LEED RATING SYSTEM

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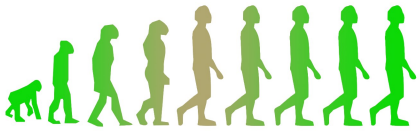
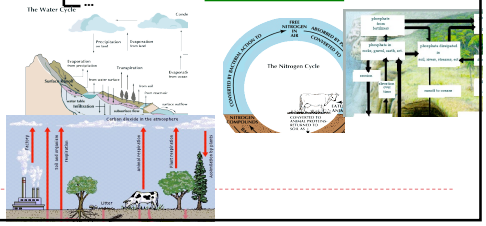
Green Architecture Evolution



Prehistoric Architecture → Actual Architecture → Future Architecture

Ecological systems

- Natural
  - Water cycle
  - Carbon cycle
  - Nitrogen cycle
  - Phosphorous Cycle
  - ...
- Man-Made
  - Environmental Architecture



Environmental Architecture Systems

- Active Systems
  - Photovoltaic cells
  - Plate Solar Collector
  - Wind Turbines
  - Hydroelectric Power
- Passive Systems
  - Wind Catchers
  - Trombe Wall
  - Passive Solar energy
  - ...

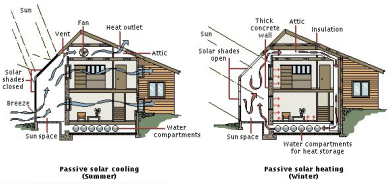
Active Systems

Photovoltaic

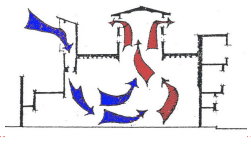
Wind Turbines

Solar Water Heating

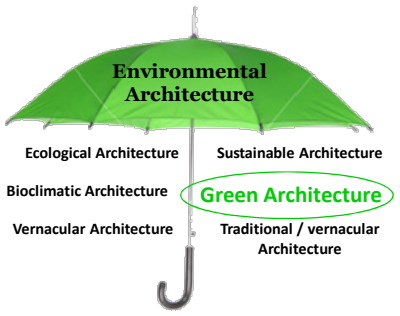
Passive Systems



Trombe Wall



Wind Catchers

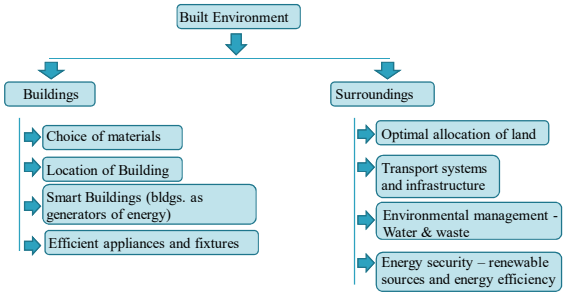


What is Green Architecture?

"An architecture that meets the needs of present without compromising the ability of the future generations to meet their own needs"

Why Green Buildings are important?

Elements of Sustainable Habitat

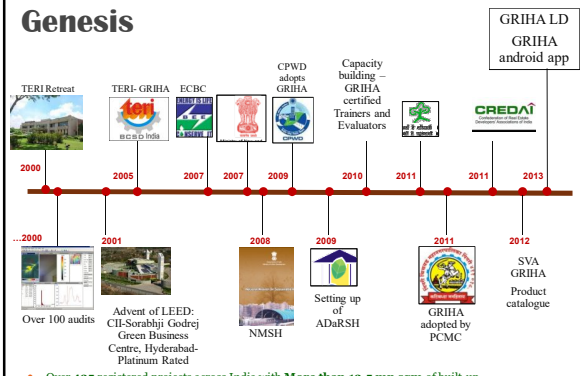


GRIHA-Green Rating for Integrated Habitat Assessment

Tool to facilitate design, construction, operation of a green building ,and in turn ….measure "greenness" of a building in India

What gets measured gets managed

Genesis



- Over **425** registered projects across India with **More than 12.5 mn sqm** of built-up
- Over **35** registered pilot projects under SVAGRIHA
- **2** pilot projects registered under Large Development Guidelines

Variants of GRIHA

13

SVAGRIHA: 100 – 2500 sqm

GRIHA: 2500 – 1,50,000 sqm

GRIHA Pre-certification

Impact of proposed development on the urban scale/surroundings

GRIHA LD: > 50 hectare site area

New/upcoming projects

SVA: Small Versatile Affordable

GRIHA LD: GRIHA for Large Developments

Projects which can be rated under GRIHA LD

All projects which satisfy either of the following two thresholds may apply for a GRIHA LD rating:

- Total built up area greater than or equal to 1, 50,000 sq.m
- Total site area greater than or equal to 50 hectares.

Projects which can be rated under GRIHA LD

1. Large (mixed–use) townships:
   - Housing complex by builders
   - Housing complexes by urban development organizations
   - Housing board and Public Sector Undertaking Townships
   - Plotted developments with part construction by the developer
2. Educational and institutional campuses
3. Medical colleges and Hospital complexes (eg: AIIMS)
4. Special economic zones
5. Hotels/ resorts

Conventional Rating System

The higher the points,

the higher the rating

GRIHA LD

The lower the

detrimental impact,

the higher the rating

Overall Impact - I_t	Rating
75 % - 66 %	1 star
65 % - 56 %	2 star
55 % - 46 %	3 star
45 % - 36 %	4 star
35 % or lower	5 star

Sections

The impact of the development is analysed across 6 sections, which are:

- Site Planning
- Energy
- Water & Waste Water
- Solid Waste Management
- Transport
- Social

Impact in each section

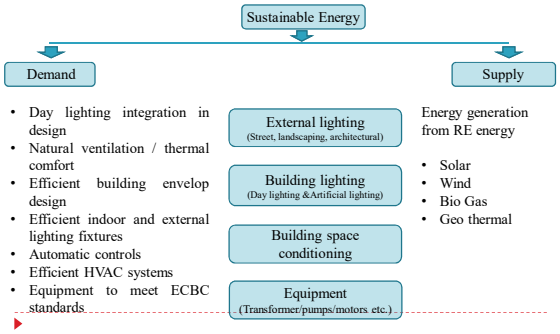
The impact in each section is evaluated in two parts:

- Quantitative parameters – how much?
- Qualitative parameters – how good/bad?

The rating of the projects is done in parts:

- Design Stage Rating
- Rating of Each Subsequent Stage

Energy balance



Energy

Demand Reduction:

- Design of energy efficient buildings, energy efficient street lighting, pumping and other site infrastructure facilities.
  - Reduce the total amount of energy (kWh) required from the local Municipal grid/Diesel gensets by at least 25 per cent. – Mandatory

Supply Optimization:

- Generation of clean energy on site to reduce the dependence on grid electricity.
  - Design the development to be self-sufficient in its annual energy requirement. - Optional

Benchmarks for Base Case

	EPI (kWh/m2/year) Daytime occupancy 5 Days a week	EPI (kWh/m2/year) 24 hours occupancy 7 Days a week
Air conditioned buildings (Commercial)		
Moderate	120	350
Composite/Warm and Humid/hot and dry	140	450
Air conditioned buildings (Residential)		
Composite/Warm and Humid/hot and dry	200	
Non air conditioned buildings		
Moderate	20	85
Composite/Warm and Humid/hot and dry	25	100

← Benchmark for buildings

Sl. No.	Classification	Road Type	Width of carriageway (m)	Lighting Power per run (W/m)
1	A1	Dual/Single Carriageway	14	14.5
2	A1	Dual/Single Carriageway	17.5	17.5
3	A1	Dual/Single Carriageway	21	21.5
4	A2	Single Carriageway	10.5	11.5
5	A2	Single Carriageway	7	10.5

← Benchmark for St. Lighting

Input fields without benchmarks

Input fields like water pumping etc. do not have a benchmark. The project will calculate the total annual energy being consumed for their respective layout and insert the information in the tool.

