practices, including green infrastructure elements like bioswales and rain gardens, to reduce urban runoff and improve water quality.

Educational Outreach

- Incorporating educational elements in design projects to inform users about water conservation practices and encourage responsible water use behavior.

What are the key principles and features of biophilic design? *(slide 1 of 2)*

Natural Light and Ventilation	Maximizing access to natural light and ventilation to create spaces that feel open and connected to the outdoors.
Greenery and Living Elements	Incorporating plants, green walls, and living elements into indoor spaces to bring nature indoors and improve air quality.
Natural Materials	Using natural materials, such as wood, stone, and natural fibers, to create a sense of authenticity and connection to the Earth.
Views of Nature	Designing spaces to provide views of nature, whether it's through large windows, skylights, or strategically placed openings.
Water Features	Introducing water elements, such as fountains or indoor ponds, to create a calming and visually appealing environment.
Natural Colors and Patterns	Incorporating natural color palettes and patterns inspired by the outdoors to evoke a sense of tranquility and connection.

What are the key principles and features of biophilic design? *(slide 2 of 2)*

Dynamic and Varied Spaces	Designing spaces that offer variety, flexibility, and a sense of discovery, mimicking the diverse environments found in nature.
Biomorphic Forms and Shapes	Incorporating organic, flowing shapes and forms inspired by nature in architectural elements and interior design.
Multi-Sensory Experiences	Engaging multiple senses, such as touch, sight, and smell, to create a rich and immersive experience that stimulates the senses.
Thermal and Acoustic Comfort	Prioritizing thermal comfort and acoustic well-being to create spaces that are conducive to health and productivity.
Nature-Inspired Art and Graphics	Incorporating art and graphics that draw inspiration from the natural world, connecting people to the broader context of the environment.
Integration with Local Ecosystems	Designing with consideration for and integration with local ecosystems, supporting biodiversity and enhancing the ecological value of the built environment.

What do we mean by “sustainable communities”?

- "Sustainable communities" refers to communities that are planned, developed, and managed in ways that prioritize environmental, social, and economic sustainability.
- These communities are designed to meet the needs of the present without compromising the ability of future generations to meet their own needs.
- Sustainable communities aim to create a harmonious balance between human activities, the built environment, and the natural world, fostering resilience, inclusivity, and well-being.



What are the design principles for sustainable communities? *(slide 1 of 2)*

Environmental Stewardship

- Prioritizing the conservation and sustainable use of natural resources, including water, energy, and green spaces.
- Implementing environmentally friendly infrastructure and practices, such as renewable energy sources and green building design.

Smart Urban Planning

- Planning and designing communities to optimize land use, promote walkability, and reduce reliance on private cars.
- Embracing mixed-use development to create vibrant, livable neighborhoods with a range of amenities and services.

Social Equity and Inclusivity

- Ensuring that all community members have equal access to resources, opportunities, and services.
- Promoting diversity, inclusivity, and affordable housing options to accommodate a range of socioeconomic backgrounds.

Community Engagement

- Involving residents in decision-making processes and community planning.
- Fostering a sense of community ownership and participation in sustainable initiatives.

Local Economy and Employment

- Supporting local businesses and economies to reduce reliance on long-distance transportation and promote economic resilience.
- Encouraging job creation within the community, especially in sustainable industries.

What are the design principles for sustainable communities? *(slide 1 of 2)*

Green Infrastructure

- Incorporating green spaces, parks, and urban forests to enhance biodiversity, improve air and water quality, and provide recreational opportunities.
- Implementing green stormwater management practices to reduce runoff and promote sustainable water use.

Energy Efficiency and Renewable Energy

- Implementing energy-efficient building practices and promoting the use of renewable energy sources.
- Encouraging community-wide energy conservation and responsible energy consumption.

Public Transportation

- Investing in and promoting public transportation options to reduce reliance on private vehicles and minimize traffic congestion.
- Designing infrastructure to support cycling and walking as sustainable transportation alternatives.

Resilience to Climate Change

- Designing communities with climate-resilient infrastructure to mitigate the impact of extreme weather events.
- Incorporating green building practices that address climate-related challenges.

Education and Awareness

- Providing educational programs to raise awareness about sustainable living practices among community members.
- Promoting a culture of environmental responsibility and social consciousness.

What are some successful examples of sustainable design?

- Bosco Verticale (Vertical Forest), Milan, Italy 
- The Edge, Amsterdam, Netherlands 
- Masdar City, Abu Dhabi, UAE 
- The Crystal, London, United Kingdom 
- Vauban, Freiburg, Germany 
- One Central Park, Sydney, Australia 
- The Great Wall of Water, Lima, Peru 
- The High Line, New York City, USA 
- Dockside Green, Victoria, Canada 

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