



IGBC Green Homes



IGBC Green Homes Rating System Ver 1.0

Abridged Reference Guide

April 2009



Confederation of Indian Industry
CII-Sohrabji Godrej Green Business Centre



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Acknowledgements

The IGBC Green Homes Abridged Reference Guide has been made possible through the efforts of many dedicated volunteers, staff members and others in the IGBC community. The Reference Guide was developed by the IGBC Green Homes Core Committee and many other members. We extend our deepest gratitude to all these members. Tremendous inputs also came in at the 'IGBC Green Homes' launch on 02 May 2008, which had an overwhelming response from stakeholders all over the country. IGBC places on record its sincere thanks to the participating companies and individuals who enthusiastically volunteered during the break-out sessions.

Our special thanks to the following members for their participation and contributions in developing the rating programme:

- Mr Sharukh Mistry, Chairman, IGBC - Green Homes Steering Committee & Director, Mistry Architects, Bangalore
- Dr Prem C Jain, Chairman, Indian Green Building Council & Chairman and Managing Director, Spectral Services Consultants Private Limited, Noida
- Mr Sanjay Seth, Energy Economist, Bureau of Energy of Efficiency, New Delhi
- Mr V Madhwa Raja, Superintending Engineer, HMDA, Hyderabad
- Mr Arjun Valluri, Chairman, Surya Ray, Hyderabad
- Mr Ankoor Sanghvi, Architect, Ankoor Sanghvi Architects, Rajkot
- Dr Archana Walia, Programme Management Specialist, USAID, New Delhi
- Mr Chandrashekar Hariharan, CEO, Biodiversity Conservation [India] Limited, Bangalore
- Mr C.N. Raghavendran, Chairman, IGBC-Chennai Chapter & Partner, CRN Architects & Engineers, Chennai
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- Mr Rajan Venkateswaran, Chief Architect, Larsen & Toubro Ltd, Chennai
- Mr Rumi P Engineer, Dy. General Manager, Godrej & Boyce Mfg.Co. Ltd, Mumbai
- Mr R Sri Kumar, Additional Director General of Police, Chairman and Managing Director, Karnataka State Police Housing Corporation Limited, Bangalore
- Mr Sanjay Chawla, Chairman, IGBC - Hyderabad Chapter, Business Head (Commercial and SEZ), Maytas Properties Ltd, Hyderabad
- Ms Suhasini Ayer, Architect, Auroville Design Consultants, Pondicherry
- Mr Vidur Bharadwaj, Chairman, IGBC - Delhi Chapter & Managing Partner, Design & Development Consultants, New Delhi
- Dr Vishal Garg, Associate Professor, Centre for IT in Building Science, International Institute of Information Technology, Hyderabad
- Mr Zubin Irani, Managing Director, Carrier Airconditioning & Refrigeration Limited, Gurgaon

Our sincere thanks are due to the following organisations for their participation in the programme:

- Adapt Technologies & Consultancy Services India Pvt Ltd, Hyderabad
- ADC KRONE ,Bangalore
- Advance Cooling Towers Pvt Ltd, Mumbai
- AFRA Consultancy, Hyderabad
- Ala Inc, Chennai
- Aliens Developers Private Limited, Hyderabad
- Altimate Envirocare Asia Pvt Ltd, Mumbai
- Aluplast India Pvt. Ltd, New Delhi
- Ankoor Sanghvi Architects, Rajkot
- Armstrong World Ind. India Pvt Ltd, Bangalore
- Architecture Autonomous, Goa
- Architect Hafeez Contractor, Mumbai
- Asahi India Glass Limited (AIS),Hyderabad
- Auroville Design Consultants, Pondicherry
- Bamboo Finance, Switzerland
- Blue Run Ventures, New Delhi
- Blue Star Limited, Hyderabad
- Brigade Group, Bangalore
- Buhari Holdings Private Limited, Chennai
- Bureau of Energy Efficiency, New Delhi
- Conserve Consultants Pvt. Ltd, Chennai
- Carrier Airconditioning & Refrigeration Limited, Gurgaon
- CEPT University, Ahmedabad
- CRN Architects & Engineers, Chennai
- CSR Estates, Hyderabad
- Design & Development Consultants, New Delhi
- DLF Services Limited, Gurgaon
- DLF Utilities Pvt Ltd, Gurgaon
- Dow Chemical International Pvt Ltd, Mumbai
- DSL Infrastructure & Space Developers, Hyderabad
- Dynacraft Air Controls , Mumbai
- Emaar MGF Land Limited, New Delhi
- KRG Rainwater Foundation, Chennai
- KR VIA, Mumbai
- L&T Infocity Limited, Hyderabad
- Larsen & Toubro Limited, Chennai
- Lodha Group of Companies, Mumbai
- Mahindra Lifespace Developers Ltd, Mumbai
- Maithel & Associates Architects Pvt. Ltd, Jaipur
- Malaviya National Institute of Technology, Jaipur
- Manasaram Architects, Bangalore
- Master Consultancy & Productivity Pvt Ltd, Hyderabad
- Maxvel Technologies Pvt Ltd, Mumbai
- Maytas Properties Ltd, Hyderabad
- Mistry Architects, Bangalore
- Mozaic Design Combine, Goa
- Nippon Paint (India) Pvt Ltd, Hyderabad
- Oceanus Infrastructure (P) Ltd, Bangalore
- Olympia Tech Park, Chennai
- Orbit Group, Kolkata
- Owens Corning Enterprise (India) Pvt Ltd, Mumbai
- Parsvnath Developers Ltd, New Delhi
- Potential Service Consultants (P) Ltd, Bangalore
- Prasad Escendo Consultancy, Hyderabad
- Rajarathnam Constructions (P) Ltd, Chennai
- Rajco Metal Industries Pvt Ltd, Mumbai
- RITES Ltd, Gurgaon
- Roads and Buildings Dept., Govt., AP, Hyderabad
- S V Properties, Hyderabad
- S&S Constructions (India) Pvt. Ltd, Hyderabad
- Sai Construction Corporation, Hyderabad
- Saint - Gobain Glass India Ltd, Chennai
- Sangam Project Consultants, Mumbai
- Satya Vani Project & Consultants Pvt. Ltd, Hyderabad

- EN3 Consulting, Chennai
- Energy Conservation Mission, Hyderabad
- Everest Industries Ltd, Gopalapuram Tamilnadu
- ETA Engineering Private Limited, Hyderabad
- Eximcorp India Pvt Ltd, New Delhi
- Federation of Engineering Institutions of South and Central Asia, Hyderabad
- Forbo Flooring India, New De lhi
- Forum (FBH), Hyderabad
- Genesis Planner (Pvt) Ltd, Mumbai
- Gherzi Eastern Limited, Mumbai
- Ghosh, Bose & Associates, Kolkata
- GMR Hyderabad Intl. Ltd, Hyderabad
- Godrej & Boyce Mfg.Co.Ltd, Mumbai
- Godrej Properties, Mumbai
- Greentech Knowledge Solutions (P) Ltd, New Delhi
- Green Tek Indika (GTI), Hyderabad
- Hindustan Aeronautics Ltd, Hyderabad
- Honeywell, Chennai
- Indu Projects Limited, Hyderabad
- Infinity Infotech Parks Ltd, Kolkata
- Infinity Township Pvt. Ltd, Hyderabad
- Infosys BPO Limited, Bangalore
- Interface Flor India Pvt Ltd, Hyderabad
- International Institute of Information Technology, Hyderabad
- JDS Architects, Bangalore
- Johnson Controls, Mumbai
- Jones Lang LaSalle Meghraj, Gurgaon
- Kalpataru Ltd, Mumbai
- Karnataka State Police Housing Corporation Limited, Bangalore
- Khivraj Tech Park Pvt Ltd, Chennai
- Kirloskar Brothers Ltd, Coimbatore
- K Raheja Corp, Mumbai
- Schneider Electric India Pvt. Ltd , New Delhi
- Sequoia Capital India Advisors Pvt. Ltd, Bangalore
- Sevcon (India) Pvt Ltd, New Delhi
- SEW Constructions Ltd, Hyderabad
- Shapoorji Pallonji & Company Limited, Mumbai
- Shika Management Services, Hyderabad
- Shilpa Architects, Chennai
- SMR Builders Pvt Ltd, Hyderabad
- SMR Live Spaces, Hyderabad
- Shree Ram Urban Infrastructure Ltd, Mumbai
- Spectral Services Consultants Private Limited, Noida
- Srinivasa Shipping & Property Development Ltd, Chennai
- Studio Decode, Bangalore
- Suchirindia Developers Pvt Ltd, Hyderabad
- Sukan Automatics Pvt. Ltd, Hyderabad
- Surbana International Consultants (India) Pvt Ltd, Hyderabad
- Supreme Petrochem Ltd, Mumbai
- Tameer Consulting Associates, Hyderabad
- Tata Housing Development Co.Ltd, Bangalore
- Team Labs & Consultants, Jaipur
- Terra Verde Architects, Hyderabad
- The Indian Institute of Architects, New Delhi
- Total Environment, Bangalore
- TSI Ventures, Bangalore
- UNUS Architects and Interior Designers, Hyderabad
- U P Twiga Fiberglass Ltd, Hyderabad
- USAID, New Delhi
- Vida Calma Homes Private Limited, Goa
- Virtuoso Consultants, Hyderabad
- Voltas Limited, Hyderabad
- V Raheja Design Construction, Bangalore



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Foreword from the IGBC

India is witnessing tremendous growth in infrastructure and construction development. The construction industry in India is one of the largest economic activities and is growing at an average rate of 9.5% as compared to the global average of 5%. As the sector is growing rapidly, preserving the environment poses a host of challenges. To enable the construction industry to be environmentally sensitive, CII-Sohrabji Godrej Green Business Centre has established the Indian Green Building Council (IGBC). IGBC is a consensus driven not-for-profit council representing the building industry, consisting of more than 500 committed members. The council encourages builders, developers and owners to build green to enhance the economic and environmental performance of buildings.

The Green Building Movement in India has been spearheaded by IGBC since 2001, by creating national awareness. The council's activities have enabled a market transformation with regard to Green Building concepts, materials and technologies.

IGBC continuously works to provide tools that facilitate the adoption of green building practices in India. The development of IGBC Green Homes Rating System is another important step in this direction.

IGBC Membership

IGBC draws its strength from its members who have been partners in facilitating the Green Building Movement in India. The local chapters led by individual champions and committed members have been instrumental in reaching out the vision of the IGBC at the regional levels. IGBC is today seen as a leader in spearheading the Indian green building movement. The council is member driven and consensus based.

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I. Introduction

The housing sector in India is growing at a rapid pace and contributing immensely to the growth of the economy. This augurs well for the country and now there is an imminent need to introduce green concepts and techniques in this sector, which can aid growth in a sustainable manner.

Green concepts and techniques in the residential sector can help address national issues like handling of consumer waste, water efficiency, reduction in fossil fuel use in commuting, energy efficiency and conserving natural resources. Most importantly, these concepts can enhance occupant health, happiness and wellbeing.

Against this background, Indian Green Building Council (IGBC) has launched 'IGBC Green Homes Rating System' to address the national priorities. By applying IGBC Green Homes criteria, homes which are sustainable over the life cycle of the building can be constructed. This rating programme is a tool which enables the designer to apply green concepts and criteria, so as to reduce the environmental impacts, which are measurable. The programme covers methodologies to cover diverse climatic zones and changing lifestyles.

IGBC Green Homes is the first rating programme developed in India, exclusively for the residential sector. It is based on accepted energy and environmental principles and strikes a balance between known established practices and emerging concepts. The system is designed to be comprehensive in scope, yet simple in operation.

IGBC has set up the Green Homes Core Committee to develop the rating programme. This committee comprised of key stakeholders including architects, developers, home owners, manufacturers, institutions and industry representatives. The committee, with a diverse background and knowledge has enriched the rating system both in its content and process.

II. Benefits of Green Homes

Green homes can have tremendous benefits, both tangible and intangible. The most tangible benefits are the reduction in water and energy consumption right from day one of occupancy. The energy savings could range from 20 – 30 % and water savings around 30 – 50%. Intangible benefits of Green homes include enhanced air quality, excellent daylighting, health & wellbeing of the occupants, safety benefits and conservation of scarce national resources. Green Homes rating system can also enhance marketability of a project.

III. National Priorities Addressed in the Rating System

The Green Homes Rating System addresses the most important National priorities which include water conservation, handling of consumer waste, energy conservation, conservation of resources like wood and lesser dependence on usage of virgin materials.

