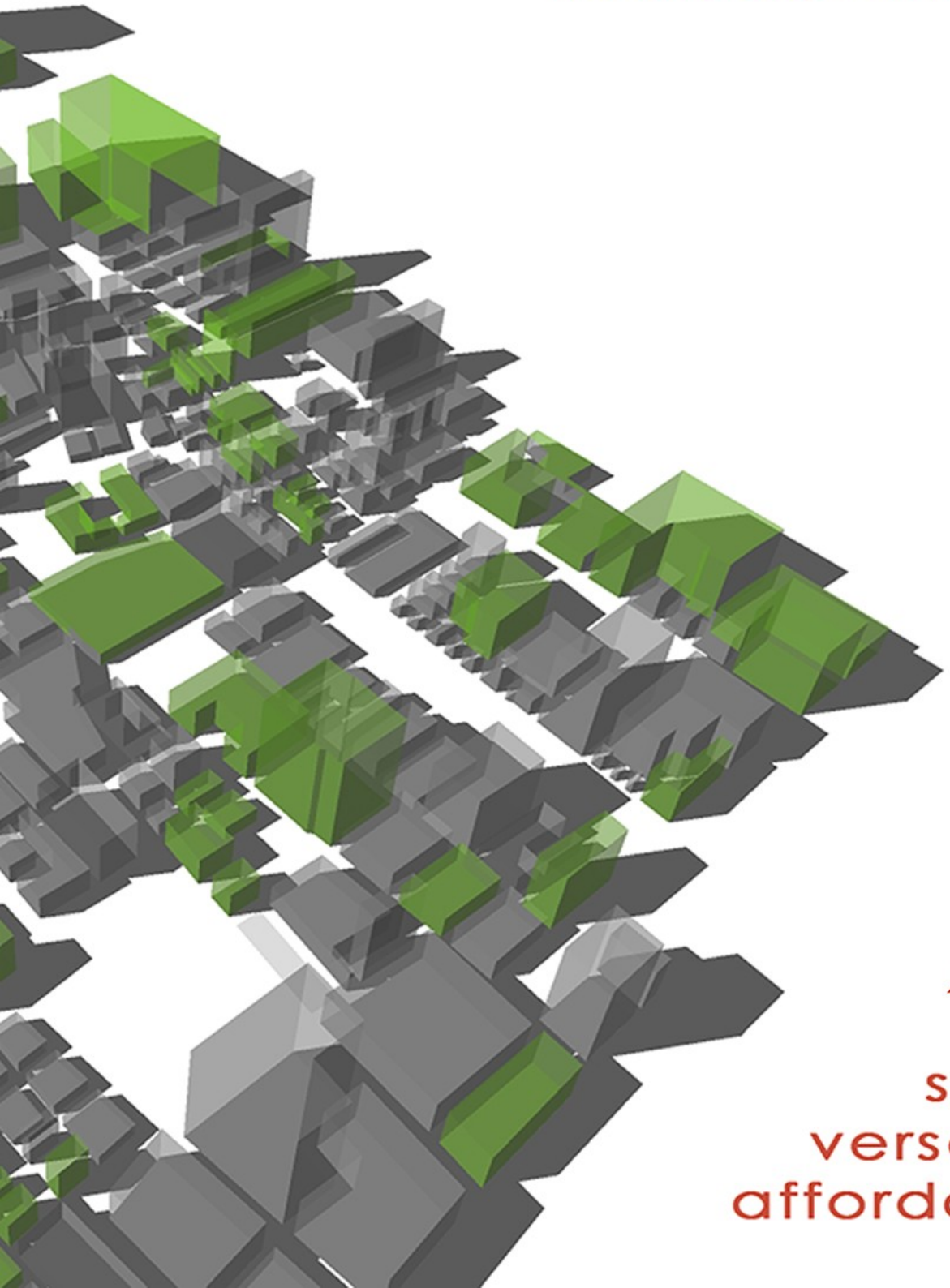
Association for Development and Research of Sustainable Habitats

SVAGRIHA

A simplified design-cum-rating tool



small
versatile
affordable

S V A G R I H A

Version 2.2

Introduction

SVAGRIHA is a guidance-cum-rating system being developed for small stand alone buildings like residences, commercial offices, motels, dispensaries, schools etc. and/or set of buildings with a cumulative built-up area of 2500 sq.m. or less.

Need

SVAGRIHA has been developed in order to help reduce the environmental impact of these small developments. SVAGRIHA has been designed as a simple online tool with guiding parameters which will evaluate the performance of the project with respect to SVAGRIHA in a simple, easy to understand manner.

