

Introduction to Sustainable Design

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Key concepts, principles, and practical steps for creating environmentally responsible products, spaces, and systems.

1. What Is Sustainable Design?

Aspect	Definition
Environmental	Minimizes resource use, waste, and pollution throughout a product's life cycle.
Social	Improves health, safety, and equity for users and communities.
Economic	Delivers value over the long term—lower operating costs, durability, and resilience.
Holistic	Integrates the three pillars (environment, society, economy) into design decisions.

2. Core Principles

Principle	What It Means	Design Implications
Life Cycle Thinking	Consider every stage: extraction ? manufacturing ? use ? end of life.	Choose materials, processes, and business models that reduce total impact.
Design for Longevity	Products should last longer and be easy to maintain.	Modular components, durable materials, upgrade paths.
Design for Disassembly & Reuse	Enable easy separation of parts for repair, recycling, or repurposing.	Standardized fasteners, clear labeling, material compatibility.
Resource Efficiency	Use less material, energy, water, and land.	Lightweight structures, passive design, renewable energy integration.
Closed Loop Systems	Keep materials in use, mimicking natural cycles.	Cradle to cradle certification, take back programs, circular business models.

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Principle	What It Means	Design Implications
Human-Centred Sustainability	Align environmental goals with user needs and wellbeing.	Ergonomic design, indoor air quality, inclusive accessibility.
Systems Thinking	View design as part of larger ecological, social, and economic networks.	Stakeholder mapping, impact assessment, collaboration across sectors.

3. Sustainable Design Process

1. Define Goals & Metrics

- Set clear sustainability targets (e.g., 30% carbon footprint reduction).
- Choose assessment tools: Life Cycle Assessment (LCA), Material Flow Analysis (MFA), carbon calculators.

2. Research & Benchmark

- Study existing solutions, regulations, and standards (LEED, BREEAM, ISO 14001, Cradle-to-Cradle).
- Identify material options, supply chain impacts, and user expectations.

3. Ideation & Concept Development

- Generate concepts that address the three sustainability pillars.
- Use sketching, digital modeling, and scenario planning to explore trade-offs.

4. Evaluation & Optimization

- Run LCA or carbon footprint simulations early.
- Iterate designs to improve energy performance, material selection, and end-of-life options.

5. Prototyping & Testing

- Build low-fidelity prototypes to test durability, reparability, and user interaction.
- Conduct environmental testing (e.g., VOC emissions, water usage).

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6. Implementation & Documentation

- Produce detailed specifications, material passports, and maintenance guides.
- Communicate sustainability credentials to stakeholders.

7. Monitoring & Feedback

- Track real-world performance (energy use, waste generated).
- Gather user feedback for future improvements and closed-loop take-back.

4. Materials & Resources

Category	Sustainable Options	Typical Benefits
Metals	Recycled aluminum, high-strength steel with high recycled content	Lower embodied energy, reduced mining waste
Plastics	Recycled plastics, bio-based polymers	Reduced carbon footprint, improved recyclability