Indian Green Building Council
Greening India since 2001

IGBC Green Homes

Indian Green Building Council

IGBC Green Homes
Rating System

Version 2.0

Abridged Reference Guide

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- TSI Ventures, Bangalore
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- Kalpataru Ltd, Mumbai
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Contents IGBC Green Homes®

Foreword from the Indian Green Building Council (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 rapidly. As the sector is growing rapidly, preserving the environment poses a host of challenges. To enable the construction industry 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 1,150 committed members. The Council encourages, builders, developers, owners, architects and consultants to design & construct green buildings thereby enhancing the economic and environmental performance of buildings.

The Green Building Movement in India has been spearheaded by IGBC (part of CII) 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 water efficiency, energy efficiency, reduction in fossil fuel use in commuting, handling of consumer waste and conserving natural resources. Most importantly, these concepts can enhance occupant health, happiness and well-being.

Against this background, the 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, builders, consultants, developers, home owners, institutions, manufacturers 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 house-hold waste, energy efficiency, reduced use of fossil fuels, lesser dependence on usage of virgin materials and health & well-being of occupants.

Water Conservation:

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 Rating System 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 intents 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. Through IGBC Green Homes rating system, 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 also recognises measures to minimise the indoor air pollutants.

IV. IGBC Green Homes®

IGBC has set up the Green Homes Core Committee to focus on residential sector. The committee includes builders, developers, home owners, architects, consultants, experts on building science, manufacturers 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 exclusively for homes. A core committee was formed under the leadership of Ar Sharukh Mistry, Mistry Architects, Bangalore. The pilot version of the programme was launched in July 2008. The rating programme has evoked tremendous response from the stakeholders. Based on the feedback and learning from various projects that have implemented the rating programme, the latest version 2.0 has been launched in March 2012. The rating system is designed to suit Indian climate and construction practices.

About 220 members representing 120 organisations have participated in the development of the rating programme. As on date (March 2012), over 400 million sq.ft. of built-up area is registered under the rating programme.

The rating system will be subject to review by the core committee, every year, 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 water efficiency, handling of house-hold waste, energy efficiency, healthy, comfortable and environmentally friendly houses.

The rating system evaluates certain mandatory requirements & credit points using a prescriptive approach and others 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 and major renovated residential buildings which are broadly classified into two construction types:

1. Individual Residential Unit
2. Multi-dwelling Residential Units
   - ❖ Gated communities
   - ❖ High-rise residential apartments
   - ❖ 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® Rating System

IGBC Green Homes® rating system addresses green features under the following categories:

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

The guidelines detailed under each mandatory requirement & credit enables the design and construction of green homes of all sizes and types. 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:

Certification Level	Recognition
Certified	Best Practices
Silver	Outstanding Performance
Gold	National Excellence
Platinum	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 designed 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.

IGBC web site will have all important details on IGBC Green Homes® registration & certification - process, schedule and fee.

c. IGBC Green Homes® Certification

The rating system caters to projects like individual homes, gated communities, high-rise residential apartments, residential buildings with major renovation, hostels, service apartments, resorts, motels, guest houses, etc., Amongst different types of dwelling units, the projects are broadly classified into two categories:

- ❖ Individual Residential Unit
- ❖ Multi-dwelling Residential Units

The threshold criteria for certification levels are as under:

Certification Level	Individual Residential Unit	Multi-dwelling Residential Unit	Recognition
Certified	38 – 44	50 – 59	Best Practices
Silver	45 – 51	60 – 69	Outstanding Performance
Gold	52 – 59	70 – 79	National Excellence
Platinum	60 - 75	80 – 100	Global Leadership

d. Documentation

To earn the IGBC Green Homes® Rating, the project must satisfy all the mandatory requirements and the minimum number of credit points.

The project team is expected to provide supporting documents at preliminary/ design and final/ construction stage of submission for all the mandatory requirements and the credits attempted.

The project needs to submit the following:

1. General information of project including
    a. Project brief stating project type, different type of spaces, occupancy, number of floors, area statement, etc.,
    b. General drawings (in PDF format only):
        i. Master/ Site plan
        ii. Parking plans
        iii. Floor plans
        iv. Elevations
        v. Sections
        vi. Photographs/ Rendered views

2. Filled-in Master Template (in excel format)
3. Narratives and supporting documentation such as drawings, calculations (in excel sheets), declarations/ contract documents, purchase invoices, manufacturer cut sheets/ letters/ material test reports, etc., for each mandatory requirement/ credit

The necessary details are mentioned in this guide, under each mandatory requirement and credit.

Documentation is submitted in two phases – preliminary submittal and final submittal:

- The preliminary 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 35 days.
- The next phase involves submission of clarifications to preliminary review queries and final submittal. The construction document is submitted on completion of the project. This review will also be provided within 35 days, after which the rating is awarded.

It is important to note that the mandatory requirements/ credits earned at the preliminary review are only considered as anticipated. These mandatory requirements/ credits are not awarded until the final documents are submitted, along with additional documents showing implementation of design features. If there are changes in any 'credit anticipated' after preliminary review, these changes need to be documented and resubmitted during the final review.

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 IGBC 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:

1. General information of project including
    a. Project brief stating project type, different type of spaces, occupancy, number of floors, area statement, etc.,
    b. General drawings (in PDF format only):
        i. Master/ Site plan
        ii. Parking plans
        iii. Floor plans
        iv. Elevations
        v. Sections
        vi. Photographs/ Rendered views
2. Filled-in Master Template (in excel format)
3. Narratives and supporting documentation such as conceptual drawings, estimate/ tentative calculations (in excel sheets), declarations from the owner, etc., for each mandatory requirement/ credit

The above necessary details are mentioned in this guide, under each mandatory requirement and credit.

IGBC would take 30 working days to review the first set of precertification documents. On receiving the clarifications posed in the first review, IGBC would take another 30 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 intent 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 Abridged Reference Guide for description of the credit intent, compliance options and approach & methodologies.
- Review the intent of the mandatory requirement/ credit and self-evaluate whether the project satisfies the intent.

- ❖ Review the Credit Interpretation web page for previous CIR on the relevant mandatory requirement or credit. 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

In rare cases, mandatory requirements or credits may be denied due to misinterpretation of the intent. On receipt of the final review and if the project team feels that sufficient grounds exist to appeal a credit denied in the final review, the project has an option to appeal to IGBC for reassessment of denied mandatory requirements or credits. The documentation for the mandatory requirements or credits seeking appeal may be resubmitted to IGBC along with necessary fee. IGBC will take 35 days to review such documentation. If an appeal is pursued, please note that a different review team will be assessing the appeal documentation.

The following documentation should be submitted:

1. General information of project including
   a. Project brief stating project type, different type of spaces, occupancy, number of floors, area statement, etc.,
   b. General drawings (in PDF format only):
      i. Master/ Site plan
      ii. Parking plans
      iii. Floor plans
      iv. Elevations
      v. Sections
      vi. Photographs/ Rendered views
2. Filled-in Letter Template for respective mandatory requirement/ credit.
3. Original, re-submittal, and appeal submittal documentation for only those mandatory requirement/ credits that the project is appealing for. Also include a narrative for each appealed mandatory requirement/ credit to describe how the documents address the reviewers` comments and concerns.

h. Fee

Registration, Certification and CIR fee details are available on IGBC website (www.igbc.in) or can be obtained from IGBC (igbc@cii.in).

VI. Updates and Addenda

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

Checklist for Green Homes

		Points Available	
		Individual Residential Unit	Multi-dwelling Residential Units
Site Selection and Planning			
SSP Mandatory Requirement 1	**Local Building Regulations**	Required	Required
SSP Mandatory Requirement 2	**Soil Erosion Control**	Required	Required
SSP Credit 1	Basic House-hold Amenities	1	2
SSP Credit 2	Natural Topography or Vegetation : 15%, 25%	2	4
SSP Credit 3	Heat Island Effect, Non Roof : 50%, 75%	NA	2
SSP Credit 4	Heat Island Effect - Roof : 50%, 75%	4	4
SSP Credit 5	Parking Facilities for Visitors : 10%	NA	1
SSP Credit 6	Electric Charging Facility for Vehicles : 5%	NA	1
SSP Credit 7	Design for Differently Abled	1	2
SSP Credit 8	Basic Facilities for Construction Workforce	1	2
SSP Credit 9	Green Home Guidelines, Design & Post Occupancy	NA	1
		9	**19**
Water Efficiency			
WE Mandatory Requirement 1	Rainwater Harvesting, Roof & Non-roof, 25%	Required	Required
WE Mandatory Requirement 2	Water Efficient Plumbing Fixtures	Required	Required
WE Credit 1	Landscape Design: 20%, 40%	2	4
WE Credit 2	Management of Irrigation Systems	1	1
WE Credit 3	Rainwater Harvesting, Roof & Non-roof: 50%, 75%	4	4
WE Credit 4	Water Efficient Plumbing Fixtures: 25%, 35%	4	4
WE Credit 5	Waste Water Treatment and Reuse: 100% (or) 50%, 95%	NA	4
WE Credit 6	Water Metering	NA	1
		11	**18**
Energy Efficiency			
EE Mandatory Requirement 1	CFC-Free Equipment	Required	Required
EE Mandatory Requirement 2	Minimum Energy Performance	Required	Required
EE Credit 1	Enhanced Energy Performance : 3%, 6%, 9%, 12%, 15%,18%, 21%, 24%, 27%, 30% (or) 2%, 4%, 6%, 8%, 10%,12%, 14%, 16%, 18%, 20%	10	10

EE Credit 2	On-site Renewable Energy: 2.5%, 5%, 7.5% (or) 10%, 20%, 30%	6	6
EE Credit 3	Solar Water Heating System : 50%, 95% (or) 25%, 50%	4	4
EE Credit 4	Energy Saving Measures in Other Appliances & Equipment	2	2
EE Credit 5	Distributed Power Generation	NA	2
EE Credit 6	Energy Metering	NA	1
		22	**25**
Materials & Resources			
MR Mandatory Requirement 1	Separation of House-hold Waste	Required	Required
MR Credit 1	Organic Waste Management, Post Occupancy : 95% (or) 50%, 95%	2	4
MR Credit 2	Handling of Construction Waste Materials : 50% (or) 50%, 95%	1	2
MR Credit 3	Reuse of Salvaged Materials : 2.5%, 5% (or) 1%, 2%	2	4
MR Credit 4	Materials with Recycled Content : 10%, 20%	2	2
MR Credit 5	Local Materials : 25%, 50%	2	2
MR Credit 6	Rapidly Renewable Building Materials & Certified Wood : 50%, 75%	4	4
		13	**18**
Indoor Environmental Quality			
IEQ Mandatory Requirement 1	Tobacco Smoke Control	Required	Required
IEQ Mandatory Requirement 2	Minimum Daylighting: 50%	Required	Required
IEQ Mandatory Requirement 3	Fresh Air Ventilation	Required	Required
IEQ Credit 1	Enhanced Daylighting : 75%, 95%	4	4
IEQ Credit 2	Enhanced Fresh Air Ventilation	2	2
IEQ Credit 3	Exhaust Systems	2	2
IEQ Credit 4	Low VOC Materials, Paints & Adhesives	2	2
IEQ Credit 5	Building Flush-out	1	1
IEQ Credit 6	Cross Ventilation : 50%, 75%	4	4
		15	**15**

Innovation & Design Process			
ID Credit 1	Innovation & Design Process	4	4
ID Credit 2	IGBC Accredited Professional	1	1
		5	**5**
	Total	**75**	**100**

IGBC Green Homes Certification Levels

Rating	Points	
	Individual Residential Unit	**Multi-dwelling Residential Units**
Certified	38 – 44	50 – 59
Silver	45 – 51	60 – 69
Gold	52 – 59	70 – 79
Platinum	60 - 75	80 – 100

Site Selection & Planning

Local Building Regulations

Construction Submittal

SSP Mandatory Requirement 1

Intent:

Ensure that the building(s) complies with necessary statutory regulatory codes.

Compliance Options:

The following approvals are required from the competent local Government authority:

- Approval of building plan (or) site plan
- Fit-for-occupancy certificate

Approach and Methodologies:

Carryout a study to understand all the statutory requirements in the project's location. Ensure that these requirements are incorporated at the design stage.

The project team should be aware of the bye-laws and design accordingly. The bye-laws would typically include set back provisions, height restrictions, maximum built up area, minimum open space requirements, parking provisions etc.,

Soil Erosion Control

Construction Submittal

SSP Mandatory Requirement 2

Intent:

Control soil erosion and sedimentation thereby, reducing negative impacts to the site and surroundings.

Compliance Options:

Adopt the following measures:

- Soil erosion control measures for pre-construction and during construction must conform to the best management practices highlighted in the National Building Code (NBC) of India, Part 10, Section 1, Chapter 4 – Protection of Landscape during Construction and Chapter 5 – Soil and Water Conservation.
- Fertile topsoil to be stockpiled prior to construction, for reuse later.
- Develop appropriate measures to address soil erosion, post occupancy.

Approach and Methodologies:

Evolve strategies to stockpile fertile 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., native grass, trees, shrubs). Paved areas can be installed with permeable paving. For impermeable surfaces, direct all run-offs towards rain water collection pits.

Basic House-hold Amenities

Design Submittal

SSP Credit 1

Points: 1; 2

Intent:

Reduce negative impacts caused to the environment from automobile use by providing basic house-hold amenities, thereby, enhancing the quality of life.

Compliance Options:

For Individual Residential Unit: ***(1 point)***

Select a site with access to atleast five basic house-hold amenities, within a walking distance of 1 km from the building entrance.