Water Efficiency:

Most of the Asian countries are water stressed and in countries like India the water table has reduced drastically over the last decade. Green Homes encourages use of water in a self - sustainable manner through reducing, recycling and reusing strategies. By adopting this rating programme green homes can save potable water to an extent of 30 – 50%.

Handling of House -hold Waste:

Handling of waste in residential buildings is extremely difficult as most of the waste generated is not segregated at source and has a high probability of going to land fills. This continues to be a challenge to the municipalities which needs to be addressed. IGBC intends to address this by encouraging green homes to segregate the house hold waste.

Energy Efficiency:

The residential sector is a large consumer of electrical energy. IGBC Green Homes can reduce energy consumption through energy efficient lighting, air conditioning systems, motors, pumps etc., The rating system encourages green homes which select and use BEE labeled equipment and appliances. The energy savings that can be realised by adopting this rating programme can be to the tune of 20 – 30%.

Reduced Use of Fossil Fuels:

Fossil fuel is a slowly depleting resource, world over. The use of fossil fuel for transportation has been a major source of pollution. The rating system encourages the use of alternate fuels for transportation and captive power generation.

Reduced Dependency on Virgin Materials:

The rating system encourages projects to use recycled & reused material and discourages the use of virgin wood thereby addressing environmental impacts associated with extraction and processing of virgin materials. Reduced usage of virgin wood is also encouraged.

Health and Well-being of Occupants:

Health and well-being of occupants is the most important aspect of Green Homes. IGBC Green Homes Rating System ensures minimum performance of daylighting and ventilation aspects which are critical in a home. The rating system recognises measures to minimise the indoor air pollutants.

IV. IGBC Green Homes Rating System

IGBC has set up the Green Homes Core Committee to focus on residential sector. **The committee includes architects, realtors, experts on building science and industry representatives.** The varied experience and professions of the committee members brings in a holistic perspective in the process of developing the rating programme.

A. Evolution of the Rating System

IGBC, in its endeavor to extend green building concepts to all building types envisioned a rating programme for homes in December 2007. A core committee was formed under the leadership of Ar Sharukh Mistry, Mistry Architects, Bangalore. The committee drafted the pilot version of the programme which was launched in May 2008. The rating system is designed to suit Indian climate and construction practices.

About 220 members representing 120 organisations participated in the pilot programme. 52 projects with 41.5 million sq.ft of building footprint area from various climatic zones registered under the pilot rating programme.

After one year of implementation, feedback from pilot projects were reviewed by the core committee and the suggestions have been incorporated in the final rating system launched in March 2009.

The rating system will be subjected to a review by the core committee, every 6 months, to ensure that it is updated and contemporary.

B. Features of IGBC Green Homes

IGBC Green Homes Rating System is a voluntary and consensus based programme. The rating system has been developed based on materials and technologies that are presently available. The objective of IGBC Green Homes is to facilitate the creation of energy efficient, water efficient, healthy, comfortable and environmentally friendly houses.

The rating system evaluates certain credit points using a prescriptive approach and other credits on a performance based approach. The rating system is evolved so as to be comprehensive and at the same time user-friendly. The programme is fundamentally designed to address national priorities and quality of life for occupants.

The rating programme uses well accepted national standards and wherever local or national standards are not available, appropriate international benchmarks have been considered.

C. Scope of IGBC Green Homes

IGBC Green Homes Rating System is a measurement system designed for rating new residential buildings which broadly include two construction types:

1. Dwellings where interiors are part of the project.
2. Dwellings where interiors are not part of the project

*Interiors include but not limited to refrigerators, internal lighting, furniture, carpets, etc.

Based on the scope of work, projects can choose any of the above options.

The following categories of dwelling can apply for rating:

- ✓ Individual homes
- ✓ Gated communities
- ✓ High rise residential apartments
- ✓ Existing residential buildings
- ✓ Residential buildings with major renovation
- ✓ Hostels, Service apartments, Resorts, Motels and Guest houses

In general all dwelling spaces which can meet the mandatory requirements and minimum points can apply. Various levels of green building certification are awarded based on the total points earned.

D. The Future of IGBC Green Homes

Many new green building materials, equipment and technologies are being introduced in the market. With continuous up-gradation and introduction of new green technologies and products, it is important that the rating programme also keeps pace with current standards and technologies. Therefore, the rating programme will also undergo periodic revisions to incorporate the latest advances and changes. It is important to note that project teams applying for IGBC Green Homes should register their projects with the latest version of the rating system. During the course of implementation, projects have an option to transit to the latest version of the rating system.

IGBC will highlight new developments on its website on a continuous basis at www.igbc.in

V. IGBC Green Homes Process

The guidelines detailed under each credit enable the design and construction of green homes of all sizes and types. IGBC Green Homes addresses green features under the following categories:

- ✓ Site Selection and Planning
- ✓ Water Efficiency
- ✓ Energy Efficiency
- ✓ Materials
- ✓ Indoor Environmental Quality
- ✓ Innovation & Design Process

Different levels of green building certification are awarded based on the total credits earned. However, every Green Home should meet certain mandatory requirements, which are non-negotiable.

The various levels of rating awarded are:

- ✓ 'Certified' to recognise best practices
- ✓ 'Silver' to recognise outstanding performance
- ✓ 'Gold' to recognise national excellence
- ✓ 'Platinum' to recognise global leadership

a. When to use IGBC Green Homes

IGBC Green Homes is designed primarily for new residential buildings. However, it is also applicable for existing buildings redesigned in accordance with the IGBC Green Homes criteria.

The project team can evaluate all the possible points to apply under the rating system using a suitable checklist. The project can apply for IGBC Green Homes certification if it can meet all mandatory requirements and achieve the minimum required points.

b. IGBC Green Homes Registration

Project teams interested in IGBC Green Homes Certification for their project must first register with IGBC. Projects can be registered on IGBC website (www.igbc.in) under 'IGBC Green Homes'. The website includes information on registration fee for IGBC member companies as well as non-members. Registration is the initial step which helps establish contact with IGBC and provides access to the required documents, templates, important communications and other necessary information.

Consult the web site for important details about IGBC Green Homes application as well as the certification review process, schedule and fee.

c. IGBC Green Homes Certification Levels

The rating system caters to projects like individual houses, apartments, motels, resorts, hostels, etc., Amongst the different types, projects are broadly classified into two categories:

- ✓ Projects where interiors are part of scope of work
- ✓ Projects where interiors are not part of the scope of work

Interiors include but not limited to materials like interior finishes & furniture and appliances like refrigerators, fans, lights etc., As a general guideline, individual owners can use the checklist ‘Projects with Interiors’ and developers & builders can use the checklist titled ‘Projects without Interiors’. However, if the context varies, projects can adopt the one which is the closest fit. The threshold criteria for certification levels are as under:

Certification Level	Points for projects with interiors	Points for projects without interiors
Certified	32 – 39	30 – 36
Silver	40 – 47	37 – 44
Gold	48 – 59	45 – 55
Platinum	60 – 80	56 – 75

d. Documentation

The project team is expected to provide supporting documents at each stage of submission for all the mandatory requirements and the credits attempted. Supporting documents are those which provide specific proof of meeting the required performance level, such as, specifications, drawings (in native format only), cutsheets, manufacturer’s literature, purchase invoices and other documents. These details are mentioned in this guide, under each credit / mandatory requirement.

Documentation is submitted in two phases – design submittals and construction submittals:

- ✓ The design submission involves those credits which can be evaluated at the design stage. The reference guide provides the list of design and construction phase credits. After the design submission, review is done by third party assessors and review comments would be provided within 40 working days.
- ✓ The next phase involves submission of clarifications to design queries and construction document submittal. The construction document is submitted on completion of the project. This review will also be provided within 40 working days, after which the rating is awarded.

It is important to note that the credits earned at the design review are only considered as anticipated and are not awarded until the final construction documents are submitted along with additional documents showing implementation of design features. If there are changes for any design credit anticipated, these changes need to be documented and resubmitted for the construction review phase.

IGBC will recognise homes that achieve one of the rating levels with a formal letter of certification and a mountable plaque.

e. Precertification

Projects by developers can register for Precertification. This is an option provided for projects aspiring to get precertified at the design stage. The documentation submitted for precertification must detail the project design features which will be implemented. The rating awarded under precertification is based on the project's intention to conform to the requirements of Green Homes Rating system. It is important to note that the precertification rating awarded need not necessarily correspond to the final certification.

Precertified projects are required to provide the status of the project to IGBC, in relation to the rating, once in every six months until the award of the final rating.

Precertification gives the owner/developer a unique advantage to market the project to potential buyers.

Those projects which seek precertification need to submit the following documentation:

- For each credit, a narrative on how the project would meet the goal
- Design calculations, wherever appropriate
- Drawings (in native format only) as appropriate
- Filled in templates wherever applicable

IGBC would take 40 working days to review the first set of precertification documents. On receiving the clarifications posed in the first review, IGBC would take another 40 working days to award the precertification.

A certificate and a letter are provided to projects on precertification.

f. Credit Interpretation Ruling

In some instances the design team can face certain challenges in applying or interpreting a mandatory requirement or a credit. It can also happen in cases where the project can opt to achieve the same goal through a different compliance route.

To resolve this IGBC uses the process of 'Credit Interpretation Ruling' (CIR) to ensure that rulings are consistent and applicable to other projects as well.

The following are the steps to be followed in case the project team faces a problem:

- ✓ Consult the Reference Guide for description of the credit goal, compliance options and calculations.
- ✓ Review the goal of the credit or mandatory requirement and self-evaluate whether the project satisfies the goal.
- ✓ Review the Credit Interpretation web page for previous CIR on the relevant credit or mandatory requirement. All projects registered under IGBC Green Homes will have access to this page.
- ✓ If a similar CIR has not been addressed or does not answer the question sufficiently, submit a credit interpretation request. Only registered projects are eligible to post CIRs. Two CIRs are answered without levying any fee and for any CIR beyond the first two CIRs, a fee is levied.

g. Appeal

Generally credits get denied due to misinterpretation of the goal. On receipt of the final review, the project team has the option to appeal to IGBC for reassessment of denied credits or mandatory requirements. The documentation for the mandatory requirements or credits seeking appeal may be resubmitted to IGBC along with necessary fee. IGBC will take 40 working days to review such documentation. These submissions would be reviewed by an assessor not involved in the earlier assessments. Documentation for appeals should include the following

- i. Documentation submitted for design submission
- ii. Documentation submitted for construction submission
- iii. Clarifications along with necessary drawings and calculations

VI. Fee

Certification fee details can be found on IGBC website.

VII. Updates and Addenda

This is the first version of IGBC Green Homes Abridged Reference Guide. As the rating system continues to improve and evolve, updates and addenda to the reference guide will be made available through the website. These additions will be incorporated in the next version of the rating system.