Police Training School, Turuchi,Tasgaon

- Visibility of green building through implementation of RE
- 21.5% of internal lighting annual energy requirements met by renewables.
- 28,105 kWh electricity generated from 1kVA of solar power and 13 windmills with power capacity of 5.5kW each.
- Energy savings compared to GRIHA benchmark: 31%

GRIHA Rated

University of Petroleum and Energy Studies, Dehradun

- 30.1% of internal lighting annual energy requirements met by solar lighting.
- 100 kWP Renewable energy installed on site
- 95.3% annual energy saved by solar hot water system
- Energy savings compared to GRIHA benchmark: 42.7%

☆☆☆☆

GRIHA Rated

Suzlon - One Earth, Pune

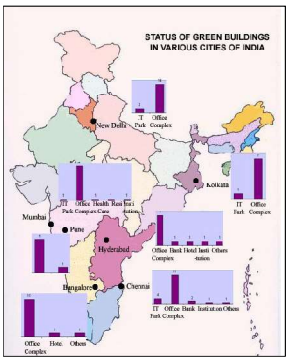
- Adequate day lighting and glare control measures adopted
- 100% desks equipped with LED lights governed by motion sensors.
- 154.83 kW Renewable energy installed on site
- 250000 units of electricity generated annually.
- Energy savings compared to GRIHA benchmark: 47%

☆☆☆☆☆

GRIHA Rated

Points scored Rating according to GRIHA System

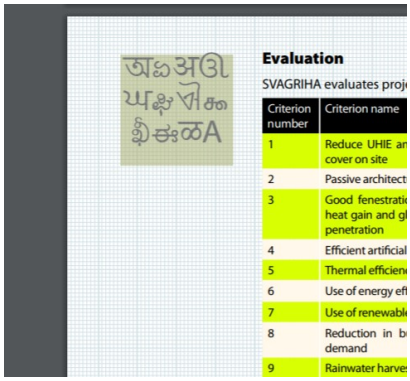
S.No	Points	Rating
1.	50–60	One star
2.	61–70	Two stars
3.	71–80	Three stars
4.	81–90	Four stars
5.	91–100	Five stars

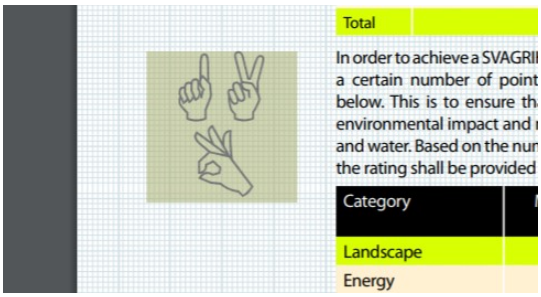


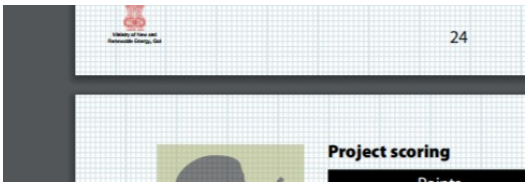
Criteria	points
Criteria 1: Site Selection Partly	1
Criteria 2: Preserve and protect landscape during construction /compensatory depository forestation.	5 Partly mandatory
Criteria 3: Soil conservation (post construction)	4
Criteria 4: Design to include existing site features	2 Mandatory
Criteria 5: Reduce hard paving on site	2 Partly Mandatory
Criteria 6: Enhance outdoor lighting system efficiency and use RE system for meeting outdoor lighting requirement	3
Criteria 7: Plan utilities efficiently and optimise on site circulation efficiency	3
Criteria 8: Provide, at least, minimum level of sanitation/safety facilities for construction workers	2 Mandatory
Criteria 9: Reduce air pollution during construction	2 Mandatory
Criteria 10: Reduce landscape water requirement	3

Criteria	points
Criteria 11: Reduce building water use	2
Criteria 12: Efficient water use during construction	1
Criteria 13: Optimise building design to reduce conventional energy demand	6 Mandatory
Criteria 14: Optimise energy performance of building within specified comfort	12
Criteria 15: Utilisation of fly ash in building structure	6
Criteria 16: Reduce volume, weight and time of construction by adopting efficient technology (e.g. pre-cast systems, ready-mix concrete, etc.)	4
Criteria 17: Use low-energy material in interiors	4
Criteria 18: Renewable energy utilization	5 Partly Mandatory
Criteria 19: Renewable energy based hot water system	3
Criteria 20: Waste water treatment	2

Criteria	points
Criteria 21: Water re-cycle and re-use (including rainwater)	5
Criteria 22: Reduction in waste during construction	2
Criteria 23: Efficient waste segregation	2
Criteria 24: Storage and disposal of waste	2
Criteria 25: Resource recovery from waste	2
Criteria 26: Use of low VOC paints/ adhesives/ sealants.	4
Criteria 27: Minimize Ozone depleting substances	3 Mandatory
Criteria 28: Ensure water quality	2 Mandatory
Criteria 29: Acceptable outdoor and indoor noise levels	2
Criteria 30: Tobacco and smoke control	1
Criteria 31: Universal Accessibility	1
Criteria 32: Energy audit and validation	Mandatory
Criteria 33: Operations and Maintenance protocol for electrical and mechanical equipment	2 Mandatory
Total score	100
Criteria 34: Innovation(beyond 100)	4
GRAND TOTAL	**104**



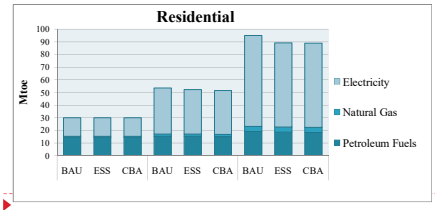




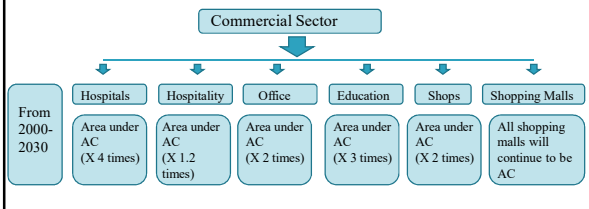
Improving energy efficiency: What the future holds...

Benefits of Efficient Appliances

- ~8% electricity savings by 2031 possible in residential sector in alternative efficiency scenarios as compared to BAU
- BEE initiative already exists:
  - Lighting
  - Refrigerators, AC
  - Fans & other appliances
- Awareness



Building Efficiency / Green Buildings



- Energy consumption is likely to increase 18 times,
- With 5-8% of EPI and low carbon intervention saving of 2.5 times is possible by 2030

Solar Roof Top Potential Estimates

- Enough radiation in India
  - Nearly 58% of the geographical area potentially represent the solar hotspots in the country.
- In 2009, TERI estimated, about 7000 MWp of solar rooftop potential can be developed in residential areas alone.
- Integrating solar energy on rooftops in building design.

- Germany as a Shining example -Houses are net generators of power / Smart homes
  - Germany produced 22 gigawatts of energy from the sun — half of the world's total and the equivalent of 20 nuclear power plants.
  - Incentives like reduction in panel prices by 66% from 2006
  - Reverse flow of energy at a prices more than the usual

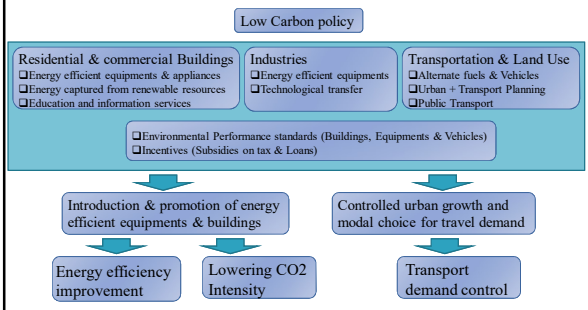
Integrating land use planning in City development Process

- Urbanization increasing – no. of cities will grow
- Integration of land use and transportation plays a major role in reducing the travel demand
- Aim should be to create compact cities
  - Reduce travel demand & distances
  - Reduce congestion
  - Improve energy security, environmental impact

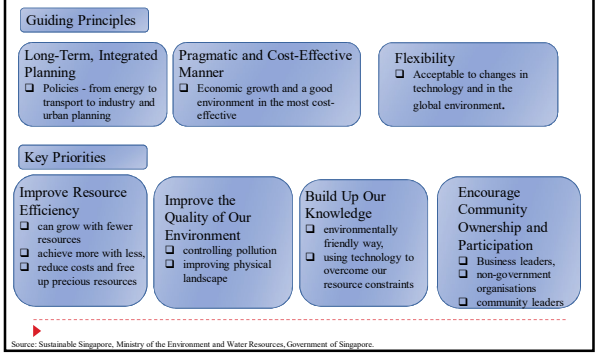
Kyoto, Japan

- Six action plans in Kyoto
  - Walkable city, Kyoto
  - Kyoto-style buildings & forest development
  - Low carbon lifestyle
  - Decarbonization of Industries
  - Comprehensive use of renewable energy
  - Establishment of a Funding mechanism

Iskandar, Malaysia



Singapore: Holistic approach



Source: Sustainable Singapore, Ministry of the Environment and Water Resources, Government of Singapore.