(For list of basic house-hold amenities, refer Exhibit – A)

For Multi-dwelling Residential Units: ***(2 points)***

Select a site with access to atleast seven basic house-hold amenities, within a walking distance of 1 km from the building entrance.

(For list of basic house-hold amenities, refer Exhibit – A)

(AND)

Additionally, provide the following within the campus premises:

- Seating facility and toilets in the common area for service staff & visitors (*minimum one toilet for every 50 dwelling units)*
- Tot-lot(s) for children

Notes:

- *This point can be earned only if the basic amenities are available before or at the time of project completion.*
- *Basic amenities within the campus can also be considered to show compliance.*
- *Toilets provided in the common area can be designed to cater both differently abled people and service staff & visitors*
- ***Toilets provided in the clubhouse cannot be considered to show credit compliance.***

Exemplary Performance:

This credit is not eligible for exemplary performance under Innovation & Design Process.

Approach and Methodologies:

Select sites near public transit and / or household services and amenities that are accessible by safe, convenient pedestrian pathways.

Exhibit A - List of Basic House-hold Amenities

- Bank/ ATM
- Beauty saloon
- Bus stop / Railway station
- Educational institutions (Pre-school, School, College, etc.,)
- Electricity / Water utility bills payment counter
- Electrical / Plumbing services
- Grocery store / Supermarket
- Hardware shop
- Laundry
- Medical clinic/ Hospital
- Park/ Garden
- Place of Worship
- Playground / Jogging track
- Pharmacy
- Post office / Courier service
- Public library
- Restaurant
- Refueling station for automobiles
- Sports club/ Fitness center/ Gym
- Stationary shop
- Theater

Notes:

- ***All basic house-hold amenities are to be considered only once.***
- ***The amenities should be accessible to building/ campus visitors also.***

Natural Topography or Vegetation

Design Submittal

SSP Credit 2

Points: 2 ; 4

Intent:

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

Compliance Options:

Avoid disturbance to the site by retaining natural topography or vegetation and/ or design vegetated spaces for atleast 15% of the site area.

Points are awarded as below:

Percentage of Site Area with Natural Topography and/or Vegetated Area	Points for Individual Residential Units	Points for Multi-dwelling Residential Units
$\geq$ 15%	1	2
$\geq$ 25%	2	4

Notes:

- *Retaining 'Natural Topography' in its broad sense means preserving natural features of the terrain such as natural rocks, water body, etc.,*
- ***For this credit, vegetation to the ground only shall be considered and vegetation over built structures such as roofs, basement, podiums, etc., cannot be considered.***
- *For this credit calculation, potted plants should not be considered as vegetation.*
- *Grass medians, grass pavers, jogging track, open-air theatre, parking areas, play ground, swimming pool, tot-lots, walkways etc., are considered as site disturbances.*

Exemplary Performance:

The project is eligible for exemplary performance under Innovation & Design Process, if more than 35% of the site area is left undisturbed (i.e. retained with natural topography and/ or vegetated).

Approach and Methodologies:

Design the building with a minimal footprint. Consider retaining the natural topography in the site or design landscape with vegetation to the maximum extent. In sites which have fully grown trees, avoid destruction. Also, minimise paved surfaces on the site.

Heat Island Effect, Non-roof

Design Submittal

Not applicable for Individual Residential Units

SSP Credit 3 **Points: 2**

Intent:

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

Compliance Options:

For atleast 50% of exposed non-roof impervious areas (such as footpaths, pathways, roads, uncovered surface parking and other impervious areas) within the project site, provide atleast one or combination of the following:

- ❖ Shade from tree cover within 5 years
- ❖ Open grid pavers, including grass pavers

Points are awarded as below:

Non-roof Impervious Area as a Percentage of Total Non-roof Area	Points
≥ 50%	1
≥ 75%	2

Note:

- *Trees/ Saplings should be in place at the time of occupancy.*

Exemplary Performance:

This credit is eligible for exemplary performance under Innovation & Design Process, if more than 95% of exposed non-roof impervious areas are under tree cover and/ or open grid pavers.

Approach and Methodologies:

Shade constructed surfaces on the site with landscape features and use open-grid pavers in impervious areas. Consider replacing constructed surfaces (i.e. roof, roads, side walks, pathways, etc.,) with vegetation and/ or open grid paving or high-albedo materials to reduce heat absorption.

Heat Island Effect, Roof

Design Submittal

SSP Credit 4 **Points: 4**

Intent:

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/ light coloured china mosaic tiles or white cement tiles or high reflective coatings or other high reflective materials/ surfaces) to cover atleast 50% of the exposed roof areas.

  (AND/ OR)

- Provide vegetation to cover atleast 50% of the exposed roof areas.

Minimum Solar Reflective Index (SRI) values for different roof types are provided below:

Table 1 - Solar Reflective Index (SRI) values for different roof types

Roof Type	Slope	SRI
Low-sloped roof	≤ 1:6	78
Steep-sloped roof	> 1:6	29

Points are awarded as below:

Percentage of High Reflective Material/ Vegetation of the Exposed Roof Areas	Points
≥ 50%	2
≥ 75%	4

Notes:

- ***For this credit, all roof areas, including podium, covered surface parking and utility blocks, which are exposed to the sky (at and above ground level) should be considered for calculations.***
- *Exposed roof area need not include equipment platforms, areas with solar photovoltaic &, solar water heaters, skylights, swimming pool, driveways, pathways, roads, play areas etc.,*
- *SRI values of high reflectance materials should be as per ASTM Standards. China mosaic tiles are exempted from showing SRI value.*

Exemplary Performance:

The project is eligible for exemplary performance under Innovation & Design Process, if more than 95% of the exposed roof area is covered with vegetation.

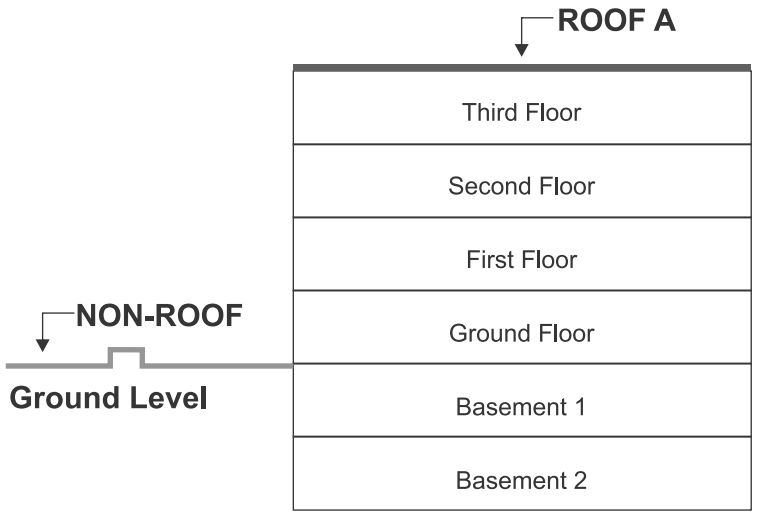
Approach and Methodologies:

Minimise heat and maximise energy savings by selecting 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.,

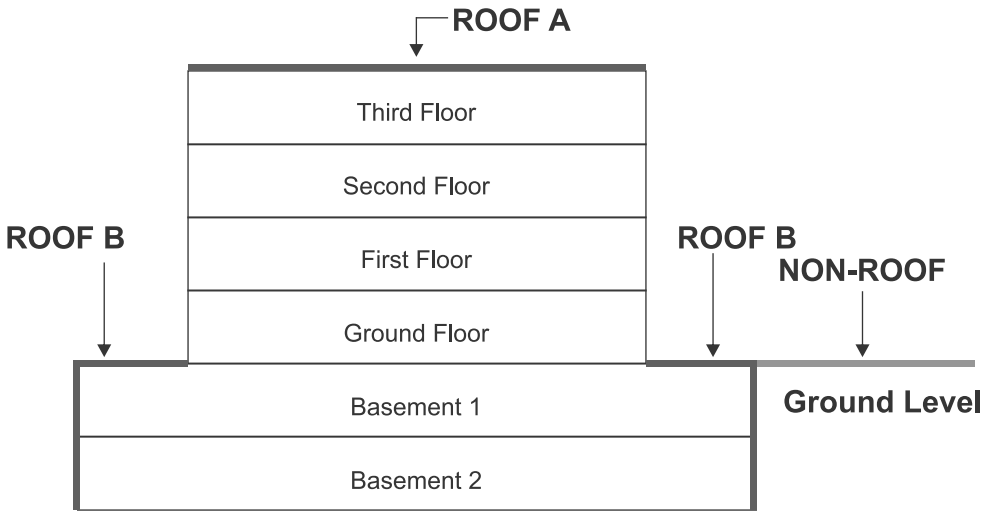
Addenda for IGBC Green Homes Ver 2

SSP Credit 3 - Heat Island Effect - Roof & SSP Credit 4 - Heat Island Effect - Non Roof

Released on 17 Jan 2014



Case 1



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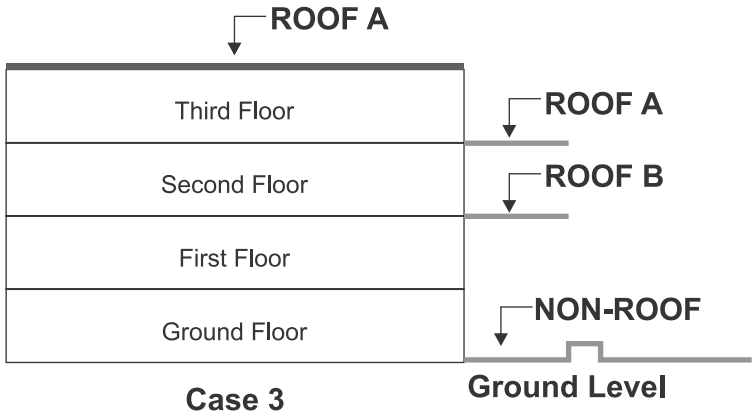

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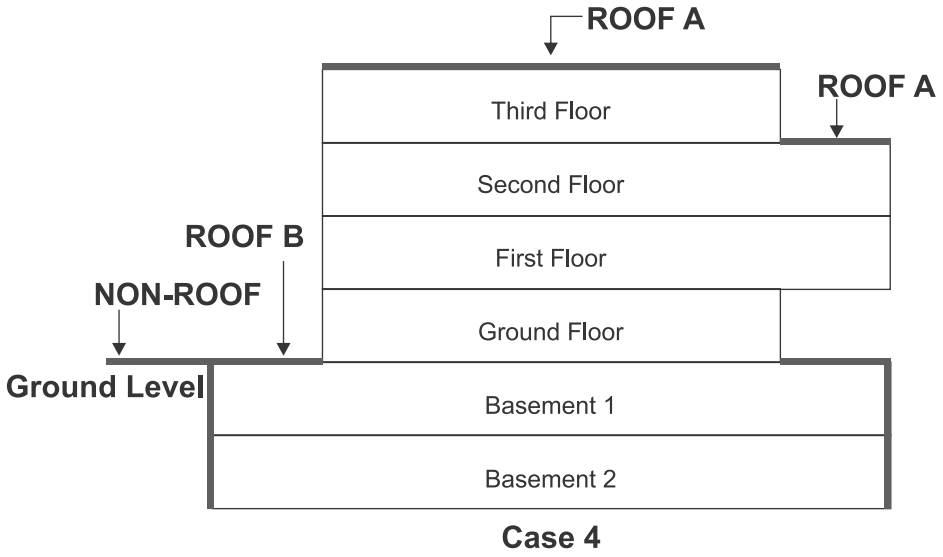


Case 4

ROOF

ROOF A:

Any surface area which is exposed to sky shall be considered as ‘Roof’. To meet the requirements, use high SRI materials or high albedo materials with SRI more than 78 or vegetation

ROOF B:

Even if part of the basement slab exposed to sky, such slab area shall come under ‘ Roof’ and shall use hardscape materials with an SRI of atleast 29 (and not higher than 64) or open grid pavers or grass pavers or vegetation

Note: Functional areas such as drive ways, ramps (part of ROOF-B) can be excluded from calculations.

NON ROOF

Any impervious surface area which is in contact with ground and exposed to sky, shall be considered as ‘Non-roof’. Such areas include uncovered surface parking, roads, drive ways, walkways, foot paths, pavements and other impervious areas within the project site.

To meet the requirements, the project shall consider ‘open grid pavers’ or ‘grass pavers’ or ‘vegetation ‘ or ‘Tree cover’ or Hardscape materials with an SRI of atleast 29 (and not higher than 64)

Note: Driveways / footpaths / walkways on Non-roof should be included in calculations

Parking Facilities for Visitors

Design Submittal

Not applicable for Individual Residential Units

SSP Credit 5 **Points: 1**

Intent:

Provide adequate parking within the site to minimise disturbance caused due to parking on public roads, thereby enhancing the quality of civic life.

Compliance Options:

Provide parking for residents, to meet or exceed local bye-law requirement.

For visitors, provide parking spaces as per local bye-law. In places where local bye-law for visitor parking does not exist, provide parking for visitors equivalent to 10% of the parking area / spaces required for residents as per local bye-law.

Exemplary Performance:

This credit is not eligible for exemplary performance under Innovation & Design Process.

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, as applicable, according to local bye-law.

While designing parking facilities, consider basement/ stilt(s) parking to reduce the heat island effect. If 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

Not applicable for Individual Residential Units

SSP Credit 6 **Points: 1**

Intent:

Encourage the use of electric vehicles thereby reducing negative impacts resulting from fossil fuel based automobile use.

Compliance Options:

Provide electric charging facilities to cater to atleast 5% of the total parking capacity, provided on site for residents (excluding visitor parking).