Checklist for Green Homes		Points Available	
		Projects with Interiors	Projects without Interiors
Site Selection and Planning			
Mandatory Requirement 1	Local Regulations	Required	Required
Mandatory Requirement 2	Soil Erosion	Required	Required
Site Credit 1.0	Basic Amenities	1	1
Site Credit 2.0	Natural Topography or Landscape : 15%, 25%	2	2
Site Credit 3.0	Heat Island Effect - Roof : 50%, 75%	2	2
Site Credit 4.0	Parking Facilities for Visitors	1	1
Site Credit 5.0	Electric charging Facility for Vehicles	1	1
Site Credit 6.0	Design for Differently Abled	1	1
Site Credit 7.0	Green Home Guidelines - Design & Post Occupancy	NA	1
		8	9
Water Efficiency			
Mandatory Requirement 1	Rainwater Harvesting, 50%	Required	Required
Mandatory Requirement 2	Water Efficient Fixtures	Required	Required
Water Credit 1.0	Turf Design : 20%, 40%	2	2
Water Credit 2.0	Drought Tolerant Species : 25%	1	1
Water Credit 3.0	Management of Irrigation Systems	2	2
Water Credit 4.0	Rainwater Harvesting : 75%,95%	2	2
Water Credit 5.0	Grey Water Treatment : 50%, 75%, 95%	3	3
Water Credit 6.0	Treated Grey Water for Landscaping : 50%, 75%, 95%	3	3
Water Credit 7.0	Treated Grey Water for Flushing : 50%, 75%, 95%	3	3
Water Credit 8.0	Water Efficient Fixtures: 20%, 30%	3	3
Water Credit 9.0	Water Metering	1	1
		20	20
Energy Efficiency			
Mandatory Requirement 1	CFC Free Equipment	Required	Required
Energy Credit 1.0	Energy Performance	10	10
Energy Credit 2.0	Energy Metering	1	1
Energy Credit 3.0	Refrigerators	1	NA
Energy Credit 4.0	Solar Water Heating Systems : 50%, 75%, 95%	3	3
Energy Credit 5.0	Captive Power Generation	1	1
Energy Credit 6.0	On-site Renewable Energy : 2.5%, 5.0%, 7.5%, 10%	4	4
Energy Credit 7.0	Efficient luminaries & Lighting power density : 20%	1	1
Energy Credit 8.0	Energy Saving Measures in Other Appliances & Equipment	1	1
		22	21

Materials			
Mandatory Requirement 1	Separation of Waste	Required	Required
Material Credit 1.0	Waste Reduction During Construction : 75%	1	1
Material Credit 2.0	Organic Waste Management, Post Occupancy : 50%, 95%	2	2
Material Credit 3.0	Materials with Recycled Content : 10%, 20%	2	2
Material Credit 4.0	Rapidly Renewable Materials : 2.5%, 5%	2	1
Materials Credit 5.0	Local Materials : 50%, 75%	2	2
Material Credit 6.0	Reuse of Salvaged Materials : 2.5%, 5%	2	2
Material Credit 7.0	Certified Wood Based Materials and Furniture : 50%, 75%	2	2
		13	12
Indoor Environmental Quality			
Mandatory Requirement 1	Tobacco Smoke Control	Required	Required
Mandatory Requirement 2	Daylighting : 50%	Required	Required
Mandatory Requirement 3	Fresh Air Ventilation	Required	Required
IEQ Credit 1.0	Exhaust Systems	2	NA
IEQ Credit 2.0	Enhanced Fresh Air Ventilation : 30%	2	2
IEQ Credit 3.0	Low VOC Materials	2	2
IEQ Credit 4.0	Carpets : 5%	1	NA
IEQ Credit 5.0	Building Flush Out	1	NA
IEQ Credit 6.0	Daylighting : 75%, 85%, 95%	3	3
IEQ Credit 7.0	Cross Ventilation	2	2
		13	9
Innovation and Design Process			
INN Credit 1.1	Innovation and Design Process	1	1
INN Credit 1.2	Innovation and Design Process	1	1
INN Credit 1.3	Innovation and Design Process	1	1
INN Credit 2.0	IGBC AP	1	1
		4	4
Total		80	75

IGBC Green Homes Certification Levels

Rating	Points	
	Projects with Interiors	Projects without Interiors
Certified	32 – 39	30 – 36
Silver	40 – 47	37 – 44
Gold	48 – 59	45 – 55
Platinum	60 – 80	56 – 75

Site Selection and Planning

Local Regulations

Construction Submittal

Mandatory Requirement 1

Goal:

To ensure that the building complies with the required statutory regulatory codes.

Compliance Options:

The following measures need to be ensured:

- Approval of the plan from the competent Government authority
- Fit for occupancy document from the competent Government authority

Documentation Required:

Provide an approved plan and / or fit for occupancy documents obtained from the competent Government authority.

Provide photographs / as-built drawings of the completed building.

Approach and Methodologies:

Survey the statutory requirements in the area that the building is constructed. Ensure that these requirements are incorporated at the design stage.

Soil Erosion

Construction Submittal

Mandatory Requirement 2

Goal:

To control soil erosion and thereby reduce negative impacts to the site.

Compliance Options:

Adopt the following measures:

- ✓ Ensure erosion control measures that conform to the best management practices highlighted in the National Building Code (NBC) of India.
- ✓ Ensure that topsoil is stockpiled for reuse later.
- ✓ Develop appropriate measures to address soil erosion, post occupancy.

Documentation Required:

Provide photographs to show stockpiling of topsoil. Submit a description on the measures implemented / provide the erosion control plan adopted. Submit a post occupancy erosion control plan.

Approach and Methodologies:

Evolve strategies to stockpile top soil and reuse later for landscaping purpose or stockpiled soil can be donated to other sites for landscaping purpose.

Consider adopting measures such as temporary and permanent seeding, mulching, earth dikes, silt fencing, sediment traps, and sediment basins as appropriate.

Open areas can be landscaped (eg., grass, trees, shrubs). Paved areas can be installed with permeable paving. For impermeable surfaces direct all run off towards storm water collection pits.

Basic Amenities

Design Submittal

Site Credit 1.0

Point: 1

Goal:

To reduce the negative impacts from automobile use and enhance the overall quality of life by providing amenities.

Compliance Options:

Select a site with access to atleast five amenities, within a walking distance of 1 Km (see list in Exhibit A)

AND

In multi-dwelling units, provide seating area & toilets in the common area and tot-lots within the campus.

Note:

This point can be earned only if the amenities are available before or at the time of project completion.

Documentation Required:

Provide an area map (to scale) indicating the path and distances from the proposed building to the household amenities or public transport systems. Provide photographs.

Approach and Methodologies:

Select sites near public transit and / or household services and amenities that are accessible by safe, convenient pedestrian pathways. Only restaurants can be counted twice and all other amenities to be considered only once.

SITE SELECTION AND PLANNING

Exhibit A - List of Basic Amenities

- Grocery store
- Electrician / Plumbing services
- School
- Dhobi / Laundry
- Bank / ATM
- Crèche
- Fitness Center /Gym
- Library
- Medical clinic / Hospital
- Pharmacy
- Post Office / Courier service
- Place of Worship
- Restaurant
- Supermarket
- Other neighborhood-serving retail
- Electricity / Water utility bills payment counter
- Playground
- Jogging track

SITE SELECTION AND PLANNING

Natural Topography or Landscape : 15%, 25%

Construction Submittal

Site Credit 2.0

Points: 2

Goal:

Minimise disturbances to the building site so as to reduce long-term environmental impacts.

Compliance Options:

Avoid disturbance to site by retaining the natural topography of the site and / or design landscape for at least 15% of the site area. Points are awarded as below:

Points for retaining natural topography or landscaping

Percentage of site area with natural topography and/or landscaped area	Points
≥ 15%	1
≥ 25%	2

Notes:

- *Parking areas, walkways etc., are considered as site disturbances.*
- *Landscape refers to soft landscaping which include only vegetative materials.*
- *Natural topography in its broad sense means preserving natural features of the terrain.*
- *Landscaped areas over built structures such as roofs, basement etc **cannot** be considered for the purpose of calculation of landscaped area.*
- *Potted plants will not be considered as landscape.*

Documentation Required:

Provide drawings, calculations and photographs showing the site area with natural topography (and / or) landscaped area.

Approach and Methodologies:

Design the building with a minimal footprint (by tightening design needs and stacking floor plans). Consider retaining the natural topography in the site or design landscape to the extent possible. In sites which have fully grown trees, avoid destruction. Avoid developing paved surfaces on the site, as much as possible.

Heat Island Effect - Roof : 50%, 75%

Construction Submittal

Site Credit 3.0

Points: 2

Goal:

Reduce heat islands (thermal gradient differences between developed and undeveloped areas) to minimise impact on microclimate.

Compliance Options:

Use material with high solar reflectance and thermal emittance (such as, white china mosaic or white cement tiles or any other highly reflective materials) **and / or** provide vegetation to cover atleast 50% of the exposed roof areas. Points are awarded as below:

Points for Heat Island Effect – Roof

Percentage of green roof/ high reflective material	Points
≥ 50%	1
≥ 75%	2

Note:

Exposed roof area does not include areas occupied by equipment such as HVAC, solar water heater, photovoltaic etc.,

Documentation Required:

Provide roof drawings highlighting location and the extent of highly reflective roof materials / green roof provided.

Approach and Methodologies:

To maximise energy savings and minimise heat island effect, select materials that exhibit high reflectivity and high emissivity. Consider providing green roofs or using highly reflective materials over roof to reduce the heat island effect. Typical materials with high reflective properties include china mosaic, white cement tiles, paints with high Solar Reflective Index (SRI) values etc.,

Parking Facilities for Visitors

Design Submittal

Site Credit 4.0

Points: 1

Goal:

To provide adequate parking within the site to minimise disturbance caused due to parking on public roads and thereby enhance quality of life.

Compliance Options:

Parking capacity to be provided as per local byelaws and parking for visitors to be provided as follows:

- For individual homes provide 1 visitor car park
- For **multi-dwelling units** provide an additional 10% parking area over and above the local code, reserved for visitors only.

Documentation Required:

Provide calculations on parking provisions as per local regulations. Submit plans indicating the visitor car park area.

Approach and Methodologies:

Design the building to ensure adequate parking provisions are made to cater to the occupants as well as the visitors. Parking provisions should take into account two wheelers and four wheelers. While designing parking facilities, consider basement/ stilts parking to reduce the heat island effect. When surface parking is planned, consider permanent cover; or other design strategies to address heat island effect as a result of such provisions.

Electric Charging Facility for Vehicles

Design Submittal

Site Credit 5.0

Point: 1

Goal:

To encourage the use of electric vehicles to reduce pollution from automobile use.

Compliance Options:

Provide electric charging facility within the site, as follows:

- For individual homes provide atleast one such facility
- For multi-dwelling units provide electric charging facility, to cover 10% of the total parking capacity reserved for building occupants and visitors. The electric charging facility should cater to both two wheelers and four wheelers.

Documentation Required:

Provide parking plans showing provisions for electric charging facility. Provide calculations demonstrating that these facilities meet the credit criteria.

Approach and Methodologies:

Survey the type of electric vehicles already plying on the roads and also survey the kind of vehicles which may come up in the future. Create facilities so as to charge these kinds of vehicles. Consider having adequate number of charging facilities based on the charging time.

While considering such charging facilities, ensure that all safety aspects have been addressed.

Design for Differently Abled

Design Submittal

Site Credit 6.0

Point: 1

Goal:

To ensure that the building can cater to differently abled people

Compliance Options:

The building design should incorporate the following provisions for differently abled people, as applicable:

- Appropriately designed preferred car parking spaces in an area which has easy access to the main entrance or closer to the lift (one parking space for every 100 dwelling units)
- Provision for easy access to the main entrance
- Uniformity in flooring level/ ramps in common areas
- Rest rooms (toilets) in common areas designed for differently abled people
- Braille and audio assistance in lifts for visually impaired people

Documentation Required:

Provide drawings showing provisions for differently abled people. Also submit photographs.

Approach and Methodologies:

Identify all probable facilities required to cater to differently abled people. Design the building to ensure that certain basic minimum provisions for differently abled people are incorporated.

Green Home Guidelines – Design & Post Occupancy

Design Submittal

Site Credit 7.0

Point: 1

Not applicable for projects with interiors

Goal:

Provide prospective buyers and occupants with descriptive guidelines that educate and help them implement green design features within their apartment / houses.

Compliance Options:

Marketing and design stage:

Include green design features proposed along with details of the green homes rating pursued in the marketing brochures.

Post Occupancy stage:

Publish green home guidelines providing information that helps occupants to implement green ideas.

Documentation Required:

Provide a copy of the marketing brochure along with green design features. Also submit a copy of the 'Green Home Guidelines' which will be given to the occupants.

Approach and Methodologies:

Develop a summary of sustainable design features incorporated in the Green Home project. Also include tips and guidelines which can be considered by the occupants in designing the interiors.

Water Efficiency

Rainwater Harvesting, 50%

Construction Submittal

Mandatory Requirement 1

Goal:

To increase the ground water table or to reduce the usage of water through effective and appropriate rainwater management.

Compliance Options:

Provide rainwater harvesting or storage system to capture atleast 50% of the runoff volumes from the roof surfaces.

In coastal areas where the groundwater table is shallow and water percolation is limited, collection tanks may be provided meeting the above requirement.

Runoff coefficients for Typical Surface Types

S.No	Surface Type	Runoff Coefficient
1	Cemented/ tiled Roof	0.95
2	Roofs Conventional	0.95
3	Roof Garden (<100 mm)	0.95
4	Roof Garden (100 – 200 mm)	0.30
5	Roof Garden (> 500 mm)	0.10

Note:

For normal annual rainfall refer Metrological Department data at <http://www.imd.gov.in>

Documentation Required:

Provide details on the rainwater harvesting system specifying storage capacity and volume of water captured. Provide details of captured rainwater.