Rating System

- SVAGRIHA will be applicable only for projects which are less than 2500 sq.m. built-up area.
- The rating system has 14 criteria.
- The criteria are divided into 5 broad sub-groups- namely: architecture & energy, water & waste, materials, landscape and lifestyle.
- It will be mandatory to attempt certain points under each sub-group. This has been listed on a later page.
- The total points that a project can achieve are 50
- The rating will be done on a 1-5 star scale.

SVAGRIHA is a TERI-ADaRSH initiative

The Process

1. Registration
2. Access to the online SVAGRIHA analysis tool will be given to the architect/consultant
3. Assessment/Review as per SVAGRIHA by the project team
4. Completed online analysis tool, along with the necessary documentation will be submitted to ADaRSH for evaluation
5. Site Visit and due diligence check post construction will be conducted by ADaRSH
6. Evaluation of the tool and documentation by ADaRSH
7. Award of Rating.

Note: The site audit to check compliance will be done once the projects is complete and all equipments to be verified are installed

Cost break-up

- The SVAGRIHA registration cost includes the following:
  - –Registration and plaque fees
  - –Professional costs for filling up the various templates (only in the pilot phase)
  - –Evaluation of documents by a GRIHA Evaluator
  - –Assistance with respect to criteria compliance
  - –Professional costs for site visit

- Projects with built-up area greater than/equal to 100 sqm and less than 300 sqm.
  - –Cost of registration = Rs. 30,000/-
  - –Cost of orientation workshop = Rs. 10,000/- (optional)

- Projects with built-up area greater than/equal to 300 sqm and less than 800 sqm.
  - –Cost of registration = Rs. 60,000/-
  - –Cost of orientation workshop = Rs. 10,000/- (optional)

- Projects with built-up area greater than/equal to 800 sqm and less than 1500 sqm.
  - –Cost of registration = Rs. 80,000/-
  - –Cost of orientation workshop = Rs. 10,000/- (optional)

- Projects with built-up area greater than/equal to 1500 sqm and less than 2500 sqm.
  - –Cost of registration = Rs. 1,00,000/-
  - –Cost of orientation workshop = Rs. 10,000/- (optional)

  - –Exclusive of government taxes

  Note: All travel and accommodation of ADaRSH professionals, for outside Delhi projects, is not included in the above cost and shall be arranged by the client or reimbursed as per actuals.

Development Team

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- Tanmay Tathagat
  –Principal, Environmental Design Solutions, New Delhi
- Usha Rangarajan
  –Principal Architect, Landmark Design Group, Pimpri Chinchwad/Pune
- Dr. Vinod Gupta
  –Space Design Consultants, New Delhi

Criterion points distribution

Criterion number	Criterion name	Points
1	Reduce exposed, hard paved surface on site and maintain native vegetation cover on site	6
2	Passive architectural design and systems	4
3	Good fenestration design for reducing direct heat gain and glare while maximising daylight penetration	6
4	Efficient artificial lighting system	2
5	Thermal efficiency of building envelope	2
6	Use of energy efficient appliances	3
7	Use of renewable energy on site	4
8	Reduction in building and landscape water demand	5
9	Rainwater harvesting	4
10	Generate resource from waste	2
11	Reduce embodied energy of building	4
12	Use of low-energy materials in interiors	4
13	Adoption of green Lifestyle	4
14	Innovation	2
Total		50

Rating

- In order to get a rating, it is mandatory for each project to achieve a certain number of minimum points in each category as mentioned below.

Sub-Group	Maximum points	Minimum points to be achieved
Landscape	6	3
Architecture & Energy	21	11
Water & waste	11	6
Materials	8	4
Lifestyle	4	1

Points achieved	SVAGRIHA Rating
25-29	★
30-34	★ ★
35-39	★ ★ ★
40-44	★ ★ ★ ★
45-50	★ ★ ★ ★ ★

Mandatory Clause

- The project for construction must have all necessary clearances as the local building bye-laws/municipal authorities.

- The project should comply with the coastal zone regulations, eco-sensitive zone regulations, heritage areas, water body zones or any other such regulation concerning a potential hazard area.

Criterion 1

Reduce exposed hard paved surface on site and maintain native vegetation cover on site

Objective

The intent of the criterion is to reduce the total exposed hard paving on site (open areas surrounding the building) or shade them. Additionally the criterion encourages the planting of native tree species on site to maintain local flora cover.

