INDIA
Green Buildings Anthology

A New Green Skyline?

Jones Lang LaSalle® Meghraj

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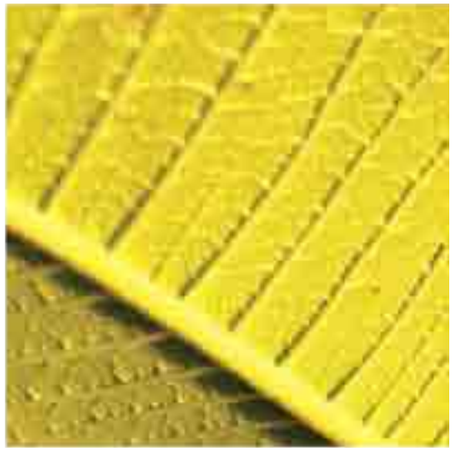

A Green Way of Life

The Green Buildings and sustainable development movement has been increasingly gaining momentum. Going behind the headlines of this movement, one discovers a whole new green way of life that is steadily emerging, both globally as well as in India, and the movement is determined to change the way we plan, construct and occupy buildings.

Globally, the Green Building movement started in 1990 with the establishment of the first Green Building rating system - BREEAM in the UK. This was followed by the formation of the US Green Building Council (USGBC) in 1993. The Indian Green Building Council (IGBC) was instituted in 2001. India got its first USGBC LEED Certified Platinum Rated Green Building - CII Sohrabji Godrej Green Building Centre in Hyderabad in 2004.

The origins of this movement is firmly embedded in the growing concern on Global Warming and the increasing accumulation of Green House Gases (GHGs) in the atmosphere, which has been well accepted to have dire environmental consequences. Moreover, the hard facts pointing to the fast dwindling energy resources from traditional sources like fossil fuels, has made markets and individuals sit up and recognize the fact that our habitat cannot be taken for granted anymore.

It is now a well proven fact that the built environment and construction sector is as much a contributor to the global warming phenomenon as are emissions from factories, transportation modes and other such factors. Fortunately, the Green Building movement is an affirmative step towards tackling climate crisis and the good news is that the stake holders in the building and construction sector worldwide have started acting on it.

The concept and issues that come hand in hand with “Green Buildings” is the main focus of our study. This document is a compilation of facts concerning Green Buildings, its basic attributes, its benefits, the rating systems through which Green Buildings are recognized and certified as well as a study of the emerging green building landscape in India. The information has been compiled in order to furnish a start up document for those who may be interested in understanding the basic nuances of a movement that is already shaping serious changes in the way people build and occupy structures across the world. This document has been kept simple in its ethos and presentation so that the basic issues in relation to Green Buildings are easily understood.

Alongside facts, within this document, there is an attempt to compile case studies of a representative selection of projects within India that have already achieved Green Building ratings (known as Certified Green Buildings) as well as a selection of projects that have applied for Green Building ratings (known as Registered projects). This Anthology of Green Buildings in no way claims to be an all comprehensive Green Building guide either from the information or technical standpoint, neither does it profess to include all Green Buildings in India, whether certified or in the pipeline, as part of the case studies compiled. Finally, in its own small way, this document aims at raising awareness within the building sector, on the pressing need to act affirmatively in saving our habitat and creating a new green skyline.

Compulsions of Going Green

Economic activities either affect or are affected by natural and environmental resources. Development without environmental considerations can cause serious long term damage to the quality of life of present and future generations. Many studies worldwide have shown that the era of global warming has been accelerated due to human activity, a fact that is quite concisely summarized in the following information available on the website http://www.climatecrisis.net/, which is climate change initiative started by Al Gore, the ex Vice President of United States, who set out the global warming issues in an stupefying film called "An Inconvenient Truth"

"The evidence is overwhelming and undeniable. We're already seeing changes. Glaciers are melting, plants and animals are being forced from their habitat, and the number of severe storms and droughts is increasing. If the warming continues, we can expect catastrophic consequences.

- Deaths from global warming will double in just 25years-- to 300,000 people a year
- Global sea levels could rise by more than 20 feet with the loss of shelf ice in Greenland and Antarctica, devastating coastal areas worldwide
- Heat waves will be more frequent and more intense
- Droughts and wildfires will occur more often
- The Arctic Ocean could be ice free in summer by 2050
- More than a million species worldwide could be driven to extinction by 2050"
  - www.climatecrisis.net

What is stated above is literally the veritable tip of the iceberg in terms of the evidence and data depicting the scale of crisis facing our world today. The major contributors to global warming is now well documented, and include among others manufacturing, transportation, land use change and forestry, electricity, heat, fossil fuel combustion and importantly construction sites as well as buildings.

Courtsey:www.climatecrises.net

There are varying estimates of the role of buildings and construction in the global warming phenomenon. Among the ones that stand out are the facts published by the United Nations Environment Programme (UNEP) Sustainable Building and Construction Initiative (2006) which states the following:

"The building and construction sector represents over 111 million people directly employed worldwide with 75% in developing countries and 90% in micro firms (less than 10 employees). It contributes to approximately 10% of the global GDP with a world wide annual investment evaluated at US $ 3,000 Billion.....

Taking into account its entire lifespan, we know that the built environment is responsible in each country for:

- 25 - 40% of the total energy use
- 30 - 40% of solid waste generation
- 30 - 40% of Global Green House Gas Emissions (CO_2, N_2O, CH_4, HFC, PFC, SF_6)

Going a step further on the same lines, there is a very interesting observation mentioned in a landmark report on "People, Planet, Profit: Property" (2007) published by Jones Lang LaSalle which states that "Commercial buildings can account for as much as 50% of all energy consumed within an economy, with air-conditioning and office equipment accounting for the majority of the end-use energy. It also accounts for significant carbon dioxide emissions and can use as much as one-third of all the water consumed within an economy."

Hence, if one includes environment in the growth equation, it is no longer enough to define economic growth in terms of Gross Domestic Product (GDP) and real estate development just in terms of millions of square feet. No wonder then concepts such as Green Gross Domestic Product (GGDP) and Triple Bottom Line (3BL) are catching up very fast. These new parameters take into account environmental and social performance in addition to financial performance, while defining growth. The fact that sustainability is becoming an important component of business planning can be understood from the study 'Green Perspectives from Corporate America' which states that 43% of the US companies view sustainability as a part of their company's growth strategy.

At a global level, governments pioneered the efforts to stabilise climate change and reduce the concentration of Green House Gases (GHG) in the atmosphere and prevent further climate damage by signing landmark Kyoto Protocol. The Kyoto Protocol is an international and legally binding agreement under the United Nations Framework Convention on Climate Change (UNFCCC, http://www.unfccc.int/), which entered into force on 16 February 2005. It has 175 countries as signatories till date, with 36 countries and EEC agreeing to reduce GHG emission below the specified limits. The provisions include flexible mechanisms to meet emission targets including three market-based mechanisms: Emissions Trading (Carbon Credits), the Clean Development Mechanism (CDM) and Joint Implementation (JI).

Translating the Kyoto Protocol provisions for stabilizing climate change within the global building and construction industry are various initiatives. Some of the leading initiatives worldwide include UNEP's Sustainable Building and Construction Initiative, World Business Council on Sustainable Development's Zero-energy Buildings Project, Clinton Climate Initiative (CCI) and the initiatives by the respective national Green Building Councils (GBC) as well as the World Green Building Council (World GBC). The green building councils have taken it upon themselves to jointly work towards introducing sustainability in the global building and construction sector.

The significant initiatives that are being driven by all the Green Building Councils is well defined in the introduction given in the World GBC website (www.worldgbc.org), which is as follows:

"The World Green Building Council is a union of national councils whose mission is to accelerate the transformation of the global property industry towards sustainability. Current members are GBC Australia, Canada GBC, Emirates GBC, India GBC, Japan SBC, Mexico GBC, New Zealand GBC, Taiwan GBC, United Kingdom GBC and the USGBC. Collectively, these nations represent over 50% of global construction activity, and touch more than eight thousand companies and organizations worldwide.

WorldGBC is a business-led coalition. Green Building Councils are consensus-based not-for-profit organisations with no private ownership, and diverse and integrated representation from all sectors of the property industry. They see business as a powerful solution-provider, and are working to improve frameworks that harness business's ability to deliver.

Green building rating systems stimulate market demand for high-performance buildings, provide "branding", and transform the skills and knowledge of the industry as a whole. WorldGBC supports member councils' efforts to adopt and implement market-based transformation tools - such as BREEAM, CASBEE, Green Star and LEED - that meet local needs. At the same time WorldGBC is providing a global forum and leadership in the effort to create a system to collect and disseminate global information on comparative attributes of building performance." http://www.worldgbc.org/

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Green Buildings - Building Blocks

"Green buildings compete in bottom-line terms as well as in aesthetics. They are relatively inexpensive to build, operate, and convert to their next use, as human needs inevitably evolve. Their mechanical systems to maintain comfort are small and well designed, or better still, eliminated by design."

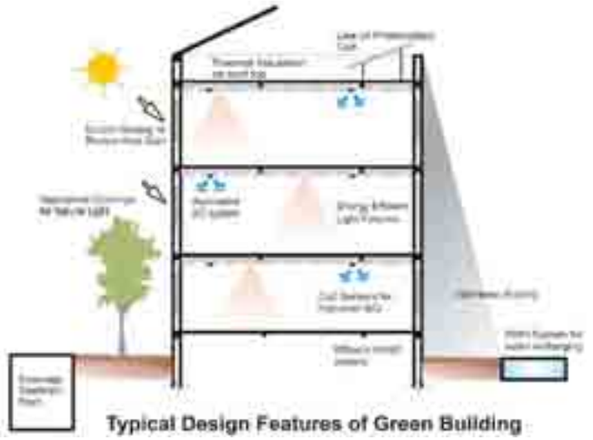
- Natural Capitalism

At the outset it is important to understand what a 'Green Building' is. In this fast emerging field of sustainability there are many interpretations of what a Green Building denotes. The basic essence of a Green Building is very succinctly summarized by the US Green Building Council (USGBC) as follows:

"Green Building is synonymous with 'high performance buildings', 'sustainable design and construction' as well as other terms that refer to a holistic approach to design and construction....Green Building design strives to balance environmental responsibility, resource efficiency, occupant comfort, well being and community sensitivity. The Green Building design includes all players in an integrated development process, from the design team (building owners, architects, engineers and consultants), the construction team (material manufacturers, contractors and waste haulers), maintenance staff and building occupants. The Green Building process results in a high quality product that maximizes the owner's returns on investment." - USGBC LEED Reference Guide for New Construction & Major Renovation (Version 2.1, 2003)

On the face of it, just by looking, it may not be possible to differentiate between a conventional building and a green one. The differences are literally under the skin and embedded in the philosophy underlying the development and in the incorporation of sustainable systems that allow the structure and the occupants of the building to be in harmony with the environment outside at many different levels.