Approach and Methodologies:

Survey the water table in the area. Design appropriate harvesting system based on the sub-surface characteristics. Factors to be considered include weathering, fractures & joints for rocky sites and thickness of aquifer for sedimentary sites.

Capture rainwater from roof top for reuse. The design should also include flushing arrangement to let out impurities in the first few showers. Such pollutants and impurities include paper waste, leaves, bird droppings, dust, etc.

WATER EFFICIENCY

Water Efficient Fixtures

Construction Submittal

Mandatory Requirement 2

Goal:

To minimise indoor water usage by installing efficient water fixtures.

Compliance Options:

Select water fixtures whose average flow rates / capacities meet the values mentioned in the table below:

Baseline Flow Rates / Capacity for Water Fixtures in a Typical Household

S.No	Items	Units	Base line average flow rates / capacity
1	Flush fixtures	LPF	6/3
2	Flow fixtures	LPM	12

** At a flowing water pressure of 3 bar*

Notes:

- *Flow fixtures include faucets, basin mixer, taps, showers, shower mixers.*
- *The baseline flows can be demonstrated at flowing water pressure of 3 bar. Flowing water pressure of 3bar does not mean that the water supply in the building is at 3 bar. The building fixtures can operate at lower pressures but to show compliance under this credit, the design flow rates are to be submitted at 3 bar.*
- *The average flow rate is a simple arithmetic average of all the respective flush / flow fixtures.*

Documentation Required:

Submit data manual by product manufacturer to confirm that conditions above have been satisfied.

Approach and Methodologies:

While selecting water fixtures, look for the efficiencies. The product catalogue or the brochure may detail the flow rates at various pressures. Fixtures are available with ultra high efficiency which can reduce substantial quantity of water consumption.

WATER EFFICIENCY

Turf Design : 20%, 40%

Design Submittal

Water Credit 1.0

Points: 2

Goal:

To limit such landscape which consumes large quantities of water.

Compliance Options:

Limit the use of turf on the site so as to conserve water. Points are awarded as below.

Points for Limited Use of Turf

Turf area as a percentage of total landscaped area	Points
$\leq 20\%$	2
$\leq 40\%$	1

Areas planted with turf should not exceed a slope of 25 percent (i.e., a 4 to 1 slope).

Notes:

- *This point is applicable only for those projects which have atleast 15% of the site area landscaped.*
- *Landscape refers to soft landscaping which include only vegetative materials.*

Documentation Required:

Provide a landscape plan specifying the species used. Provide photographs.

Approach and Methodologies:

During landscape design minimise turf to the extent possible. Select plants, shrubs and trees which consume less water.

WATER EFFICIENCY

Drought Tolerant Species : 25%

Design Submittal

Water Credit 2.0

Points: 1

Goal:

Landscape to be designed to ensure minimum consumption of water.

Compliance Options:

Ensure that atleast 25% of the landscaped area is planted with drought tolerant species.

Notes:

- *This point is applicable only for those projects which have atleast 15% of the site/ plot area landscaped.*
- *Drought tolerant species are those species that do not require supplemental irrigation. Generally accepted time frame for temporary irrigation is one to two years.*

Documentation Required:

Provide a landscape plan indicating the percentage of landscaped area which uses drought tolerant species. Also provide a list of the species used and highlight their drought tolerant nature.

Approach and Methodologies:

Select species that are well-adapted to the site. Select those species which are drought tolerant. Consider xeriscaping as an approach for landscaping.

WATER EFFICIENCY

Management of Irrigation Systems

Construction Submittal

Water Credit 3.0

Points: 2

Goal:

Reduce the demand for irrigation water through water-efficient management techniques.

Compliance Options: (1 point for any three features)

Provide highly efficient irrigation system incorporating atleast two features mentioned below:

- Provide a central shut-off valve
- Provide a moisture sensor controller
- Turf and each type of bedding area must be segregated into independent zones based on watering needs
- Atleast 50% of landscape planting beds must have drip irrigation system to reduce evaporation
- Install time based controller for the valves such that the evaporation loss is minimum and plant health is ensured
- Use pressure regulating devices to maintain optimal pressure to prevent water loss
- Any other innovative methods for watering

Documentation Required:

Provide a detailed description of managing the irrigation systems installed. Provide landscape plans with the names of the species. Provide cut sheets and photographs of the systems installed.

Approach and Methodologies:

The irrigation management system must be designed based on the requirements of the landscape plan, and installed as per the design. The designer and the installer must work together and ensure the planned performance of the system.

WATER EFFICIENCY

Rainwater Harvesting, 75%, 95%

Construction Submittal

Water Credit 4.0

Points: 2

Goal:

To increase the ground water table or to reduce the usage of water through effective and appropriate rainwater management.

Compliance Options:

Provide rainwater harvesting system to capture roof water generated from roof area to utilize in landscape irrigation or indoor water usage.

In coastal areas where the groundwater table is shallow and water percolation is limited, collection tanks may be provided meeting the above requirement.

Points are awarded as below:

Points for Rainwater Harvesting

Rainwater Harvesting System to capture / recharge	Points
• 75% runoff from roof area	1
• 95% runoff from roof area	2

Notes:

- *In areas where recharging the aquifer is not feasible, collection and reuse may be considered.*
- *For normal annual rainfall refer Metrological Department data at <http://www.imd.gov.in>*

Documentation Required:

Provide details on the rainwater harvesting system specifying storage capacity and volume of water captured. Provide details of captured rainwater.

WATER EFFICIENCY

Approach and Methodologies:

Survey the water table in the area. Design appropriate harvesting structure based on the sub-surface characteristics. Factors to be considered include weathering, fractures & joints for rocky sites and thickness of aquifer for sedimentary sites.

Capture rainwater from roof top for reuse. The design should also include flushing arrangement to let out impurities in the first few showers. Such pollutants and impurities include paper waste, leaves, bird droppings, dust, etc.

WATER EFFICIENCY

Grey Water Treatment : 50%, 75%, 95%

Construction Submittal

Water Credit 5.0

Points: 3

Goal:

Reduce the consumption of water by *in situ* treatment of grey water generated so as not to pollute the municipal streams.

Compliance Options:

Provide an on-site grey water treatment system to treat atleast 50% of grey water generated in the building, to standards suitable for flushing and landscaping purpose. Points are awarded as below:

Points for Grey Water Treatment

Grey Water Treated as a Percentage of Total Grey Water generated in Building	Points
• 50%	1
• 75%	2
• 95%	3

Note:

Grey water is neither clean nor heavily soiled waste water that comes from clothes washers, bathtub, showers, bathroom wash basins, kitchen sinks and dish washers. More specifically, it is the untreated waste water which has not come into contact with toilet waste.

Documentation Required:

Provide a detailed description of the on-site grey water treatment system. Provide photographs / cut sheets from the manufacturers. Provide water balance of the building. Provide details of usage of treated grey water within the building.

WATER EFFICIENCY

Approach and Methodologies:

Calculate the grey water volumes generated in the building. Design appropriately the capacity of the on-site grey water treatment system. While designing the treatment system, ensure that the treated grey water meets the required quality standards based on its purpose of application. Have signages all around the building to caution occupants and housekeeping staff that this water is not potable.

WATER EFFICIENCY

Treated Grey Water for Landscaping : 50%, 75%, 95% *Construction Submittal*

Water Credit 6.0

Points: 3

Goal:

Reduce demand for fresh water by using treated grey water for landscaping.

Compliance Options:

Reduce atleast 50% of potable water requirement for landscaping by using treated grey water generated within the site.

AND

The treated grey water for reuse must conform to the quality standards as prescribed by Central / State Pollution Control Board.

Points are awarded as below.

Points for Treated Grey Water for Landscaping

Percentage of Treated Grey Water Treated used for Landscaping	Points
• 50%	1
• 75%	2
• 95%	3

Note:

This point can be claimed only if the grey water that is reused is treated in situ.

Documentation Required:

Provide a detailed description of landscaping water requirement and how the treated grey water or rain water will meet this requirement. Also provide calculations on quantity and quality of grey water reused.

WATER EFFICIENCY

Approach and Methodologies:

Install an adequately sized grey water treatment plant. Ensure that the quality of the treated grey water is fit and safe for reuse. Prioritise the use of treated grey water such that irrigation requirements are given top priority. Excess treated grey water can also be used for flushing and make-up water for air-conditioning systems. Ensure periodic testing of the treated water to meet the quality standards as prescribed by Central / State Pollution Control Board.

WATER EFFICIENCY

Treated Grey Water for Flushing : 50%, 75%, 95%

Construction Submittal

Water Credit 7.0

Points: 3

Goal:

Reduce demand for fresh water by using treated grey water for flushing requirements.

Compliance Options:

Provide separate water plumbing lines for flushing purpose and source atleast 50% of the flushing water requirements from the treated grey water available.

AND

The treated grey water for reuse must conform to the quality standards as prescribed by Central / State Pollution Control Board.

Points are awarded as below.

Points for Treated Grey Water for Flushing

Percentage of Treated Grey Water Treated used for Flushing	Points
• 50%	1
• 75%	2
• 95%	3

Note:

This point can be claimed only if the grey water that is reused is treated in situ.

Documentation Required:

Submit drawings showing separate plumbing lines for treated grey water. Provide calculations to show the quantity of grey water used for flushing.

WATER EFFICIENCY

Approach and Methodologies:

Evaluate the water consumption in the building and ascertain the quantity of grey water generated. Also evaluate the availability of grey water for flushing purposes and accordingly install the dual plumbing lines. Design the plumbing system accordingly.

WATER EFFICIENCY

Water Efficient Fixtures : 20%, 30%

Construction Submittal

Water Credit 8.0

Points: 3

Goal:

To minimise indoor water usage by installing efficient water fixtures.

Compliance Options:

Select water fixtures whose average flow rates / capacities are lower than the given baseline values for all the items mentioned below. Points are awarded as below:

Points for Water Efficient Flow Fixtures

S.No	Items	Base line Average Flow / Capacity	Units	Points Awarded	
				Water consumption 20% lower than baseline	Water consumption 30% lower than baseline
1	Flush fixtures	6/3	LPF	-	1
2	Flow fixtures *	12	LPM	1	2

* At a flowing water pressure of 3 bar

Notes:

- Flow fixtures include faucets, basin mixer, taps, showers, shower mixers.
- The baseline flows can be demonstrated at flowing water pressure of 3 bar. Flowing water pressure of 3bar does not mean that the water supply in the building is at 3 bar. The building fixtures can operate at lower pressures but to show compliance under this credit, the design flow rates are to be submitted at 3 bar.
- The average flow rate is a simple arithmetic average of all the respective flush / flow fixtures.

Documentation Required:

Submit data manual by product manufacturer to confirm that conditions above have been satisfied. Provide calculations to show the percentage of water savings.

WATER EFFICIENCY

Approach and Methodologies:

While selecting water fixtures, look for the efficiencies. The product catalogue or the brochure may detail the flow rates at various pressures. Fixtures are available with ultra high efficiency which can reduce substantial quantity of water consumption.

WATER EFFICIENCY

Water Metering

Design Submittal

Water Credit 9.0

Points: 1

Goal:

To encourage continuous monitoring and enhance the performance of the residential dwelling unit(s).

Compliance Options:

Provide water meters for any three of the following:

- Treated grey water consumption
- Landscape water consumption
- Rain water reuse
- Airconditioning cooling tower make-up
- Hot water consumption
- Any other major source of water consumption such as, swimming pools, water fountain, common car wash facilities

Documentation Required:

Describe the metering equipment installed. Provide cut sheets for the meters installed.

Approach and Methodologies:

Identify all the major water consuming areas and install systems to monitor their consumptions. Develop and implement a measurement and verification mechanism to compare predicted water savings to actual water consumption.

Energy Efficiency

ENERGY EFFICIENCY

CFC-Free Equipment

Design Submittal

Mandatory Requirement 1

Goal:

To avoid the use of such refrigerants and ozone layer depleting gases which will negatively impact the environment

Compliance Options:

Refrigerants used in Heating, Ventilation & Air-conditioning (HVAC) equipment and unitary air-conditioners installed must be CFC-free.

Documentation Required:

Provide a declaration signed by a responsible party declaring that the building HVAC systems do not use CFC based refrigerants.

Approach and Methodologies:

Survey the market for all CFC-free HVAC systems. Such systems are also available in smaller capacities. Install HVAC equipment which does not use CFC based refrigerant.