Developing a framework for Sustainable Habitat development

Indian context

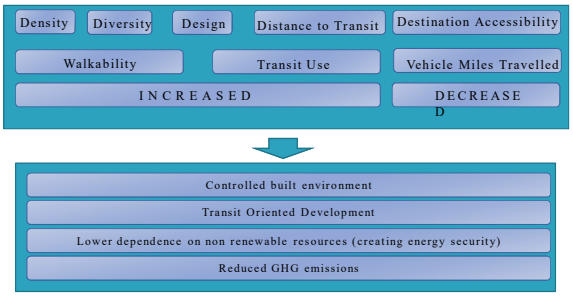
- Urbanization
- No of large cities to increase
- Energy security : fuel import dependency, coal dependency increasing
- Energy shortages already, low per capita energy consumption; environmental considerations
- Sustainable habitats
- Integrated planning esp. for cities
- Self-sufficient neighborhood

Elements contributing to sustainable habitat

- Density: It is the **concentration** of population, dwelling units, employment or any other variable over a specific area which can be either gross or net
- Design: the **street network** which is pedestrian oriented rather than auto and whose characteristics include side walk, inter connection with in the streets, number of intersection, pedestrian crossing, street lighting
- Diversity: It is a measure of **variety of land uses** present in a given area on the basis of floor area, employment and land area
- Distance to transit: the average of the **shortest street routes** from home or work to the nearest rail stations and bus stops
- Destination accessibility: the **ease** with which one can **access the trip attraction** to both local (market) and regional (jobs) destinations

Source: Travel & Built Environment: A Meta Analysis, Reid Ewing and Robert Cervero

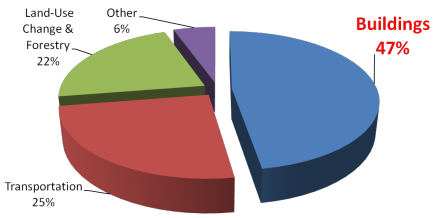
Generalised framework



Source: Travel & Built Environment: A Meta Analysis, Reid Ewing and Robert Cervero

The Global CO2 Emissions by Sector

1- Buildings (Electricity + Heat + Construction) = **47.5%**
2- Transportation = 25%
3 - Land-Use Change & Forestry = 22%
4- Other = 5.5%



Source: World Resources Institute, 2008

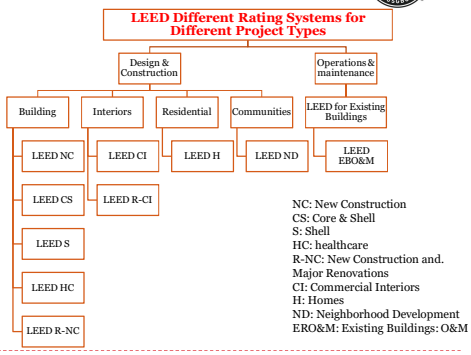
	LEED	BREEAM	CASBEE
Date Introduced	1998	1990	2004
Ratings	Certified / Silver / Gold / Platinum	Pass / Good / Very good / Excellent/ Outstanding	C / B- / B+ / A / S
Assessment	USGBC	Trained assessors	Design / management team
Third Party Validation	GBCi	BRE	Third Party Agencies e.g. JSBC (Japan Sustainable Building Consortium)

130,000 building professionals across all areas of practice have become LEED credentialed professionals.

LEED Certification Levels

Source: USGBC-LEED Brochure

Leadership in Energy and Environmental Design (LEED)



NC: New Construction
CS: Core & Shell
S: Shell
HC: healthcare
R-NC: New Construction and. Major Renovations
CI: Commercial Interiors
H: Homes
ND: Neighborhood Development
ERO&M: Existing Buildings: O&M

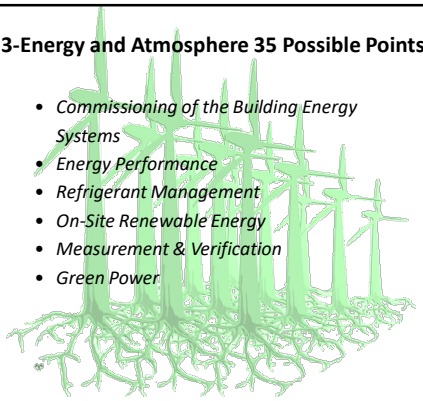
1-Sustainable Sites 26 Possible points

- *Construction Activity Pollution Prevention*
- *Site Selection*
- *Development Density & Community Connectivity*
- *Brownfield Redevelopment*
- *Alternative Transportation*
- *Site Development*
- *Stormwater Design*
- *Heat Island Effect*
- *Light Pollution Reduction*

2-Water Efficiency 14 Possible Points

- *Water Efficient Landscaping*
- *Innovative Wastewater Technologies*
- *Water Use Reduction*

3-Energy and Atmosphere 35 Possible Points

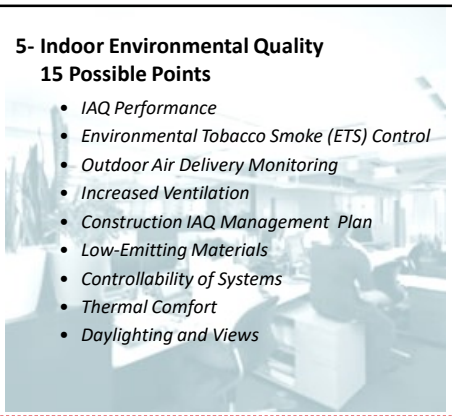


- *Commissioning of the Building Energy Systems*
- *Energy Performance*
- *Refrigerant Management*
- *On-Site Renewable Energy*
- *Measurement & Verification*
- *Green Power*

4- Materials and Resources 10 Possible Points

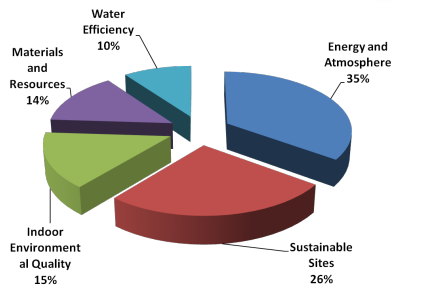
- *Storage and Collection of Recyclables*
- *Building Reuse*
- *Construction Waste Management*
- *Materials Reuse*
- *Recycled Content*
- *Regional Materials*
- *Rapidly Renewable Materials*
- *Certified Wood*

5- Indoor Environmental Quality 15 Possible Points



- *IAQ Performance*
- *Environmental Tobacco Smoke (ETS) Control*
- *Outdoor Air Delivery Monitoring*
- *Increased Ventilation*
- *Construction IAQ Management Plan*
- *Low-Emitting Materials*
- *Controllability of Systems*
- *Thermal Comfort*
- *Daylighting and Views*

LEED for New Construction (LEED NC)



HOW TO IMPLEMENT LEED THROUGH DIFFERENT STAGES OF A PROJECT ??