Note:

- *If the project has exclusive parking spaces for two-wheelers, electric charging has to be provided in such areas also.*

Exemplary Performance:

The credit is not eligible for exemplary performance under Innovation & Design Process.

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. Provide facilities so as to charge such vehicles. Consider having adequate number of charging facilities based on their charging time.

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

Design for Differently Abled

Design Submittal

SSP Credit 7

Points: 1 ; 2

Intent:

Ensure that the building/ campus design caters to differently abled people.

Compliance Options:

Design the building/ campus to provide the following, as applicable, for differently abled people in accordance with the guidelines of National Building Code (NBC) of India.

For Individual Residential Unit: ***(1 point)***

- Easy access to the main entrance of the building
- Non-slippery ramps with hand rails on atleast one side
- Main entrance door with adequate width
- Uniformity in floor level for hindrance-free movement

For Multi-dwelling Residential Units: ***(2 points)***

- Appropriately designed preferred car park space(s) having an easy access to the main entrance or closer to the lift lobby (one car park space for every 100 dwelling units)
- Easy access to the main entrance of the building(s)
- Non-slippery ramps with hand rails on atleast one side
- Braille and audio assistance in lifts for visually impaired people
- Uniformity in floor level for hindrance-free movement in common areas & exterior areas
- Rest rooms (toilets) in common areas designed for differently abled people (minimum one rest room for every 100 dwelling units.
- Walkways/ pathways with adequate width in exterior areas
- Visual warning signages in common areas & exterior areas

Notes:

- *Toilets provided in the common area can be designed to cater both differently abled people and service staff & visitors*
- ***Toilets provided in the clubhouse cannot be considered to show credit compliance***

Exemplary Performance:

This credit is not eligible for exemplary performance under Innovation & Design Process.

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.

Basic Facilities for Construction Workforce

Construction Submittal

SSP Credit 8 **Points: 1; 2**

Intent:

Promote welfare of construction workforce by providing safe and healthy work conditions.

Compliance Options:

For Individual Residential Unit: ***(1 point)***

Provide the following on-site basic facilities for construction workforce:

- Mobile/ Permanent toilet (atleast one toilet seat)
- First-aid facility
- Adequate drinking water facilities
- Personal protective equipment (by owner/ contractor)
- Dust suppression measures.
- Adequate illumination levels in construction work areas.

For Multi-dwelling Residential Units: ***(2 points)***

Provide the following on-site basic facilities for construction workforce:

- Adequate housing to meet or exceed local/ labour bye-law requirement.
- Sanitary measures to meet or exceed local/ labour bye-law requirement (OR) provide atleast one toilet seat/ urinal for every 50 workers in any shift, whichever is more stringent. The sanitary measures should be provided separately for men and women.
- First-aid and emergency facilities.
- Adequate drinking water facilities.
- Personal protective equipment (by owner/ contractor).
- Dust suppression measures.
- Adequate illumination levels in construction work areas.
- Day care/ crèche facility for workers' children

Exemplary Performance:

This credit is not eligible for exemplary performance under Innovation & Design Process.

Approach and Methodologies:

Study the local/ labour bye-law requirement facilities for construction workforce and ensure that provision of such facilities are included in the construction contract agreement.

Green Home Guidelines, Design & Post Occupancy

Design Submittal

Not applicable for Individual Residential Units

SSP Credit 9 **Points: 1**

Intent:

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

Compliance Options:

Design Stage:

Include green design features proposed, in the project brochures.

Post-occupancy Stage:

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

Exemplary Performance:

This credit is not eligible for exemplary performance under Innovation & Design Process.

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. Strategies include providing signages of the green features implemented in the residential building; awareness programme for workers, occupants & visitors etc.,

Water Efficiency

Rainwater Harvesting, Roof & Non-roof

Construction Submittal

WE Mandatory Requirement 1

Intent:

Enhance ground water table and reduce municipal water demand through effective rain water management.

Compliance Options:

Provide rainwater harvesting system to capture atleast 25% of run-off volumes from roof and non-roof areas. The harvesting system designed should cater to atleast 1 day of normal rainfall* occurred in the last 5 years.

In areas where the central/ state ground water board does not recommend artificial rain water recharge (or) if the groundwater table is less than 4 m, the projects are deemed to have shown compliance, without installing rainwater harvesting system.

Notes:

- *For rainfall information, refer Indian Metrological Department data at http://www.imd.gov.in*
- ** To arrive at the normal rainfall, divide peak month rainfall occurred in each year (in last 5 years) by number of rainy days in the respective month, and take the average of the five values obtained. Abnormal rainy days like flash floods can be excluded from calculations.*
- *Projects which do not have data on the number of rainy days, a maximum of 15 rainy days can be considered to arrive at normal rainfall.*
- *In areas where the water percolation is limited, collection tanks may be provided to meet the above requirement.*

Run-off coefficients for typical surface types are listed below:

Table 2 - Runoff coefficients for Typical Surface Types

S No	Surface Type	Runoff Coefficient
1	Cemented / Tiled Roof	0.95
2	Roof Garden (<100 mm thickness)	0.95
3	Roof Garden (100 – 200 mm thickness)	0.3
4	Roof Garden (201 – 500 mm thickness)	0.2
5	Roof Garden (> 500 mm thickness)	0.1
6	Turf, Flat (0 - 1% slope)	0.25
7	Turf, Average (1 - 3% slope)	0.35
8	Turf, Hilly (3 - 10% slope)	0.4
9	Turf, Steep (> 10% slope)	0.45
10	Vegetation, Flat (0 - 1% slope)	0.1
11	Vegetation, Average (1 - 3% slope)	0.2
12	Vegetation, Hilly (1 - 3% slope)	0.25
13	Vegetation, Steep (> 10% slope)	0.3
14	Concrete Pavement	0.95
15	Gravel Pavement	0.75
16	Open-grid Concrete Pavement	0.75
17	Open-grid Grass Pavement	0.5

Approach and Methodologies:

Survey the water table in the project's location. 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 Efficient Plumbing Fixtures

Design Submittal

WE Mandatory Requirement 2

Intent:

Minimise the use of municipal water and reduce load on waste water systems.

Compliance Options:

Select water efficient plumbing fixtures whose flow rates / capacities meet the baseline criteria.

The baseline criterion is as below:

Table 3 - Baseline Flow Rates / Capacity for Plumbing Fixtures in a Typical House-hold

Fixture Type	Maximum Flow Rate / Capacity	Duration	Daily Uses per Person/ Day
Water Closets	6 LPF (High flush)	1 Flush	1
	3 LPF (Low flush)	1 Flush	4
Health Faucet/ Bidet, Hand-held spray*	8 LPM	15 Seconds	1
Faucet*	8 LPM	15 Seconds	8
Kitchen Sink*	8 LPM	15 Seconds	6
Showerhead* / Hand-held Spray*	10 LPM	8 Minutes	1

Source: Uniform Plumbing Code – India, 2008

** At a design pressure of 3 bar*

Notes:

- *The number of permanent occupants has to be considered as two persons each for the first two bed rooms, and one additional person for each additional bedroom.*
- ***Rain showers (if any) need to be considered in the calculations. Considering that bath tubs may not be used on a daily basis, they may be excluded for the calculations.***
- ***Treated waste water/ captured rain water can be reused for flushing. The reused quantity for flushing can be subtracted from the annual water use and compared against the baseline annual quantity.***
- *Groundwater is considered as potable water and cannot be used to show water savings.*

- *The baseline flows can be demonstrated at flowing water pressure of 3 bar. Flowing water pressure of 3 bar 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 mandatory requirement, the design flow rates are to be submitted at 3 bar.*

Approach and Methodologies:

While selecting water fixtures, look for their 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.

Consider reuse of treated waste water and captured rain water for flushing. Ensure periodic testing of the treated water to meet the quality standards for flushing, as prescribed by Central / State Pollution Control Board.

Landscape Design

Design Submittal

WE Credit 1

Points: 2; 4

Intent:

Design landscape to ensure minimum water consumption.

Compliance Options:

Limit use of turf on the site so as to conserve water and/ or ensure that landscaped area is planted with drought tolerant species.

Points are awarded as below:

Individual Residential Unit: ***(2 points)***

Drought Tolerant Species as a Percentage of Total Landscaped Area	Points
$\geq$ 20%	1
$\geq$ 40%	2

Multi-dwelling Residential Units: ***(4 points)***

Turf Area as a Percentage of Total Landscaped Area	Points
$\leq$ 20%	2
$\leq$ 40%	1

Drought Tolerant Species as a Percentage of Total Landscaped Area	Points
$\geq$ 20%	1
$\geq$ 40%	2

Notes:

- ***This credit is applicable only for those projects which have atleast 15% of the site area landscaped.***
- *For this credit, landscape areas over built structures such as basements, podium, roofs, etc., can be considered for landscape area calculations.*
- *Landscape here refers to soft landscaping which includes only vegetation.*
- *Areas planted with turf should not exceed a slope of 25 percent (i.e., a 4 to 1 slope).*
- *For this credit calculation, potted plants should not be considered under landscaping.*

Exemplary Performance:

This credit is eligible for exemplary performance under Innovation & Design Process, if:

- There is no turf in the landscaped designed (AND)

More than 60% of the landscaped area is planted with drought tolerant species

Approach and Methodologies:

During landscape design minimise turf to the extent possible. Select ground covers, shrubs and trees which consume less water. Select species that are well-adapted to the site and which are drought tolerant. Consider xeriscaping as an approach for landscaping.

Management of Irrigation Systems

Design Submittal

WE Credit 2

Points: 1

Intent:

Reduce water demand for irrigation through water efficient management systems and techniques.

Compliance Options:

Provide or install highly efficient irrigation systems incorporating the features mentioned below:

For Individual Residential Unit: *(minimum three features)*

- Central shut-off valve
- 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
- Pressure regulating device(s) to maintain optimal pressure to prevent water loss
- Any other innovative methods for watering

For Multi-dwelling Residential Units: *(minimum four features)*

- Central shut-off valve
- 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
- Time based controller for the valves such that evaporation loss is minimum and plant health is ensured
- Pressure regulating device(s) to maintain optimal pressure to prevent water loss
- Any other innovative methods for watering

Exemplary Performance:

This credit is not eligible for exemplary performance under Innovation & Design Process.

Approach and Methodologies:

Design irrigation management system based on the requirements of the landscape plan. Conduct a market survey on the technologies available to manage irrigation efficiently. The designer and the installer must work together and ensure the planned performance of the system. Also, identify local manufacturers supplying systems such as moisture sensor, time based controllers, etc.,

Rainwater Harvesting, Roof & Non-roof

Construction Submittal

WE Credit 3 **Points: 4**

Intent:

Enhance ground water table and reduce municipal water demand through effective rain water management.

Compliance Options:

Provide rainwater harvesting system to capture atleast 50% of run-off volumes from roof and non-roof areas. The harvesting system designed should cater to atleast 1 day of normal rainfall* occurred in the last 5 years.

Points are awarded as below:

Rainwater Harvesting System to Capture / Recharge	Points
≥ 50% from roof & non-roof areas	2
≥ 75% from roof & non-roof areas	4

In areas where the central/ state ground water board does not recommend artificial rain water recharge (or) if the groundwater table is less than 4 m, the projects can show nominal compliance by collection & reuse and points are awarded as below:

Rainwater Harvesting System to Capture	***Points***
≥ 10% from roof & non-roof areas	*2*
≥ 20% from roof & non-roof areas	*4*

Notes:

- *For normal rainfall, refer Indian Metrological Department data at http://www.imd.gov.in.*
- ** To arrive at the normal rainfall, divide peak month rainfall occurred in each year (in last 5 years) by number of rainy days in the respective month, and take the average of the five values obtained. Abnormal rainy days like flash floods can be excluded from calculations.*
- *Projects which do not have data on the number of rainy days, a maximum of 15 rainy days can be considered to arrive at normal rainfall.*
- *In areas where the water percolation is limited, collection tanks may be provided to meet the above requirement.*

Run-off coefficients for typical surface types are listed below:

Table 2 - Runoff coefficients for Typical Surface Types

S No	Surface Type	Runoff Coefficient
1	Cemented / Tiled Roof	0.95
2	Roof Garden (<100 mm thickness)	0.95
3	Roof Garden (100 – 200 mm thickness)	0.3
4	Roof Garden (201 – 500 mm thickness)	0.2
5	Roof Garden (> 500 mm thickness)	0.1
6	Turf, Flat (0 - 1% slope)	0.25
7	Turf, Average (1 - 3% slope)	0.35
8	Turf, Hilly (3 - 10% slope)	0.4
9	Turf, Steep (> 10% slope)	0.45
10	Vegetation, Flat (0 - 1% slope)	0.1
11	Vegetation, Average (1 - 3% slope)	0.2
12	Vegetation, Hilly (1 - 3% slope)	0.25
13	Vegetation, Steep (> 10% slope)	0.3
14	Concrete Pavement	0.95
15	Gravel Pavement	0.75
16	Open-grid Concrete Pavement	0.75
17	Open-grid Grass Pavement	0.5

Exemplary Performance:

This credit is eligible for exemplary performance under Innovation & Design Process, if more than 95% run-off from roof & non-roof areas is captured and/ or recharged.

Approach and Methodologies:

Survey the water table in the project location. 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 Efficient Plumbing Fixtures

Design Submittal

WE Credit 4 **Points: 4**

Intent:

Minimise the use of municipal water and reduce load on waste water systems.