Building green can involve many facets, but the main objectives include efficient use of land and energy, water conservation, improved indoor air quality, and resource conservation, primarily by using recycled & regional materials. Green building brings together a vast array of practices and techniques to reduce and ultimately eliminate the impacts of buildings on the environment. Conventionally built buildings use more energy than necessary. Designing and operating buildings from an energy efficient perspective can significantly reduce the waste in energy, water usage and materials.



Typical Design Features of Green Building

Graphic designed by Anshuman

The following quote from a Green Building paper by the The Energy and Resources Institute (TERI), India well describes the process of building green " The available options in architectural intervention, building materials and design methodologies need to be carefully evaluated to minimize the ecological degradation that may be caused by the construction of the building and provide cost effective solutions. The aim is to achieve the desired comfort with the least input of conventional energy....While designing such buildings, not only new building stock can be targeted but also existing buildings can be retrofitted with energy efficient and eco friendly technologies, thereby substantially reducing energy consumption."

Evolution of Green Buildings Phenomenon

Sustainability, the guiding philosophy behind the Green Building movement, was an integral part of ancient civilizations world over as indeed in ancient India. Abundant use of sustainable design concepts such as orientation of building to effectively use sunlight, use of perforated screens for cooling ambient air, smart use of water bodies for evaporative cooling and recharging water tables have been established norms of ancient architecture. These principles were scaled up from building unit level and applied to entire cities and towns in the ancient civilizations.

In the industrial era, as far back as the mid 19th century, the western world had already used passive systems to control air quality in the Crystal Palace in London. The more contemporary Green Building movement can be dated to 1990, when the Building Research Establishment Environmental Assessment Method (BREEAM) was instituted in the UK, the first formal international rating system for Green Buildings. In April 1993, the US Green Building Council was formed with a goal to develop industry standard design guidelines, policy positions, conferences and educational tools that support the adoption of sustainable design and building practices.

The turning point in the history of Green Building movement was the convention held in June 1993 "Architecture at the Crossroads: Designing a Sustainable Future" at the World Congress of Architects in Chicago where the issue of sustainability in buildings was first recognized widely.

The watershed was the formulation of Leadership in Energy and Environmental Design green rating system (LEED). The LEED Version 1.0 Pilot Program was launched at the USGBC Membership Summit in August 1998. 12 Projects completed the application process and were recognized as the first LEED Certified Pilot Projects in March 2000.

The growth thereafter has been remarkable, both in terms of the spread of the Green Building movement worldwide as well the development of alternative systems for rating Green Buildings in various countries that embarked on this mission. Today many countries have adopted some form of a formal Green Building rating system or other. The table in the facing page is a compilation of the various rating systems being followed across countries.

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Indicative list of Green Buildings rating systems followed in respective countries*

Rating System	Agency	Countries Following it
Asia		
Green Olympic Building Assessment System (GOBAS)	Ministry of Science and Technology (MoST), Qinghua University	China
GRIHA	The Energy Research Institute (TERI)	India
LEED India	Indian Green Building Council (IGBC)	India
Green Mark	Building and Construction Authority (BCA)	Singapore
Hong Kong Building Environmental Assessment Method (HK-BEAM)	HK BEAM Society, Business Environment Council (BEC)	Hong Kong
Ecology, Energy saving, Waste reduction and Health (EEWH)	Taiwan Green Building Council	Taiwan
Comprehensive Assessment System for Building Environmental Efficiency (CASBEE).	Japan Sustainable Building Consortium (JSBC), The Institute for Building Environment and Energy Conservation	Japan
Europe		
BREEAM	UKGBC	UK
Protocollo ITACA	Federal Association of the Italian Regions	Italy
ESCALE	CSTB	France
Eco Quantum	IVAM Environmental Research	Netherlands
Papoose	TRIBU	Finland
Eco Effect	Royal Institute of Technology, Stockholm	Sweden
Eko Profiles	The Norwegian Building Research Institute	Norway
Eco Building Total Quality Assessment	Arge TQ	Austria
North America		
LEED	USGBC	USA, Thailand, UAE, Brazil, Sri Lanka, Chile, Israel, South Korea, Mexico, New Zealand, Republic of Panama, Puerto Rico, China
LEED Canada	Canada GBC	Canada
Australia		
Green Star	Green Building Council Australia	Australia
NABERS/ABGR	New South Wales Department of Environment and Climate Change	Australia

Source: From respective websites

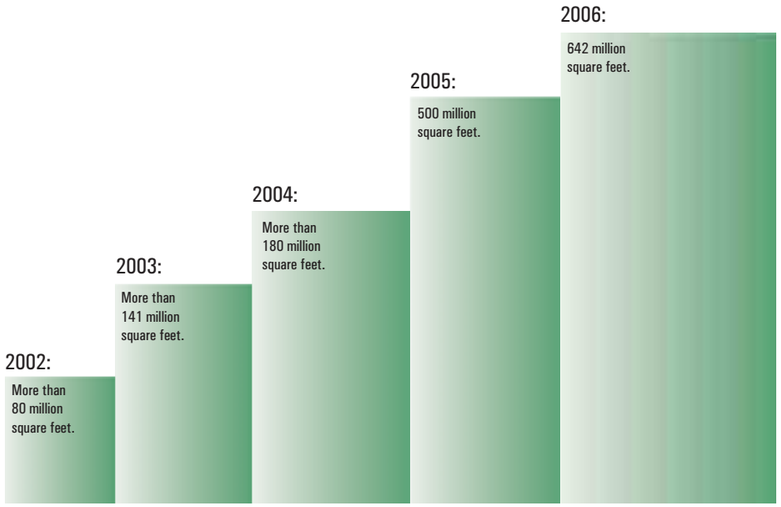
*Subject to Change

Working in alliance with the World GBC is another initiative - The International Initiative for a Sustainable Built Environment (iiSBE) a non-profit organization whose overall aim is to actively facilitate and promote the adoption of policies, methods and tools to accelerate the movement towards a global sustainable built environment. While the World GBC's objective is market transformation, iiSBE focuses on global R&D issues related to sustainable built environment.

In whatever manner the Green Building movement may have spread or is being implemented across countries, it is abundantly clear that it is a rapidly growing movement. The introduction of formal rating tools, which ever type they may be, for implementing Green Buildings has definitely ushered in a new era in the way in which buildings are designed, constructed, maintained and operated. As a result the global property sector has in turn been elevated to a new level altogether, reflecting efficiency and environmental orientation.

The fact that this movement is spreading like wildfire is evident from the following graph which depicts the impressive quantum of increase in the size of LEED projects (USGBC) over the period of 2002 to 2006.

Trend of increase in the LEED projects



Source: USGBC

It so happens that among all the rating systems, the LEED rating system has emerged over time as quite a popular system not only in its home base of United States but also across many other countries in the world. As of now, the LEED system is being followed in Brazil, Canada, China, UAE, India, Italy, Mexico, Portugal, Puerto Rico, Singapore, South Korea, Spain, Sri Lanka, Taiwan, Thailand and Vietnam among others.

India has been very much part of this fascinating story. The Green Building movement in India kicked off with the establishment of the Indian Green Building Council in 2001, which is an initiative of Confederation of Indian Industries (CII) along with the World Green Building Council and the USGBC. The movement really got a fillip when India's first LEED platinum rated Green Building - the CII-Sohrabji Godrej Green Business Centre in Hyderabad covering around 20,000 square feet was inaugurated in 2004. Within a fairly short period of time, the growth in the number and volume of green buildings has been phenomenal, in the context and the base of where it started. As of September 2007, India has 17 certified LEED Green Buildings totaling to just over 4 million square feet.

Further, after the IGBC opened the LEED India rating system in January 2007 for New Construction (NC) projects in India, there has been a quantum jump in the number of registrations. As of now there are around 58 projects registered in India under the LEED rating system with a cumulative area of around 23.4 million square feet of development. This is further expected to touch 100 million square feet by 2010 - 12 as per indications given at the Green Building Congress in Chennai (Sep'07).

Aside of this, an indigenous rating system "GRIHA" for Green and Sustainable Buildings was instituted by the Delhi based 'The Energy Research Institute' (TERI). Within the GRIHA rating system itself, around 12 projects have already been registered as of September 2007 totaling to around 8.79 million square feet. Interestingly among the registered projects under GRIHA, there is an integrated township of around 4.2 million square feet in West Bengal.

Attributes of a Green Building

There is a substantial amount of documentation that has been produced on Green Buildings across the world, as indeed in India, describing the various facets of the same. Green Buildings have been described in many ways and formats. An attempt has been made to compile the basic attributes of what a Green Building implies, from available published sources. The typical features of Green Buildings is outlined in the following page:

Typical Green Building features

- **Buildings that strive for Energy Efficiency through**
  - Appropriate orientation of the building
  - Efficient HVAC systems
  - Efficient lighting systems
  - Use of alternative renewable energy sources such as Solar or Wind
  - Effective insulation of walls and roof
  - Use of double glazed Ultra Violet reflective glass to prevent heat gain
  - Appropriate balance of openings in façade and optimized shading
  - Good management, maintenance & monitoring to facilitate continuous performance improvement
  - Use of reflective material on roofs like Albedo roof finish
- **Buildings that ensure Water Efficiency through**
  - Recycling of waste water
  - Rain Water Harvesting Systems
  - Water saving fixtures
  - Sewerage Treatment Plant
  - Water efficient landscaping
- **Buildings that use local/recycled material for construction**
  - Use of rapidly renewable materials such as fly ash blocks
  - Recycling of material from the construction site
  - Use of construction materials available locally
  - Use of Wood certified with the Forest Stewardship Council
- **Buildings that have Effective Waste Management**
  - Re-use of construction waste
  - Garbage disposal & Compositing
  - Recycling of waste water
- **Ensuring Improved Indoor Environment Quality**
  - Achieving optimum Indoor Air Quality
  - Ensuring maximum daylight and natural views
  - CO_2 monitoring through sensors
  - Allowing natural ventilation
  - Use of Low VOC adhesives, sealants, paints, etc.
- **Buildings using integrated and efficient Building Management Systems**
- **Buildings that strive to be on appropriate sustainable sites**
- **Buildings that use innovative and holistic design features to achieve sustainable development**

Whilst it is difficult to distinctly pinpoint the differences in brick and mortar terms between a bespoke built for purpose contemporary office buildings and such buildings that could qualify for becoming a Green Building, the following table is an attempt at specifying typical variations that may occur between the two.

