

Economic Evaluation of Sustainable Building Practices

Economic Evaluation of Sustainable Building Practices

(A concise, structured guide for students, professionals, and decision makers)

1. Why Economic Evaluation Matters

Reason	Explanation
Resource Allocation	Determines where limited capital should be invested for maximum environmental and financial return.
Risk Management	Identifies cost overruns, performance gaps, and market uncertainties early.
Policy & Incentives	Provides evidence for subsidies, tax credits, and building codes.
Stakeholder Confidence	Demonstrates that “green” does not mean “more expensive” when life-cycle costs are considered.

2. Core Concepts & Terminology

Term	Definition	Typical Use in Sustainable Building
Life Cycle Costing (LCC)	Sum of all costs (initial, operation, maintenance, disposal) over a building’s useful life, discounted to present value.	Compare conventional vs. green façade, HVAC, or insulation options.
Net Present Value (NPV)	Present value of cash inflows minus cash outflows; positive NPV = financially attractive.	Assess payback of solar PV or rainwater harvesting.
Internal Rate of Return (IRR)	Discount rate that makes NPV = 0; higher IRR = better investment.	Rank multiple sustainability retrofits.
Benefit-Cost Ratio (BCR)	Ratio of discounted benefits to discounted costs; BCR > 1 indicates net benefit.	Evaluate energy efficiency upgrades.
Payback Period	Time required for cumulative cash savings to equal initial investment.	Quick screening of LED lighting upgrades.
Externalities	Costs or benefits that affect third parties (e.g., reduced air pollution).	Often monetized in policy analysis.

Economic Evaluation of Sustainable Building Practices

Term	Definition	Typical Use in Sustainable Building
Carbon Pricing	Monetary value assigned to CO ₂ emissions (tax, cap-and-trade, carbon credit).	Incorporates climate impact into LCC.
Green Premium / Discount	Additional cost (premium) or savings (discount) associated with sustainable options.	Quantifies market perception of “green”.

3. Evaluation Frameworks

3.1 Life-Cycle Costing (LCC) Workflow

1. **Define Scope** – building type, geographic location, analysis horizon (usually 30–50-yr).
2. **Identify Cost Categories**
 - *Initial*: design, permits, construction, sustainable materials.
 - *Operating*: energy, water, waste, maintenance, replacement.
 - *End-of-Life*: demolition, recycling, disposal.
3. **Collect Data**
 - Vendor quotes, utility rates, performance curves, degradation rates.
4. **Select Discount Rate**
 - Public sector: 3–5%; private sector: weighted average cost of capital (WACC).
5. **Compute Present Values** ? LCC, NPV, IRR, BCR.
6. **Sensitivity & Scenario Analysis** (energy price, discount rate, occupancy).

3.2 Multi-Criteria Decision Analysis (MCDA)

- **Purpose**: Combine quantitative economics with qualitative sustainability criteria (e.g., indoor environmental quality, resilience).
- **Steps**
 1. List alternatives (e.g., conventional HVAC vs. geothermal).
 2. Choose criteria (cost, energy use, GHG emissions, occupant health).
 3. Assign weights (often via stakeholder workshops).
 4. Score each alternative; aggregate to a ranking.

Economic Evaluation of Sustainable Building

3.3 Integrated Assessment Models (IAMs) for Policy Practices

- Link building