ENERGY EFFICIENCY

Energy Performance

Design Submittal

Energy Credit 1.0

Points: 10

**(3 points mandatory for Non - Air conditioned buildings)
(4 points mandatory for Air conditioned buildings)**

Goal:

Optimise energy efficiency of the building to reduce environmental impacts from excessive energy use.

Compliance Options:

The project can choose any one of the following options:

Option 1 - Prescriptive Approach (1 to 7 points)

The prescriptive approach allows the project to comply with applicable criteria as outlined below:

A. Envelope Measures: (1 to 4 points) – 2 points mandatory

The project must ensure that the envelope measures meet the baseline criteria as outlined in Annexure I. Points are awarded as follows:

- Window Glazing 'U' Value (1 point)
- SHGC Value – by proper shading and glass selection (1 point)
- Overall Roof Assembly 'U' Value (1 point)
- Wall Assembly 'U' Value (1 point)

B. Lighting Power Densities (1 point) – mandatory

The project must ensure that the interior and exterior LPDs meet the baseline values as outlined under Annexure I

ENERGY EFFICIENCY

C. Air-conditioning and Heating systems/ equipment (1 - 2 points)

(1 point mandatory for projects having conditioned area for more than 25% of living space)

- **Air-Conditioning System (1 point)**
 - Unitary air-conditioners must meet the baseline criteria (Annexure I)
 - Centralised air-conditioning chiller should meet the criteria as per Annexure I

Alternative Compliance:

Projects using passive cooling techniques can claim this point and are required to show compliance through calculations and simulation.

- **Space Heating Systems (1 point: projects can claim this point only if HDD 18 is greater than 150)**
 - Unitary heat pumps must meet the baseline criteria (Annexure I)
 - Non-electricity based heating system should have a minimum thermal efficiency of 70%

OR

Option 2 – Performance Based Approach (7 to 10 points)

The Performance based approach involves a building energy simulation and modeling. Tradeoffs are permissible. This approach allows the project to demonstrate improvements over the baseline criteria.

The project must perform a building energy simulation model taking into consideration the building envelope, lighting, HVAC and other systems. The base case requirements for the energy simulation module are given in Annexure I.

The following conditions should be considered for energy simulation:

- ✓ Indoor temperature set point for simulation should be between 24 and 28⁰C for cooling systems & 18 - 22⁰C for Space heating systems all through the year.
- ✓ Comfort conditions should be considered both for summer and winter.

ENERGY EFFICIENCY

Points are awarded based on percentage savings as detailed below:

Points for Energy Performance (Option 2)

Percentage Energy Cost Savings	Points
Equivalent to base case	7
10 % above base case	8
15 % above base case	9
20 % above base case	10

The protocol for energy simulation is detailed in Annexure II.

Documentation Required:

Option 1 – Prescriptive Approach

Provide the following documents:

- The manufacturer’s cut sheets indicating ‘U’ values and SHGC values for glazing.
- Details of roof, roof insulation material, specifying the U value of the overall roof assembly.
- Details of the wall construction, specifying the U value of the wall assembly.
- Manufacturer’s cut sheets specifying the energy efficiency or performance values of the Air conditioning or Heating units.
- Details of the design Lighting Power Density along with LPD calculations for exterior and interior spaces.
- Details on all the automatic controls installed. Provide manufacturers cut sheets/ photographs.

Option 2 – Performance Based Approach

Provide the following documents:

- The building energy simulation results indicating savings in energy cost in the format prescribed in Annexure II
- The manufacturer’s cut sheets indicating ‘U’ values and SHGC values of the glazing.

ENERGY EFFICIENCY

- Details of roof, roof insulation material, specifying the U value of the overall roof assembly.
- Details of the wall construction, specifying the U value of the wall assembly.
- Manufacturer's cut sheets specifying the energy efficiency or performance values of the Air conditioning or Heating units.
- Details of the design Lighting Power Density along with LPD calculations for exterior and interior spaces.
- Modeling inputs such as Equipment Power Density (EPD), air supply, set points, schedules etc.,

ENERGY EFFICIENCY

Format for reporting energy simulation results:

Energy savings

End Use	Proposed building			Energy (10 ⁶ kWh)	Baseline building	
	Energy Type	Energy (10 ⁶ kWh)	Peak (10 ⁶ kW)		Peak (10 ⁶ kW)	Energy (%)
Interior Lighting	Electricity					
Exterior Lighting	Electricity					
Space Heating	Natural Gas					
Space Cooling	Electricity					
Fans - Interior	Electricity					
Plug loads & other miscellaneous loads	Electricity					
Service Water Heating	Electricity					
Total Building Consumption						100%

Cost savings

Type	Proposed building		Base Building		% Improvement	
	Energy Use (10 ⁶ kWh)	Energy Cost (Rs/yr)	Energy Use (10 ⁶ kWh)	Energy Cost (Rs/yr)	Energy %	Cost %
Regulated & Unregulated						
Electricity						
Natural Gas						
Steam or Hot Water						
Chilled Water						
Sub-Total						
Site generated renewable energy						
Exceptional Calculations Savings						
Total (excluding renewable energy & including exceptional calculations)						

Note: The tables detailed are not exhaustive and only indicate the format for energy savings from the energy simulation results.

ENERGY EFFICIENCY

Approach and Methodologies:

Consider a holistic energy efficiency approach to include the building orientation, envelope, systems, lighting and other equipment.

Identify the materials and equipment available in the market and their properties with regard to energy performance. While selecting these material and equipment, consider their associated environmental impacts.

Decision making with respect to selection of materials can be based on the life cycle assessment approach rather than the initial cost.

Determine the applications where automatic controls can help in energy savings. Obtain details of the controls and ensure proper installation.

ENERGY EFFICIENCY

Energy Metering

Design Submittal

Energy Credit 2.0

Point: 1

Goal:

To encourage continuous monitoring and enhance the performance of the residential dwelling unit(s).

Compliance Options:

Provide meters for any four of the following:

- Energy meter for air-conditioning
- Energy meter for internal lighting
- Energy meter for external lighting
- Btu Meter for chilled water consumption
- Energy meter for municipal water pumping
- Energy meter for grey water pumping
- Energy meter for water pumping for landscaping

Documentation Required:

Describe the metering equipment installed. Provide cut sheets for the meters installed.

Approach and Methodologies:

Identify all the major energy and water consuming equipment and install systems to monitor their consumptions. Develop and implement a measurement and verification mechanism to compare predicted savings to actual energy performance.

ENERGY EFFICIENCY

Refrigerators

Construction Submittal

Energy Credit 3.0

Point: 1

Not applicable for projects without interiors

Goal:

To encourage the use of energy efficient appliances to reduce energy consumption in the proposed building.

Compliance Options:

All Direct Cool and Frost Free Refrigerators installed must be rated atleast three stars under BEE labeling or equivalent.

List of Refrigerators rated by BEE can be referred from the BEE website <http://www.bee-india.nic.in/>

Documentation Required:

Provide manufacturer's brochures of the refrigerators used. Provide photographs.

Approach and Methodologies:

Conduct a market survey before selecting appliances. Consider the energy efficiency of these appliances. Consider BEE rated appliances.

ENERGY EFFICIENCY

Solar Water Heating Systems : 50%, 75%, 95%

Construction Submittal

Energy Credit 4.0

Point: 3

Goal:

To encourage use of solar energy for water heating applications in the building.

Compliance Options:

Provide solar water heating system to satisfy hot water requirement for domestic purposes. The minimum hot water requirement for domestic purposes should be calculated for 25 liters per person per day.

Points are awarded as below:

Points for Solar Water Heating Systems

Hot water through solar water heating systems as a percentage of total hot water requirements of the building	Points
$\geq 50 \%$	1
$\geq 75 \%$	2
$\geq 95 \%$	3

Documentation Required:

Submit installation design for solar hot water system. Provide manufacturers cut sheets and purchase invoice.

Approach and Methodologies:

Calculate hot water requirement for the building. The design should consider the availability of space to install the solar heating panels.

ENERGY EFFICIENCY

Captive Power Generation

Construction Submittal

Energy Credit 5.0

Point: 1

Goal:

To reduce dependence on fossil fuels for *insitu* power generation.

Compliance Options:

Generator sets used in the building must meet the following criteria, as applicable:

- Use bio fuels or non edible oils or any other non-fossil based fuel for captive power generation.
- Use diesel generator sets which are certified by Central Pollution Control Board (CPCB) for emissions and noise compliance
- ISI rated generator sets

Note:

This credit is applicable only if the generator sets cater to atleast 10% of the total connected load of the building.

Documentation Required:

Provide manufacturer's cut sheets and purchase invoice of the generator sets used.

Submit details on the alternative fuel used for captive power generation or provide details on the noise and emission levels of the diesel generator sets along with the CPCB certification.

Approach and Methodologies:

Survey the market for available captive power generators which operate on bio-fuels or non-edible oils and diesel generator sets which are CPCB certified for emissions and noise. Also consider availability of fuel on a sustained basis and the economic viability of the system.

ENERGY EFFICIENCY

On-site Renewable Energy : 2.5%, 5%, 7.5%, 10%

Design Submittal

Energy Credit 6.0

Points: 4

Goal:

Promote self sufficiency in energy through renewable technologies for on-site power generation and use within the building.

Compliance Options:

Install renewable energy systems for atleast 2.5% of annual consumption of the building. Points are awarded as below:

Points for Renewable Energy Power

Renewable Energy as a Percentage of annual consumption	Points
≥ 2.5 %	1
≥ 5.0 %	2
≥ 7.5 %	3
≥ 10.0 %	4

Documentation required:

Submit installation design for renewable energy source. Submit cut sheets from manufacturers and provide purchase invoice.

Approach and Methodologies:

Take into consideration the renewable energy feasibility while determining the power requirement from the local utility. The following are the sources of renewable energy that can be considered under this credit: Solar energy, Wind energy, Biomass, Bio gas etc.,

ENERGY EFFICIENCY

Efficient Luminaires & Lighting Power Density: 20%

Design Submittal

Energy Credit 7.0

Point: 1

Goal:

To encourage use of energy efficient lighting systems to reduce energy consumption within the home.

Compliance Options:

Luminaires:

Install energy efficient internal and external lighting luminaires (as applicable) which are atleast three star rated under BEE labeling programme or luminaires which are more efficient.

AND

Lighting Power Density (LPD):

Maintain interior and exterior LPD (as applicable) which is 20% lower than baseline values highlighted in Annexure I.

Notes:

- *'Projects with Interiors' must address both interior and exterior lighting requirements for luminaires and LPD as mentioned above.*
- *'Projects without Interiors' must address exterior lighting requirements for luminaires and LPD as mentioned above.*
- *To earn this credit, atleast 80% of all fixtures used must be BEE 3 star rated or more efficient*
- *The list of BEE labeled light fittings can be referred from the BEE website <http://www.bee-india.nic.in/>.*

ENERGY EFFICIENCY

Documentation Required:

Provide specifications and drawings of the internal light fixtures used and provide copies of purchase orders/ receipts for lighting in all rooms. When calculating the percentage of energy efficient light fittings the following rooms must be considered: living rooms, dining rooms, kitchens, bedrooms, hallways, study rooms, bathrooms and utility rooms. Provide details of the design Lighting Power Density along with LPD calculations for interior spaces.

Provide specifications and drawings of the external light fixtures used or provide copies of purchase orders/ receipts for lighting in all external spaces. Provide details of daylight cut off sensors or timers. Provide details of the design Lighting Power Density along with LPD calculations for exterior spaces.

Approach and Methodologies:

Survey available energy efficient lighting fixtures in the market. Also consider the life of the lamps and evaluate the economic viability. Following are some of the energy efficient light fittings: efficient tubular fluorescent light fittings with electronic ballasts, T5 lamps, Compact fluorescent light fittings, Light emitting diodes etc.,

ENERGY EFFICIENCY

Energy Saving Measures in Other Appliances & Equipment

Construction Submittal

Energy Credit 8.0

Point: 1

Goal:

To conserve energy in the use of other equipment.

Compliance Options:

Provide any four of the following measures:

- Level controllers in overhead water tanks
- Energy efficient lifts with group control
- Minimum 60% efficiency for pumps of capacity greater than 3 HP and ISI rated water pumps for others
- Minimum 75% efficiency for motors of capacity greater than 3 HP and ISI rated motors for others
- LED lamps in all display/ exit sign boards
- ISI rated gas burners in kitchen/ cafeteria
- Automatic shades and blinds
- Movement sensors for lighting control to cover the following areas: toilets, study, staircases, stair cabins, corridors, garage, balconies, wash and storage areas
- Dimmer controls / daylight cut-off sensors for internal and external lighting, as appropriate.
- Sleep mode control for air conditioners in bedrooms
- Key based master switch control

Documentation Required:

Provide details of the energy efficient appliances & equipment used which include manufacturer's cut sheets, drawings etc., as applicable.