Parameter	Typical Built for Purpose Bespoke Office Building	Typical features of a Built For Purpose Bespoke Office Building incorporating Green Features
Walls	9" – 12" brick wall	AAC Blocks or Cellular Concrete Blocks or Cavity Walls with rigid insulation using fly ash bricks.
Roofing	Flat slab - 250mm thick (without any beam)	Roof with at least 75 mm of overdeck rigid insulation.
Roofing protection	Normal roof protection with normal waterproofing.	Membrane waterproofing topped up with light colored roof china mosaic or other high albedo roof finish.
Flooring	Floor Tiles	Local stone or Bamboo floor tiles.
Façade glazing	High quality tinted glass glazing.	Double Glazed Units with spectrally selective coatings with low heat transfer but higher light transmittance.
Interior Lighting	Tube lights & CFL lighting.	T-5 or next generation T-8 tube lights with dimming ballast or on off control and daylight sensors.
Heating, Ventilation & Air Conditioning (HVAC)	No Automated system, chilled water plant, AC plant room in the basement, with AHU rooms on each floor.	AHU with larger face area for increased air intake, outside air economizer (free cooling), intelligent BMS control for all building energy related operations, Thermal Energy Storage systems (where differential tariff exists), Energy Recovery systems at AHU, CO_2 sensor based for fresh air system.
Water Efficiency	Normal system without recycling water system.	100% on site water treatment to tertiary standards. Non-potable water for landscape use. Grey water reuse for flushing and cooling tower make up water. Water efficient fixtures and integrated rain water storage and recharge system.
Chillers	Normal Chillers without, any dust control and without automation.	VFD chillers with high COP
Fire Suppression system	Water Sprinklers used.	No halons or other CFCs used in the fire suppression system.
BMS	Typical Basic system or sometimes absent	Detailed monitoring and evaluation of all energy end uses. Separate meters and controls for each endues. Intelligent BMS system with high degree of automation.
Building orientation	As per site or design with no particular consideration of sunlight and ventilation.	Optimized orientation with less surface area exposed to the East or West sides. Shading of facades and glazing.
Ratio of Voids to built areas	As per normal design parameters	Increase number of voids to bring more natural light and views to the inside of buildings
Electrical & lighting	As per typical design standards	Lighting power significantly reduces to less than 8 Watts per square meter.
External Lighting	Normal External Lighting	Low lighting power used with density (0.12 watts/sqft), & no upward lighting to reduce night light pollution.
Super Structure	Typically pre- stressed concrete and brick used	Fly ash bricks or concrete blocks with concrete structure.

Source: EDS, KGA & JLLM

It is important to note here that the table represented in previous page is not a comprehensive and technical analysis of the differences between a typical office building and a Green Building. With rapid improvements in construction techniques and ethos, it is possible that many of the contemporary office buildings being built across metropolitan cities in India may have already included some of the Green features listed in the table as part of the buildings being delivered for occupation.

Benefits of Green Buildings

Green Buildings save the resources in the entire lifecycle of the structure and it starts from Green design. Green design has environmental, economic and social elements that benefit all stakeholders, including owners and the occupants. Even though these broad benefits are oft discussed in the context of Green Buildings, it is interesting to go a step forward and compile the specific salutary spin offs that may come with Green Buildings.

USGBC cites certain examples to showcase instances of such benefits: "energy efficiency measures have reduced operating expenses of the 'Denver Dry Goods' building by approx $75,000 per year. Students in daylit schools in North Carolina consistently score higher on tests than students in schools using conventional lighting fixtures. Studies of workers in Green Buildings reported productivity gains of up to 16%, including reduction in absenteeism and improved work quality, based on "people friendly" green design. Waste management costs were reduced by 56% and 48 tons of waste was recycled during construction of a grocery store in Spokane, Washington." - USGBC LEED Reference Guide for New Construction & Major Renovation (Version 2.1, 2003)

In a nutshell the benefits that may accrue from Green Buildings has been compiled from the vast amount of literature available on the same. The main advantages of Green Buildings can be categorized into three broad headings of environment benefits, economic benefits and health and safety benefits as follows:

- **Environment Benefits**
  - Reduces environmental impact through energy efficiency and waste recycling
  - Reduction in energy requirements and carbon footprint
- **Economic benefits**
  - Lower operational cost resulting from efficient resource use through reduction in energy and water requirements
  - Maximizes owner's interest on investment and bottom line of firms
  - Increases the asset value
  - Reduces liability & improved risk management for the buildings
  - Gives a 'green' image to corporates adding to their prestige
  - Ensures optimal building and occupier performance
  - Additional Revenue through carbon trading
- **Health & Safety Benefits**
  - Increases occupier retention, productivity and satisfaction
  - Improves health through better indoor air quality

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"Green buildings and operations can drive economic and productivity benefits.

For commercial real estate there are increases in occupancy rate, tenant retention, tenant satisfaction, asset value and shareholder value while driving down operating costs.

Corporate owned buildings experience reduced operating costs, improved employee relations and increased share holder value.

Government drivers are environmental stewardship and public relation benefits, reduced operating cost, improved employee satisfaction and stakeholder relations."

- USGBC

Green Rating Systems

It is worth the while to delve for a bit into the brass tacks of the rating process for two reasons. First, it would prove to be useful guide for those uninitiated into Green Building landscape and second, the rating process itself provides a list of what it really takes to go Green.

Having said that, it is important to caveat that in India, there are two distinct systems of rating that are popular and that may be chosen from. The first is the LEED rating system which is implemented by Indian Green Building Council, which is managed by the CII Green Building Centre. The second is an indigenous rating system called GRIHA which has been developed and implemented by the organization called TERI.

LEED RATING

The USGBC had instituted the LEED rating, which covers various project types detailed as follows:

LEED is a "National-consensus based, market driven building rating system designed to accelerate the development and implementation of Green Building practices".

LEED takes into account all the project types including: New Construction, Existing Buildings, Commercial Interiors, Core& Shell, Homes (in pilot) and neighborhood development (in pilot).

LEED for New Construction is a one time event, designed to guide and distinguish high-performance commercial and institutional projects, with a focus on office buildings.

LEED for Existing Building deals with ongoing operations, maintenance and upgradation of building over the life time. Recertification is required after every 5 years. It can also be applied to buildings that have been previously certified under LEED NC.

LEED for Commercial Interiors is the recognized standard for certifying high-performance green interiors. It gives the power to make sustainable choices to tenants and designers, who do not always have control over whole building operations

LEED for Core and Shell product recognizes that the division between owner and tenant responsibility for certain elements of the building varies between markets.

The LEED India rating system was formally launched by the IGBC in order to indigenize LEED US to suit Indian requirements. It adopts several Indian codes and standards such as the National Building Code, guidelines of the Environment and Forests Ministry, Central Pollution Control Board norms and the Energy Conservation Building Codes of the Bureau of Energy Efficiency. From January 2007 onwards LEED-India started registering projects under the Green Building New Construction (NC) system. In addition, LEED India Core & Shell rating system (CS) was launched by IGBC at the Green Building Congress, Chennai in September 2007.

Rating Criterion for LEED India

We try and detail the criterion for LEED India NC, as a case in point to understand the basics of the system. The LEED system for New Construction (NC), globally and in India, promotes a whole-building approach to sustainability by recognizing performance in five key areas of human and environmental health and assigning points according to the following criterion: sustainable site development, water efficiency, energy and atmosphere, material and resources, indoor environmental quality, innovation and design process. Each of these mentioned attributes are accorded certain amount of credit points and are further detailed into sub parameters. These parameters are essentially what any building aspiring to go Green should satisfy. For projects that go through the certification process through LEED accredited professionals there are additional points that can be attained. The total number of credit points that are accorded for all the mentioned parameters for Green Buildings is 69 for New Construction projects.

Based on how much a building can achieve compliance to the main and subsidiary parameters outlined, becomes the basis for the number of points it can earn out of the total of 69 credit points. The certification level accorded by LEED is thus based on the following rating scale:

LEED India NC Certification levels

Certification Levels	Points Required
LEED Certified	26-32 points or > 37% of max.
LEED Certified Silver Level	33-38 points or > 47% of max.
LEED Certified Gold Level	39-51 points or > 56% of max.
LEED Certified Platinum Level	52-69 points or > 75% of max

Source: http://www.igbc.in

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The steps involved in the LEED rating process include: registration of the project through IGBC. Once a project is registered, the building project team begins to prepare documentation and calculations to satisfy the prerequisite and credit point requirements. Then the credit interpretations are done in which IGBC has established a review process for registered project inquiries, called Credit Interpretation Requests (CIRs), to ensure that rulings are consistent and available to other projects. Then the certification and documentation is done. To earn LEED India NC certification, the applicant project must satisfy all of the prerequisites and a minimum number of points as per the rating level applied for.

The IGBC charges a designated fee for project registration and upon successful certification of the registered buildings, the IGBC further charges a certification fee which depends upon the size of the building.

GRIHA RATING

The Energy Research Institute (TERI) based out of New Delhi is also actively popularizing the concept of Green Buildings in India. It has an indigenously developed Green Building rating system called GRIHA for various kinds of buildings including new, existing, commercial, institutional and residential. GRIHA has been developed taking into account both international rating systems and based on Indian codes, standards and best practices.

TERI GRIHA is a voluntary rating system developed on a point based scoring system to evaluate buildings on "green scale". It is a guiding and performance-oriented system where points are earned for meeting the design and performance intent of a 100 point system consisting of some core points, which are mandatory to be met while the rest are optional points, which can be earned by complying with the commitment of the criterion for which the point is allocated. Different levels of certification (one star to five star) are awarded based on the number of points earned. The point based rating scale of GRIHA is detailed as follows:

GRIHA Certification Levels

Points scored	Rating
50-60	One star
61-70	Two star
71-80	Three star
81-90	Four star
91-100	Five star

Source: www.teriin.org

The steps involved in GRIHA Rating process include: online registration of projects through the TERI website. After that documentation is submitted by the building project team. The buildings are evaluated and rated in a three-tier process. The preliminary evaluation is done by team of professionals and experts from TERI, by reviewing the mandatory criteria. The TERI team then evaluates the optional criteria and estimates the total number of achievable points. The evaluation summary report is sent to members of the evaluation committee, which independently review the documents for the award of points. The GRIHA rating is valid for a period of five years from the date of commissioning of the building and the schedule of fees for registration and certification are mentioned in the TERI website.