Design Guidelines

Part 1: Reduction of Exposed hard paved surface on site

- Calculate the total paved area on your site. Use the following formula:
- Total paved area = Site area – (building footprint + landscape area) Eq 1
- Calculation for compliance with the criterion:

$$\frac{\text{Soft paved area + hard paved area under shade}}{\text{Total paved area (as per eq 1)}} > 50\% \quad \text{Eq 2}$$

Part 2: Maintaining tree cover on site

- If the site has fully grown mature trees:
  - Demarcate the periphery zone (definition as per local building bye-laws or 2 metres from the site boundary, inside the site) for the site and identify the various fully grown mature trees located in that zone. Ensure that all the trees in the periphery zone are protected.
  - Count the total number of mature trees on site and identify the number of trees which require to be cut. Plan your landscape plan such that you plant as many trees that you have cut and the trees should be of the same species as cut or native species.

Commitment

•If the site has no fully grown mature trees:

–Plant trees in the ratio (as mentioned in Table 1.1 below) and ensure that all new trees on site are native.

Site Area	Number of trees
Less than or equal to 250 sq.m.	2
Between 250 sq.m and 750 sq.m.	3
Site area greater than 750 sq.m.	3+1 for every additional 250 sq.m.

1.1.1 At least 50% of the total paved area on site should either be soft-paved and/or shaded under trees/pergolas/solar PhotoVoltaics etc.

1.1.2 If there are trees on site:

1.1.2.1 Ensure that all mature trees in the periphery zone (as defined by local building bye-laws or 2 metres from the boundary wall) of your site are preserved and protected during construction (follow the GRIHA manuals for tree protection guidelines)

1.1.2.2 The total number of mature trees on site before and after construction should be same

1.1.2.3 All new trees being planted on site should be native

1.1.3 If there are no mature trees on site:

1.1.3.1 Plant trees on site which are native to the given location

1.1.3.2 The trees being planted on site should follow the ratio mentioned in the table 1.1.

Compliance documents

1.2.1 Submit a drawing of the site highlighting the following:

– hard paved area on site;

– soft paved area on site;

– Hard paved area under shade;

– Existing trees on site & trees in the perimeter zone;

– Total number of trees which are cut;

– Trees which will be replanted and their location; and

– Mention the site area, building footprint area and landscape area

1.2.2 Upload photographs, along with descriptions, in the online photo-library highlighting the following:

– Soft paved surfaces on site

– Hard paved areas under shade

– Tree protection during construction

– New tree plantation

– the site prior to construction to demonstrate the existing vegetation on site

1.2.3 List of trees being planted on site and whether they are native/naturalized

Appraisal

1.3.1 At least 50% of the total paved area on site should be soft and/or shaded – 2 points

1.3.2 If there are mature trees on site:

1.3.2.1 All trees in the perimeter zone shall be protected – 1 point

If there are no trees in the perimeter zone, then 1 point will be added to 1.3.2.3

1.3.2.2 The total number of trees on site before and after construction would stay the same - 2 points

1.3.2.3 All new trees planted on site will be native – 1 point

OR

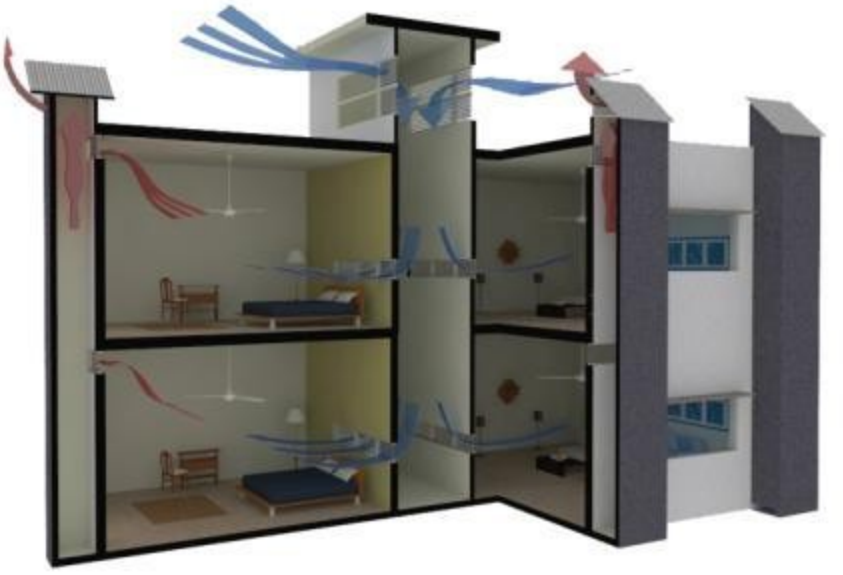
If there are no mature trees on site:

1.3.2.4 Trees should be planted on site in the ratio as prescribed – 2 points

1.3.2.5 All new trees being planted on site will be native – 2 points

Criterion 2

Adopt passive architectural design strategies



Objective

Adopt passive architectural design strategies in building design to create climate sensitive buildings which have reduced energy consumption while maintaining occupant comfort.