Compliance Options:

Select water efficient plumbing fixtures whose flow rates / capacities are atleast 25% less than the baseline criteria. The baseline criterion is as below:

Table 3 - Baseline Flow Rates / Capacity for Plumbing Fixtures in a Typical House-hold

Fixture Type	Maximum Flow Rate / Capacity	Duration	Daily Uses per Person/ Day
Water Closets	6 LPF (High flush)	1 Flush	1
	3 LPF (Low flush)	1 Flush	4
Health Faucet/ Bidet, Hand-held Spray*	8 LPM	15 Seconds	1
Faucet*	8 LPM	15 Seconds	8
Kitchen Sink*	8 LPM	15 Seconds	6
Showerhead* / Hand-held Spray*	10 LPM	8 Minutes	1

Source: Uniform Plumbing Code – India, 2008

** At a design pressure of 3 bar*

Points are awarded as below:

Water Efficient Plumbing Fixtures	Points
$\leq$ 25% less than baseline criteria	2
$\leq$ 35% less than baseline criteria	4

Notes:

- *The number of permanent occupants has to be considered as two persons each for the first two bed rooms, and one additional person for each additional bedroom.*
- ***Rain showers (if any) need to be considered in the calculations. Considering that bath tubs may not be used on a daily basis, they may be excluded for the calculations.***
- ***Treated waste water/ captured rain water can be reused for flushing. The reused quantity for flushing can be subtracted from the annual water use and compared against the baseline annual quantity.***
- *Groundwater is considered as potable water and cannot be used to show water savings.*
- *The baseline flows can be demonstrated at flowing water pressure of 3 bar. Flowing water pressure of 3 bar 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 mandatory requirement, the design flow rates are to be submitted at 3 bar.*

Exemplary Performance:

This credit is eligible for exemplary performance under Innovation & Design Process, if water consumption is 45% lesser than the baseline criteria.

Approach and Methodologies:

While selecting water fixtures, look for their 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.

Consider reuse of treated waste water and captured rain water for flushing. Ensure periodic testing of the treated water to meet the quality standards for flushing, as prescribed by Central / State Pollution Control Board.

Waste Water Treatment and Reuse

Design Submittal

Not applicable for Individual Residential Units

WE Credit 5 — Points: 4

Intent:

Reduce consumption of potable water and waste water generation to minimise the burden on municipal streams.

Compliance Options:

Waste Water Treatment: ***(2 points)***

- Provide an on-site treatment system to treat 100% of waste water generated in the building/ campus, to the quality standards suitable for reuse as prescribed by Central (or) State Pollution Control Board, as applicable.

Waste Water Reuse: ***(2 points)***

- Reuse treated waste water or captured rain water for atleast 50% of landscaping & flushing water requirements.

Points are awarded as below:

Percentage of Landscaping & Flushing Water Requirement catered through Treated Water	Points
≥ 50%	1
≥ 95%	2

Notes:

- *Waste water here refers to both grey and black water.*
- *The credit point(s) can be claimed only if the waste water is treated in-situ and reused in-situ.*
- *Potted plants should not be considered under landscaping.*

Exemplary Performance:

This credit is not eligible for exemplary performance under Innovation & Design Process.

Approach and Methodologies:

Calculate the waste water volumes generated in the building. Design appropriately the capacity of the on-site waste water treatment system. While designing the treatment system, ensure that the treated waste water meets the required quality standards based on its purpose of application. Ensure that the quality of the treated waste water is fit and safe for reuse.

Prioritise the use of treated waste water such that irrigation, flushing, etc., Excess treated waste water can also be used for make-up water for air-conditioning systems and other purposes. Ensure periodic testing of the treated water to meet the quality standards as prescribed by Central / State Pollution Control Board. Have adequate signages all around the building to caution occupants and housekeeping staff that this water is not potable.

Water Metering

Design Submittal

Not applicable for Individual Residential Units

WE Credit 6 — Points: 1

Intent:

Encourage continuous monitoring to enhance the water performance of residential dwelling unit(s).

Compliance Options:

Provide water meters for the following, as applicable: *(minimum three water meters)*

- Potable water consumption at individual dwelling unit level
- Captured rain water reuse
- Landscape water consumption
- Hot water consumption through solar systems, at building level
- Treated waste water consumption
- Air-conditioning cooling tower make-up
- Any other major source of water consumption such as, swimming pools, water fountain, common car wash facilities, etc.,

Exemplary Performance:

This credit is not eligible for exemplary performance under Innovation & Design Process.

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

CFC-Free Equipment

Design Submittal

EE Mandatory Requirement 1

Intent:

Avoid use of refrigerants and ozone depleting gases which has negative impact to the environment.

Compliance Options:

Use CFC-free refrigerants in Heating, Ventilation & Air-conditioning (HVAC) equipment and Unitary Air-Conditioners installed in the building(s).

Approach and Methodologies:

Survey the market for CFC-free HVAC system/ unitary air-conditioners. Install HVAC equipment/ unitary air-conditioners which does not use CFC based refrigerant.

Minimum Energy Performance

Design Submittal

EE Mandatory Requirement 2

Intent:

Improve energy efficiency of the building(s) to reduce environmental impacts from excessive energy use.

Compliance Options:

The project can choose any one of the following options to show compliance for minimum energy performance:

- Option 1 – Prescriptive Approach
- Option 2 – Performance Based Approach

Note:

- ***Projects having multiple building types must independently (i.e. each residential typology; eg: apartments, villas, club house, etc.,) meet the minimum energy performance criteria.***

Option 1 - Prescriptive Approach

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

1. **Building Envelope:**

   The project must ensure that the following building envelope measures meet the baseline criteria as outlined in Annexure –I.

   - Solar Heat Gain Coefficient (SHGC) *
   - Window Glazing U-value *(only if WWR > 30%)***
   - Overall Roof Assembly U-value

   Notes:

   - **Low SHGC value can be achieved through chajjas or efficient fenestration or a combination of both*
   - ***Compliance for window glazing U-value should be shown only if window-to-wall ratio (WWR) is more than 30%*
   - ***Compliance for overall wall assembly U-value need not be shown for mandatory requirement***

2. **Lighting:**

The project must ensure that the interior, exterior, common and parking area lighting power densities meet the baseline values through 'building area method' as outlined in Annexure–I.

Notes:

- ***Individual dwelling unit should show compliance for interior and exterior lighting, whereas Multi-dwelling units should show lighting compliance for all the areas which are in developer's/ owner's scope only.***
- ***Compliance for interior, exterior, common and parking area lighting must be shown separately.***
- *Decorative lighting in respective areas should be considered for lighting power density calculations.*
- *The areas considered to calculate the LPD should be those areas which are illuminated by external lighting (not the entire exterior area).*
- *This LPD includes the power consumption of the complete fixtures, which includes lamps and ballasts.*

3. **Air-conditioning Systems:**

The project must ensure that the air-conditioning systems meet the baseline criteria as outlined below:

- ❖ Unitary air-conditioner(s) must be BEE minimum 3-star rated or equivalent
  (Or)
- ❖ Centralised air-conditioning system(s) must meet the baseline values as per Annexure - I

Notes:

- ***Both Individual and Multi-dwelling units should show compliance for all the air-conditioning system(s) installed in the project, as per the owner's/ developer's scope***
- *For latest list of air-conditioners rated by BEE, please refer BEE website http://www.bee-india.nic.in*
- *Minimum Efficiency Requirements for VRF Systems can be referred from ASHRAE Standard 90.1-2010*

Option 2 – Simulation Based Approach

The simulation (performance) based approach involves a building energy simulation and modeling. **This approach allows the project to demonstrate compliance with the baseline criteria.**

The project must perform building energy simulation considering the following, as per annexure - I:

- Building envelope
  - Solar heat gain coefficient (SHGC)
  - Window glazing U-value
  - Overall wall assembly U-value
  - Overall roof assembly U-value
- Lighting
  - Interior, exterior, common & parking area lighting, whichever is in owner's / developer's scope
- Air-conditioning
- Space heating
- Plug loads & Process loads

The following comfort conditions should be considered for energy simulation:

- Indoor temperature set point for simulation should be 26^0C for cooling systems & 20^0C for Space heating systems all through the year.
- Comfort conditions should be considered both for summer and winter.

Notes:

- *Trade-offs among different building parameters (such as lighting, air-conditioning, etc.,) are permissible.*
- ***Projects which use on-site renewable energy sources (such as solar photovoltaics, wind turbines, etc.,) can be subtracted from the total energy of the proposed case.***
- ***Solar hot water systems should not be modeled in both base case and proposed case, to show energy savings. Such systems are separately recognised under EE Credit 3 – Solar water heating systems.***
- *Electric water heating system should be considered under Plug loads.*
- *The base case requirements for the energy simulation module are given in Annexure - I.*
- *The protocol for energy simulation, calculation of the proposed & baseline building performance and indicative format for reporting energy simulation results are detailed in Annexure - III.*

Approach and Methodologies:

The approach would be to look at orientation, right at the design stage. The design should then consider and select appropriate measures such as insulation of walls, roof, selection of glass, sizing of windows, lighting and efficient air-conditioning & heating systems.

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

Also, consider 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.,

Enhanced Energy Performance

Design Submittal

EE Credit 1

Points: 10

Intent:

Enhance energy efficiency of the building(s) to reduce environmental impacts from excessive energy use.

Compliance Options:

The project can choose any one of the following options:

- Option 1 – Prescriptive Approach (Maximum 10 points)
- Option 2 – Performance Based Approach (Maximum 10 points)

Note:

- ***Projects having multiple building types must independently (i.e. each typology eg: apartments, villas, club house, etc.,) meet the minimum energy performance criteria to be eligible for Enhanced Energy Performance.***

Option 1 - Prescriptive Approach

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

1. **Building Envelope:**

   The project should ensure that the building envelope measures meet the below criteria as outlined in Annexure - II.

   - Solar Heat Gain Coefficient (SHGC)
   - Window Glazing U-value
   - Overall Wall Assembly U-value
   - Overall Roof Assembly U-value

   Points are awarded as below for Building Envelope Measures:

Building Envelope Measures	Points for Individual Residential Units *(Maximum 5 points)*	Points for Multi-dwelling Residential Units *(Maximum 7 points)*
Solar Heat Gain Coefficient (SHGC)	2	2
Window Glazing U-value	1	1
Overall Wall Assembly U-value	1	2
Overall Roof Assembly U-value	1	2

Note:

- ***SHGC can be achieved through chajjas or efficient fenestration or a combination of both***

2. Lighting:

❖ **Lighting Power Density (LPD):** *(2 points)*

The project must ensure that the interior, exterior, common and parking area lighting power densities are reduced by atleast 20% from the baseline values through 'building area method' as outlined in Annexure -I.

Points are awarded as below for Lighting Power Density (LPD):

Reduction in Interior, Exterior Common & Parking Area LPDs from Baseline Values	Points
≥ 20 %	1
≥ 30 %	2

❖ **Lighting Controls:** *(1 point)*

All non-emergency exterior & common area lighting such as façade, pathways, landscaping, surface and covered parking, street lighting, staircases should have atleast one of the following:

- Day light sensor
- Occupancy/ Motion sensor
- Timer

Notes:

- ***Individual dwelling unit should show compliance for interior and exterior lighting, whereas Multi-dwelling units should show compliance for all the areas which are in developer's/ owner's scope only.***
- ***Compliance for interior, exterior, common and parking area lighting must be shown separately.***
- *Decorative lighting in respective areas should be considered for lighting power density calculations.*
- *Exterior areas illuminated by lighting only should be considered for lighting power density calculations.*
- *This LPD includes the power consumption of the complete fixtures, which includes lamps and ballasts.*

3. Air-conditioning Systems:

(Applicable for project only if 25% of the total regularly occupied spaces are air-conditioned, excluding kitchen)

The project must ensure that the air-conditioning systems meet the enhanced criteria as outlined below:

- Unitary air-conditioner(s) must be BEE 5-star rated or equivalent *(2 points)*

  (Or)
- Centralised air-conditioning system(s) must be efficient by atleast 10% from the baseline values as outlined in Annexure -I *(2 points)*

Points are awarded as below for Centralised Air-conditioning Systems:

Efficiency in Centralised Air-conditioning Systems from Baseline Values	Points
$\geq$ 10 %	1
$\geq$ 20 %	2

Notes:

- *For latest list of air-conditioners rated by BEE, please refer BEE website http://www.bee-india.nic.in*
- *Minimum Efficiency Requirements for VRF Systems can be referred from ASHRAE Standard 90.1-2010*

4. Space Heating Systems *(1 point)*

(Applicable for project only if HDD** 18 is greater than 150)

- Unitary heat pumps must meet the baseline criteria, as per Annexure - I
- Non-electricity based heating system should have a minimum thermal efficiency of 70%

Notes:

- ***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^{o}C, HDD 18: for any one day, when the mean temperature is less than 18^{o}C, there are as many degree-days as degree Centigrade temperature difference between the mean temperature for the day and 18^{o}C. Annual heating degree-days (HDDs) are the sum of the degree-days over the calendar year*

Option 2 – Performance Based Approach

The simulation (performance) based approach involves a building energy simulation and modeling. **This approach allows the project to demonstrate improvements over the baseline criteria.**

Points are awarded based on energy cost percentage savings as detailed below:

Option - 2: Points for Energy Performance

Percentage Energy Cost Savings above Base case		Points
Individual Residential Unit	**Multi-dwelling Residential Units**	
3 %	2 %	1
6 %	4 %	2
9 %	6 %	3
12 %	8 %	4
15 %	10 %	5
18 %	12 %	6
21 %	14 %	7
24 %	16 %	8
27 %	18 %	9
30%	20 %	10

The project must perform building energy simulation considering the following, as per annexure - I:

- Building envelope
  - Solar Heat Gain Coefficient (SHGC)
  - Window Glazing U-value,
  - Overall Wall Assembly U-value
  - Overall Roof Assembly U-value
- Lighting
  - Interior, exterior common and parking area lighting, whichever is in owner's / developer's scope
- Air-conditioning
- Space heating
- Plug loads & Process loads

The following comfort conditions should be considered for energy simulation:

- ❖ Indoor temperature set point for simulation should be 26^0C for cooling systems & 20^0C for Space heating systems all through the year.
- ❖ Comfort conditions should be considered both for summer and winter.

