

Sustainable Architecture

Sustainable Architecture – Quick Reference Notes

1. Core Definition

Sustainable architecture (also called green or eco-architecture) designs, constructs, and operates buildings in a way that minimizes environmental impact, conserves resources, and promotes the health and well-being of occupants over the building's entire life cycle.

2. Why It Matters

Issue	Architectural Impact	Sustainable Response
Climate change	Buildings account for ~40% of global energy use & 30% of CO ₂ emissions.	Reduce energy demand, use low-carbon materials.
Resource depletion	Extraction of concrete, steel, timber, and water.	Choose renewable, recycled, or locally sourced materials; implement water-saving systems.
Urban heat islands	Dense, impermeable surfaces raise city temperatures.	Green roofs, reflective façades, vegetation.
Human health	Poor indoor air quality, inadequate daylight.	Passive ventilation, non-toxic finishes, daylighting.

3. The Life-Cycle Approach

1. Planning & Site Selection

- Prioritize brownfield or infill sites.
- Conduct a *Site Analysis*: climate, orientation, vegetation, water flow, transport links.
- Use *Strategic Environmental Assessment* (SEA) to evaluate alternatives.

2. Design & Materials

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- **Passive design** (orientation, shading, thermal mass).
- **Material selection**: low embodied energy, recycled content, FSC-certified wood, bio-based composites.
- **Modular/Prefabricated** components to reduce waste.

3. Construction

- Implement a **Construction Waste Management Plan** (target >90% diversion).
- Use **low-VOC** adhesives, paints, sealants.
- Monitor on-site energy use (solar generators, efficient equipment).

4. Operation & Maintenance

- Install **high-efficiency HVAC**, LED lighting, smart controls.
- Use **Building Management Systems (BMS)** for real-time monitoring.
- Schedule regular commissioning and retro-commissioning.

5. End-of-Life / Deconstruction

- Design for **disassembly** (reversible connections, labelled components).
- Plan for material reuse or recycling (e.g., steel, timber, concrete aggregate).

4. Key Performance Metrics

Metric	What It Measures	Typical Target
Energy Use Intensity (EUI)	kWh/m ² ·yr of operational energy	<30 kWh/m ² ·yr (net-zero goal)
Embodied Carbon	CO ₂ e per kg of material or per m ³ of building	<150 kg CO ₂ e/m ³ (varies by typology)
Water Use Intensity (WUI)	Liters per occupant per day	<50 L/occupant·day
Indoor Environmental Quality (IEQ)	Air quality, daylight, acoustic comfort	Meets WELL/LEED IEQ credits
Thermal Comfort	PMV (Predicted Mean Vote) range -0.5 to +0.5	Achieved through passive & active systems

5. Design Strategies

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5.1 Passive Design

- **Orientation & Layout:** Maximize north-facing glazing (in NH) for winter solar gain; minimize east/west glazing to reduce overheating.
- **Thermal Mass:** Use concrete, rammed earth, or masonry to store