Design Guidelines

•Following are a list of passive design strategies commonly prevalent for various climatic zones. Demonstrate through sketches/photographs/drawings how these features have been incorporated in your building design. Identify the climate zone for your building as per NBC 2005 or ECBC 2007. The list of passive measures are given on the following pages.

Active low-energy systems for thermal comfort

•Use of low-energy or passive heating/cooling measures helps to ensure that the overall energy consumption of the building is reduced while ensuring good thermal comfort conditions for the occupants. Highlight the use of low-energy or passive heating/cooling measures. Few examples of the same are given below:

- –Desert coolers and fans
- –Earth Air tunnels
- –Passive Downdraught Evaporative Cooling
- –Direct/Indirect Evaporative cooling
- –Solarium
- –Trombe Wall

Passive Design Measures

Composite
Solar Chimney/Wind Tower
Courtyards
Water bodies for evaporation
Reduced solar access
Building/Site planning to increase cross ventilation (layout of windows in the rooms and building for wind flow)
Earth berming
Thermal mass to reduce heat gain/loss
Dense vegetation cover to moderate micro-climate
Cavity walls
Terrace Garden/Green Roof
Roof insulation using clay pots(mutkas)
Design according to site slopes
Light shelves
Internal distribution of spaces to be carried out such that buffer spaces like store rooms, staircases, toilets etc. are located on the eastern and western facades
Cool roofs in the form of terrace gardens/roof ponds etc. (high reflective paint finish would not be accepted here)
Geothermal cooling/heating
Ventilators

Passive Design Measures

Cold
Trombe walls
Solarium
Heat capturing wall panels
Sun spaces
Solar wall
Solar heat collector based ventilation/thermal system
Direct solar gain in rooms
Earth berm
Maximum openings on positioned in order to bring in more heat
In-direct solar gain
Air lock to prevent heat loss
Thermal Mass
Glass covered atrium/central spaces
Design according to site slopes
Orientation of the building
Geothermal heating/cooling

Passive Design Measures

Warm & Humid
Building/Site planning to increase cross ventilation (layout of windows in the rooms and building for wind flow)
Internal distribution of spaces to be carried out such that buffer spaces like store rooms, staircases, toilets etc. are located on the eastern and western facades
Earth berming
Solar Chimneys
Terrace gardens/Green roofs
Thermal mass
Ventilators

Moderate
Light coloured external surfaces
Design according to site topography
Design of openings according to local wind patterns
Internal distribution of spaces to be carried out such that buffer spaces like store rooms, staircases, toilets etc. are located on the eastern and western facades
Ventilators

Passive Design Measures

Hot & Dry
Design according to site topography
Courtyards
Wind towers
Thermal Storage
Earth berming
Internal distribution of spaces to be carried out such that buffer spaces like store rooms, staircases, toilets etc. are located on the eastern and western facades
Passive evaporative cooling structures
Cool roofs in the form of terrace gardens/roof ponds etc. (high reflective paint finish would not be accepted here)
Geothermal heating/cooling
Building envelope designed such that wind flow helps reduce the heat gain inside the building
Ventilators

Commitment

2.1.1 Design the building such that it incorporates certain passive architectural features in building design

2.1.2 Install active, low-energy cooling/heating systems in the building like earth-air tunnel systems, desert coolers, air-washers, PDEC (Passive downdraft evaporative cooling) etc.

Compliance documents

2.2.1 Submit architectural drawings highlighting the key passive design measures and active, low-energy cooling/heating systems adopted in the building

2.2.2 Submit sketches highlighting the adoption of passive design measures and active, low-energy cooling/heating systems