Approach and Methodologies:

Determine the applications where energy saving measures can be adopted. Obtain details of the equipment required, identify the vendors and install energy saving measures.

Materials

MATERIALS

Separation of Wastes

Design Submittal

Mandatory Requirement 1

Goal:

To facilitate segregation of waste at source so as to prevent such waste being sent to landfills.

Compliance Options:

- Provide separate bins at individual house level to collect organic waste, plastics and paper.

AND

- In multi dwelling units, in addition to the above, also provide a common facility to collect waste which should cover the following:
 - ✓ Metals (tins and cans)
 - ✓ 'e' waste
 - ✓ Lamps
 - ✓ Batteries

Documentation Required:

Submit detailed drawings of the bins and their location within the building.

Approach and Methodologies:

Allocate suitable site for sorting out dry and wet wastes. Examine the scope for recycling items of waste collected from building debris and residential wastes. Locate local dealers of waste material such as glass, plastic, paper, newspaper, cardboard, organic wastes and 'e' wastes & batteries. Educate residents about recycling methods.

MATERIALS

Waste Reduction during Construction : 75%

Construction Submittal

Materials Credit 1.0

Point: 1

Goal:

Minimise construction waste being sent to landfills.

Compliance Options:

Waste Reduction

Avoid atleast 75% of the waste generated during construction from being sent to landfills and incinerators. Calculate percentage either by weight or volume.

Documentation Required:

Submit records tabulating the total waste material generated and the quantities which were diverted from landfills.

Approach and Methodologies:

Collect all construction debris generated on site. Segregate these waste based on their utility. Examine means of sending such waste to manufacturing units which use them as raw materials. Typical construction debris in residential projects could be broken bricks, steel bars, broken tiles, glass, wood waste, paint cans, cement bags, packing materials etc.,

MATERIALS

Organic Waste Management, Post Occupancy : 50%, 95%

Construction Submittal

Materials Credit 2.0

Points: 2

Goal:

To ensure effective organic waste management in the building, post occupancy.

Compliance Options:

Install on-site waste treatment technology for treating organic waste. The output from such systems like manure, power, etc., should be reused *insitu*. Points are awarded as below:

Points for Organic Waste Management, Post Occupancy

Percentage of treated organic waste	Points
$\geq 50\%$	1
$\geq 95\%$	2

Note: Organic waste includes household kitchen waste and garden waste.

Documentation Required:

Submit design details of the waste treatment system installed. Submit cut sheets from manufacturers and provide purchase invoice. Also provide photographs.

Approach and Methodologies:

Calculate the quantum of organic waste generated in the building. Design the waste treatment plant with suitable capacity to efficiently manage the waste and recover resources. Typical technologies recognised are digesters, gasifiers, vermicomposting etc.

MATERIALS

Materials with Recycled Content : 10%, 20%

Construction Submittal

Materials Credit 3.0

Points: 2

Goal:

To encourage the use of products which contain recycled materials to reduce environmental impacts associated with the use of virgin materials.

Compliance Options:

Use materials with recycled content such that the total recycled content constitutes atleast 10 % of the total cost of the materials used in the project. Points are awarded as below:

Points for Recycled Content

Percentage of Recycled content	Points
≥ 10%	1
≥ 20 %	2

Notes:

- *Material Cost = Total Cost – (Labour Cost + Installation Cost)*
- *If Labour and Installation cost is not known, the default material cost can be considered as 60% of the total cost of the component*
- *Cost of equipment, systems, lighting fixtures, appliances, movable furniture need not be considered in the total material cost*

Documentation Required:

Provide details on all materials used in the project with the material cost. Specify recycled content in the materials used. Submit letters from manufacturers specifying the recycled content.

Approach and Methodologies:

Survey the materials with recycled content and locate such local suppliers. Some of the materials with recycled content are Fly ash blocks, Tiles, Steel, Glass, Cement, False Ceiling, Aluminium and Composite Wood.

MATERIALS

Rapidly Renewable Materials : 2.5%, 5%

Construction Submittal

Materials Credit 4.0

Point: 2

1 point not applicable for projects without interiors

Goal:

Maximise the use of materials which are rapidly renewable.

Compliance Options:

Use rapidly renewable building materials and products (made from plants that are typically harvested within a ten-year cycle or shorter) such that the renewable material content constitutes atleast 2.5% of the cost of the building materials. Points are awarded as below:

Points for Rapidly Renewable Materials

Percentage of Rapidly Renewable Materials	Points
$\geq 2.5\%$	1
$\geq 5\%$	2

Documentation Required:

Provide details on the use of rapidly renewable materials in the building. Provide a calculation on the area of such materials used. Also provide the percentage of carpet area that rapidly renewable materials constitute.

Approach and Methodologies:

Survey the applications of rapidly renewable materials in the building design. Consider materials such as bamboo, wool, cotton insulation, agrifiber, linoleum, wheat board, strawboard and cork. During construction, ensure that the specified rapidly renewable materials are used.

MATERIALS

Local Materials : 50%, 75%

Construction Submittal

Materials Credit 5.0

Points: 2

Goal:

Encourage the use of building materials available locally thereby minimising the associated environmental impacts.

Compliance Options:

Ensure atleast 50% of the total building materials by cost used in the building should have been manufactured within a radius of 500 Km. Points are awarded as follows:

Points for Local Materials

Percentage of local materials	Points
≥ 50 %	1
≥ 75%	2

Documentation Required:

Provide calculations demonstrating that the project uses the required percentage of local materials in terms of cost. Provide letters from the manufacturers/ vendors indicating the distance from the place of manufacture to the project site.

Approach and Methodologies:

Set a project goal for utilization of locally sourced materials from identified suppliers. During construction, ensure that the specified local materials are utilised and quantify the total percentage of local materials used.

MATERIALS

Reuse of Salvaged Materials : 2.5%, 5%

Construction Submittal

Materials Credit 6.0

Points: 2

Goal:

Encourage the use of salvaged building materials and products to reduce the demand for virgin materials thereby minimizing the impacts associated with extraction and processing of virgin materials.

Compliance Options:

Ensure atleast 2.5% of the total building materials by cost used in the building is salvaged, refurbished and reused. Points are awarded as below:

Points for Reuse of Salvaged Materials

Percentage of Salvaged material reused	Points
≥ 2.5 %	1
≥ 5%	2

Documentation Required:

Provide calculations demonstrating that the project uses the required percentage of salvaged materials in terms of cost. Provide sources of such salvaged material.

Approach and Methodologies:

Identify opportunities to incorporate salvaged materials into building design and research potential material suppliers. Consider salvaged materials such as flooring, paneling, doors, frames, furniture, brick etc.,

MATERIALS

Certified Wood Based Building Materials and Furniture : 50%, 75%

Construction Submittal

Materials Credit 7.0

Points: 2

Goal:

To minimise the usage of virgin wood thereby encouraging responsible forest management.

Compliance Options:

Ensure atleast 50% (by cost) of all new wood used in the building will be FSC (Forest Stewardship Council) certified or the local Forest Department certified wood. Points are awarded as below:

Points for Use of FSC/ Forest Department certified wood

Percentage of FSC/ Forest Dept certified wood	Points
≥ 50 %	1
≥ 75%	2

Documentation Required:

Provide details showing the total cost of wood based products procured for the building. Provide details on the FSC/ Forest Department certified wood used. Also show the percentage calculations of the certified wood used to the total cost of new wood used for doors, windows, furniture etc.,

Approach and Methodologies:

Ascertain wood based applications in the home. Substitute the use of virgin wood with FSC or Forest Department Certified wood.

Indoor Environmental Quality

Tobacco Smoke Control

Design Submittal

Mandatory Requirement 1

Goal:

Minimise exposure of non-smokers to the adverse health impacts arising due to passive smoking, post occupancy.

Compliance Options:

Smoking should be prohibited in the common areas of the building.

Documentation Required:

Provide details on how the building complies with the requirement. Also provide details on how this would be implemented and identify the agency responsible to ensure compliance.

Approach and Methodologies:

Prohibit smoking in common areas like corridors, lobby, lifts etc., Design the building to eliminate or minimise tobacco smoke pollution in the common areas. Occupant guidelines can **also** specify that smokers should ensure that tobacco smoke does not leak into common areas or other dwelling units. Signages can be placed at several places in the building campus to educate occupants and visitors.

Daylighting : 50%

Design Submittal

Mandatory Requirement 2

Goal:

To ensure connectivity between the interior and the exterior environment, by providing good daylighting.

Compliance Options:

Achieve a minimum glazing factor of 2% in each of the living spaces. 50% of the total floor area of all regularly occupied spaces which include kitchens, living rooms, bed rooms, dining rooms and study rooms.

Average glazing factor can be calculated using the formula given below:

$$\text{Glazing Factor} = \frac{\text{Window Area [SF]}}{\text{Floor Area [SF]}} \times \text{Actual Visible transmittance} \times \text{Constant}$$

Constant Values:

Windows on wall : 0.2

Window on roof (skylight) : 1.0

Notes:

- For living spaces which are large in size, part of the areas which have access to daylighting can be factored in the calculation.*
- Living spaces which are used for multi-purposes such as dining and drawing can be considered as separate spaces based on the function. The separating boundary need not be a physical boundary.*

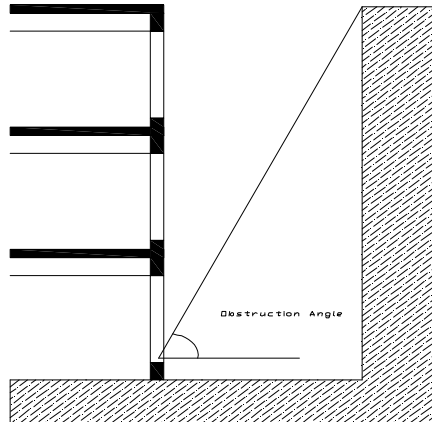
INDOOR ENVIRONMENTAL QUALITY

Exceptional calculation for compliance:

The required glazing factor can also be shown using daylight simulation tools.

Note:

Window openings where the angle of obstruction of objects obscuring the sky dome is greater than 70° from the horizontal shall not be considered for daylight calculations



Documentation Required:

Provide calculation of daylight for each occupied area like living rooms, bed rooms, dining areas, study areas, kitchens etc., Sum up all areas which achieve 2% or higher daylight factor. This aggregate area as a percentage of the total livable area should be more than 50%. Areas exempted are bathrooms, storage space, corridors, etc.

Approach and Methodologies:

Ensure that daylighting is considered at the design stage by appropriate orientation. The orientation of the building can be such that maximum daylighting to all the spaces is achieved for most part of the day.

Fresh Air Ventilation : 30%

Design Submittal

Mandatory Requirement 3

Goal:

To avoid indoor pollutants affecting indoor air quality by providing adequate outdoor air ventilation.

Compliance Options:

For Air Conditioned Spaces:

Design a ventilation system for air conditioned spaces, to meet a requirement of 5 cfm per person for each air conditioned space.

For Non-Air conditioned Spaces:

Install openable windows or doors in living spaces, kitchens and bathrooms such that the openable area is designed to meet the criteria as outlined in the table below:

Design Criteria for Openable Windows and Doors

Space Type	Openable area as a percentage of total carpet area
Living Spaces	10%
Kitchens	8%
Bathrooms	4%

Note :

Openable windows / doors shall be within 4 meters (13 feet) of the living spaces

Documentation Required:

Provide details on the building ventilation design giving specific information on fresh air intake volumes for air conditioned spaces. Provide drawings and calculations showing that the openable area requirement for non-air conditioned spaces are met.

Approach and Methodologies:

Study the possible methods of taking in fresh air into the air conditioned spaces. Also take into consideration the quality of the fresh air itself and appropriately consider treatment methods. Taking in fresh air may result in higher energy consumption; however suitable pre-cooling technologies of fresh air can be envisaged during design.

Having adequate window openings will help in bringing in fresh air into the building, thereby ensuring good air quality. The approach would be to have large openings on atleast two different directions so as to allow cross-ventilation.