- Design Stage
- Construction Stage
- Documentation Stage

BUILDING RESEARCH ESTABLISHMENT'S ENVIRONMENTAL ASSESSMENT METHOD (BREEAM)

breeam

Over 115,000 buildings certified
Nearly 700,000 registered

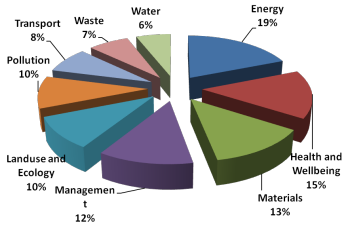
As of 2008

BREEAM Different Rating Systems for Different Project Types

- BREEAM Courts
- BREEAM Education
- BREEAM Industrial
- BREEAM Healthcare
- BREEAM Offices
- BREEAM Retail
- BREEAM Prisons
- BREEAM Multi-residential

Building Research Establishment's Environmental Assessment Method (BREEAM)

breeam



Comprehensive Assessment System for Built Environment Efficiency (CASBEE)

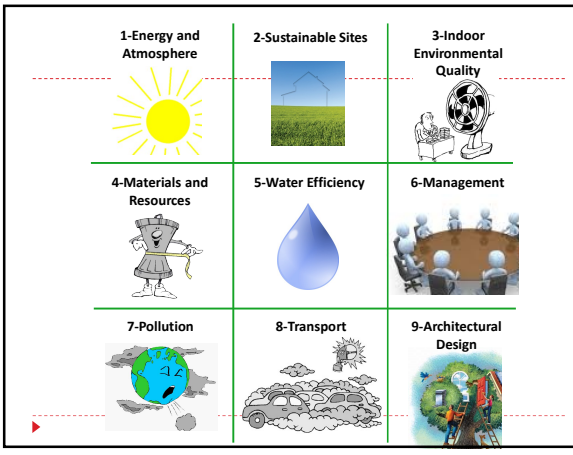
CASBEE 建築環境総合性能評価システム

The number of certified buildings is 80

As of 2009

CASBEE Different Rating Systems for Different Project Types

- CASBEE for Pre-design
- CASBEE for New Construction
- CASBEE for Existing Building
- CASBEE for Renovation



Green Building Standards

- **LEED – Leadership in Energy and Environmental Design**
  - Administered by the U. S. Green Building Council
  - Voluntary, consensus-based system

LEED INDIA

- Effective in India from 1st Jan 2007
- Based on professional reference standards like NBC, ASHRAE, and ECBC etc.
- Assessment by 3rd party assessors & USGBC
- Voluntary, Consensus- based, Market driven

LEED India Green building Rating System

Certification levels

Rating	F
LEED Certified	2
LEED Certified Silver level	3
LEED Certified Gold level	3

Few LEED rated buildings in India

- Platinum rated :
  - CII –Godrej GBC ,Hyderabad
  - ITC Green Center, Gurgaon
  - Wipro Technologies, Gurgaon
- Gold Rated :
  - IGP Office, Gulbarga
  - NEG Micon, Chennai
  - Grundfos Pumps, Chennai
- Silver Rated :
  - L&T EDRC , Chennai
  - World Bank, Chennai
- Important to note, that there are about 650 LEED certified projects in India and 4500 more have registered for certification.

LEED India New Construction Overview

- LEED India Green Building Rating System
- **Important criterions and Point allocation**

Sr.no:	Criterions
	Prerequisites
1	Sustainable Sites
2	Water efficiency
3	Energy and atmosphere
4	Materials and Resources
5	Indoor Environmental quality
6	Innovations and Accredited

Credits under sustainable site

Credit	Title	Points
Prereq 1	Erosion and Sedimentation Control	1
Credit 1	Site Selection	1
Credit 2	Development density and Community connectivity	1
Credit 3	Brownfield redevelopment	1
Credit 4	Alternative transportation	1-3
Credit 5	Site development	1-2
Credit 6	Storm water design	1-2
Credit 7	Heat Islands Effect	1-2
Credit 8	Light pollution reduction	1
Total		13

Sustainable site

- The Sustainable sites section of LEED NC Program outlines various "green" opportunities for reducing the negative impact the building has on the environment.
- The opportunities range from preventing erosion of top soil,
- water contamination & creation of heat islands, effective use of a barren or waste lands etc.
- The basic principle to be followed

TIME and NATURE have sculpted your land

- Importantly, use what nature has given you by working with existing topography, plants and views. Touch the earth lightly, rather than cutting deep and covering it with concrete.

Format adopted to explain Credit requirements

Prerequisite : Erosion and Sedimentation control

- **Intent :**

- Control erosion and sedimentation of soil to reduce negative impact on
  a) Water quality
  b) Air quality – dust generation

Impacts :

- Erosion from construction sites
  a) Can carry toxicants & nutrients
  b) Polluting storm water run –off

- **Requirements :**
- Design to a site sedimentation and erosion control plan that conforms to the best management practices. (Should address both during construction & post occupancy)
- Advocates process like temporary or Permanent vegetation, Mulching, earth dikes, silt fencing etc

Water Efficiency

- **Water efficiency can be defined as**
- The accomplishment of a function, task, process, or result with the minimal amount of water feasible.
- An indicator of the relationship between the amount of water required for a particular purpose and the amount of water used or delivered.
- Water efficiency differs from water conservation in that it focuses on reducing waste. A proposition is that the key for efficiency is reducing waste not restricting use.
- It also emphasizes the influence consumers can have in water efficiency by making small behavioral changes to reduce water wastage and by choosing more water efficient products. Examples of water efficient steps include simple measures like, fixing leaking taps.

Credits under water efficiency

Credit	Title	F
Credit 1	Water Efficient Landscaping	
Credit 2	Water efficiency in A/C systems	
Credit 3	Innovative wastewater technologies	
Credit 4	Water use	

Energy And Atmosphere

- Using energy wisely is a cornerstone of sustainable design. LEED recognizes the importance of optimizing energy performance by allocating the greatest number of potential points within this category.
- In general points can be earned through efficient design, use of renewable energy, deliberate mechanical and electrical system selection, and proper commissioning and monitoring.

Credits under Energy and Atmosphere

Credit	Title	Points
Prereq 1	Fundamental building systems commissioning	R
Prereq 2	Minimum Energy Performance	R
Prereq 3	CFC reduction in HVAC & R equipment	R
Credit 1	Optimized Energy Performance	1-10
Credit 2	Renewable Energy	1-3
Credit 3	Additional commissioning	1
Credit 4	Ozone depletion	1
Credit 5	Measurement and Verification	1
Credit 6	Green Power	1
Total		**17**

Material and resource

- **Material and Resources**
- When we think of greenhouse gas emissions, most of us envision a Tailpipe spewing exhaust out of the back of a car.
- But 40% of the carbon dioxide that contributes to our warming planet comes from buildings. While some of it is a secondary effect of operational needs such as electricity, A/C, and heating, many GHG's arise from resource extraction, manufacturing and Production of the building materials themselves.
- Of all the criteria covered by LEED , **MATERIALS and RESOURCES has perhaps the broadest application and relevance. They are the ingredients, and choosing them wisely makes all the difference in terms of the overall impact of the building throughout its life. This is where 'environmental footprint' or 'life cycle assessment' comes into play.**
- The materials are in the picture from the first round of planning to the final stages of demolition or renovation of a building or product.

Credits under Material and resource

Credit	Title	Points
Prereq 1	Storage & collection of recyclables	R
Credit 1	Construction waste management	3
Credit 2	Resource Reuse	2
Credit 3	Recycled content	2
Credit 4	Local / Regional Materials	2
Credit 5	Rapidly Renewable material	1
Credit 6	Certified Wood	1
Total		**13**

Credit : Resource Reuse

Intent :

- Reuse building materials and products in order to reduce demand for virgin material and reduce waste, thereby reducing impacts associated with the extraction and processing of virgin resources.