Notes:

- ***Projects having multiple building types must independently (i.e. each typology eg: apartments, villas, club house, etc.,) meet the minimum energy performance criteria to be eligible for Enhanced Energy Performance.***
- *Trade-offs among different building parameters (such as lighting, air-conditioning, etc.,) are permissible.*
- ***Projects which use on-site renewable energy sources (such as solar photovoltaics, wind turbines, etc.,) can be subtracted from the total energy of the proposed case.***
- ***Solar hot water systems should not be modeled in both base case and proposed case, to show energy savings. Such systems are separately recognised under EE Credit 3 – Solar water heating systems.***
- *Electric water heating system should be considered under Plug loads.*
- *The base case requirements for the energy simulation module are given in Annexure - I.*
- *The protocol for energy simulation, calculation of the proposed & baseline building performance and indicative format for reporting energy simulation results are detailed in Annexure - III.*

Exemplary Performance:

This credit is eligible for exemplary performance under Innovation & Design Process, if:

Prescriptive Based Approach:

- ❖ Interior, exterior, common and parking area lighting power densities are reduced by 40% from the baseline values through 'building area method' as outlined in Annexure -I.

  (Or)
- ❖ Centralised air-conditioning systems are 30% better than the baseline system, as outlined in Annexure - I.

Performance Based Approach:

- ❖ Energy cost savings is more than 22% in individual dwelling units and 33% in multi-dwelling units, when compared to the base case as outlined in Annexure - I.

Approach and Methodologies:

The approach would be to look at orientation, right at the design stage. The design should then consider and select appropriate measures such as insulation of walls, roof, selection of glass, sizing of windows, lighting and efficient air-conditioning & heating systems.

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

Also, consider 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.,

On-site Renewable Energy

Design Submittal

EE Credit 2

Points: 6

Intent:

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

Compliance Options:

For Individual Residential Unit:

Install renewable energy systems for atleast 5% of total connected load of the building.

Points are awarded as below:

Renewable Energy as a Percentage of Total Connected Load of the Building	Points
$\geq$ 5 %	2
$\geq$ 10 %	4
$\geq$ 15 %	6

For Multi-dwelling Residential Units:

Install renewable energy systems for atleast 2.5% of total connected load of the building/ campus (includes interior, common and exterior areas).

Points are awarded as below:

Renewable Energy as a Percentage of Total Connected Load of the Building/ Campus	Points
$\geq$ 2.5 %	2
$\geq$ 5 %	4
$\geq$ 7.5 %	6

Note:

- ***Solar hot water systems cannot be considered as power generation source and cannot be subtracted from the total energy of the proposed case.***

Exemplary Performance:

This credit is eligible for exemplary performance under Innovation & Design Process, if:

- More than 20% of total connected load of the building is through renewable energy systems for Individual residential unit.
- More than 10% of total connected load of the building/ campus is through renewable energy systems for Multi-dwelling residential units.

Approach and Methodologies:

Consider 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.,

Solar Water Heating System

Design Submittal

EE Credit 3

Points: 4

Intent:

Encourage use of solar energy for water heating applications in the building(s).

Compliance Options:

Provide solar water heating system to meet hot water requirement for domestic purposes. The minimum hot water requirement for domestic purposes should be considered as 20 liters per person per day.

Points are awarded as below:

Individual Residential Unit

Hot Water through Solar Water Heating System as a Percentage of Total Hot Water Requirements of the Building(s)	Points
$\geq$ 50 % $\geq$ 95 %	2 4

Multi-dwelling Residential Units

Hot Water through Solar Water Heating System as a Percentage of Total Hot Water Requirements of the Building(s)	Points
$\geq$ 25 % $\geq$ 50 %	2 4

Exemplary Performance:

For Individual residential unit, this credit is not eligible for exemplary performance under Innovation & Design Process.

For Multi-dwelling residential units, this credit is eligible for exemplary performance under Innovation & Design Process, if solar water heating system meets 75% of hot water requirement for domestic purposes.

Approach and Methodologies:

Calculate hot water requirement for the entire project. Install solar water heating system, thereby catering to hot water requirement in the project. The design should also consider the availability of space to install the solar panels.

Energy Saving Measures in Appliances & Other Equipment *Design Submittal*

EE Credit 4 **Points: 2**

Intent:

Conserve energy in the use of house-hold appliances and other equipment, thereby reducing environmental impacts.

Compliance Options:

Individual Residential Unit: *(2 points)*

Provide any four of the following with minimum BEE 4-star rated or equivalent appliances:

- Ceiling Fans
- Electric geysers
- Refrigerators
- Television
- Washing machines (Semi-automatic/ Automatic)
- Pumps & Motors*
- Other rated appliances

** Where BEE star rating is not applicable, compliance can be shown through ISI certified Pumps & Motors*

Multi-dwelling Residential Units: *(2 points)*

Provide any two of the following measures:

- Pumps: BEE 4-star rated Pumps (or) Minimum 60% efficiency for Pumps of capacity greater than 3 HP and ISI certified pumps for others
- Motors: BEE 4-star rated Motors (or) Minimum 75% efficiency for Motors of capacity greater than 3 HP and ISI certified motors for others
- Elevators operating with intelligent group controls
- Energy efficient parking garage exhaust system
- Other energy efficient equipment/ system

Exemplary Performance:

This credit is not eligible for exemplary performance under Innovation & Design Process.

Approach and methodology

Conduct market survey before selecting appliances. Consider the energy efficiency of these appliances and select minimum BEE 4-star rated or equivalent appliances.

Distributed Power Generation

Design Submittal

Not applicable for Individual Residential Units

EE Credit 5 **Points: 2**

Intent:

Reduce dependence on fossil fuels for *in-situ* power generation.

Compliance Options:

Install hybrid distributed power generation sets which operate both bio-fuels/ non-edible oils/ any other non-fossil based fuel and fossil fuel. These sets should comply with the Central Pollution Control Board (CPCB) requirements for emission and noise levels.

Notes:

- *Distributed Power Generation is an energy system based on interconnected small and medium size power generators.*
- *This credit is applicable only if the generator sets cater to atleast 15% of the total connected load of the building / campus.*

Exemplary Performance:

This credit is not eligible for exemplary performance under Innovation & Design Process.

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 compliant for emissions and noise. Also, consider availability of fuel on a sustained basis and economic viability of the system.

Energy Metering

Design Submittal

Not applicable for Individual Residential Units

EE Credit 6 **Points: 1**

Intent:

Encourage continuous monitoring to enhance the energy performance of residential dwelling unit(s).

Compliance Options:

Provide energy meters for any three of the following, as applicable:

- Energy meter for external lighting
- Energy meter for municipal water pumping
- Energy meter for grey water pumping for flushing
- Energy meter for water pumping for landscaping
- Btu Meter for chilled water consumption

Exemplary Performance:

This credit is not eligible for exemplary performance under Innovation & Design Process.

Approach & Methodologies:

Identify all the major energy consuming equipment and install systems to monitor energy consumption. Develop and implement a measurement & verification mechanism to compare predicted savings to actual energy performance of the installed meters.

Materials & Resources

Separation of House-hold Waste

Design Submittal

MR Mandatory Requirement 1

Intent:

Facilitate segregation of house-hold waste at source so as to prevent such waste being sent to land-fills.

Compliance Options

For Individual Residential Unit:

Provide separate bins to collect dry waste (paper, plastic, metals, glass, etc.,) and wet waste (organic).

For Multi-dwelling Residential Units:

Provide separate bins to collect dry waste (paper, plastics, metals, glass, etc.,) and wet waste (organic) at each dwelling unit and common areas (as applicable) in the building(s)/ campus.

Additionally, provide a common facility with separate bins to collect waste which should cover the following, including dry and wet waste bins:

- Batteries
- 'e' waste
- Lamps

Approach and Methodologies:

Allocate suitable space on-site for sorting out dry and wet waste. Examine the scope for recycling of waste collected from the project. Identify local dealers to collect and dispose waste material such as paper, plastic, metals, glass, cardboard, organic waste, batteries, 'e' waste and lamps. Educate residents about various recycling methods.

Organic Waste Management, Post-occupancy

Construction Submittal

MR Credit 1 **Points: 2; 4**

Intent:

Ensure effective organic waste management, post-occupancy, so as to prevent waste being sent to land-fills.

Compliance Options:

For Individual Residential Units: ***(2 points)***

Install on-site waste treatment system for treating 95% organic waste generated from the building. The output from such systems like manure, power, etc., should be reused *in-situ*.

For Multi-dwelling Residential Units: ***(4 points)***

Install on-site waste treatment system for treating atleast 50% organic waste generated from the building(s). The output from such systems like manure, power, etc., should be reused *in-situ*.

Points are awarded as below:

Percentage of Treated Organic Waste	Points
$\geq$ 50%	2
$\geq$ 95%	4

Notes:

- *Organic waste includes household kitchen and garden waste.*
- *The number of permanent occupants has to be considered as two persons each for first two bed rooms, and one additional person for each additional bedroom.*
- *Default organic waste quantity per person per day can be considered as 0.25 kgs or as prescribed by the local bye-law, whichever is more stringent.*

Exemplary Performance:

This credit is not eligible for exemplary performance under Innovation & Design Process.

Approach and Methodologies:

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

Handling of Construction Waste Materials

Construction Submittal

MR Credit 2 **Points: 1 ; 2**

Intent:

Encourage practices to manage construction waste, thereby, avoiding waste being sent to land-fills.

Compliance Options:

Avoid atleast 50% of the waste generated (by either weight or volume) during construction from being sent to landfills.

Points are awarded as below:

Percentage of Construction Waste Materials Handled	Points for Individual Residential Unit	Points for Multi-dwelling Residential Unit
$\geq$ 50%	1	1
$\geq$ 95%	-	2

Notes:

- ***Excavated earth & stones should not be considered under this credit, as these are natural resources.***
- *Temporary materials such as materials used for form-work, scaffolding etc., shall not be considered for credit calculations.*

Exemplary Performance:

This credit is not eligible for exemplary performance under Innovation & Design Process.

Approach and Methodologies:

Collect all construction debris generated on-site. Segregate these waste based on their utility. Examine means of reusing such waste with in the project or other projects, (or) identify appropriate vendors to divert such waste to manufacturing units which would use them as raw materials. Typical construction debris in residential projects include broken bricks, steel bars, broken tiles, glass, wood waste, paint cans, cement bags, packing materials, etc.,

Reuse of Salvaged Materials

Construction Submittal

MR Credit 3 **Points: 2; 4**

Intent:

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

Compliance Options:

Ensure atleast 2.5% (or) 1% of the total building materials (by cost), used in the building(s)/ campus, are salvaged, refurbished and reused.

Points are awarded as below:

Individual Residential Units

Percentage of Salvaged Materials Reused	Points
$\geq$ 2.5%	1
$\geq$ 5%	2

Multi-Dwelling Residential Units

Percentage of Salvaged Materials Reused	Points
$\geq$ 1%	2
$\geq$ 2%	4

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 electrical, mechanical & plumbing - equipment, systems & appliances and movable materials & furniture should not be considered in the total material cost.*
- *Movable materials & furniture should not be considered under this credit.*
- *Temporary materials such as materials used for form-work, scaffolding etc., shall not be considered for credit calculations.*

Exemplary Performance:

This credit is eligible for exemplary performance under Innovation & Design Process.

For Individual Residential Units, more than 7.5% of the total building materials (by cost) used in the building must be salvaged, refurbished and reused.

For Multi-dwelling Residential Units, more than 3% of the total building materials (by cost) used in the building(s)/ campus must be salvaged, refurbished and reused.

Approach and Methodologies:

Identify opportunities to incorporate salvaged materials into building. Consider using salvaged materials for applications such as bricks, doors, flooring, frames, furniture, paneling, etc.,

Materials with Recycled Content

Construction Submittal

MR Credit 4

Points: 2

Intent:

Encourage use of materials which contain recycled content 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 15% of the total cost of the materials used in the building(s)/ campus.

Points are awarded as below:

Percentage of Materials with Recycled Content	Points
$\geq$ 10%	1
$\geq$ 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 electrical, mechanical & plumbing - equipment, systems & appliances and movable materials & furniture should not be considered in the total material cost*
- *Temporary materials such as materials used for form-work, scaffolding etc., shall not be considered for credit calculations.*

Exemplary Performance:

This credit is eligible for exemplary performance under Innovation & Design Process, if more than 30% of the total building materials (by cost) used in the building(s)/ campus are with materials with recycled content.

Approach and Methodologies:

Survey the materials with recycled content and locate such local suppliers. Materials with recycled content include aluminium, cement, composite wood, concrete, glass, gypsum, false ceiling, fly ash blocks, steel, tiles, etc.,

Local Materials

Construction Submittal

MR Credit 5

Points: 2

Intent:

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

Compliance Options:

Ensure atleast 50% of the total building materials (by cost), used in the building(s)/ campus, are manufactured within a distance of 400 km.