INDOOR ENVIRONMENTAL QUALITY

Exhaust Systems

Design Submittal

IEQ Credit 1.0

Points: 2

Not applicable for projects without interiors

Goal:

To ensure that kitchens and bathrooms are better ventilated to improve indoor environment.

Compliance Options:

Design exhaust systems in bathrooms and kitchen as per the requirements highlighted in the table below:

Minimum Intermittent Exhaust Flow Requirements

Location	Minimum Airflow		Minimum Airflow
Kitchen	For < 9.3 sq.m (100 sq.ft) floor area	100 cfm	For > 9.3 sq.m (100sq.ft) proportionally increase air flow
Bathroom	For < 4.64 sq.m (50 sq.ft) floor area	50 cfm	For > 4.64 sq.m (50sq.ft) proportionally increase air flow

Notes:

- *For kitchens, kitchen range vent hoods which meet the above air flows are also acceptable*
- *Ensure exhaust systems remove polluted indoor air to the outdoors (i.e. exhaust outlets into common areas are not allowed)*

Documentation Required:

Provide the description and specifications of the exhaust system design.

Approach and Methodologies:

Exhaust from bathrooms and kitchens are very vital in preserving the indoor air quality within homes. It is not just adequate to install exhaust fans, but sizing these systems to purge out sufficient quantities of indoor air will determine the performance and thereby the indoor air environment.

INDOOR ENVIRONMENTAL QUALITY

Enhanced Fresh Air Ventilation : 30%

Design Submittal

IEQ Credit 2.0

Points: 2

Goal:

To avoid indoor pollutants affecting indoor air quality by providing adequate outdoor air ventilation.

Compliance Options:

For Air Conditioned Spaces:

Design a ventilation system for air conditioned spaces, to meet a requirement of 6.5 cfm per person for each air conditioned space.

For Non-Air conditioned Spaces:

Install openable windows or doors in living spaces, kitchens and bathrooms such that the openable area is designed to meet the criteria as outlined in the table below:

Design Criteria for Openable Windows and Doors

Space Type	Openable area as a percentage of total carpet area
Living Spaces	13%
Kitchens	10.5%
Bathrooms	5%

Note :

Openable windows / doors shall be within 4 meters (13 feet) of the living spaces

Documentation Required:

Provide details on the building ventilation design giving specific information on fresh air intake volumes for air conditioned spaces. Provide drawings and calculations showing that the openable area requirement for non-air conditioned spaces are met.

Approach and Methodologies:

Study the possible methods of taking in fresh air into the air conditioned spaces. Also take into consideration the quality of the fresh air itself and appropriately consider treatment methods. Taking in fresh air may result in higher energy consumption; however suitable pre-cooling technologies of fresh air can be envisaged during design.

Having adequate window openings will help in bringing in fresh air into the building, thereby ensuring good air quality. The approach would be to have large openings on atleast two different directions so as to allow cross-ventilation.

Low VOC Materials

Construction Submittal

IEQ Credit 3.0

Points: 2

Goal:

To encourage the use of materials with low emissions so as to reduce adverse health impacts for building occupants.

Compliance Options:

Use paints with low or no VOC content to the extent of 100% of interior wall surface area. (1 point)

AND

For adhesives and sealants used within the interiors ensure that the VOC content does not exceed the limits as specified in the table below. (1 point)

VOC Limits for Materials

Type of material	VOC Limit
Paints:	
Non-flat paints	150 g/L
Flat (Mat) paints	50 g/L
Anti-corrosive/ anti-rust paints	250 g/L
Varnish	350 g/L
Adhesives:	
Wood flooring Adhesive	100 g/L
Tile adhesives	65 g/L
Indoor carpet adhesives	50 g/L
Wood	30 g/L

Documentation Required:

Provide(letter/brochure) from the manufacturer indicating the VOC limit of the paints used **or** provide purchase invoices and provide supporting photographs of paint containers specifying VOC content.

INDOOR ENVIRONMENTAL QUALITY

Approach and Methodologies:

Develop a project outline specification and include low or no VOC materials as a criterion for interior material selection. List down all possible interior materials which can have high VOC content. Research and specify no or low VOC materials based on durability, performance and environmental characteristics

INDOOR ENVIRONMENTAL QUALITY

Carpets : 5%

Construction Submittal

IEQ Credit 4.0

Point: 1

Not applicable for projects without interiors

Goal:

To encourage the use of carpets with low emissions so as to reduce adverse health impacts for building occupants.

Compliance Options:

Use CRI certified carpets for 5% of the carpet area.

OR

Use carpets made of naturally available materials like coir, wool etc., for 5% of the carpet area.

Documentation Required:

Provide CRI certificate or provide photographs of carpets used in the building. State the material used and its environmental features

Approach and Methodologies:

Prepare a list of all carpet requirements in the building and also conduct a market survey of the materials available and their eco-friendly features. In many places, carpets are made of naturally available materials which do not require any adhesives while installing.

Building Flush Out

Design Submittal

IEQ Credit 5.0

Point: 1

Not applicable for projects without interiors

Goal:

To avoid occupant's exposure to indoor airborne contaminants before occupying the premises.

Compliance Options:

Before the building is occupied and after paints, adhesives and sealants have been used, a building flush out needs to be carried out for ten days by keeping all windows open.

OR

If the building prefers to carry out the flush out using forced ventilation systems, the flush out can be carried out for five days.

Documentation Required:

Provide a narrative describing the flush out procedure followed.

Approach and Methodologies:

Flush out needs to be carried out just before the occupancy. Once the home is ready including the interiors, flushing will be effective in driving away the pollutants in the building materials.

Daylighting : 75%, 85%, 95%

Design Submittal

IEQ Credit 6.0

Points: 3

Goal:

To ensure connectivity between the interior and the exterior environment, by providing good daylighting.

Compliance Options:

Achieve a minimum glazing factor of 2% for atleast 75% of the total floor area of all regularly occupied spaces which include kitchens, living rooms, bed rooms, dining rooms and study rooms.

Points for Day Light for Living Spaces

Percentage of Lighting	Points
≥ 75%	1
≥ 85%	2
≥ 95%	3

Average Glazing factor can be calculated using the formula given below:

$$\text{Daylight Factor} = \frac{\text{Window Area [SF]}}{\text{Floor Area [SF]}} \times \text{Actual Visible transmittance} \times \text{Constant}$$

Constant Values:

Window on wall : 0.2

Window on roof (skylight) : 1.0

Notes:

- *For living spaces which are large in size, part of the areas which have access to daylighting can be factored in the calculation.*
- *For living spaces which are used for multi-purposes such as dining and drawing, can be considered as separate spaces based on the function. The separating boundary need not be a physical boundary.*

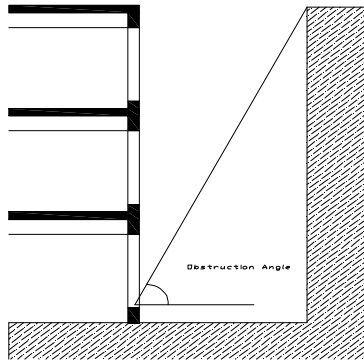
INDOOR ENVIRONMENTAL QUALITY

Exceptional calculation for compliance:

The required glazing factor can also be shown using daylight simulation tools.

Note:

Window openings where the angle of obstruction of objects obscuring the sky dome is greater than 70 deg. from the horizontal shall not be considered for daylight calculations



Documentation Required:

Provide calculation of daylight for each occupied area like living rooms, bed rooms, dining areas, study areas, kitchens etc., Sum up all areas which achieve 2% or higher day light factor. This aggregate area as a percentage of the total livable area should be more than 75%. Areas exempted are bathrooms, storage space, corridors etc.,

Approach and Methodologies:

Ensure that daylighting is considered at the design by appropriate orientation. The orientation of the building can be such that maximum daylighting to all the spaces is achieved for most part of the day.

Cross Ventilation

Design Submittal

IEQ Credit 7.0

Points: 2

Goal:

To encourage home design which have adequate cross ventilation thereby providing a healthy environment.

Compliance Options:

Design the building to ensure that each of the living spaces has an opening to the outdoor environment in atleast two of the orientations.

Notes:

- *The window should not have any obstruction within 2 m from outside surface.*
- *The opening considered should meet the IEQ Mandatory Requirement 3.*

Documentation Required:

Provide floor plans showing openings (doors, windows) for each of the living spaces. Such openings should overlook the exterior environment.

Approach and Methodologies:

Adequate spaces between dwelling units is important to ensure cross ventilation. Many a time, this aspect is neglected which can lead to poor indoor environment both in terms of indoor air and the daylighting aspect. Narrow corridors can impact the indoor environment as well.

Innovation and Design Process

Innovation and Design Process

Design/ Construction Submittal

INN Credit 1

Points: 3

Goal:

To provide design teams and projects the opportunity to be awarded points for exceptional performance above requirements set by the IGBC Green Homes Rating System and/or innovative performance in Green Building categories not specifically addressed by the IGBC Green Homes Rating System.

Compliance Options:

Some of the points that can be earned under this credit are as follows

Credit 1.1: Innovation and Design Process

Identify the intent of the proposed innovation credit, the proposed requirement for compliance, and the proposed documentation to demonstrate compliance, and the design approach used to meet the required elements.

Credit 1.2: Innovation and Design Process

Same as credit 1.1

Credit 1.3: Innovation and Design Process

Same as credit 1.1

Documentation Required:

Provide photographs/ drawings/ manufacturer's cut sheets whichever is applicable

Approach and Methodologies:

The following can be considered for credit points under innovation:

- ✓ Exemplary performance under any of the credits.
- ✓ Strategies or measures not covered by IGBC Green Homes such as
 - Adoption of passive architecture techniques
 - Green education etc

IGBC Accredited Professional

Design Submittal

INN Credit 2

Point: 1

Goal:

To support and encourage the involvement of IGBC AP accredited professionals in the green home building project.

Compliance Options:

At least one principal participant of the project team shall be an IGBC AP.

Note:

The project team can apply for an additional innovation and design process till the IGBC Accredited Professional Exam is launched.

Documentation Required:

Submit the IGBC AP certificate.

Approach and Methodologies:

Educate the project team members about the Green Home design & construction and application of the IGBC Green Homes Rating System at the design stage of the project.

Baseline Criteria for Energy Performance of the Building

A. Envelope Measures:

Glazing - 'U' Value

Climate Zone *	Maximum U-Value (W/m ² K)
Composite	3.3
Hot and Dry	3.3
Warm and Humid	5.0
Moderate	6.9
Cold	3.3

Fenestration - SHGC Value

Climate Zone *	Maximum SHGC Value	
	WWR < 20%	WWR 20 - 30%
Composite	0.38	0.30
Hot and Dry	0.38	0.30
Warm and Humid	0.38	0.30
Moderate	0.50	0.40
Cold	No limit	No limit

Roof Assembly 'U' Value

Climate Zone*	Maximum 'U'-Value of the overall assembly (W/m ² K)
Composite	0.50
Hot and Dry	0.50
Warm and Humid	0.50
Moderate	0.50
Cold	0.50

Wall Assembly ‘U’ Value

Climate Zone*	Maximum ‘U’-Value of the overall assembly (W/m ² K)
Composite	1.1
Hot and Dry	1.1
Warm and Humid	1.25
Moderate	1.25
Cold	0.5

Note: For Climatic Zones of India, please refer Exhibit – B.

B. Air conditioning and Heating Systems/ Equipment

Depending on the climatic zone, heating/ cooling systems should be considered as follows:

Heating and Cooling Requirements for Climatic Zones

Climate Zone*	System
Composite	Cooling & Heating (for places having more than 150 Heating degree days – HDD18)
Hot and Dry	Cooling
Warm and Humid	Cooling
Moderate	Cooling
Cold	Heating

Notes:

For Climatic Zones of India, please refer Exhibit – B.

- Degree day: The difference in temperature between the outdoor mean temperature over 24 hour period and a given base temperature
- Heating degree day base 18°C, HDD 18: for any one day, when the mean temperature is less than 18°C, there are as many degree-days as degree Centigrade temperature difference between the mean temperature for the day and 18°C. Annual heating degree-days (HDDs) are the sum of the degree-days over the calendar year.

Air-Conditioners:

Baseline air-conditioning system to be considered as unitary air-conditioners with COP/ EER equivalent to three star rated equipment under BEE labeling programme.