Requirements :

- Use salvaged or refurbished materials for 5-10% of building materials (by value)
- Methods suggested like, reuse of partition panels, broken tiles, Used carpets.(Note : Movable furniture like chairs are not accounted for calculation)

- **Format adopted to explain Credit requirements …**
- Pre-requisite : Erosion and Sedimentation control

Intent :

- Control erosion and sedimentation of soil to reduce negative impact on
  a) Water quality
  b) Air quality – dust generation

- **Impacts :**
- Erosion from construction sites
  a) Can carry toxicants & nutrients
  b) Polluting storm water run –off
- **Requirements :**

Credit: Resource Reuse

- Intent :
- Reuse building materials and products in order to reduce demand for virgin material and reduce waste, thereby reducing impacts associated with the extraction and processing of virgin resources.

Requirements :

- Use salvaged or refurbished materials for 5-10% of building materials (by value)
- Methods suggested like, reuse of partition panels, broken tiles, Used carpets.(Note : Movable furniture like chairs are not accounted for calculation)

Credit : Recycled Content

- **Typical Materials with High Recycled Contents**

Materials	% Recycled co
Fly ash blocks	30-40
Glass	10-15
Ceramic tiles	20-30
MDF wood	15
Steel	20-25

Credit: Recycled content

Intent :

- Increase demand for building products that incorporated recycled content materials, therefore reducing impacts resulting from extraction and processing of new virgin materials

Requirements :

- Use materials with recycled content such that the sum of *post consumer recycled content plus one-half of the post-industrial constitutes at least 5% of the total value of the materials in the project.*
- The value of the recycled content portion of a material or furnishing shall be determined by dividing the weight of recycled content in the item by the total weight of all material in the item, then multiplying the resulting percentage by the total value of the item.

Credit local/ regional Materials

Intent :

- Increase demand for building materials and products that are extracted and manufactured within the region, thereby supporting the regional economy and reducing environmental impact resulting from transportation

Requirements :

- Use a minimum of 20 %(extra points for going up to to 50 %) of building materials and products that are manufactured regionally within a radius of 800 kms (manufacturing refers to the final assembly of components)

Credit : Rapidly Renewable Material

Intent :

- Reduce the use and depletion of finite raw and long cycle renewable materials by replacing them with rapidly renewable materials

Requirements:

- Use rapidly renewable building materials and products (made from plants that are typically harvested within a ten-year cycle or shorter)
- for 5% of the total value of all building materials and products used in the project.
- Consider use of materials such as bamboo, wool, cotton insulation, agri fiber, linoleum, wheat board, strawboard and cork.

Indoor Environmental Quality

- Building green means considering not only the environmental impact of materials and construction, but also the physical and psychological health of the occupants.
- Indoor Environmental Quality (IEQ) addresses the subtle issues that influence, how we feel in a space. Some can argue that it is not only desirable, but also a fundamental human right to live and work in spaces with healthy indoor environments.
- Buildings enhance people's lives when they permit ample air circulation, maintain clean air and comfortable temperatures, and allow individuals to have a sense of control over their own indoor experience

Indoor Environmental Quality

Credits under IEQ section Credit

Credit	Title	Points
Prereq 1	Minimum IAQ Performance	R
Prereq 2	Environmental Tobacco Smoke (ETS) control	R
Credit 1	Outdoor Air Delivery Monitoring	1
Credit 2	Increased Ventilation	1
Credit 3	Construction IAQ Management Plan	2
Credit 4	Low-emitting Material	4
Credit 5	Indoor Chemical & Pollutant Source Control	1
Credit 6	Controllability of system	2
Credit 7	Thermal Control	2
Credit 8	Daylight & Views	2
Total		**15**

Credit : Low Emitting Materials

Intent :

- Reduce the quantity of indoor air contaminants that are odorous or potentially irritating and harmful to the comfort and well being of installer and building occupants.

Requirements :

- All adhesives and sealants used on the interior of the building shall comply with the requirements of the reference standard.
- VOC (Volatile Organic Compound) content of adhesive and sealants to be monitored.
- Carpet systems must meet the requirements of the carpet and rug institute Green label indoor Air quality test program
- Composite wood and agrifiber products used on the interior of the building must contain no added urea – formaldehyde resins.

Innovation & Design Process

Credit	Title	Points
Credit 1	Innovation in Design	4
Credit 2	LEEDTM Accredited Professional	1
Total		**5**

Where we can contribute

Architects can lead the way and demonstrate its commitment to public health and the environment by producing better, safer products. At the same time, we strive to secure future sales growth by tapping one of the fastest growing markets worldwide.

- **Green Design Strategy**

1. Optimized utilization of raw material to *conserve natural resources*
   - Maximize recycled content
   - Reduction in product volume to reduce transportation cost
   - Use of rapidly renewable wood & wood substitutes (planted & replenished in less than 15 years cycle) to reduce impact on eco system.
   - Modular products make various options with the use of minimum basic standard components
   - Possibility of refurbishing for reuse (Ease of servicing – assembly and disassembly)
   - Design for durability – adherence to performance standards to enhance product life.

Green Process for manufacturing

- Confirming to ISO 14001
- Energy conservation
- Use of natural lighting in the plant
- 30 % increase in production over last year with the same consumption of electric energy
- Converted to CNG for all high fuel consuming processes
- Recycling of water with reverse osmosis plant
- Effective utilization of in-process waste water, after effluent treatment is used for watering gardens
- Influencing our vendors to follow green processes
- Sale of hazardous waste only to 'Pollution Control Board' authorized parties

Product Carbon Footprint tracking

- Tool used to track carbon footprints
- A product's life cycle consists of the activities that go into making, transporting, using and disposing of that product

EXAMPLE OF LIFE-CYCLE ASSESSMENT

- **Spacio open plan office system**
- 80% steel for the panelling compared to conventional wood based partition
- Fabrics : 100% Cotton or polypropylene (PP) based without any blend
- 100 % use of reconstituted wood: (PB or MDF) for work surfaces
- Number of parts reduced to minimum
- Easy to disassemble reconfigure and refurbish for reuse
- Paper based packing material: 100 % Recyclable

- **Role of furniture in getting credits**
- System furniture can contribute in garnering credits by methods like..
- Provision of energy efficient task lights, can help in reducing the overall lighting load of the project.
- Leading to "Optimizing energy performance" – @ 3 Points
- Use of easily recyclable material (like corrugated cardboard, expanded polystyrene) packing which can reduce landfill disposal.
- Aiding in "Construction waste management "– @ 2 points
- Manufacture products with longer life cycle, so that can be used in many sites. Tile – frame construction making it easy for reconfiguration and reuse.
- Demonstrating "Resource reuse" - @ 1 points
- Identifying components which could be made from recycled materials like, recycled plastics, worktop made of baggage boards etc.
- Thereby contributing to "Recycled content" - @ 2 points

- Can explore the option of using boards made of bamboo, fabrics made of agricultural waste etc.
- Thereby demonstrate use of "Rapidly Renewable material" - @ 1 points
- Working towards usage of material which confirm to VOC level
- Requirements for GREENGUARD certification and also by evolving a NO WOOD offering
- Contributing to usage of "Low emitting materials" - @ 1 points
- Task lighting feature can ensure better control and proper optimization of electricity Used for lighting.
- Help in demonstrating "Controllability of the system" - @ 1 points
- To the credit "Daylight and views" - @ 3 points

- furniture can contribute by usage of transparent material and low ht partitions allowing daylight and outside view to the building occupants.

LEED Basics – Why LEED?

- The "built environment" accounts for approximately:
  - 40% of global consumption of raw materials
  - 37% of primary U. S. energy consumption (operations)
  - 68% of U. S. electricity consumption
  - 12% of U. S. potable water consumption
  - 40% of U. S. sold waste stream
  - 35% of U. S. carbon dioxide emissions

LEED Basics – Why LEED?

- Advertised as:
  - Reducing environmental impact
  - Reducing operating costs
  - Increasing occupant comfort and productivity
- Other potential benefits:
  - Higher rents?
  - Higher sales price?