Points are awarded as below:

Percentage of Local Materials	Points
$\geq$ 25%	1
$\geq$ 50%	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 electrical, mechanical & plumbing - equipment, systems & appliances and movable materials & furniture should not be considered in the total material cost*
- *Manufacturing refers to the final assembly of components into the building product that is furnished and installed by the tradesmen.*
- *Local materials are those which are assembled as a finished product within 400 km distance of the project site. Assembly, here does not include on-site assembly, erection or installation of finished components, as in structural steel, miscellaneous iron or systems furniture.*
- *Temporary materials such as materials used for form-work, scaffolding etc., shall not be considered for credit calculations.*

Exemplary Performance:

This credit is eligible for exemplary performance under Innovation & Design Process, if more than 75% of the total building materials (by cost), used in the building(s)/ campus, are sourced locally.

Approach and Methodologies:

Survey and identify building materials which are in the specified radius, in early stages of project design. While selecting local materials, ensure that they perform better in terms of strength, maintenance and durability.

Rapidly Renewable Building Materials & Certified Wood *Construction Submittal*

MR Credit 6 **Points: 4**

Intent:

Minimise use of virgin wood thereby encouraging responsible forest management and maximise use of materials which are rapidly renewable.

Compliance Options:

Ensure atleast 50% of all wood based materials (by cost) used in the building(s)/ campus must be:

- Rapidly renewable

  (AND/ OR)

- Wood certified by Forest Stewardship Council (FSC) or Programme for the Endorsement for Forest Certification (PEFC) or equivalent

Points are awarded as below:

Percentage of Rapidly Renewable Material / Certified Wood	Points
≥ 50%	2
≥ 75%	4

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*
- *Movable materials & furniture should not be considered in the total material cost*
- *Temporary materials such as materials used for form-work, scaffolding etc., shall not be considered for credit calculations.*

Exemplary Performance:

This credit is eligible for exemplary performance under Innovation & Design Process, if more than 95% of all wood based products (by cost), used in the building(s)/ campus, are certified or rapidly renewable.

Approach and Methodologies:

Identify all wood based applications in the project. Determine the types of materials/ products needed (e.g., doors, windows, furniture, flooring etc.,). Explore the possibility of using rapidly renewable materials and wood certified by Forest Stewardship Council (FSC) or Programme for the Endorsement for Forest Certification (PEFC) or equivalent, for all such wood based applications. Also, while sourcing wood for various applications, specify the quality or grade of wood required. Locate local suppliers so as to reduce additional costs and environmental impacts caused during transportation.

Indoor Environmental Quality

Tobacco Smoke Control

Design Submittal

IEQ Mandatory Requirement 1

Intent:

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

Compliance Options:

Individual Residential Unit:

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

Multi-dwelling Residential Units:

Smoking should be prohibited in the common areas of the building(s) and campus.

Approach and Methodologies:

Design the building to eliminate or minimise tobacco smoke pollution in the common areas. Prohibit smoking in common areas like corridors, lobby, lifts, etc., Also, the design must be such that tobacco smoke does not leak into common areas or other dwelling units. Signages can be displayed at several places in the building/ campus to educate occupants and visitors.

Minimum Daylighting

Design Submittal

Mandatory Requirement 2

Intent:

Ensure connectivity between the interior and the exterior environment, by providing adequate daylighting.

Compliance Options:

The project can choose any one of the following options:

- Option 1 – Prescriptive Approach
- Option 2 – Simulation Approach

Option 1: Prescriptive Approach

For Individual Residential Unit:

Achieve minimum glazing factors as below in atleast 50% of the regularly occupied spaces.

For Multi-dwelling Residential Units:

Achieve minimum glazing factors as below in atleast 50% of the regularly occupied spaces in each dwelling unit.

Table 4 - Glazing factors for Regularly Occupied Spaces

Type of Regularly Occupied Spaces	Glazing Factor (GF)*
Living/ Bedroom	1
Study room	2
Kitchen	2

Note:

- *For other regularly occupied spaces which are not listed in the above table, a minimum glazing factor of 1.0 should be achieved.*

Glazing Factor Calculation

Glazing factor can be calculated using the formula given below:

$$\text{Glazing Factor} = \frac{\text{Window Area [sq.m]}}{\text{Floor Area [sq.m]}} \times \text{Actual Visible Transmittance of Glazing} \times \text{Constant} \times 100$$

Constant Values:

Windows on wall : 0.2

Window on roof (skylight) : 1.0

Notes:

- *Regularly occupied spaces include living room, bed rooms, dining room, study room, kitchen, etc.,.*
- ***Regularly occupied spaces which are used for multi-purposes, such as living-cum-dining room, can be considered as separate spaces based on the function. The room boundary need not be a physical boundary***
- ***Regularly occupied spaces which are partially lit with daylight, shall not be considered for the calculations***
- ***Window openings where the angle of obstruction of objects obscuring the sky dome is greater than 70^0 from the horizontal shall not be considered for daylight calculations (refer figure no.1)***

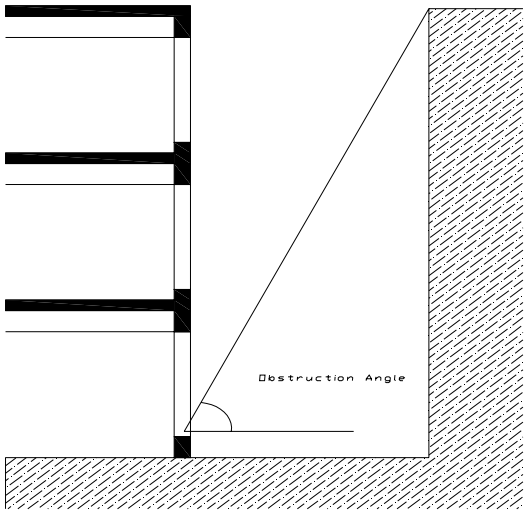


Figure No.1 – Angle of Obstruction

Alternative Compliance for Prescriptive Approach:

For dwelling units, where compliance cannot be shown through the prescriptive approach, daylight simulation tools can also be used to demonstrate that the required illuminance levels are achieved.

Option 2: Simulation Approach

For Individual Residential Unit

Demonstrate through computer simulation that 50% of the regularily occupied spaces achieve daylight illuminance levels of a minimum of 10 footcandles (fc) (108 lux) in a clear sky condition on September 21 at 12 noon, at working plane.

Multi-dwelling Residential Units:

Demonstrate through computer simulation that 50% of the regularly occupied spaces, in each dwelling unit, achieve daylight illuminance levels of a minimum of 10 footcandles (fc) (108 lux) in a clear sky condition on 21st September at 12 noon, at working plane.

Approach and Methodologies:

Ensure that daylighting is considered at the design stage by appropriate orientation. The orientation of the building(s) can be such that maximum daylighting to all the spaces is achieved during most part of the day. While designing for daylight, care should be taken to control glare which causes discomfort. Strategies include building orientation towards the north, appropriately designed windows to ensure adequate daylighting, double height roof, etc.,

Fresh Air Ventilation

Design Submittal

Mandatory Requirement 3

Intent:

Avoid indoor pollutants affecting indoor air quality by providing adequate outdoor air ventilation.

Compliance Options:

For Naturally Ventilated Spaces:

Provide openable windows or doors to the exteriors in all regularly occupied spaces of each dwelling unit such that the openable area is designed to meet the criteria as outlined in the table below:

Table 6 - Design Criteria for Openable Windows and Doors to the Exteriors

Space Type	Openable Area as a Percentage of Total Carpet Area
Living Spaces	10%
Kitchen	8%
Bathrooms*	4%

Notes:

- *Regularly occupied spaces include living room, bed rooms, dining room, study room, kitchen etc.,*
- ***For sliding windows / doors, only openable area to the exteriors shall be considered in calculations***
- **Compliance for bathrooms can also be shown through exhaust system and/ or louvers. The minimum intermittent exhaust flow requirements for bathroom should meet the criteria listed in IEQ Credit 3 – Exhaust Systems, whereas the louver openings should be with an openable area of 4% of total carpet area.*

For Air Conditioned Spaces:

Design a ventilation system for air-**conditioned** spaces, as 5 cfm per person for each air-conditioned space in base case.

Note:

- *Projects installing unitary air conditioning system(s) for a limited period in a entire year can show compliance by providing openable windows & doors. Projects installing centralised air-conditioning system(s) should meet the fresh air requirement of 5 cfm per person in each of the conditioned spaces*

Approach and Methodologies:

Design the building envelope with adequate window openings to bring in fresh air into the building, thereby ensuring good indoor air quality. The approach would be to have sufficient openings in atleast two different directions, so as to allow good cross-ventilation.

Also, study the possible methods of taking in fresh air into the air-conditioned spaces, considering the quality of the fresh air through apropriate 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.

Enhanced Daylighting

Design Submittal

IEQ Credit 1

Points: 4

Intent:

Ensure connectivity between the interior and the exterior environment, by providing adequate daylighting.

Compliance Options:

The project can choose any one of the following options:

- Option 1 – Prescriptive Approach
- Option 2 – Simulation Approach

Option 1: Prescriptive Approach

For Individual Residential Unit:

Achieve minimum glazing factors as below in atleast 75% of the regularly occupied spaces.

For Multi-dwelling Residential Units:

Achieve minimum glazing factors as below in atleast 75% of the regularly occupied spaces in each dwelling unit.

Points are awarded as below:

Percentage of Regularly Occupied Spaces with Daylighting	Points
$\geq$ 75%	2
$\geq$ 95%	4

Table 4 - Glazing Factors for Regularly Occupied Spaces

Type of Regularly Occupied Spaces	Glazing Factor (GF)*
Living/ Bedroom	1
Study room	2
Kitchen	2

Note:

For other regularly occupied spaces which are not listed in the above table, a minimum glazing factor of 1 should be achieved.

Glazing Factor Calculation

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

Daylight Factor = Window Area [SF] / Floor Area [SF] x Actual Visible Transmittance of Glazing x Constant x 100

Constant Values:

Windows on wall : 0.2

Window on roof (skylight) : 1.0

Notes:

- *Regularly occupied spaces include living room, bed rooms, dining room, study room, kitchen, etc.,.*
- ***Regularly occupied spaces which are used for multi-purposes, such as living-cum-dining room, can be considered as separate spaces based on the function. The room boundary need not be a physical boundary.***
- ***Regularly occupied spaces which are partially lit with daylight, shall not be considered for the calculations***
- ***Window openings where the angle of obstruction of objects obscuring the sky dome is greater than 70^0 from the horizontal shall not be considered for daylight calculations (refer figure no.1)***

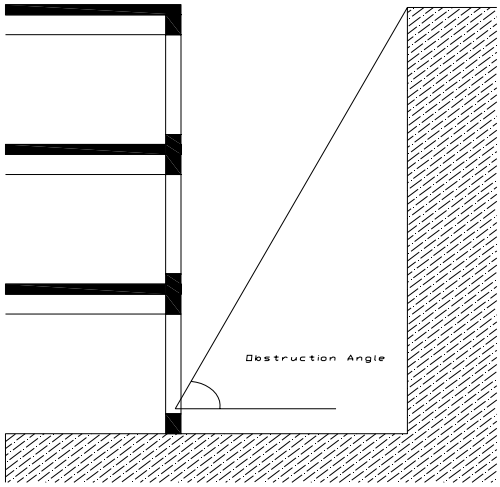


Figure No.1 – Angle of Obstruction

Alternative Compliance for Prescriptive Approach:

For dwelling units, where compliance cannot be shown through the prescriptive approach, daylight simulation tools can also be used to demonstrate that the required illuminance levels are achieved.

Option 2: Simulation Approach

For Individual Residential Unit

Demonstrate through computer simulation that 75% of the regularily occupied spaces achieve daylight illuminance levels of a minimum of 10 footcandles (fc) (108 lux) in a clear sky condition on September at 12 noon, at working plane.

Multi-dwelling Residential Units:

Demonstrate through computer simulation that 75% of the regularily occupied spaces, in each dwelling unit, achieve daylight illuminance levels of a minimum of 10 footcandles (fc) (108 lux) in a clear sky condition on September 21 at at 12 noon, at working plane.

Exemplary Performance:

This credit is not eligible for exemplary performance under Innovation & Design Process.

Approach and Methodologies:

Ensure that daylighting is considered at the design stage by appropriate orientation. The orientation of the building(s) can be such that maximum daylighting to all the spaces is achieved during most part of the day. While designing for daylight, care should be taken to control glare which causes discomfort. Strategies include building orientation towards the north, appropriately designed windows to ensure adequate daylighting, double height roof, etc.,

Enhanced Fresh Air Ventilation

Design Submittal

IEQ Credit 2 Points: 2

Intent:

Avoid indoor pollutants affecting indoor air quality by providing adequate outdoor air ventilation.

Compliance Options:

For Naturally Ventilated Spaces:

Provide openable windows or doors to the exteriors in all regularly occupied spaces of each dwelling unit such that the openable area is designed to meet the criteria as outlined in the table below:

Table 7 - Design Criteria for Openable Windows and Doors to the Exteriors

Space Type	Openable Area as a Percentage of Total Carpet Area
Living Spaces	13%
Kitchen	10%
Bathrooms*	5%

Notes:

- *Regularly occupied spaces include living room, bed rooms, dining room, study room, kitchen etc.,*
- ***For sliding windows / doors, only openable area to the exteriors shall be considered in calculations***
- ****Compliance for bathrooms can also be shown through exhaust system or louvers. The minimum intermittent exhaust flow requirements for bathroom should meet the criteria listed in IEQ Credit 3 – Exhaust Systems, whereas the louver openings should be with an openable area of 5% of total carpet area.***

For Air Conditioned Spaces:

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

Note:

- *Projects installing unitary air conditioning system(s) for a limited period in a entire year can show compliance by providing openable windows & doors. Projects installing centralised air-conditioning system(s) should meet the fresh air requirement of 5 cfm per person in each of the conditioned spaces*

Exemplary Performance:

This credit is not eligible for exemplary performance under Innovation & Design Process.