Green Buildings : The India Scenario

There is no doubt that the formal Green Building rating system is being earnestly adopted by the Indian construction and building industry. This is evident from the fact that since India's first LEED platinum rated Green Building - the CII-Sohrabji Green Business Centre in Hyderabad was awarded its certification there has been a steady increase in certifications and even more significant growth in the number and volume of registrations both under LEED and GRIHA methods of rating. The table highlights the list of Green Buildings that have already been certified by LEED in India:

LEED Certified Green Buildings in India

No.	Project Name	City	LEED Rating	Project Type	Area (Sq ft)
1	Gurgaon Development Centre Wipro Ltd.	Gurgaon	Platinum	IT Park	175,000
2	Olympia Technology Park	Chennai	Gold	IT Park	12,00,000
3	ETL BPO Park	Chennai	Gold	IT Park	12,00,000
4	Technopolis	Kolkata	Gold	Office	650,000
5	Grundfos Pumps India Pvt Ltd	Chennai	Gold	Office	50,000
6	World Bank Building	Chennai	Silver	Office	136,000
7	Vestas India Pvt. Ltd. (Existing Building)	Chennai	Gold	Office	20,000
8	CII Godrej Green Business Centre	Hyderabad	Platinum	Office	20,000
9	ITC Green Centre	Gurgaon	Platinum	Office	170,000
10	IGP OFFICE COMPLEX	Gulbarga	Gold	Office	29,000
11	ABN Amro Central Enterprise Services	Chennai	Gold	Office	80,000
12	L& T EDRC 1	Chennai	Silver	Office	81,000
13	Hiranandani BG Building	Mumbai	Platinum	Office	120,000
14	Hyderabad Institute of Technology & Management (HITAM)	Hyderabad	Silver	Educational Institute	70,000
15	Spectral Services Consultants	Noida	Platinum	Office	16,000
16	Wipro SDB 1	Kochi	Gold	Office	100,000
17	Rane Institute of Employee Dev.	Chennai	Silver	Institute	16,500
Total					**41,33,500**

Source: CII GBC

But, just to put things into context, the graphic on the facing page highlights the position of India, vis a vis the scenario of LEED certified and registered Green Buildings across the world and in China, as available at the time of compilation of this document (Sep '07).

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Green Building Stats

Total LEED certified projects worldwide - 1325

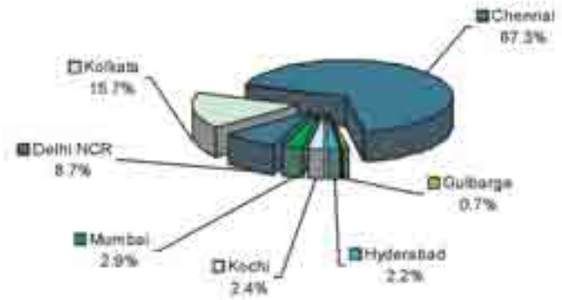
Total LEED Certified projects India - 17
Total LEED Certified projects in China - 4
Total LEED Registered projects worldwide - 16047
Total LEED Registered projects India - 58
Total LEED Registered projects in China - 43

Source: USGBC & IGBC

In context, the statistics for India as compared to the global green buildings trends under LEED are still modest as of now. However, it is encouraging to note that in the context of the Asia Pacific region, India is ahead of China both in terms of terms of projects certified as well as registered under LEED, even though experts in this field suggest that the total area of Green Buildings registered in China exceeds that of India as large township projects as well as the Olympic Games infrastructure are going in for Green certification.

Within India, if one considers all the buildings that have been certified Green till now (Sep 07) under LEED, and analyse them by regional distribution of the total 4.13 million square feet that these buildings cover, it is apparent that Chennai leads the pack in terms of share in the total volume of certified Green Building space and also in number. A noteworthy fact is that in spite having only one certified Green Building, Kolkata is second only to Chennai with 15.7% share of the total Green Building space, as of now. Delhi NCR comes third in the ranking with a 8.7% share in the total area, while Mumbai clocks a 2.9% share followed closely by Hyderabad.

Regional Distribution Of LEED Certified Green Buildings Area



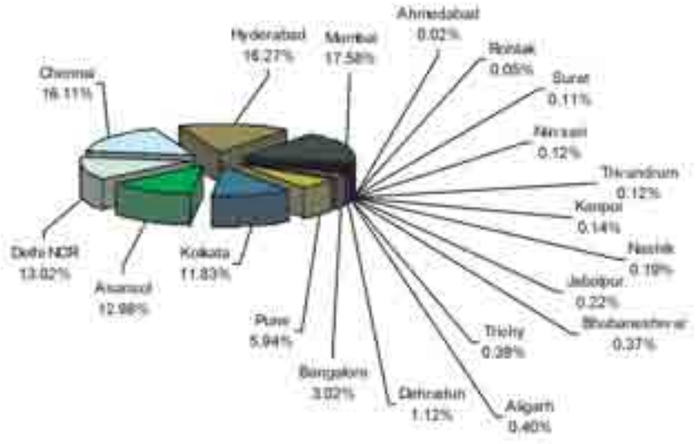
Source: CII GBC

Importantly, from an analysis of the typology of the LEED certified Green Buildings, it is evident that just around 97% of the total area of these buildings comprises of self occupied corporate offices and IT parks, clearly indicating that companies and developers have taken the first lead in getting their buildings green rated. In terms of ownership, 95% of the area under LEED certified Green Buildings is attributable to profit making corporations, 3.77% is under non profit making organizations and 0.7% is under a public service organisation.

On extending the scope of analysis to registered buildings in the pipeline as per the data available as of September 2007, under both the LEED and the TERI rating systems, several illuminating facts come to the fore. The entire data set available as of September 2007 comprises of 70 projects that are registered under LEED and TERI comprising a total area of around 32.22 million square feet.

An analysis on the basis of the regional distribution reveals that Mumbai tops the list with 17.58% of the total cumulative area under registered buildings, followed by Hyderabad (at 16.27%) and Chennai, which today, leads in terms of certified buildings. Notably, also the regional distribution suggests the emergence of a far wider spread of the Green Building phenomenon in terms of geographic spread within the country, as compared to the existing scenario of the certified Green Buildings.

Distribution of Registered Buildings Area for Green Certification By Geography

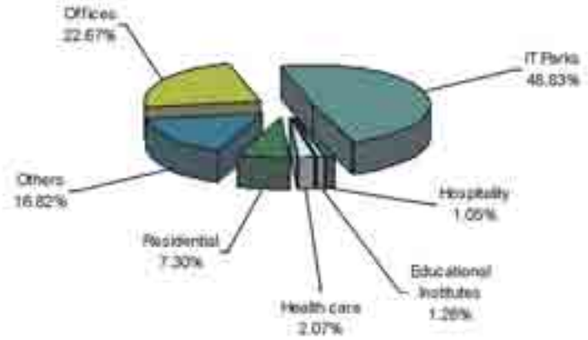


Source: CIIGBC & TERI

While the existing certified buildings under LEED, as detailed previously, are present mostly in large metropolitan cities in India like Chennai, Kolkata, Mumbai, Hyderabad and Delhi NCR, the only smaller towns in the group are Kochi & Gulbarga. This scenario is likely to change quite significantly in future, if one considers the emerging trends within registered buildings. Apart from all the major metropolitan cities of the country, the projects registered for Green Building certification are spread far and wide across the country in around 12 smaller cities and towns.

On further analysis of the registered buildings in the pipeline as per the data available as of September 2007, under both the LEED and the TERI rating systems, it is clear that in terms of typology, the trend evident from the certified building data set is likely to continue. The graph alongside depicts that IT parks and corporate offices would dominate the future Green Building scenario, comprising of over 71 % of the total area under registered projects for Green certification. Significantly there is also the clear possibility of addition of several new asset types such as residences, hospitals and hotels into the Green Building basket in coming years, as such projects have already started getting registered either under LEED or GRIHA.

Distribution of Registered Buildings Area for Green Certification By Typology



Source : CII GBC & TERI

The diversity of the kind of projects getting registered for Green Building certification is certainly heartening. Apart from residential, health care, hospitality projects joining the bandwagon, there are a first few examples of large infrastructure and township development projects also going Green. The Hyderabad International Airport Passenger Terminal has been registered under LEED and an integrated township in Asansol has been registered under GRIHA. These projects have been clubbed together in the “Others” category in the graph above.

Apart from the wide variety of projects which are driving the Green Building movement in India through certification with formal rating agencies such as IGBC and TERI, it is also worth mentioning that there are other initiatives in the realm of sustainable development in India that also exist.

A case in point is the approach of a Bangalore based developer called Biodiversity Conservation [India] Limited (BCIL), which has developed several sustainable environmentally friendly residential projects. One of these, called T-Zed Homes, has been developed in Whitefield, Bangalore and is spread over 1.5 million square feet of land. According to the developer, this project has secured Carbon Emission Reduction certification for up to 24,000 tonnes, for the saving of Carbon Emission during the construction of this project, the benefits of which are passed onto each home owner through Carbon Financial Credits every year. The 95 homes in the project have been constructed using compressed stabilized earth blocks and does not rely on external water supply, treats all its sewerage and its wet waste. Captive power is generated in the project by bio diesel and incorporates eco friendly measures such as passive solar designs for efficient lighting, rain water harvesting and waste water management.

It is hence quite apparent that the Green Building movement in India, is a juggernaut that has just started and is rapidly gaining in momentum. The stakeholders in this movement include developers, corporates, institutions, non governmental organizations, urban planners and designers, architects, public and governmental agencies, all of whom are contributing their bit in both spreading the word and actually implementing green measures thereby slowly transforming the urban built scape in the country, and in turn making it greener, more sustainable and most importantly sensitive to the environment that we inhabit.

Economics of Going Green

"Green design can actually decrease construction costs, chiefly by saving infrastructure expenses and by using passive heating and cooling techniques that make most costly mechanical equipment unnecessary"

- Natural Capitalism

There are three parts to the Triple Bottom Line (3 BL) People, Planet and Profits. From the evidence widely available, there is little doubt that creating green buildings is more beneficial for occupants and employees and is undoubtedly much less demanding on precious environmental resources. This takes care of the People and Planet part of the 3 BL. The third P that of Profits needs a bit more explaining as one should not forget that the context to all of this is hardnosed free markets.

According to a study on "The costs and Financial benefits of Green Buildings" by Gregory H Kats (Massachusetts Technology Collaborative, 2003) in the United States, "an increase of upfront cost of about 2% for greening the project, results in life cycle savings of about ten times the initial investment. The majority of this cost is due to the increased architectural and engineering (A&E) design time, modeling costs and time necessary to integrate sustainable building practices into projects. Generally, the earlier green building features are incorporated into the design process, the lower the cost."

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There is other evidence which suggests that Green Buildings make financial sense as well, with the economics of which is only getting better with time. Just that to understand this, one needs to take a bit of "lifecycle view" of investment in buildings. Given the nascent stage of Green Building sector in India, it is possible that Green Buildings may require higher initial investment, but this cost increment is offset by much lower running costs over a longer term. In the longer run, savings take place in the form of lower energy and water bills as well as lower maintenance cost.

This is already well evident in India despite the relatively short time that Green Buildings have been in operation. The following table quite succinctly substantiates two important trends: first that the pay back period for going Green in buildings is showing a distinct declining trend and second that as green technology is getting more accessible and cheaper, the cost of greening the building is also coming down.