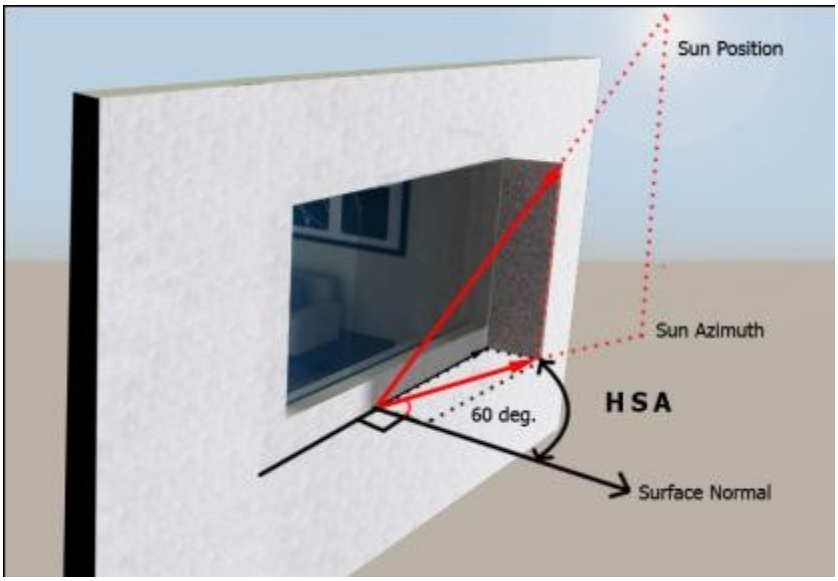
Appraisal

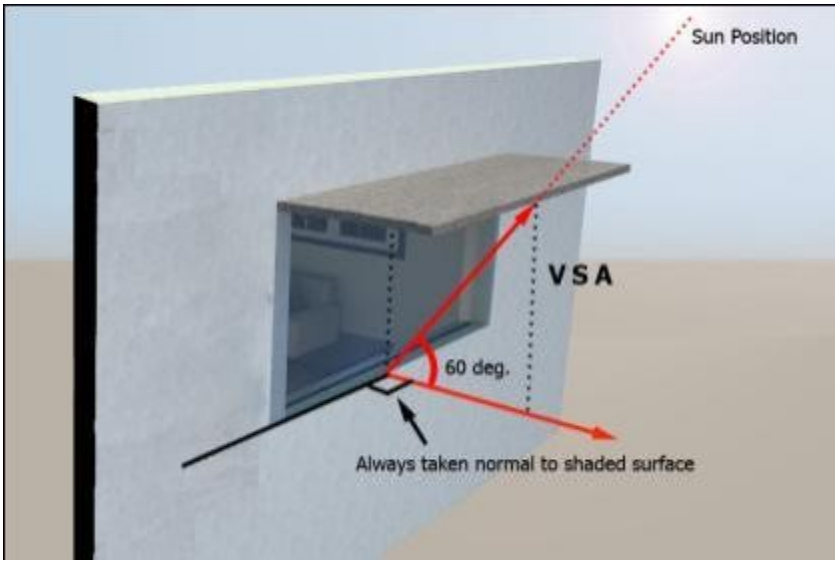
2.3.1 Adopt a minimum of 2 passive design measures in building – 2 points

2.3.2 Active, low-energy cooling/heating systems are installed in the building – 2 points

Criterion 3

Good Fenestration design for reducing direct heat gain and glare while maximising daylight penetration





Objective

The intent of this criterion is to assess the fenestration design of the building and to promote design of openings such that direct heat gain through fenestration is minimized while maximising daylight penetration.

Design Guidelines

- The intent of this criterion is to reduce the direct heat gain through fenestration while ensuring good daylighting.
- Key points:
  - The direct heat gain through fenestrations is dependent upon the orientation of the window, window area and the Solar Heat Gain Coefficient of the fenestration (glass+shade)
  - The amount of direct insolation on each orientation is different. East and West have the highest insolation values while North and South have the least. Therefore the more windows that you have on North and South, the more the reduction in the insolation.
  - Besides this, shading windows plays a critical factor in reducing the direct heat of the sun from coming inside the building. The shades of the window along with the glass of the window define the net reduction in the direct heat gain through insolation. Therefore the next step after proper orientation is to provide optimized shading devices to the windows and to select a glass with low-SHGC values.
  - Additionally the size of the windows dictates the amount of daylight and insolation that would be allowed inside the building. Small windows create dark spaces while extra large windows create glare. Therefore it is advisable to optimize the window design in order to balance heat gain with sufficient daylight.

Note: It is mandatory in SVAGRIHA to maintain the maximum limit of 60% WWR as per ECBC.

Part 1: Reduction in direct heat gain through the fenestrations:

–Calculator 1: Insolation

–Design Case: In the design case, you enter the total window area on each façade according to the orientation of the façade. This helps calculate the total direct insolation on the building through the insolation.

–Base Case: In the base case, the calculator distributes the total window area of your projects equally across all the facades and calculates the total insolation in the base case.