For latest list of air-conditioners rated by BEE please refer the BEE website <http://www.bee-india.nic.in/>

Minimum Efficiency Requirements

Equipment Type	Size Category	Minimum Efficiency^a	Test Procedures
Air-Cooled, with Condenser, Electrically Operated	All Capacities	2.80 COP 3.05 IPLV	ARI 550/590
Air-Cooled, without Condenser, Electrically Operated	All Capacities	3.10 COP 3.45 IPLV	
Water-Cooled, Electrically Operated	All Capacities	4.45 COP 5.20 IPLV	ARI 550/590
Air-Cooled Absorption, Single Effect	All Capacities	0.60 COP	ARI 560
Water-Cooled Absorption, Single Effect	All Capacities	0.70 COP	
Absorption Double Effect, Indirect-Fired	All Capacities	1.00 COP 1.05 IPLV	
Absorption Double Effect, Direct-Fired	All Capacities	1.00 COP 1.00 IPLV	

Heat pumps:

For buildings with unitary heat pumps, the minimum efficiency requirements are detailed below.

Minimum efficiency requirements for Packaged Terminal Heat Pumps (PTHP)

Equipment Type	Size Category (Input)	Minimum Efficiency COP	Test Procedure
PTHP (Heating Mode)	All capacities	2.5	ARI 310/380

C. Lighting Power Density

The Lighting Power Density (LPD) can be achieved either by the Space-by-space method or the Building area method. The baseline LPDs for the interior and the exterior spaces under each method is outlined below:

1. Space-by-Space Method :

S.No	Space	Lighting Power Density	
		W/Sq.m	W/Sq.ft
1.	Living room	11.8	1.1
2.	Bed room	11.8	1.1
3.	Dining area	9.7	0.9
4.	Kitchen	12.9	1.2
5.	Dressing room	6.4	0.6
6.	Rest room	9.7	0.9
7.	Gymnasium	4.3	0.4
8.	Exercise center	3.2	0.3
9.	Home theatre	12.9	1.2
10.	Lounge	15	1.4
11.	Corridor	5.4	0.5
12.	Stair case	5.4	0.6
13.	Motels / Resorts - Guest room	11.8	1.1
14.	Motels / Resorts – Dinning area	12.9	1.2
15.	Lobby / Reception	13.9	1.3
16.	Hostels / Dormitories	11.8	1.1
17.	External lighting / Parking	3.2	0.3

2. Building Area Method:

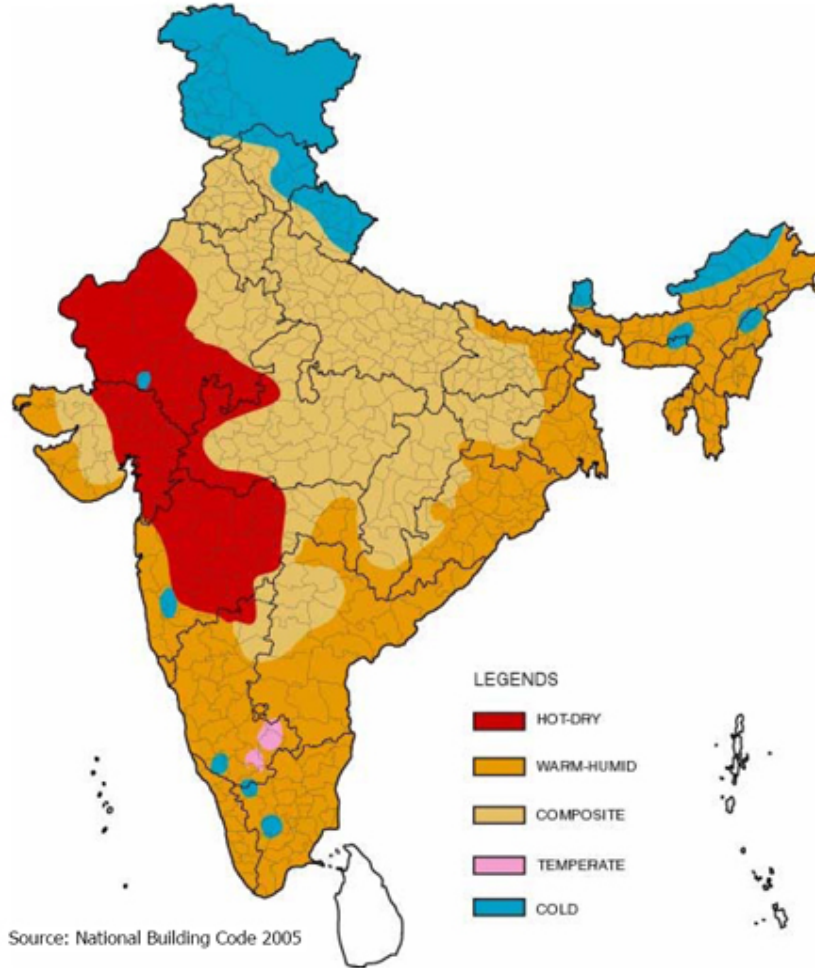
S.No	Building Type	Lighting Power Density	
		W/Sq.m	W/Sq.ft
1.	Motel	10.7	1.0
2.	Resorts	10.7	1.0
3.	Hostels	10.7	1.0
4.	Multi-family units	7.5	0.7
5.	Individual homes	7.5	0.7

Note:

This LPD includes the power consumption of the complete fixtures which include lamps and ballasts.

Exhibit B – Climatic Zones of India

Climate Zone Map Of India



Protocol for Building Energy Simulation

Performance Based Approach

This method can be adopted for buildings which implement energy efficiency measures beyond those specified in the baseline parameters outlined in Annexure I.

Simulation general requirements:

- Performance Evaluation.

The proposed building performance and baseline building performance shall be evaluated using the same:

- (a) Simulation program
- (b) Weather data
- (c) Energy rates

- Simulation Program.

The simulation program shall be a computer-based program for the analysis of energy consumption in buildings (a program such as, but not limited to, DOE-2, E-10, BLAST, or Energy Plus). The simulation program shall include calculation methodologies for the building components being modeled. For components which cannot be modeled by the simulation programme, the project may submit calculations for the performance of such components.

The simulation program shall, at a minimum, have the ability to explicitly model all of the following:

- § 8,760 hours per year
- § Hourly variations in occupancy, lighting power, miscellaneous equipment power, thermostat set points, and HVAC system operation, defined separately for each day of the week and holidays
- § Thermal mass effects
- § Two or more thermal zones
- § Part-load performance curves for mechanical equipment
- § Capacity and efficiency correction curves for mechanical heating and cooling equipment

- The simulation program shall perform the simulation using hourly values of climate data, such as temperature and humidity from representative climate data, for the site in which the proposed design is to be located. For cities or urban regions with several climate data entries, and for locations where weather data are not available, the designer shall select available weather data that best represent the climate at the construction site.
- For projects which use on-site renewable energy sources or site-recovered energy, the energy from such sources can be subtracted from the total energy of the proposed case.
- The equipment capacities for the baseline building design shall be oversized by 15% for cooling and 25% for heating as compared to the system sizing done by the simulation programme.
- Unmet load hours for each of the zones in the proposed design or baseline building designs shall not exceed 300 hours (of the 8,760 hours simulated). The unmet hours in the proposed case shall not exceed the unmet hours in the base case by more than 50 hours.
- If unmet load hours for the proposed design or baseline building design exceed 300, simulated capacities shall be increased incrementally, and the building with unmet loads resimulated until unmet load hours are reduced to 300 or less.

Calculation of the Proposed and Baseline Building Performance

Building energy modeling requirements for proposed and baseline building:

The baseline model shall be identical to the proposed model except as specifically detailed in the table below.

	Case	Proposed building	Baseline building
1.	Design model	<p>a) The simulation model of the proposed design shall be consistent with the actual design and should include envelope measures and all systems</p> <p>b) All end use energy consumers in the building and associated with the building must be modeled.</p>	<p>a) The baseline model should have the same conditioned area and same number of floors as the proposed building.</p> <p>b) All end use energy consumers in and associated with the building in the base case should be the same as the proposed case.</p>
2.	Schedules	The schedules shall be typical of the proposed building as determined by the designer.	Same as proposed design
3.	Building envelope	<p>All components of the building envelope in the proposed design shall be modeled as shown on architectural drawings or as installed for existing building envelopes.</p> <p>a) Orientation: As per design</p> <p>b) Opaque assemblies such as roof and walls shall be modeled with the same heat capacity and U-value as per proposed design.</p> <p>c) Fenestration: as per design Manually operated fenestration shading devices such as blinds or shades shall not be modeled.</p>	<p>The standard design shall have identical conditioned, unconditioned floor area and identical exterior dimensions and orientations as proposed design, unless otherwise mentioned.</p> <p>a) Orientation: The baseline energy performance shall be the average of the performance with original orientation and after rotating the entire building 90, 180, 270 degrees. The building shall be modeled so that it does not shade itself.</p> <p>b) Opaque assemblies such as roof and walls shall be modeled with the same heat capacity as the proposed design but the U-values as per Annexure I .</p> <p>c) Fenestration: Fenestration areas shall be equal to that in the proposed design or 30% of gross wall area above grade, whichever is smaller, and shall be distributed</p>

		<p>Permanent shading devices such as fins, overhangs, and light shelves shall be modeled.</p> <p>d) For exterior roofs the reflectance and emittance of the roof surface shall be modeled as 0.45 if the actual value is more than 0.7 for reflectance and 0.75 for emittance.</p>	<p>uniformly in horizontal bands across the four orientations.</p> <ul style="list-style-type: none"> • No shading projections are to be modeled; fenestration shall be assumed to be flush with the exterior wall or roof. • Manually operated fenestration shading devices such as blinds or shades shall not be modeled. • Fenestration U-factor and SHGC shall be as per Annexure I. <p>d) Roof albedo: all roof surfaces shall be modeled with a reflectivity of 0.30.</p>
4.	Lighting	<p>Lighting power in the proposed design shall be as per the actual design. In addition, the following Energy conservation measures (ECM) can be factored, if considered in design.</p> <p>a) Occupancy/Motion sensors with daylight cut-off features used in the common areas (like staircases, common corridors, parking areas) in the proposed case, should not be modeled but can be giving a direct saving upto 15% over the lighting power of those fixtures connected to such sensors.</p> <p>b) Using timer/ daylight based controls for the external lighting systems (areas like façade lighting, landscape</p>	<p>Lighting power in the standard design shall be determined using the Baseline values as detailed in Annexure I.</p>

		lighting, and street lighting) will have a direct saving upto 15% on the lighting power of those fixtures connected to such controls.	
5.	Heating and Cooling systems	<p>a) Where a cooling and heating system has been designed, the model shall be consistent with design documents.</p> <p>b) Where no heating or cooling system is proposed, the system shall be same as the baseline. The bedrooms and living rooms shall be assumed as conditioned.</p>	<p>a) The Cooling system for the base case is to be modeled considering the system defined in Annexure I. If the building requires heating (as defined in the table 'Heating and Cooling Requirements for Climatic Zones' of Annexure I) the heating system would incorporate heat pump with efficiencies as per the baseline criteria – Annexure I.</p>
6.	Service hot water	<p>a) The system shall be as per the design.</p> <p>b) Where no service hot water system exists or it is specified, no service hot water heating shall be modeled.</p>	Base case system should be an electrical heating system.
9.	Miscellaneous load	Plug loads and process loads shall be modeled as designed. All end-use load components shall be modeled, such as exhaust fans, parking garage ventilation fans, exterior building lighting, swimming pool heaters and pumps, elevators and escalators, refrigeration equipment, and cooking equipment.	Plug loads and process loads shall be modeled same as the proposed design.

ABBREVIATIONS

ARI

Air-conditioning and Refrigeration Institute

ASHRAE

The American Society of Heating, Refrigerating and Air-conditioning Engineers

BEE

Bureau of Energy Efficiency

CFM

Cubic Feet per Minute

COP

Coefficient of Performance

CRI

Carpet and Rug Institute

ECBC

Energy Conservation Building Code

EER

Energy Efficiency Ratio

EPD

Equipment Power Density

FSC

Forest Stewardship Council

HDD

Heating Degree Days

HVAC

Heating Ventilation and Air-conditioning

IPLV

Integrated Part Load Value

LPD

Lighting Power Density

ABBREVIATIONS

LPF

Liters per Flush

LPM

Liters per Minute

NA

Not Applicable

NBC

National Building Code

PTHP

Packaged Terminal Heat Pumps

SHGC

Solar Heat Gain Coefficient

SRI

Solar Reflective Index

VOC

Volatile Organic Compound



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