LEED Basics – Rating Systems

- New Construction
- Existing Buildings: O&M
- Commercial Interiors
- Core and Shell
- Schools
- Homes

LEED Basics – Pilot Rating Systems

- **Neighborhood Development**
  - *Encourage healthy living* by creating compact, walkable, vibrant, mixed-use neighborhoods with good connections to nearby communities.
  - *Reduce urban sprawl*
  - *Protect threatened species*
  - *Increase transportation choice and decrease automobile dependence.*
- 8 LEED-ND Pilot projects in Washington
  - Including -- Thorton Place, South Lake Union

LEED Basics – Pilot Rating Systems

- Retail
- Health Care
  - In cooperation with the Green Building for Health Care rating system

LEED Basics

- LEED updated in 2009
  - **Harmonization** – prior systems, with wisdom from Credit Interpretation Rulings, consolidated and aligned
  - **Credit Weightings** – credits have different weight depending on how most affect energy efficiency and CO_2 reduction
  - **Regionalization** – credits prioritized based on regionally important environmental issues

LEED Basics – Rating System Example (LEED 2009-NC)

Category	Prerequisites	Credits	Possible points
Sustainable Sites (SS)	1	8	26
Water Efficiency (WE)	1	3	10
Energy & Atmosphere (EA)	3	6	35
Materials & Resources (MR)	1	7	15
Indoor Environmental Quality (EQ)	2	8	15
Innovation & Design Process (ID)	None	2	5
Regional Priority	None	1	4
Totals:	*8*	*35*	*110*

LEED Basics – Category Examples

- Sustainable Sites (SS)
  - Site Selection
  - Density and Connectivity
  - Brownfield Redevelopment
  - Alternative Transportation
  - Site Development – Habitat/Open Space
  - Stormwater Control
  - Reduction of "Heat Island" Effect
  - Light Pollution Reduction

LEED Basics – Category Examples

- Water Efficiency
  - Water Use Reduction
  - Water Efficient Landscaping
  - Innovative Wastewater Technology

LEED Basics – Category Examples

- Energy & Atmosphere (EA)
  - Energy Efficiency
  - Renewable Energy
  - Building Commissioning

LEED Basics – Category Examples

- Materials & Resources (MR)
  - Building Reuse
  - Construction Waste Management
  - Materials Reuse
  - Recycled Materials
  - Regional Materials
  - Rapidly Renewing Materials
  - Certified Wood

LEED Basics – Category Examples

- Indoor Environmental Quality (EQ)
  - Ventilation
  - Low-Emitting Materials
  - Controllable Systems: Lighting - Thermal
  - Thermal Comfort
  - Daylight & Views

LEED Basics – Certification

- Certification is dependent upon number of points earned
- LEED-NC 100 base points + 6 Innovation in Design and 4 Regional Priority points

LEED Basics – Certification

2009 LEED-NC Certification Levels	
Certified:	40 - 49 points
Silver:	50 - 59 points
Gold:	60 - 79 points
Platinum:	80 points and above

LEED Basics

2009 Minimum Program Requirements

1. Must comply with environmental laws
2. Must be a complete, permanent building or space
3. Must use a reasonable site boundary
4. Must comply with minimum floor area requirements
5. Must comply with minimum occupancy rates
6. Must commit to sharing whole-building energy and water usage data
7. Must comply with a minimum building area to site area ratio

LEED Basics

- Must commit to sharing whole-building energy and water usage data
  - for a period of at least 5 years
  - in a free, accessible, and secure online tool or, if necessary, taking any action to authorize the collection of information directly from service or utility providers
  - must carry forward if the building or space changes ownership or lessee

LEED Basics

- **Decertification**
- MPR "Preamble" contains this "Note":
- "CERTIFICATION MAY BE REVOKED FROM ANY LEED PROJECT UPON GAINING KNOWLEDGE OF NON-COMPLIANCE WITH ANY APPLICABLE MPR"

BRE Environmental Assessment Method *BREEAM, UK*

BREEAM

- **BRE Environmental Assessment Method (BREEAM)** is a voluntary measurement rating for green buildings that was established in the UK by the **Building Research Establishment** (BRE).
- BREEAM was established in 1990 as a tool to measure the sustainability of new non-domestic buildings in the UK . It has been updated regularly in line with UK building regulations and underwent a significant facelift on 1 August 2008, called BREEAM 2008.
- **BREEAM is the world's foremost environmental assessment method and rating system for buildings, with 200,000 buildings with certified BREEAM assessment ratings and over a million registered for assessment since it was first launched in 1990.**

Scandinavia's first BREEAM-rated building, Kremmertorget at Elverum Norwa

- BREEAM sets the standard for best practice in sustainable building design, construction and operation and has become one of the most comprehensive and widely recognized measures of a building's environmental performance.
- A BREEAM assessment uses recognized measures of performance, which are set against established benchmarks, to evaluate a building's specification, design, construction and use. The measures used represent a broad range of categories and criteria from energy to ecology. They include aspects related to energy and water use, the internal environment (health and well-being), pollution, transport, materials, waste, ecology and management processes.
- **Facts and Figures**
- The number of buildings certified is quoted as 116,000 buildings and 714,000 buildings registered, but the breakdown as to which scheme (building type and year) is not publicized.

BREEAM REGISTERED ASSESSMENTS

BREEAM RATING

BREEAM 2008
The main differences between BREEAM 2006 and BREEAM 2008 are:

- A new two stage assessment process: Design stage and Post Construction
- Introduction of mandatory credits
- A new rating level of BREEAM Outstanding

BREEAM Section	Credits Achieved	Credits Available	% of Credits Achieved	Sec We
Management	10	22	45.45%	
Health & Wellbeing	8	10	80.00%	
Energy	16	30	53.33%	
Transport	5	9	55.56%	
Water	5	9	55.56	
Materials	6	12	50.00%	
Waste	3	7	42.86%	
Land Use & Ecology	5	10	50.00%	
Pollution	5	13	38.50%	

BREEAM score and rating calculation

- The table below shows the percentage score required for each rating

BREEAM Rating	% Score
UNCLASSIFIED	<30
PASS	≥30
GOOD	≥45
V. GOOD	≥55
EXCELLENT	≥70
OUSTANDING*	≥85

Buildings are rated on a scale of ***Pass***, ***Good***, ***Very Good***, ***Excellent*** **and** ***Outstanding***. All government-funded buildings require a rating of *Very Good*, and some local authorities now require a BREEAM rating for planning permission.

BREEAM CATEGORIES

BREEAM is a credit based assessment system covering the following aspects of a building and the construction process: management A high BREEAM rating can help get planning permission, finance and enhanced rental income

BREEAM major categories of criteria for Design and Procurement include the following:

Management	commissioning period and process adopted, monitoring of commissioning, energy use in site activities, waste management, pollution minimization
Health and comfort	adequate ventilation, humidification, presence of controllable blinds, energy efficient lighting, thermal and visual comfort, low noise levels
Energy	sub-metering
Transport	modes of transport to and from site, alternative transport facilities
Water	consumption reduction, metering, leak detection
Materials	asbestos mitigation, storage facilities, reuse of structures, specifications of envelope, use of crushed aggregate and sustainable timber
Land use	previously used land, use of re mediated contaminated land
Ecology	land with low ecological value or minimal change in value, maintaining major ecological systems on the land, minimization of biodiversity impacts
Pollution	leak detection systems, on-site treatment, local or renewable energy sources, light pollution design, avoid use of ozone depleting and global warming substances

Aims of BREEAM

- To mitigate the life cycle impacts of buildings on the environment
- To enable buildings to be recognized according to their environmental benefits
- To provide a credible, environmental label for buildings
- To stimulate demand for sustainable buildings

Assessments can be made on the following types of project:

1. whole new buildings
2. development of similar buildings such as shops
3. shell and core buildings
4. major refurbishments of existing buildings
5. new build extensions to existing buildings
6. existing building fit-out

- The assessment is carried out in two stages, a design stage assessment leading to an interim rating, and a post construction stage assessment after which the final certificate and rating is awarded. There is also the optional pre-assessment report, which is a useful tool when developing your initial designs, showing you where you need to improve to get the required rating.