Building	Area in Sq ft	Rating	% increase in cost	Typical Payback
CII Godrej GBC, Hyderabad	20,000	Platinum (56 points)	18%	7 years
ITC Green Centre, Gurgaon	1,70,000	Platinum (52 points)	15%	6 years
Wipro, Gurgaon	1,75,000	Platinum (57 points)	8%	5 years
Grundfos Pumps, Chennai	40,000	Gold (42 points)	6%	3 years

Source CII GBC - Green Buildings in India: Lessons Learnt

It is important to note here that the capital cost of going Green also depends on the level of rating that a project aspires for. Further, data furnished by Technopolis, India's first IT Park (650,000 Sq Ft) to get a Gold Rating, developed by Forum Projects in Kolkata, suggests the quantum of savings that can be achieved actually on ground. The following statistics kindly shared by Forum Projects is a telling example of what savings benchmarks can be set for Green Buildings.

SAVINGS BENCHMARK FOR TECHNOPOLIS

Parameters	Normal Building	Technopolis	Savings
Electrical Load	6500 KW	4500 KW	2000 KW
Total Water Consumption	4,00,000 liters per day	2,25,000 liters per day	1,75,000 liters per day
Fresh Water Consumption	4,00,000 liters per day	75,000 liters per day	3,25,000 liters per day
Sewerage Discharge	3,00,000 liters per day	ZERO DISCHARGE	3,00,000 liters per day

Source: Forum Projects, Kolkata

The savings that have been accomplished in Technopolis is an enormous feat by any standards ensuring a win-win for all the stake holders involved in such Green Building projects, all the more if one considers that such IT parks are 24X7 workplaces which are extremely energy intensive. Technopolis on its own has been able to record a 35.57 % reduction in overall energy requirements for itself reflected in an estimated Rs. 43.5 million rupees worth of savings annually, which has reduced its "Greening Payback" period to around two years.

Savings is just one side of the story. The economics of a Green Building project can be further improved by the other side of the story-that is revenues that can be generated through sale of carbon credits trading under the CDM (provided under the Kyoto Protocol) mechanism. It is important to caveat here that getting carbon credits is a rigorous process involving appropriate international agencies. However, increasingly it is emerging as an alternative revenue option for many certified green projects.

As Green Buildings economise energy consumption and reduce the emissions of Green House Gases, therefore they are technically also eligible under Clean Development Mechanism (CDM) to earn carbon credits. In India, there is an established precedence in the form of carbon credits that have been earned by industrial houses through industrial process changes. But the potential is palpable as is evident from a recent article in the Business World (16th August, 2007) which states that "In India about 18 million CERs (Certified Emission Reductions) have been issued by the CDM executive borad. 267 projects were registered in 2007 making India the country with the largest number of CDM projects in the world."

Though the potential in terms of CDM exists for Green Buildings in India, it is important to note that the first green building project in the world which is availing of carbon credits under the CDM mechanism is Technopolis in Kolkata.

With growing awareness about environment and energy consumption, stakeholders are increasingly getting attracted towards Green ways of building, it may just be a matter of time before main stakeholders in the urban built environment such as developers, corporations, institutions, government, occupiers and even individuals work together to build a new Green Skyline.

End Note

There is a whole new Green marketplace that is emerging globally and India is also an important part of the same. In India some are coming to this new green marketplace for commitment towards the environment, some are coming to enhance their building USP's, some are coming to be a part of the movement. But, the underlying important theme is that individuals and institutions are coming together through a free market mechanism to create a new Green paradigm in the country.

In India, Green Buildings are no longer just a fashionable blip on the Indian real estate development scene. It is a serious movement and is growing bigger by the day. And if one believes in the theory that India tends to skip a generation, it may not be very long before the Green brigade in India walks proudly alongside nations that are redefining the way they build and inhabit their environment.

Jones Lang LaSalle is a strong advocate of creating a more sustainable environment for current and future generations. As an industry leader in property and facilities management, the firm recognizes that the commercial real estate industry has the capacity to drive real change and innovation to ensure our buildings are environmentally sustainable. At Jones Lang LaSalle, sustainability means making the right decisions today to achieve long-term, commercial benefits for property assets while making a positive and lasting contribution to enhancing our environment. In India, Jones Lang LaSalle Meghraj is a member of Indian Green Building council (IGBC) affiliated to the USGBC.

Jones Lang LaSalle has an Environmental Sustainability Board, a group that oversees not only client service offerings but also the firm's internal initiative to minimize it's impact on the environment. The internal initiative, known as Act for a Cleaner Tomorrow (ACT), is carrying out programs to reduce the consumption of energy, paper, water and other waste at Jones Lang LaSalle's offices worldwide.

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Prelude to the India Green Buildings Anthology

The anthology of Green Buildings in India is an attempt to compile a representative selection of newly built and existing buildings in the country that have been registered or certified as Green Buildings under the LEED (Indian Green Building Council) system. In addition, the TERI RETREAT project has been showcased in the anthology, which even though not formally rated as a green building, was among the pioneering developments to demonstrate the sustainable implementation of green practices. The projects included are a representation of the range and geographical diversity of the newly built and existing buildings in the country that have been registered or certified as Green Buildings in order to provide readers with the scope and depth of the Green Building movement underway in the country.

The projects included in the anthology have been compiled from published lists of such projects which are under certification or registration with LEED on a pan India basis, as of September 2007, at the time of compilation of this document. It is important to caveat here that the certification of registered projects is dependent on the respective rating agencies mentioned. Such registered projects, some of which are included in this anthology, would only be certified Green Buildings once their rating is confirmed from the respective agencies. Only then would the registered projects be formally known as certified Green Buildings.

The selection in no way claims to be comprehensive and inclusive of all such projects on offer, as there may be other such projects that exists in various stages of certification and construction. The compilation is based on voluntary response to request for inclusion in the Anthology from owners and developers of listed projects and hence is dependent on affirmative responses from such organisations.

The Green Building projects represented in the Anthology describes a fair array of asset types from commercial offices, IT parks, institutions, airport, exhibition centre and a retail bank. In terms of spatial range, the projects represented are spread out over large and small cities in India.

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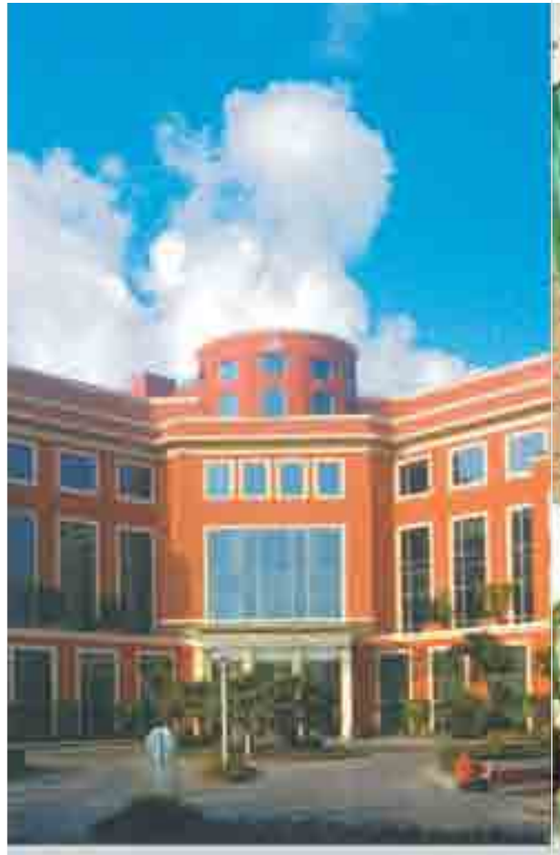
Certified Green Buildings in India*

*As of September 2007



Project Name: ITC Green Centre
Developer: ITC
Location: Sector 32, Institutional Area
City: Gurgaon
Project Usage: Office
Project Architect: Rajinder Kumar Associates
Energy Consultant: TERI
Project Start: 2002 **Completion:** 2006
LEED Rating Status: Certified
LEED Rating Type: New Construction
LEED Rating Level: Platinum
Built up Area (Sq ft): 170,000
Material Selection:
10% of building material salvaged from other building sites, 40% building material from within 500 miles. Recyclable material is used for construction
Number of Occupants: 300
Project Highlights/ Special Green features:
Universally designed building. 40 % reduction in water consumption with zero discharge and water banking system. CFC free HVAC system and use of solar thermal technology. The building is a no smoking zone.

ITC Green Centre
Gurgaon

Wipro Development Centre
Gurgaon

Project Name: Wipro Development Centre
Developer: Wipro Technologies
Location: Udyog Vihar, Phase III
City: Gurgaon
Project Usage: IT Office
Project Architect: Design and Development
Energy Consultant: EDS
Project Start: 2004 **Completion:** 2006
LEED Rating Status: Certified
LEED Rating Type: New Construction
LEED Rating Level: Platinum
Built up Area (Sq ft): 175,000
Material Selection:
40% of the material sourced within 500 miles of the site. Use of certified wood.
Project Highlights/ Special Green features:
Energy efficient technologies for non regulated loads. Water efficiency by use of water saving fixtures.

Project Name: Spectral Services Consultants- Corporate Office
Developer: Spectral Services Consultants Pvt. Ltd
Location: A-197, Sector-63
City: Noida
Project Usage: Corporate Office
Project Architect: ABRD Architects
Energy Consultant: EDS
Project Start: 2006 **Completion:** 2007
LEED Rating Status: Certified
LEED Rating Type: New Construction
LEED Rating Level: Platinum
Built up Area (Sq ft): 16,000
Material Selection:
About 55% materials are locally sourced. Use of 10% recycled content & 8% rapidly renewable material used in construction.
Number of Occupants: 150
Project Highlights/ Special Green features:
Project initiates green education. 95% of the occupants get day light and natural views.

Spectral Services Corporate Office
Noida

Project Name: CII Sohrabji Godrej Green Business Centre
Developer: CII
Location: Kothaguda, R.R. District
City: Hyderabad
Project Usage: Institution
Project Architect: Karan Grover & Associates
Energy Consultant: TERI
Project Start: 2003 **Completion:** 2004
LEED Rating Status: Certified
LEED Rating Type: New Construction
LEED Rating Level: Platinum
Built up Area (Sq ft): 20,000
Material Selection:
75% building material is recycled, use of fly ash based cement blocks. 90% of the wood is recycled, low VOC paints & carpets used for interiors, roof is carpeted with grass.
Number of Occupants: 55
Project Highlights/ Special Green features:
The first LEED certified building of India and the third Platinum rated building outside US. 35% water saving, by use of efficient fixtures, rain water for irrigation, etc. Building development did not obliterate the natural site environment. Solar energy used.

CII Sohrabji Godrej Green Business Centre
Hyderabad

Hyderabad Institute of Technology and Management (HITAM)
Hyderabad

Project Name: Hyderabad Institute of Technology and Management (HITAM)
Developer: Royal Education Society, Hyderabad
Location: Gaudavelle Village, Medchal
City: Hyderabad
Project Usage: Educational Institute
Project Architect: Inertia Architects
Energy Consultant: Price & Myers
Project Start: 2006 **Completion:** 2007
LEED Rating Status: Certified
LEED Rating Type: New Construction
LEED Rating Level: Silver
Built up Area (Sq ft): 78,820
Material Selection:
81% of construction material from the region.
Number of Occupants: 700
Project Highlights/ Special Green features:
First educational institutional LEED certified building in India. PDEC System for air cooling. 100 % on site water recycling. Common Bus Service for the occupants.