–This calculator is designed is evaluate the design of facades from the perspective of the distribution of fenestrations as per the best orientation.

Calculator 2: SHGC

–Design Case: In the design case, the ECBC method is used to calculate the overall SHGC of the fenestration. Details of the glass SHGC and fenestration design must be fed into the calculator.

–Base Case: In the base case fenestration, it is assumed that the glass SHGC is 0.64 for non-north orientations and 0.68 for north glass.

Calculator 3: Combination of Calculator 1 & 2

–In this case, both the design cases and base cases are combined to calculate the overall reduction in direct heat gain through fenestration using the following equation:

–Direct heat gain through fenestrations= insolation x window area x SHGC

Calculator 4: Daylit spaces

–Using the ECBC method of calculation of daylit zones, identify the total daylit spaces in your living areas. The percentage of your daylit spaces as compared to living areas should be at least 25%.

Commitment

3.1.1 Provide maximum openings on orientations with the least amount of insolation i.e. North and South facades

Note: Direct Heat gain through window = Insolation x Window area x shading coefficient ***Eq. -3***

3.1.2 The windows should be adequately sized such that at least 25% of the total living area should fall under a daylit zone

For every 25% increase in living area under daylit zone, project gets an additional 1 point. The living areas would be considered as per the table 3.1 below:

Type of building	List of Living Area	Daylight Factor Percent
Dwellings	Kitchen	2.5
	Living Room	0.625
	Study room	1.9
	Circulation	0.313
Schools	Class room desk top, black board	1.9—-3.8
	Laboratory	2.5—3.8
Offices	General	1.9
	Drawing, typing	3.75
	Enquiry	0.625—1.9
Hospitals	General wards	1.25
	Pathological laboratory	2.5-3.75
Libraries	Stack room	0.9—1.9
	Reading room	1.9-3.75
	Counter area	2.5—-3.75
	Catalogue room	1.9—2.5

The Daylight Factors (DF)mentioned in the above table indicate the minimum daylight as required by SP-41. When the above mentioned DF are met in a space, it means that the space has sufficient daylight for visual comfort. However, in SVAGRIHA, it is not mandatory to meet these daylight factors.

3.1.3 The windows should be well shaded in order to ensure glare-free daylight and reduced insolation

The table 3.2 lists the Daylight Factor that can be achieved for at the centre of the daylit zone in a sample room (7 meters deep) for few combinations of WWR (window on only one wall) and glass vlt. These values are prescriptive in SVAGRIHA for the projects but recommended for better daylighting:

Table 3.2

Visual Light Transmittance of Glass (%)	DF for WWR 10%	DF for WWR 20%	DF for WWR 30%	DF for WWR 40%	DF for WWR 50%	DF for WWR 60%
10	0.3	0.5	0.6	0.7	0.8	0.8
20	0.6	1.0	1.2	1.4	1.5	1.7
30	1.0	1.6	1.8	2.1	2.3	2.5
40	1.2	2.1	2.4	2.8	3.1	3.3
50	1.5	2.6	3.1	3.5	3.8	4.1
60	1.9	3.1	3.7	4.2	4.5	5.0

Compliance documents

3.2.1 Submit all floor plans highlighting the daylit areas in each and the overall daylit areas

3.2.2 Submit elevations, building sections and door & window schedule detailing the shading devices on windows

3.2.3 Submit details/manufacturer specifications of the glass selected for use

Appraisal

For Composite/Warm & Humid/Hot & Dry

3.3.1 Reduce the overall insolation through the fenestration by 30% or more over the base case- 1 points

3.3.2 Reduce the overall insolation through the fenestration by 45% or more over the base case– 2 points

3.3.3 Reduce the overall insolation through the fenestration by 60% or more over the base case– 3 points

For Moderate

3.3.1 Reduce the overall insolation through the fenestration by 10% or more over the base case- 1 points

3.3.2 Reduce the overall insolation through the fenestration by 2% or more over the base case– 2 points

3.3.3 Reduce the overall insolation through the fenestration by 30% or more over the base case– 3 points

Appraisal (contd.)

3.3.4 More than 25% of the total living area should be under daylit zones – (mandatory- no points))

3.3.5 More than 50% of the total living area falls under daylit zones – 1 point

3.3.6 More than 70% of the total living area falls under daylit zones – 2 points

3.3.7 More than 90% of the total living area falls under daylit zones – 3 points

Criterion 4

Design of efficient artificial lighting system

Objective

To promote the design and adoption of energy efficient artificial lighting systems (lamps/luminaires/ballasts etc.) in order to reduce the overall LPD (Lighting Power Density) below ECBC recommended levels

Design Guidelines

Using the calculator, enter the total area, total number of fixtures, the lamps and ballasts used in each case for each room of your building. The more efficient and lamps and ballast, the lower the LPD levels of your project.