	Weighting (%)	
BREEAM Section	New builds, extension & major refurbishments	Building fit-out only (where applicable to scheme)
Management	12	13
Health & Wellbeing	15	17
Energy	19	21
Transport	8	9
Water	6	7
Materials	12.5	14
Waste	7.5	8
Land Use & Ecology	10	N/A
Pollution	10	11

BREEAM 2011 New Construction is the latest version of the BREEAM Scheme.

Commercial:	Public (non housing):	Residential accommodation:	Other:
• Offices; • Industrial Units; and • Retail (Shops, retail park, showroom, restaurant, hot food takeaway);	• Education (Pre-school, schools, colleges, higher education institutions); • Healthcare (teaching hospitals, general acute hospitals, community hospitals, General Practice surgeries, health centres and clinics); • Prisons (high security prison, standard secured prison, local prison); and • Law Courts (crown and criminal courts, county courts, family and youth courts).	Residential institutions (care home, sheltered accommodation, residential college, military barrack);	• Residential Institutions (hotel, hostel, boarding and guest house, secure training centre); • Non residential institutions (art gallery, museum, library, day centre, community centre, place of worship); • Assembly and leisure (Cinema, theatre/music/concert hall, exhibition/conference hall); and • Other (transport hub, creche).

- A full list of the non-domestic building types which can be assessed and rated using the BREEAM 2011 New Construction scheme can be found on the BREEAM website.

CASBEE, JAPAN

CASBEE Certification System

- **CASBEE** (**Comprehensive Assessment System for Built Environment Efficiency**) is the green building management system in Japan.
- CASBEE is broadly used by many construction companies, design offices, real-estate developers, etc. as a voluntary-basis evaluation tool for checking the environmental performance of their buildings.

CASBEE ACCREDITED PROFESSIONAL REGISTRATION SYSTEM

- CASBEE is based on assessment as quantitative as possible, but it includes qualitative items in the system. In such items, it requires specific expertise and knowledge for its assessment. So we established CASBEE Accredited Professional Registration System in 2005.

To become a CASBEE-AP, it is needed to take the training courses, pass the examination and complete registration. The candidate must be Japanese first-class architect to qualify for taking the examination.

For now, There are over 10000 CASBEE-APs in Japan. (as of December 2011)

Three Major Concepts on which CASBEE is based

(1) Consideration of lifecycle stages of buildings

(2) Two environmental aspects; environmental load (L) and quality of building performance (Q)

(3) BEE (Building Environmental Efficiency) as an indicator based on Eco-efficiency

Framework of CASBEE: CASBEE Family

THE CYCLICAL PROCESS OF BUILDING DESIGN

As shown in figure, CASBEE was developed in the suite of architectural design process, starting from the pre-design stage and continuing through design and post design stages.

BUILDING LIFECYCLE

PRE DESIGN
This is the stage at which the preconditions that form the background to the plan, such as natural, social, cultural and business environment are subjected to a multi-faceted, three-dimensional investigation and analysis. In the process, the parties involved identify design themes and build shared concepts and policies

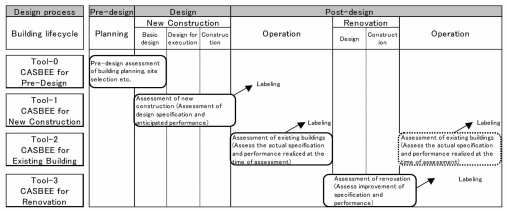
DESIGN
The concept and policies distilled in the pre-design stage are examined further at the design stage to define their ecological, technical , social, aesthetic and economic aspects. The design also passes through a self-evaluation process at this stage to integrate as best practice.

POST DESIGN
When a design that has been integrated through the design stage is put into practice. It is subjected to an overall verification followed by ongoing retrospective verification through its life cycle, to evaluate sustainability. The results of the verification are constantly reflected in improvements to the implemented design and concept.

FOUR BASIC ASSESSMENT TOOLS

Corresponding to the building lifecycle, CASBEE is composed of four assessment tools,
- CASBEE for Pre-design,
- CASBEE for New Construction,
- CASBEE for Existing Building and
- CASBEE for Renovation, and to serve at each stage of the design process .

CASBEE Family is the collective name for these four basic tools and the tools for specific purposes. Each tool is intended for the specific purpose and target users, and is designed to accommodate a wide range of building types (offices, schools, apartments, etc.).



BUILDING LIFECYCLE AND FOUR ASSESSMENT TOOLS

FOUR BASIC ASSESSMENT TOOLS

CASBEE for Pre-design (underdevelopment)	CASBEE for New Construction	CASBEE for Existing Building	CASBEE for Renovation
This tool aims to assist the owner, planner and others involved at the planning (pre-design) stage of the project. It has two main roles:	This is a self-assessment check system that allows architects and engineers to raise the BEE value of the building under consideration during its design process.	This assessment tool targets existing building stock, based on operation records for at least one year after completion.	There is growing demand for building stock renovation, especially in Japanese market. In the same way as CASBEE for Existing Building, this tool targets existing buildings
1) To assist in grasping issues such as the basic environmental impact of the project and selecting a suitable site. 2) To evaluate the environmental performance of the project at the Pre-design stage.	It makes assessments based on the design specification and the anticipated performance. It can also serve as a labeling tool when the building is subjected to expert third-party assessment.	It was developed to be applicable to asset assessment as well.	It can be used to generate proposals for building operation monitoring, commissioning and upgrade design with a view to ESCO (Energy Service Company) projects, which will be increasingly important in future, and for building stock renovation.

CASBEE for Specific Purposes

CASBEE FOR SPECIFIC PURPOSES

- We have also developed the various versions of CASBEE according to the specific purposes.

For Detached houses	The CASBEE basic tools are applicable for apartment complexes, but not detached houses. CASBEE for Detached Houses was developed for an assessment of detached houses.
For Temporary Construction	The tool "CASBEE for Temporary Construction," was developed as an extension tool of CASBEE for New Construction. It can be applied for assessment of temporary buildings for short-term use like exhibition hall and Olympic facilities.
Brief versions	The brief versions were developed to meet the growing needs for tools to handle objectives shown below. 1.The need for setting goals of the built environment efficiency in the early stage of building project (as a tool for consensus forming between owners, designers and builders, etc.). 2.The need for setting management targets of environmental performance of existing buildings (like a management tool under ISO14001 etc.). 3.The need for establishing the report system by local governments (like Nagoya city, Osaka city and Yokohama city etc.).
Local government versions	As noted above, CASBEE is used by some local governments in Japan. The local governments tailor it to local conditions, such as climate and prioritized policies. Changes are generally made by modifying the weighting coefficients. Report of the assessment result to the local government is mandatory .
For Heat Island Effect	The heat island effect is becoming a critical issue in major urban areas, such as Tokyo and Osaka. CASBEE-HI (Heat Island) was developed to evaluate efforts in buildings to alleviate the heat island effect. The role is to make a more detailed and quantitative assessment of the heat island-related items of the basic tools.
For Urban Development	CASBEE for Urban Development was developed to make broader assessments, adopting holistic approach delivered through the urban area
For Cities	. CASBEE for Cities is a system for comprehensively evaluating the environmental performance of cities, using a triple bottom line approach of "environment", "society" and "economy". It can objectively assess the effectiveness of the city's policies and environmental measures.