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Olympia Tech Park
Chennai

Project Name: Olympia Tech Park
Developer: Khivraj Tech Park (P) Ltd.
Location: SIDCO, Industrial Estate, Guindy
City: Chennai
Project Usage: IT Park
Project Architect: RSP Architects, Planners & Engineers
Energy Consultant: EDS
Project Start: 2004 **Completion:** 2006
LEED Rating Status: Certified
LEED Rating Type: Core & Shell
LEED Rating Level: Gold
Built up Area (Sq ft): 1,800,000
Material Selection:
Glass glazing with low U factor used. Construction waste collected and recycled. Low VOC paints and adhesives used. Over deck insulation of terrace.
Number of Occupants: 8,000
Project Highlights/ Special Green features:
Installation of CO_2 sensors to monitor IAQ. 100% recycling of grey water. 50% of terrace covered with garden. Entire building is declared as no smoking zone.

Project Name: ETL Park
Developer: ETL Infrastructure Services Limited
Location: Pallavaram, Thoraipakkam 200ft Road
City: Chennai
Project Usage: IT Park
Project Architect: Oscar Concessao International
Energy Consultant: EDS
Project Start: 2005 **Completion:** 2006
LEED Rating Status: Certified
LEED Rating Type: Core & Shell
LEED Rating Level: Gold
Built up Area (Sq ft): 1,280,000
Material Selection:
Regional and recycled materials used.
Number of Occupants: 7,000
Project Highlights/ Special Green features:
CO_2 & Light Sensors. Automated Air Conditioning. RWH system used STP with 100% water recycling.

ETL Park
Chennai

Grundfos Pumps Corporate Office
Chennai

Project Name: Grundfos Pumps India Pvt. Limited Office
Developer: Grundfos Pumps Pvt. Limited
Location: Old Mahabalipuram Road, Thoraipakkam
City: Chennai
Project Usage: Office & Assembling Plant
Project Architect: Vineeta Badawe
Energy Consultant: C.R.Narayana Rao
Project Start: 2001 **Completion:** 2003
LEED Rating Status: Certified
LEED Rating Type: New Construction
LEED Rating Level: Gold
Built up Area (Sq ft): 68,000
Material Selection:
Use of 60% regional materials. 10% of building material is salvaged from other sites. Double glazed low U-factor glass. Low VOC adhesives and sealants used.
Number of Occupants: 160
Project Highlights/ Special Green features:
95% of the building is day light lit. 100% waste water recycling. Appropriate landscaping resulting in 43% reduction in water consumption.

ABN AMRO
Central Enterprise Services
Chennai

Project Name: ABN AMRO Central Enterprise Services Pvt. Ltd
Developer: KTPL
Location: Olympia Tech Park, SIDCO, Industrial Estate, Guindy
City: Chennai
Project Usage: Office
Project Architect: CS Designs
Energy Consultant: CII GBC and Godrej
Project Start: June 2006 **Completion:** September 2006
LEED Rating Status: Certified
LEED Rating Type: Commercial Interiors
LEED Rating Level: Gold
Built up Area (Sq ft): 80,000
Material Selection:
High recycled content used in construction.
Number of Occupants: 800
Project Highlights/ Special Green features:
Use of energy efficient light fixtures like T5 lamps, dimmable ballast, motion sensitive lighting.

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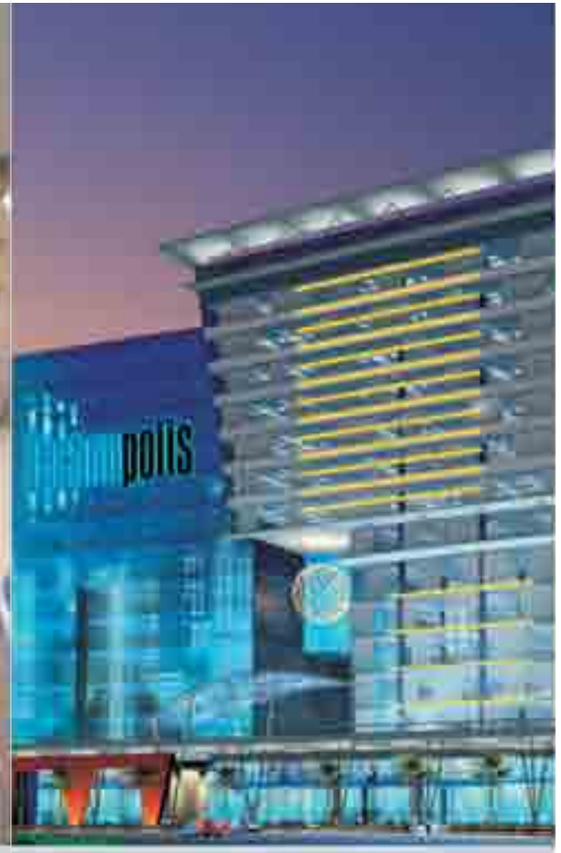

Technopolis
Kolkata

Project Name: Technopolis
Developer: Forum Projects Pvt. Ltd.
Location: Salt Lake Electronic Complex, Sector V
City: Kolkata
Project Usage: IT Park
Project Architect: Agarwal and Agarwal
Energy Consultant: EDS
Project Start: 2004 **Completion:** 2006
LEED Rating Status: Certified
LEED Rating Type: Core & Shell
LEED Rating Level: Gold
Built up Area (Sq ft): 655,000
Material Selection: 74% of the total material used from within 500 miles. 12% recycled content used in construction.
Number of Occupants: 8,000 per shift
Project Highlights/ Special Green features:
First green building in the world to be registered under UNFCCC as a CDM project. Saves 2 MW of electrical load. Reduces fresh water demand and sewage discharge significantly.

Project Name: BG House
Developer: LakeView Developers
Location: Hiranandani Business Park, Powai
City: Mumbai
Project Usage: Corporate Office
Project Architect: Hafeez Contractor
Energy Consultant: EDS
Project Start: 2005 **Completion:** 2006
LEED Rating Status: Certified
LEED Rating Type: New Construction
LEED Rating Level: Platinum
Built up Area (Sq ft): 95,000
Material Selection:
91.82% materials used from local sources. Flyash blocks, bamboo flooring with FSC certified wood and low U value glazing used.
Number of Occupants: 665
Project Highlights/ Special Green features:
Natural light and views are maximized by the atrium and windows on the external walls and the east- west orientation of the building.

BG House
Mumbai

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Projects Registered for Green Building Certification in India*

*As of September 2007

Paharpur Business Centre
New Delhi

Project Name: Paharpur Business Centre & Software Technology Incubator Park
Developer: Paharpur Group
Location: Nehru Place
City: New Delhi
Project Usage: Office
Project Start: 2004 **Completion:** 2008
LEED Rating Status: Registered
LEED Rating Type: Existing Building
LEED Rating Level Applied for: Gold
Built up Area (Sq ft): 50,000
Material Selection:
Use of eco friendly house keeping materials. Albedo coat on the roof. Solar films used in windows.
Number of Occupants: 300
Project Highlights/ Special Green features:
Efficient Solid Waste Management. Green screens in the balcony. Motion Sensors with use of CFL Lamps. Water requirements are minimized by 13,000 liters per month. Very high levels of IAQ maintained.

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Green Boulevard
Noida

Project Name: Green Boulevard
Developer: THE 3C COMPANY
Location: Plot No B - 9 A, Sector 62
City: Noida
Project Usage: IT & ITES Offices
Project Architect: Design & Development
Energy Consultant: EDS
Project Start: 2007 **Completion:** 2008
LEED Rating Status: Registered
LEED Rating Type: Core & Shell
LEED Rating Level Applied for: Gold
Built up Area (Sq ft): 900,000
Material Selection
Aerated concrete blocks used for construction. Low U factor glass glazing used.
Number of Occupants: 7,500
Project Highlights/ Special Green features:
Building has optimized life cycle economic performance. Anticipated 30% water saving and 33% reduction in HVAC running cost. 50% total energy savings projected.

Haworth Showroom
Pune

Project Name: Haworth Showroom
Developer: Haworth India Pvt. Ltd.
Location: Raisoni Industrial Park, Hinjewadi
City: Pune
Project Usage: Showroom & Office
Project Architect: Dandekar Associates
Project Start: 2005 **Completion:** 2006
LEED Rating Status: Applied for Registration
LEED Rating Type: Commercial Interiors
LEED Rating Level Applied for: Gold
Built up Area (Sq ft): 59,400
Material Selection:
Use of Non Toxic Materials for construction. 80% of construction material has been sourced regionally.
Number of Occupants: 34
Project Highlights/ Special Green features:
75% of the building has daylight and natural views. 40% reduction in water usage.

Nirlon Knowledge Park
Mumbai

Project Name: Nirlon Knowledge Park
Developer: Nirlon Limited
Location: Off Western Express Highway, Goregaon
City: Mumbai
Project Usage: IT Park
Project Architect: Venkataramanan Associates and KSL Netherlands
Energy Consultant: EDS
Project Start (Phase I): 2007 **Completion (Phase I):** 2008
LEED Rating Status: Registered
LEED Rating Type: Core & Shell
LEED Rating Level Applied for: Gold
Built up Area (Sq ft): 2,800,000
Material Selection:
Reuse of salvaged steel from the old buildings on site in the new buildings
Number of Occupants: 20,000 (approx.)
Project Highlights/ Special Green features:
Central utility hub with high efficiency HVAC systems. AHUs are equipped with energy recovery systems. Optimum building orientation. Designed with access to views and daylight.

Kalpataru Square
Mumbai

Project Name: Kalpataru Square
Developer: Kalpataru Properties
Location: Andheri (E)
City: Mumbai
Project Usage: Commercial Office
Project Architect: Hafeez Contractor
Energy Consultant: EDS
Project Start: 2007 **Completion:** 2008
LEED Rating Status: Registered
LEED Rating Type: Core & Shell
LEED Rating Level Applied for: Gold
Built up Area (Sq ft): 240,000
Material Selection:
20% of the construction material is sourced regionally and around 10% of the material has recycled content.
Number of Occupants: 1,800
Project Highlights/ Special Green features:
High efficiency water saving fixtures used. Light and CO_2 sensors installed in the building for energy saving.