Commitment

4.1.1 The overall LPD (Lighting Power Density) levels for the entire building will be less than the ECBC recommended LPD level. Some of the spaces which are to be considered under SVAGRIHA are as follows:

Building Area Type	LPD (W/sq.m.)
Hostel	10.8
Healthcare-Clinic	10.8
Hotel/Motel	10.8
Library	14.0
Multifamily Residential	7.5
Office	10.8
Retail/Mall	16.1
School	12.9

Other spaces, as mentioned in ECBC, as well as the Space Function Method may be considered

Compliance documents

4.2.1 Submit internal artificial lighting drawings for the building

4.2.2 Submit manufacturer details/specifications of the lamps selected

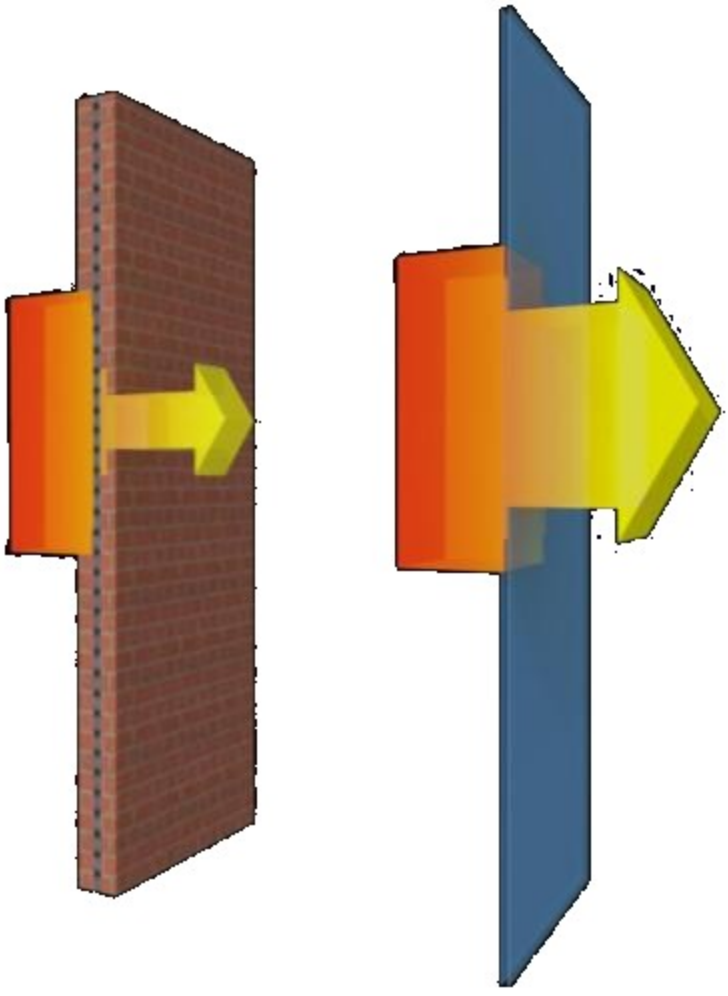
4.2.3 Submit purchase orders/BOQ for the purchased fixtures and lamps

Appraisal

4.3.1 Demonstrate lower LPD levels in the building design as compared to ECBC recommended LPD levels – 2 points

Criterion 5

Design of building envelope to reduce overall heat gain



Objective

The intent of this criterion is to design the building envelope, external wall sections and select construction materials such that the overall heat gain through the building envelope is within acceptable limits, thereby reducing the energy consumption required by the HVAC system and/or induced thermal comfort

Design Guidelines

•This criterion attempts to analyze the thermal efficiency of the building envelope. The thermal efficiency of the building dictates its energy efficiency. For example, in composite or hot climates, if the thermal efficiency of the building is too less, then it will gain a lot of heat from its surroundings and this will in turn require the air-conditioners to consume more energy in order to keep the building occupants comfortable. Similarly in colder climates, a thermally non-efficient building envelope will loose a lot of heat and make the building occupants feel cold and uncomfortable.

•The thermal efficiency of the building envelope is dependent upon the following key parameters:

•External heat gain

–SHGC of glass: Glass SHGC defines the percentage of the heat that gets transmitted inside the building through glass when compared to the total direct insolation on the glass surface.