Approach and Methodologies:

Design the building envelope with adequate window openings to bring in fresh air into the building, thereby ensuring good indoor air quality. The approach would be to have sufficient openings in atleast two different directions, so as to allow good cross-ventilation.

Also, study the possible methods of taking in fresh air into the air-conditioned spaces, considering the quality of the fresh air through apropriate 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.

Exhaust Systems

Design *Submittal*

IEQ Credit 3

Points: 2

Intent:

Ensure that kitchens and bathrooms are adequately ventilated, so as to improve the quality of indoor environment.

Compliance Options:

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

Table 8 - Minimum Intermittent Exhaust Flow Requirements

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

Notes:

- *For rooms with higher floor areas than the above values, airflow has to be proportionally increased.*
- *For kitchens, kitchen range vent hoods which meet the above air flows are also acceptable*
- *Ensure exhaust systems take away the polluted indoor air to the outdoors (i.e. exhaust outlets into common areas are not allowed)*

Exemplary Performance:

This credit is not eligible for exemplary performance under Innovation & Design Process.

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.

Survey the market for exhaust systems which meet the minimum airflow requirements specified under the credit. Develop a database of such systems, and include the list in the 'Green Home Guidelines', which would be circulated to all residents.

Low VOC Materials, Paints & Adhesives

Construction Submittal

IEQ Credit 4 **Points: 2**

Intent:

Encourage use of materials with low emissions so as to reduce adverse health impacts on building occupants.

Compliance Options:

- Use paints and coatings with low or no VOC content for 100% of interior wall and ceiling 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)*

Table 9 - VOC Limits for Materials

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

Note:

- *If the project has used small quantities of non- complying paints and/or adhesives, a VOC budget can be calculated to demonstrate that the weighted average VOC of all products (based on litres of each applied) is below the allowed limit, by each type.*

Exemplary Performance:

This credit is not eligible for exemplary performance under Innovation & Design Process.

Approach and Methodologies:

Develop an outline project specification by selecting materials/ products with low or no VOC content, based on their durability, performance and environmental characteristics. Building products with low VOC content include adhesives, sealants, interior paints, coatings, varnish, carpets, composite wood and agrifiber products. Identify manufacturers supplying such products.

Building Flush-out

Construction Submittal

IEQ Credit 5

Points: 1

Intent:

Avoid occupant's exposure to indoor airborne contaminants before occupying the premises, so as to reduce the adverse health impacts on building occupants.

Compliance Options:

Perform a building flush-out for ten days by keeping all windows open before the building is occupied. Flushing is to be carried after paints & coatings and adhesives & sealants have been applied.

(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.

Exemplary Performance:

This credit is not eligible for exemplary performance under Innovation & Design Process.

Approach and Methodologies:

Flush-out needs to be carried out just before the occupancy, and after paints, adhesives, sealants, etc., are used. Once the home is ready including the interiors, flushing will be effective in driving away the pollutants in the building.

Cross Ventilation

Design Submittal

IEQ Credit 6

Points: 4

Intent:

Encourage adequate cross ventilation in the design thereby, providing a healthy environment.

Compliance Options:

Ensure that minimum 50% of the regularly occupied spaces (by area) in each dwelling unit shall have an opening (doors/ ventilators/ windows) to the outdoor environment, in atleast two of the orientations.

Points are awarded as below:

Percentage of Regularly Occupied Spaces with Cross Ventilation	Points
$\geq$ 50%	2
$\geq$ 75%	4

Notes:

- *Regularly occupied spaces include living room, bed rooms, dining room, study room, kitchen, etc.,*
- ***The* doors/ ventilators/ windows *should not have any obstruction within 2 m from outside surface.***
- ***The opening considered should meet IEQ Mandatory Requirement 3 - Fresh Air Ventilation criterion.***
- *Regularly occupied spaces with an opening to the outdoors only in one orientation can also be considered for calculations, if there is a permanent opening to the adjoining room which meets cross ventilation criteria (refer figure no.2).*

  (In figure no.2, along with the drawing room and kitchen, the living cum dining room will also have adequate cross ventilation through the permanent opening from drawing room).

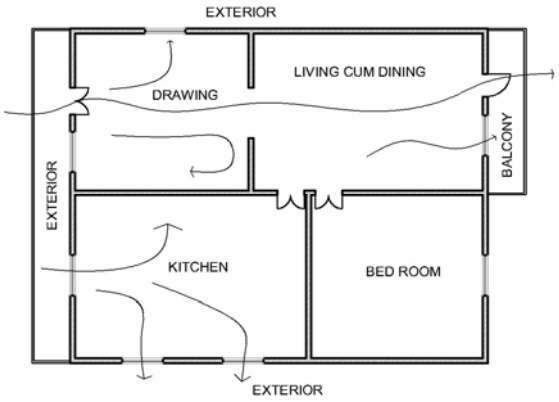


Figure No. 2 – Cross Ventilation

Exemplary Performance:

This credit is eligible for exemplary performance under Innovation & Design Process, if more than 95% of the regular occupied spaces have cross ventilation.

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 & Design Process

Innovation & Design Process

Design/ Construction Submittal

ID Credit 1

Points: 4

Intent:

Provide design teams and projects an opportunity to be awarded points for exemplary 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:

Credit 1.1: Innovation & 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 measures.

Credit 1.2: Innovation & Design Process

Same as credit 1.1

Credit 1.3: Innovation & Design Process

Same as credit 1.1

Credit 1.4: Innovation & Design Process

Same as credit 1.1

Notes:

The project should also meet the following criteria for achieving an Innovation point:

- *Quantitative performance improvements (comparing a baseline and design case)*
- *Strategy must be significantly better than standard sustainable design practices*
- *Measures must be voluntary. Measures that are mandated by the local bye-laws and not addressed in the rating system, are not eligible for Innovation.*
- *Measures should be done both in common areas and tenant areas, as applicable.*

Approach and Methodologies:

Exemplary Performance: The projects should identify the appropriate strategies that greatly exceed the requirements of IGBC Green Homes rating system credits. As a general rule, innovation credits for exemplary performance are awarded for doubling the credit requirements and/or achieving the next incremental percentage threshold. Eligibility criteria for different credits are defined in respective credits (refer Exhibit - B).

Innovative Performance: The projects can also identify the innovation strategies those are not addressed by any existing credits in the rating system. These strategies should demonstrate a comprehensive approach and have significant, measurable environmental benefits. For example, singe signage in a building would not be considered a significant educational effort by itself. But a visitor's center and interactive display, coupled with a website and video would be an appropriate level of effort for earning an innovation credit.

Exhibit B - List of Base Credits eligible for Exemplary Performance

Site Selection and Planning	
SSP Credit 2	Natural Topography or Vegetation : 35%
SSP Credit 3	Heat Island Effect, Non Roof : 95%
SSP Credit 4	Heat Island Effect, Roof : 95% (Vegetation)
Water Efficiency	
WE Credit 1	Landscape Design: 60%
WE Credit 3	Rainwater Harvesting, Roof & Non-roof: 95%
WE Credit 4	Water Efficient Plumbing Fixtures: 45%
Energy Efficiency	
EE Credit 1	Enhanced Energy Performance : 33% (or) 22%
EE Credit 2	On-site Renewable Energy: 20% (or) 10%
EE Credit 3	Solar Water Heating System: 75%
Materials & Resources	
MR Credit 3	Reuse of Salvaged Materials : 7.5% (or) 3%
MR Credit 4	Materials with Recycled Content : 30%
MR Credit 5	Local Materials : 75%
MR Credit 6	Certified Wood & Rapidly Renewable Building Materials : 95%
Indoor Environmental Quality	
IEQ Credit 6	Cross Ventilation : 95%

IGBC Accredited Professional

Design Submittal

ID Credit 2

Point: 1

Intent:

Support and encourage involvement of IGBC Accredited Professional in green home projects, so as to integrate appropriate design measures and streamline certification process.

Compliance Options:

Atleast one principal participant of the project team shall be an IGBC Accredited Professional.

Approach and Methodologies:

Identify an IGBC Accredited Professional who has expertise in IGBC rating systems and green building concepts. The Accredited Professional understands the importance of integrated design and considers synergy amongst various requirements.

Annexures

Baseline Criteria for Energy Performance of the Building

A. Envelope Measures:

(* For Climatic Zones of India, please refer Exhibit – C)

Fenestration - SHGC value

Climate Zone *	Maximum SHGC Value		
	WWR < 20%	**WWR 20 to 30%**	**WWR > 30%**
Composite	0.5	0.42	0.36
Hot and Dry	0.5	0.42	0.36
Warm and Humid	0.5	0.42	0.36
Moderate	0.6	0.48	0.4
Cold	0.8	0.8	0.8

Glazing U-value
(Applicable only if Window to Wall Ratio (WWR) > 30%)

Climate Zone *	Maximum U-Value (W/m^2K) *(WWR > 30%)*
Composite	5.7
Hot and Dry	5.7
Warm and Humid	5.7
Moderate	5.7
Cold	5.7

Wall Assembly - U Value

Climate Zone*	Maximum 'U'-Value of the Overall Wall Assembly (W/m^2K)
Composite	2.5
Hot and Dry	2.5
Warm and Humid	2.5
Moderate	2.5
Cold	1.1

Roof Assembly - U Value

Climate Zone*	Maximum 'U'-Value of the Overall Roof Assembly (W/m^2K)
Composite	1.2
Hot and Dry	1.2
Warm and Humid	1.2
Moderate	1.8
Cold	1.2

B. Lighting Power Density

The Lighting Power Density (LPD) can be achieved by the Building area method. The baseline LPDs are outlined as below:

Lighting	Applicable Areas	Baseline Lighting Power Density (LPD)
Interior Lighting (for residential units)	Individual dwelling unit, Apartments, Villas, Gated communities	5.0 W/m^2
Interior Lighting (for non-residential units)	Resorts, Motels, Service apartments, Hostels, Guest houses, etc.,	10.8 W/m^2
Exterior Lighting, excluding Parking Area (for residential & non-residential units)	Landscaping, Façade, Street lighting, Pathways, Signages, etc.,	2.5 W/m^2
Common Area Lighting, excluding Parking Area (for residential & non-residential units)	Corridors, Lobbies, Staircases, Terrace, etc.,	4.0 W/m^2
Parking Area	Surface parking (covered & uncovered), Basement parking,	2.5 W/m^2

Notes:

- ***Individual dwelling unit should show compliance for interior and exterior lighting, whereas Multi-dwelling units should show lighting compliance for all the areas which are in developer's/ owner's scope only.***

- ***Compliance for interior, exterior, common and parking area lighting must be shown separately.***
- *Decorative lighting in respective areas should be considered for lighting power density calculations.*
- *The areas considered to calculate the LPD should be those areas which are illuminated by external lighting (not the entire exterior area).*
- *This LPD includes the power consumption of the complete fixtures which include lamps and ballasts.*

C. Air conditioning and Heating Systems/ Equipment

(* For Climatic Zones of India, please refer Exhibit – C)

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

- **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^{o}C, HDD 18: for any one day, when the mean temperature is less than 18^{o}C, there are as many degree-days as degree Centigrade temperature difference between the mean temperature for the day and 18^{o}C. Annual heating degree-days (HDDs) are the sum of the degree-days over the calendar year.

Air-Conditioners:

❖ **Unitary air-conditioners**

Baseline air-conditioning system to be considered as unitary air-conditioners with COP/ EER equivalent to 3-star rated equipment under BEE labeling programme.