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Godrej IT Park
Mumbai

Project Name: Godrej IT Park.
Developer: Godrej & Boyce Mfg. Co. Ltd.
Location: Pirojsha Nagar, LBS Marg, Vikhroli (W)
City: Mumbai
Project Usage: IT Park
Project Architect: D. V. Joshi & Co.
Energy Consultant: EDS
Project Start: 2008 **Completion:** 2009
LEED Rating Status: Applied for Registration
LEED Rating Type: Core & Shell
LEED Rating Level Applied for: Gold
Built up Area (Sq ft): 1,400,000
Material Selection:
Materials used are of high specifications and meeting Green Building standards.
Number of Occupants: 10,000 (approx.)
Project Highlights/ Special Green features:
100% water recycling. Partial use of solar energy.

Lodha i-think Techno Campus
Mumbai

Project Name: Lodha i-think Techno Campus
Developer: Lodha Group
Location: Kanjurmarg, off the Jogeshwari - Vikhroli Link Road
City: Mumbai
Project Usage: IT & Office Park
Project Architect: Kapadia Associates
Energy Consultant: EDS
Project Start: 2006 **Completion:** 2008
LEED Rating Status: Applied for Registration
LEED Rating Type: Core & Shell
LEED Rating Level Applied for: Silver
Built up Area (Sq ft): 850,000
Material Selection
20% of the building material is sourced regionally and 10% of construction material has recycled content.
Number of Occupants: 18,000 (approx.)
Project Highlights/ Special Green features:
Features a STP and RWH for water recycling and recharging.

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Lodha Excelus
Mumbai

Project Name: Lodha Excelus
Developer: Lodha Group
Location: Apollo Mills compound, MahaLaxmi
City: Mumbai
Project Usage: Corporate Offices
Project Architect: Kapadia Associates
Energy Consultant: EDS
Project Start: 2007 **Completion:** 2009
LEED Rating Status: Applied for Registration
LEED Rating Type: Core & Shell
LEED Rating Level Applied for: Certified Basic
Built up Area (Sq ft): 400,000 sq.ft office space & 200,000 sq.ft of podiums
Material Selection:
20% of the building material is regionally sourced and 10% of construction material has recycled content.
Number of Occupants: 4,000
Project Highlights/ Special Green features:
STP & RWH system for water recycling and recharge.

Reliance Energy -IT Park
Mumbai

Project Name: Reliance Energy-IT Park
Developer: Reliance Energy Ltd.
Location: Santacruz East
City: Mumbai
Project Usage: IT Park
Project Architect: Edifice Architects
Energy Consultant: EDS
Project Start: 2007 **Project Completion:** 2009
Green Rating Status: Registered
Rating Type: New Construction
LEED Rating Level Applied for: Platinum
Built up Area (Sq ft): 650,000
Material Selection:
Use of regional and recycled and environmental friendly materials.
Number of Occupants: 3,500
Project Highlights/ Special Green features:
Building management system ensures high quality indoor air for occupiers.

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Kesar Solitaire
Navi Mumbai

Project Name: Kesar Solitaire
Developer: Kesar Group
Location: Palm Beach road
City: Navi Mumbai
Project Usage: Corporate Offices
Project Architect: Soyuz Talib
Energy Consultant: Energy Network Incorporation
Project Start: 2007 **Project Completion:** 2009
LEED Rating Status: Registered
LEED Rating Type: New Construction
LEED Rating Level Applied for: Platinum
Built up Area (Sq ft): 185,000
Material Selection:
Maximum use of recycle materials. Use of Non VOC adhesive and sealants for interiors.
Number of Occupants: 3,700 (approx.)
Project Highlights/ Special Green features: Positioned as an Intelligent Building. Use of CO_2 censors. Use of smart cards in the building. Oxygen diffusers to be installed in the building.

IMTMA
International Exhibition Centre
Bangalore

Project Name: IMTMA, Bangalore International Exhibition Centre
Developer: IMTMA (Indian Machine Tool Manufacturers Association)
Location: Tumkur Road
City: Bangalore
Project Usage: Exhibition Centre & Conference Facility
Project Architect: Mistry Architects
Energy Consultant: CII GBC & EDS
Project Start: 2005 **Completion:** 2007
LEED Rating Status: Registered
LEED Rating Type: New Construction
LEED Rating Level Applied for: Silver
Built up Area (Sq ft): 773,900
Material Selection
Use of Fly ash and concrete mix along with materials available within 500 miles of site. Reuse of debris as landscape features.
Number of Occupants: 30 (10,000 number of occupants during events)
Project Highlights/ Special Green features:
Retained the contour of land. Extensive greening and transplanting of trees. An ozone free HVAC system with water air cooling in the exhibition centre.

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InterfaceFLOR
Bangalore

Project Name: InterfaceFLOR
Developer: InterfaceFLOR
Location: 'Pride Elite', No. 10, Museum Road
City: Bangalore
Project Usage: Office Corporate and Showroom space
Project Architect: DWP Interics
Energy Consultant: Green Footprints
Project Start: March 2007 **Completion:** June 2007
LEED Rating Status: Registered
LEED Rating Type: Commercial Interiors
LEED Rating Level Applied for: Gold
Built up Area (Sq ft): 4,265
Material Selection:
Use of locally sourced building materials and naturally available materials. Use of rapidly renewable materials in construction.
Number of Occupants: 20
Project Highlights/ Special Green features:
30% reduction in consumption of water in toilets. Use of natural lighting is maximized by gadgets like day light sensors.

HSBC
Hyderabad

Project Name: HSBC
Developer: Babu Khan
Location: Banjara Hills
City: Hyderabad
Project Usage: Office
Project Architect: In-house
Energy Consultant: In-house
Project Start: 2006 **Completion:** 2007
LEED Rating Status: Registered
LEED Rating Type: Existing Building
LEED Rating Level Applied for: Silver
Built up Area (Sq ft): 129,158
Material Selection
Locally available material was used in construction. Interiors furnished with low VOC 'Green' carpets.
Number of Occupants: 3,000
Project Highlights/ Special Green features:
Use of solar energy. Efficient energy management system.

Microsoft Corporate Office
Hyderabad

Project Name: Microsoft Corporate Office
Developer: Microsoft
Location: Manikonda Jagir Village, R. R. District
City: Hyderabad
Project Usage: Corporate Office Campus
Project Architect: RSP Architects
Project Start: 2006 **Completion:** 2007
LEED Rating Status: Applied for Registration
LEED Rating Type: New Construction
LEED Rating Level Applied for: Gold
Built up Area (Sq ft): 600,000
Material Selection:
About 60 % of the material is locally sourced and rapidly renewable materials used.
Number of Occupants: 2,350
Project Highlights/ Special Green features:
Anticipated 20% more energy efficient as compared to conventional building of same size.
Use of Solar Energy for Heating.

Rajiv Gandhi Hyderabad International Airport Passenger Terminal
Hyderabad

Project Name: Rajiv Gandhi International Airport Hyderabad (Passenger Terminal Building)
Developer: GMR Hyderabad International Airport Limited (GHIAL)
Location: Shamshabad
City: Hyderabad
Project Usage: Passenger Terminal for Airport
Project Architect: Integrated Design Associates (IDA, HK)
Energy Consultant: EDS & CII GBC
Project Start: 2005 **Completion:** 2008
LEED Rating Status: Registered
LEED Rating Type: New Construction
LEED Rating Level Applied for: Silver
Built up Area (Sq ft): 1,267,450
Material Selection:
Use of regional available materials. Fly ash blocks and double glazed glass used for construction.
Number of Occupants: 3,200 people per hour at peak capacity (projected)
Project Highlights/ Special Green features:
First airport in India to register for LEED Certification. Day light is maximized through the use of glazing and skylights. Innovative waste water technologies and storm water harvesting.

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TECCI Park
Chennai

Project Name: TECCI Park
Developer: Buhari Group
Location: Old Mahabalipuram Road, Karappakkam , Sholinganallur Village
City: Chennai
Project Usage: IT Park
Project Architect: Team 3
Energy Consultant: TTS
Project Start: 2006 **Completion:** 2007
LEED Rating Status: Registered
LEED Rating Type: New Construction
LEED Rating Level Applied for: Gold
Built up Area (Sq ft): 600,000
Material Selection:
High use of regional and recycled materials for construction. Fly ash used for construction. Low VOC sealants and adhesives used for interiors.
Number of Occupants: 6,000
Project Highlights/ Special Green features:
High performance pumps, BMS monitoring system adopted for all the equipment. Double glazing system for façade, and High Albedo coating over terrace.

RMZ Millenia Business Park
Chennai

Project Name: RMZ Millenia Business Park
Developer: RMZ Corporation
Location: Off Old Mahabalipuram Road
City: Chennai
Project Usage: Corporate Park
Project Architect: RSP Architects
Energy Consultant: EDS
Project Start: 2006 **Completion:** 2008
LEED Rating Status: Registered
LEED Rating Type: Core and Shell
LEED Rating Level Applied for: Gold
Built up Area (Sq ft): 2,600,000
Material Selection:
Use of construction materials with high level of recycled content. Low emitting construction materials are used along with Albedo finish for the roofing.
Number of Occupants: 15,000
Project Highlights/ Special Green features:
Combination of air and water cooled HVAC system. Demand Control Ventilation system for fresh air intake. Reuse of STP treated water. Water saving fixtures reduces requirements by 50%.

India Land Tech Park
Chennai

Project Name: India Land Tech Park
Developer: India Land and Properties Ltd.
Location: Ambattur Industrial Estate
City: Chennai
Project Usage: IT Park
Project Architect: Zaha Hadid
Energy Consultant: EDS
Project Start: 2006 **Completion:** 2008
LEED Rating Status: Registered
LEED Rating Type: Core & Shell
LEED Rating Level Applied for: Gold
Built up Area (Sq ft): 1,700,000 (Offices)
Material Selection:
Use of 20% regional material and 10 % recycled material for construction. Segregation and reuse of solid construction waste generated at site.
Number of Occupants: 20,000
Project Highlights/ Special Green features:
30 battery charging stations in the parking for electric cars. IAQ is 30% above the minimum rates required by ASHRAE standards.Temperature & humidity levels are maintained as per ASHRAE standards.

Project Name: Synthesis Business Park
Developer: Bengal Shrachi Housing Development Ltd.
Location: New Town, Rajarhat
City: Kolkata
Project Usage: Corporate Park
Project Architect: Karan Grover & Associates
Energy Consultant: TERI
Project Start: 2006 **Completion:** 2009
LEED Rating Status: Registered
LEED Rating Type: Core & Shell
LEED Rating Level Applied for: Platinum
Built up Area (Sq ft): 648,016
Material Selection:
30% recycled materials used in the building for construction.
Number of Occupants: 1,500
Project Highlights/ Special Green features:
Optimized day light in the interiors. 75% of the buildings face gardens. Orientation and passive systems minimize air-conditioning load. 100% waste water recycling.