EXPANSION OF CASBEE FOR SPECIFIC PURPOSES

Application	Name
For Detached Houses	CASBEE for Detached Houses (for New Construction, for Existing Building)
For Temporary Construction	CASBEE for Temporary Construction
Brief versions	CASBEE for New Construction (Brief Version), for Existing Buildings (Brief version), for Renovation (Brief version) CASBEE for Urban Development (Brief version)
Local government versions	CASBEE-Nagoya, CASBEE-Osaka, CASBEE-Yokohama etc.
For Heat Island effect	CASBEE for Heat Island
For Urban Development	CASBEE for Urban Development
For Cities	CASBEE for Cities

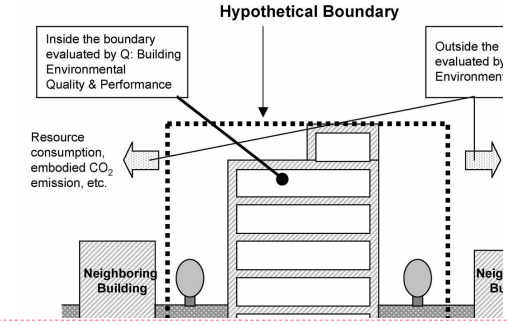
ASSESSMENT METHOD EMPLOYED BY CASBEE

TWO CATEGORIES OF ASSESSMENT: Q AND L

- Under CASBEE there are two spaces**, internal and external**, divided by the hypothetical boundary, which is defined by the site boundary and other elements, with two factors related to the two spaces.
- Under CASBEE, these two factors are defined below as **Q and L**, the main assessment categories, and evaluated separately.

Q (Quality): Built Environment Quality	**Evaluates "improvement in living amenity for the building users, within the hypothetical enclosed space (the private property)."**
L (Load): Built Environment Load	Evaluates "negative aspects of environmental impact which go beyond the hypothetical enclosed space to the outside (the public property)."

Division of the assessment categories for Q: Built Environment Quality and L: Built Environment Load based on the hypothetical boundary



Four Target Fields of CASBEE and Its Rearrangement

CASBEE covers the following four assessment fields:

(1) Energy efficiency

(2) Resource efficiency

(3) Local environment

(4) Indoor environment.

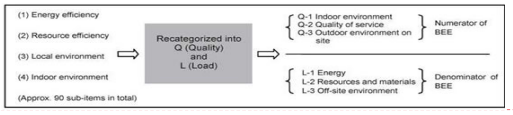
The assessment categories were classified into BEE numerator Q (built environment quality) and BEE denominator L (built environment load).

Q is further divided into three items for assessment:

- Q1 Indoor environment,
- Q2 Quality of services and
- Q3 Outdoor environment on site.

Similarly, L is divided into

- L1 Energy,
- L2 Resources & Materials and
- L3 Off-site Environment.



Environmental parameters involved in THE CASBEE method

Q: Environmental quality and performance of the building	
Q-1. Indoor environment	1. Noise and acoustics 2. Thermal comfort 3. Lighting and illumination 4. Air quality
Q-2. Quality of service	1. Service ability 2. Durability & reliability 3. Flexibility and adaptability
Q-3. Outdoor environment on site	1. Preservation & creation of biotope 2. Townscape and landscape 3. Local characteristics and outdoor amenity
LR: Reduction of building environmental loadings	
LR-1 Energy	1. Building thermal load 2. Natural energy utilization 3. Efficiency in building service system 4. Efficient operation
LR-2.Resources and materials	1. Water resources 2. Materials of low environmental load
LR-3 Off-site environment	1. Air pollution 2. Materials of low environmental load 3. Wind damage and sunlight obstruction 4. Light pollution 5. Heat island effect 6.Load on local infrastructure

VARIOUS ASSESSMENT TOOLS

NAME	BREEAM	LEED	LEED INDIA	CASBEE
ORIGIN	U.K.	U.S.	INDIA	JAPAN
PROGRESS	1990(1st ESTB)	1990(draft)		2001(1st ESTB)
CERTIFICATION	1. BRE	1. US-GBC	1. GRIHA	
RATINGS	1. PASS 2. GOOD 3. VERY GOOD 4. EXCELLENT 5. OUTSTANDING	1. CERTIFIED 2. SILVER 3. GOLD 4. PLATINUM	1. CERTIFIED 2. SILVER 3. GOLD 4. PLATINUM	
SCHEMES AVAILABLE	1.whole new buildings 2.development of similar buildings such as shops 3.shell and core buildings 4.major refurbishments of existing buildings 5.new build extensions to existing buildings 6.existing building fit-out	1. NEW CONSTRUCTION 2. EXISTING BUILDINGS 3. COMMERCIAL 4. INTERIORS 5. SHELL & CORE 6. SCHOOLS 7. RETAIL 8. HEALTHCARE 9. HOMES 10. NEIGHBOURHOOD DEVELOPMENT	LEED India For new construction LEED India for core & shell IGBC for Green homes IGBC for green townships IGBC for Green factories IGBC for Green SEZ	1. For Detached Houses 2. For Temporary Construction 3. Brief versions 4. Local government versions 5. For Heat Island effect 6. For Urban Development 7. For Cities

ASSESSMENT ITEMS OF WELL-KNOWN SYSTEMS

ASSESSMENT ITEMS OF WELL-KNOWN SYSTEMS				
NAME	BREEAM	LEED	LEED INDIA	CASBEE
ORIGIN	U.K.	U.S.	INDIA	JAPAN
PROGRESS	1990(1st ESTB)	1990(draft)		2001(1st ESTB)
CATEGORIES	1. Management 2. Health & well being 3. Energy 4. Transport 5. Water consumption 6. Materials 7. Land use 8. Ecology 9. pollution	1. Sustainable site 2. Water efficiency 3. Energy &atmosphere 4. Materials and resources 5. Indoor env. quality 6. Innovation & design process	1. Sustainable site 2. Water efficiency 3. Energy &atmosphere 4. Materials and resources 5. Indoor env. quality 6. Innovation & design process	Q: quality of building performance Q1: indoor env. Q2: quality of service Q3: outdoor env. On site L: environment load L1: energy L2: resources & materials L3:off-site env. BEE: Building environmental efficiency Q/L

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GREEN GLOBES

- Environmental impacts assessed on a 1,000 point scale in multiple categories:
  - Energy
  - Indoor Environment
  - Site
  - Water
  - Resources
  - Emissions
  - Project/Environmental Management

Green Globes

- After achieving a threshold of at least 35% of the total number of 1,000 points, new and existing commercial buildings can be certified for their environmental achievements and sustainability by pursuing Green Globes certification that assigns a rating of one to four globes

Green Globes

- Two Categories
  - New Construction
  - Continual Improvement of Existing Buildings

Green Globes

- New Construction – 2 Stages
  - Stage I -- review of construction documents, working drawings, landscape designs, energy analysis, documentation, commissioning reports, etc.
  - Stage II -- onsite walk through, review of additional documentation, and interview of key team members.

Green Globes

- Continual Improvement of Existing Buildings
  - extensive documentation review and an on-site visit with a walk through and interview of facility manager and chief engineer

Energy Star

- A program of the US Environmental Protection Agency
- Focuses on energy consumption
- Different tools for residential and commercial buildings

Energy Star -- Residential

- Home Energy Rating System (HERS) Index established by the Residential Energy Services Network (http://www.natresnet.org/).
- Home meeting the 2006 International Energy Conservation Code scores "100" and a net zero energy home scores "0".
- Each 1-point decrease in the HERS Index corresponds to a 1% reduction in energy consumption compared to the HERS Reference Home.
- To qualify for Energy Star, a home in Washington State (Climate Zones 4, 5 or 6) must achieve a HERS Index score of 85 or lower.

Energy Star - Commercial

- "National Energy Performance Rating System" -- scale of 1-100.
- A building that scores 75 or above on this scale (placing its energy performance among the top 25 percent among similar buildings nationwide) can earn an Energy Star label.
- Energy Star also offers an energy management tool, Portfolio Manager, on the energystar.gov web site.

Government Requirements/Incentives

- Approaches
  - Mandating compliance with specific standards like LEED
  - Requiring measurement and public reporting of energy use on an on-going basis
  - Incenting compliance with standards by offering bonuses, expedited processing, etc.
  - Government procurement: Structures of at least a certain size must comply
  - Adoption of codes

Governmental Green Requirements and Incentives

- Federal
  - tax incentives to the private sector
  - require federal agencies to adopt green building principles

Quality Results

Integrated System Approach