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

❖ **Centralised air-conditioner systems:**

The baseline COP/ IPLVs for centralised air-conditioning systems are detailed below:

Minimum Efficiency Requirements

Equipment Type	Size Category	Minimum Efficiency	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	
Equipment Type	**Size Category**	**Minimum Efficiency**	**Test Procedures**
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	

Note: *Minimum Efficiency Requirements for VRF Systems can be referred from ASHRAE Standard 90.1-2010*

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

Prescriptive Criteria for Building Envelope Measures (EE Credit 1 - Enhanced Energy Performance)

A. Envelope Measures:

*(*For Climatic Zones of India, please refer Exhibit – C)*

Fenestration - SHGC value

Climate Zone *	Maximum SHGC Value		
	WWR < 20%	WWR 20 to 30%	WWR > 30%
Composite	0.38	0.32	0.27
Hot and Dry	0.38	0.32	0.27
Warm and Humid	0.38	0.32	0.27
Moderate	0.50	0.40	0.30
Cold	0.8	0.8	0.8

Glazing U-value

Climate Zone *	Maximum U-Value (W/m^2K) WWW<30%	Maximum U-Value (W/m^2K) WWW>30%
Composite	3.3	2.8
Hot and Dry	3.3	2.8
Warm and Humid	3.3	2.8
Moderate	5.7	3.3
Cold	3.3	2.8

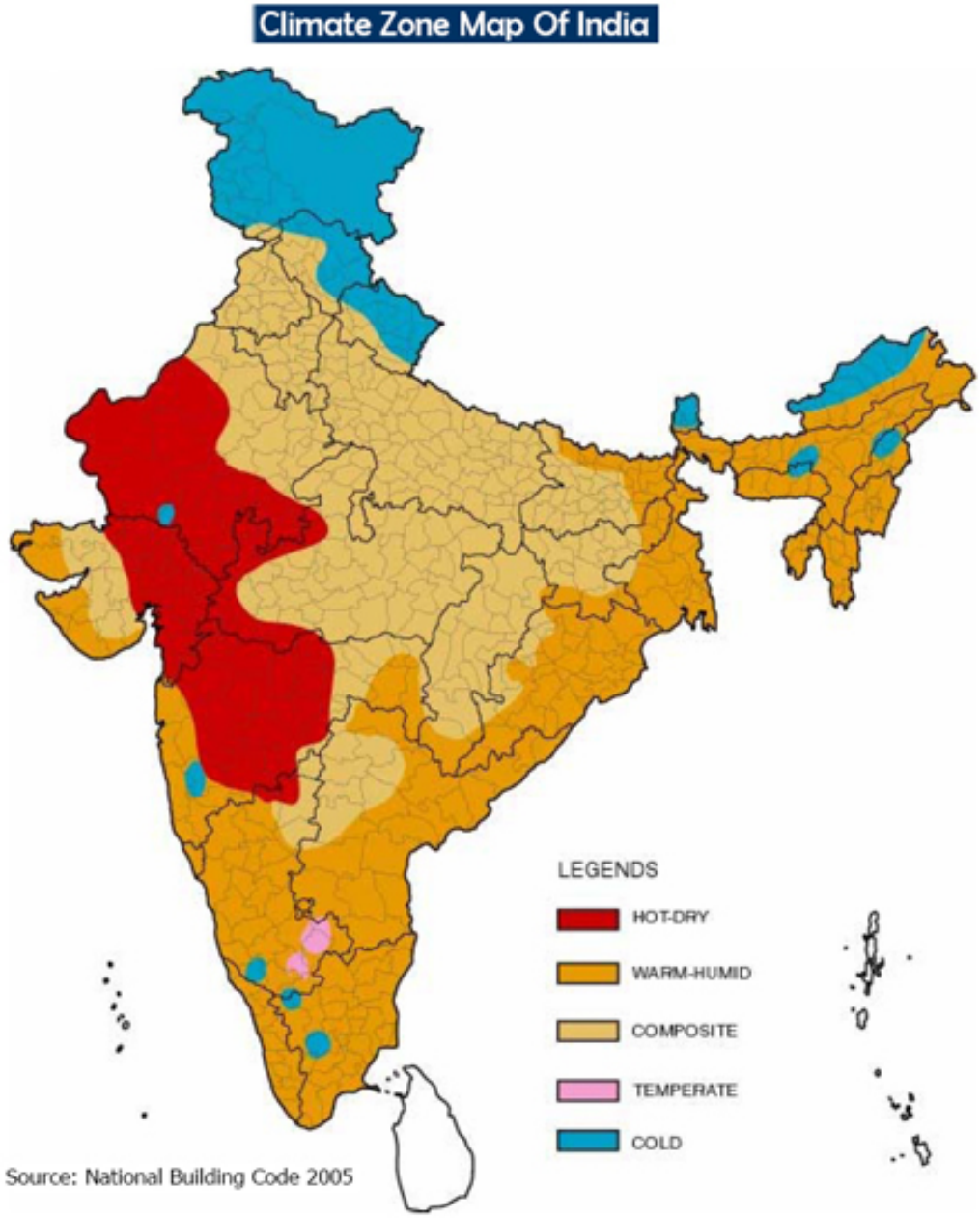
Wall Assembly - U Value

Climate Zone*	Maximum 'U'-Value of the Overall Wall Assembly (W/m^2K)
Composite	1.8
Hot and Dry	1.8
Warm and Humid	1.8
Moderate	1.8
Cold	0.8

Roof Assembly - U Value

Climate Zone*	Maximum 'U'-Value of the Overall Roof Assembly (W/m^2K)
Composite	0.5
Hot and Dry	0.5
Warm and Humid	0.5
Moderate	0.75
Cold	0.5

Exhibit C – Climatic Zones 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 Require ments

- **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, IES, 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 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
  - 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 have the ability to either (1) directly determine the proposed building performance and baseline building performance or (2) produce hourly reports of energy use by an energy source suitable for determining the proposed building performance and baseline building performance using a separate calculation.

- **Climate Data:**

  The simulation program shall perform the simulation using hourly values of climatic data, such as temperature and humidity from representative climatic data, for the site in which the proposed design is to be located. For cities or urban regions with several climatic 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. The selected weather data shall be approved by IGBC.

- **Energy Rates:**

  Annual energy costs shall be determined using actual rates for purchased energy.

- **On-Site Renewable Energy Sources:**

  Projects which use on-site renewable energy sources (such as solar photovoltaics, wind turbines, etc.,) can be subtracted from the total energy of the proposed case.

- **Water Heating Systems:**

  Solar hot water systems should not be modeled in both base case and proposed case, to show energy savings. Such systems are separately recognised under EE Credit 3 – Solar water heating systems.

  Electric water heating system should be considered under Receptacle loads.

- **Exceptional Calculation Methods:**

  Where no simulation program is available that adequately models a design, material, or device, IGBC may approve an exceptional calculation method to demonstrate above-standard performance using this method. Applications for approval of an exceptional method shall include documentation of the calculations performed and theoretical and/or empirical information supporting the accuracy of the method.

- **Schedules:**

  Schedules capable of modeling hourly variations in occupancy, lighting power, miscellaneous equipment power, thermostat setpoints, and HVAC system operation shall be used. The schedules shall be typical of the proposed building type as determined by the designer and approved by IGBC.

- **General Baseline HVAC System Requirements**

  - **Equipment Efficiencies:**

    All HVAC equipment in the baseline building design shall be modeled at the minimum efficiency levels, both part load and full load. Where efficiency ratings, such as EER and COP, include fan energy, the descriptor shall be broken down into its components so that supply fan energy can be modeled separately.

  - **Equipment Capacities:**

    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 centralised air-conditioning system)*

  Unmet load hours for each of the zones in the proposed design or baseline building designs shall not exceed 300 hours. 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 shall be re-simulated until unmet load hours are reduced to 300 or less.

- **Fan System Operation:** *(for centralised air-conditioning system)*

  Supply and return fans shall operate continuously whenever spaces are occupied and shall be cycled to meet heating and cooling loads during unoccupied hours. If the supply fan is modeled as cycling and fan energy is included in the energy-efficiency rating of the equipment, fan energy shall not be modeled explicitly. Supply, return, and/or exhaust fans will remain on during occupied and unoccupied hours in spaces that have health and safety mandated minimum ventilation requirements during unoccupied hours.

- **Ventilation:**

  Minimum outdoor air ventilation rates shall be the same for the proposed and baseline building designs. Design a ventilation system for air-conditioned spaces, as 5 cfm per person for each air-conditioned space in base case.

- **Design Air Flow Rates:** *(for centralised air-conditioning system)*

  System design supply air flow rates for the baseline building design shall be based on a supply-air-to-room-air temperature difference of 11.1°C (20°F). If return or relief fans are specified in the proposed design, the baseline building design shall also be modeled with fans serving the same functions and sized for the baseline system supply fan air quantity less the minimum outdoor air, or 90% of the supply fan air quantity, whichever is larger.

❖ **Heat Pumps:**

Electric air-source heat pumps shall be modeled with electric auxiliary heat. The systems shall be controlled with multistage space thermostats and an outdoor air thermostat wired to energize auxiliary heat only on the last thermostat stage and when outdoor air temperature is less than 4.4°C (40°F).

❖ **Receptacle and Process Loads:**

Both the proposed building performance and the baseline building performance shall include all end-use load components, such as receptacle and process loads.

Receptacle, process and equipment loads shall be estimated based on the building type or space type category and shall be assumed to be identical in the proposed and baseline

building designs. These loads shall be included in simulations of the building and shall be included when calculating the baseline building performance and proposed building performance.

The default receptacle and process loads cost shall be considered as 25% of the total energy cost for the baseline building.

For buildings, where the process energy cost is less than 25% of the baseline building energy cost, the submittal must include supporting documentation substantiating that process energy inputs are appropriate.

Receptacle and Process loads include, but not limited to, refrigerator, washing machine, television, electric geysers, computers, parking garage exhaust, pumps & motors, elevators, etc.,

Documentation Requirements:

Simulated performance shall be documented, and documentation shall be submitted. The information submitted shall include the following:

- A list of the energy-related features which are included in the design. This list shall document all energy features that differ between the models used in the baseline building performance and proposed building performance calculations.
- Comparison & calculated values for the baseline building performance and the proposed building performance.
- The percentage improvement in energy consumption between baseline building performance and proposed building performance.
- The schedules for lighting power, thermostat set-point, HVAC system, miscellaneous equipment power, etc., for proposed building, as determined by the designer.
- Input and output report(s) from the simulation program or compliance software including a breakdown of energy usage by atleast the following components: lights, space cooling & heating equipment and heat rejection equipment, fans, other HVAC equipment (such as pumps), internal equipment loads, etc.,. The output reports shall also show the amount of time any loads are not met by the HVAC system for both the proposed design and baseline building design.
- An explanation of any error messages noted in the simulation program output.

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.

S. No.	Case	Proposed building	Baseline building
1.	Design model	a) The simulation model of the proposed design shall be consistent with the actual design and should include envelope measures and all systems b) All end use energy consumers in the building and associated with the building must be modeled.	a) The baseline model should have the same conditioned area and same number of floors as the proposed building. b) All end use energy consumers in and associated with the building in the base case should be the same as the proposed case.
2.	Schedules	The schedules for lighting power, thermostat set-point, HVAC system, miscellaneous equipment power, etc., shall be typical of the proposed building as determined by the designer.	Same as proposed design
3.	Building envelope	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. a) Orientation: As per design b) Opaque assemblies such as roof and walls shall be modeled with the same heat capacity and U-value as per proposed design. c) Fenestration: as per design Manually operated fenestration shading devices such as blinds or shades shall not be modeled. Permanent shading devices such as fins, overhangs, and light shelves shall be modeled.	The standard design shall have identical conditioned, unconditioned floor area and identical exterior dimensions and orientations as proposed design, unless otherwise mentioned. 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. 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. c) Fenestration: Fenestration areas shall be equal to that in the proposed design or 30% of gross wall area above grade, whichever is smaller, shall be distributed on each face of the building in the same proportions in the proposed design.

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S. No.	Case	Proposed building	Baseline building
		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.	• 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. d) Roof albedo: all roof surfaces shall be modeled with a reflectivity of 0.30.
4.	Lighting	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. 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 upto15% over the lighting power of those fixtures connected to such sensors. b) Using timer/ daylight based controls for the external lighting systems (areas like façade lighting, landscape lighting, and street lighting) will have a direct saving upto15% on the lighting power of those fixtures connected to such controls. ***Notes:*** ***Individual residential unit – Interior & Exterior LPDs should be considered as per design.***	Lighting power in the standard design shall be determined using the Baseline values as detailed in Annexure - I.

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S. No.	Case	Proposed building	Baseline building
		Multi-dwelling residential units – Interior LPD should be same as base case (or, as per design, if interior lighting is in the scope of developer) and Exterior, Common & Parking area LPD should be considered as per design.	
5.	Heating and Cooling systems	a) Where a cooling and heating system has been designed for more than 25% of living spaces of the project, the model shall be consistent with design documents. b) Where no heating or cooling system is proposed, the system shall be same as the baseline.	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. ***<u>Notes:</u>*** ***Individual & Multi-dwelling residential units:*** • ***In actual design, if less than 25% of living spaces are air-conditioned, then model atleast 25% of living spaces as air-conditioned in both base case and proposed case.*** • ***If more than 25%, then consider air-conditioned area as per actual design in both base case and proposed case.*** • ***The project should consider minimum of 12 hours per day for atleast 120 days in a year (for cooling & heating in summer and winter respectively), for air-conditioning in both base case and proposed case.***

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S. No.	Case	Proposed building	Baseline building
7.	Receptacle and Process loads	a) Receptacle and Process loads shall be modeled as designed. All end-use load components shall be modeled.	a) Receptacle and Process loads shall be modeled same as the proposed design. ***Notes:*** • ***The default receptacle and process loads cost shall be considered as 25% of the total energy cost for the baseline building.*** • *For buildings, where the process energy cost is less than 25% of the baseline building energy cost, the submittal must include supporting documentation substantiating that process energy inputs are appropriate.*

Note: *In cases, where the parameters and their values are not specified in the protocol, they should be referred to ECBC or ASHRAE 90.1 – 2007. If the values are specified neither in ECBC nor in ASHRAE 90.1 – 2007, they should be taken from the proposed design.*

Format for Reporting Energy Simulation Results:

Energy Savings

	Proposed building			Baseline building		Percentage Savings
End Use	**Energy Type**	**Energy (10^6 kWh)**	**Peak (10^6 kW)**	**Energy (10^6 kWh)**	**Peak (10^6 kW)**	**Energy (%)**
Interior Lighting*	Electricity					
Exterior Lighting*	Electricity					
Air-conditioning						
Space Heating	Electricity					
Total Building Consumption						

Energy Cost Savings

	Proposed building		Base Building		% Improvement	
Energy Savings	Energy Use (10^6 kWh)	Energy Cost (Rs/yr)	Energy Use (10^6 kWh)	Energy Cost (Rs/yr)	Energy %	Cost %
Electrical energy						
Savings through exceptional methods						
Total						

Notes:

- *The tables detailed are not exhaustive and only indicate the format for energy savings from the energy simulation results.*
- **Interior space lighting, common area lighting, exterior lighting and parking area lighting power density calculations should also be submitted along with simulation report.*

The improved performance of the proposed building design shall be calculated using the following formula:

$$\text{Percentage improvement} = 100 \times \frac{\text{(Baseline building performance - Proposed building performance)}}{\text{Baseline building performance}}$$