Synthesis Business Park
Kolkata

Infinity Benchmark
Kolkata

Project Name: Infinity Benchmark
Developer: Infinity Infotech Parks Ltd.
Location: Salt Lake Electronic Complex, Sector V
City: Kolkata
Project Usage: IT Park, Commercial Offices & Retail
Project Architect: Agarwal and Agarwal
Energy Consultant: EDS
Project Start: 2005 **Completion:** 2007
LEED Rating Status: Registered
LEED Rating Type: Core & Shell
LEED Rating Level Applied for: Platinum
Built up Area (Sq ft): 560,000
Material Selection:
More than 40% recycled content used in the building construction.
Number of Occupants: 4,000
Project Highlights/ Special Green features:
100% waste water recycling, RWH for ground water recharge. Double skin AHUs with variable frequency drives used. Treated fresh air units with heat recovery wheels incorporated in HVAC system. High performance glass used which would lead to 10-20% energy saving and increased day light

Ecospace Business Park
Kolkata

Project Name: Ecospace Business Park
Developer: Ambuja Realty Development Limited & RMZ Corp
Location: New Town Rajarhat
City: Kolkata
Project Usage: IT, ITES & Business Park
Project Architect: RSP Architects, Planners & Engineers
Energy Consultant: EDS
Project Start: 2007 **Completion:** 2009
LEED Rating Status: Registered
LEED Rating Type: Core & Shell
LEED Rating Level Applied for: Platinum
Built up Area (Sq ft): 2,060,000
Material Selection:
85% material for construction is locally sourced and high use of rapidly renewable materials.
Number of Occupants: 16,450
Project Highlights/ Special Green features:
Solar energy for external illumination. Use of thermal insulation to reduce air conditioning load.

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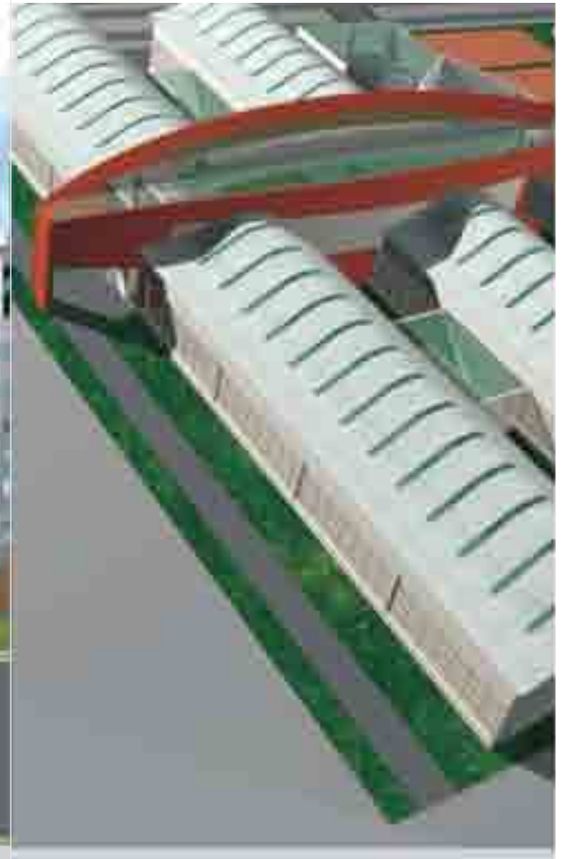

Minestone Green Diamond Factory
Navsari

Project Name: Minestone Green Diamond
Developer: Keen Diam
Location: P Dadanagar, Abrama Road
City: Navsari, Gujarat
Project Usage: Diamond processing and jewelry manufacturing unit
Project Architect: Karan Grover and Associates
Energy Consultant: TERI
Project Start: 2006 **Completion:** In progress
Green Rating Status: Registered
Rating Type: New Construction
LEED Rating Level Applied for: Gold
Built up Area (Sq ft): 48,757
Material Selection:
Use of rapidly renewable materials for construction. Low VOC adhesives, sealants and paints used for interiors. Certified composite wood products used.
Number of Occupants: 450
Project Highlights/ Special Green features:
Increased outdoor air ventilation rates and CO_2 monitoring for enhanced occupant comfort. 100% waste water treated at site.

ABN AMRO Bank
Ahmedabad

Project Name: ABN AMRO Bank
Developer: ABN AMRO
Location: Viva Complex, Opp. Parimal Garden, C G Road
City: Ahmedabad
Project Usage: Retail Bank Branch and Office
Project Architect: Karan Grover and Associates
Project Start: Feb 2007 **Completion:** Aug 2007
LEED Rating Status: Registered
LEED Rating Type: Commercial Interiors
LEED Rating Level Applied for: Platinum
Built up Area (Sq ft): 7,815
Material Selection:
Materials used with high recycled content. Use of rapidly renewable materials. Use of low VOC adhesives and sealants, paints, carpet and composite wood products to reduce indoor air contaminants.
Number of Occupants: 165
Project Highlights/ Special Green features:
High efficiency water fixtures resulting in water use reduction by over 30%. Environment friendly refrigerant used, which reduces ozone depletion .Reuse of existing building components such as walls, columns, flooring etc. to reduce waste and environmental impacts of new construction.

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TERI RETREAT
Gurgaon

Project Name: TERI RETREAT
Developer: TERI
Location: Gual Pahri
City: Gurgaon
Project Usage: Institution
Project Architect: Sanjay Prakash
Energy Consultant: TERI
Project Start: 1997 **Completion:** 2000
Green Rating Status: Not formally rated as a Green Building. But it was among the first developments in India to demonstrate the sustainable implementation of green practices.
Built up Area (Sq ft): 32,291
Material Selection:
100% regional material used in construction. Roof insulation using vermiculite concrete (a porous material mixed with concrete to form a homogenous mix) topped with china mosaic for heat reflection.
Number of Occupants: 60
Project Highlights/ Special Green features:
Innovative day lighting by means of skylights. Assisted cooling by air washer in dry summer and dehumidifer in monsoon. South portion of structure partially sunk into the ground to reduce heat gain.

Terminology

Aerated Concrete Blocks: lower density, light weight concrete block.
Albedo Finish: reflective roof paint to reduce Urban Heat Island effect.
Ammonia Absorption Chillers: chillers that use clean refrigerant (ammonia), free of CFCs.
Automated Air Conditioning: maintains the manually selected interior temperature at the desired level while taking the sun's position into account.
Carbon Credits: is a tradable permit scheme with creates a market for reducing Green House Gas emissions by giving a monetary value to the cost of polluting the air.
CO_2 Sensors: is an instrument for the measurement of carbon dioxide gas in the interiors.
Clean Development Mechanism (CDM): an arrangement under the Kyoto Protocol allowing industrialised countries with a GHG reduction commitment to invest in projects that reduce emissions in developing countries as an alternative to more expensive emission reductions in their own countries.
Demand Control Ventilation system (DCV): makes it possible to maintain proper ventilation and improve air quality while saving energy, the amount of air ventilated is in accordance to the occupancy.
Dual Flush System (DFS): to affect a partial or mini-flush of the toilet to carry away liquid wastes by partially opening of the main valve and different system for solid waste, helps in reducing water consumption.
Eco-Glass: a glass without lead or arsenic having very low emission and no colour.
Embodied Energy: amount of energy consumed in the extraction, manufacture, transport, construction and assembly on site of building materials. It will also include the energy costs of disposal of waste or surplus materials.
Fly Ash Blocks: blocks of size 290x185x125mm made up of Fly ash, lime, gypsum and coarse sand or Fly ash, cement and coarse sand
Global Warming: a gradual warming of the Earth's atmosphere reportedly caused by the burning of fossil fuels and industrial pollutants.
Green Gross Domestic Product (GGDP): is an index of economic growth with the environmental consequences of that growth factored in
Heat Recovery Wheels: provides a way of recovering total (sensible as well as latent) air conditioning energy in hot, humid climates.
Indoor Air Quality (IAQ): deals with the content of interior air that could affect health and comfort of building occupants.
Joint Implementation (JI): a programme under the Kyoto Protocol that allows industrialized countries to meet part of their required cuts in greenhouse-gas emissions by paying for projects that reduce emissions in other industrialized countries.
Light Sensors: measures the surrounding light conditions with the aid of a photo cell and switches on the low-beam headlights automatically at dusk.
Light Transmission Coefficient: a measure of amount of light that passes through a surface
Operational Energy: the energy consumed in heating, cooling, lighting and powering equipment and appliances in buildings to make it function.
Passive Down Draft Evaporative Cooling (PDEC) System: in this system ambient hot-dry air is trapped, cooled by evaporation of water and then introduced in the building.
Regionally Available: according to LEED the material available within 500 miles of the site.
Shading Co-efficient: a measure of the ability of a window or skylight to transmit solar heat, relative to that ability for 1/8-inch clear, double-strength, single glass.
Solar Heat Gain Coefficient (SHGC): measures how well a window blocks heat from sunlight. The lower a window's SHGC, the less solar heat it transmits.
Thermal Insulation: refers to materials used to reduce the rate of heat transfer or the methods and processes used to reduce heat transfer
Urban Heat Island Effect (UHI): area which is significantly warmer than its surroundings due to modification of the land surface by urban development and waste heat generated by energy usage.
U Value: a measure of the heat flow through a glass (loss or gain) by conduction and convection driven by the temperature difference across the glass.

Abbreviations

AAC: Autoclaved Aerated Concrete
AHU: Air Handling Unit
ASHRAE: American Society of Heating, Refrigerating and Air Conditioning Engineers
BREEAM: Building Research Establishment Environmental Assessment Method
BMS: Building Management System
C & S: Core & Shell
CASBEE: Comprehensive Assessment System for Building Environmental Efficiency
CDM: Clean Development Mechanism of the Kyoto Protocol
CFC: Chloro Fluoro Compounds
CII: Confederation of Indian Industries
CFL: Compact Fluorescent Lamp
CH_4: Methane
CO_2 : Carbon di Oxide
COP: Coefficients-of-Performance
EB: Existing Building
EEC: European Economic Council
FSC: Forest Stewardship Council
GDP: Gross Domestic Product
GHG: Green House Gases
GRIHA: Green Rating for Integrated Habitat Assessment
HFC: Hydro Fluoro Carbon
HVAC: Heating Ventilation and Air Conditioning
IAQ: Indoor Air Quality
IEQ: Indoor Environment Quality
IGBC: Indian Green Building Council
KVA: Kilo Volt Ampere
KW: kilo Watt
kWp: kilo Watt peak
LEED: Leadership in Energy and Environmental Design
MDI: Mean Daily Intake
N_2O: Nitrous Oxide
NC: New Construction
NCR: National Capital Region
PFC: Perfluoro Carbon
RWH: Rain Water Harvesting
SF_6: Sulfur Hexafluoride
STP: Sewage Treatment Plan
TERI: The Energy Research Institute
UNEP: United Nations Environment Program
UNFCCC: United Nations Framework Convention on Climate Change
USGBC: United States Green Building Council
VOC: Volatile Organic Compounds
VFD: Variable Frequency Drive

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