–U-value of glass/walls/roof: U-value is a variable which defines the amount of heat that gets tranmitted through a unit are of a material for a unit difference in tempreature. The lower the U-value of a material, the lesser the heat transfer and better the thermal efficiency. Therefore the roof and walls should be well insulated in order to reduce the overall U-value and the selection of glass should also keep this in mind.

•Internal heat gain

–LPD level: LPD as described in the previous criterion determines the total heat that is generated inside the building. An efficient internal artificial lighting system will generate lesser heat.

- EPD levels: EPD stands for Equipment Power Density. EPD levels are determinate of the heat generated by equipments used inside a space. The more efficient the equipments, the lesser the EPD level for the space/building. Lower EPD results in lesser internal heat gain.
- Building Occupancy: People also give off a lot of heat. If a space is over-crowded then the temperature and humidity levels will be very high, making the occupants uncomfortable. Therefore an optimum building occupancy is a must.

Commitment

5.1.1 The thermal efficiency of the building envelope should meet the benchmarks as prescribed. The thermal efficiency can be measured in sq.ft./TR or W/sq.m. In case the thermal efficiency is being measured in sq.ft./TR, the efficiency of the building envelope should exceed the thresholds. In case the thermal efficiency of the building envelope is being measured in W/sq.m., the resultant number should be less than the prescribed thresholds.

Compliance documents

5.2.1 Submit drawings highlighting the use of materials in the building envelope that help improve the energy efficiency of the building

5.2.2 Submit purchase orders/BOQ for the materials used in the building envelope

5.2.3 Upload photographs in the online photo-library, of the building materials as installed on site

Appraisal

5.3.1 The appraisal points are awarded for different regions and building types. The thresholds are given in sq.ft./TR or W/sq.m. In the calculator, the output can be viewed in either format and points scored.

- When viewing the output in sq.ft./TR, the project should achieve sq.ft./TR higher than the prescribed thresholds.
- When viewing the output in w/sq.m., the project should achieve w/sq.m. lower than the prescribed thresholds.

Appraisal

City	Threshold				Points awarded
	Residential		Commercial		
	higher than sq.ft./TR	lower than W/sq.m.	higher than sq.ft./TR	lower than W/sq.m.	
Allahabad	225	165	200	190	1
	300	125	275	135	2
New Delhi	275	135	225	170	1
	325	115	275	135	2
Mumbai	325	115	275	135	1
	400	95	350	110	2
Pune	300	125	275	135	1
	375	100	325	115	2
Hyderabad	300	125	250	150	1
	350	110	300	125	2
Chennai	275	135	250	150	1
	350	110	325	115	2
Bengaluru	275	135	250	150	1
	325	115	300	125	2
Kolkata	300	125	275	135	1
	375	100	325	115	2
Chandigarh	275	135	250	150	1
	350	110	300	125	2
Jodhpur	275	135	250	150	1
	350	110	300	125	2

Criterion 6

Use of energy efficient appliances

Objective

The intent of this criterion is to promote the adoption of energy efficient appliances.

Design Guidelines

This criterion evaluates the project on the basis of the total number of key appliances in your building which have a BEE star labelling of 3 – star or more. In order to attempt this criterion, ensure that all your key appliances are more than BEE 3 – star rated.

Commitment

6.1.1 Install BEE star labelled Air-Conditioners in the building with star rating higher than 3

6.1.2 Install BEE star labelled fans in the building with star rating higher than 3

6.1.3 Install BEE star labelled water geyser in the building with star rating higher than 3

Compliance documents

6.2.1 Purchase orders/BOQ for all air-conditioners, fans and geysers.

6.2.2 Submit technical specification documents for each highlighting their energy efficiency

6.2.3 Upload photographs in the online photo-library, of the systems installed on site

Appraisal

6.3.1 All of the Air-conditioners, fans and geyser installed on site are are 3-star BEE labelled – 1 point

6.3.2 All of the Air-conditioners, fans and geyser installed on site are are 4-star BEE labelled – 2 points

6.3.3 All of the Air-conditioners, fans and geyser installed on site are are 5-star BEE labelled – 3 points

**A VRV system for Air-conditioning would be considered as a 5-star BEE equivalent.*

Criterion 7

Use of renewable energy on site

Objective

To promote the use of renewable energy

Design Guidelines

Part 1: Renewable energy system for electricity generation

•In this case, install a renewable energy system on site which meets the minimum size compliance as established in the table 7.1 below.

Built-up area (in sq.m.)	Minimum size of renewable energy system to be installed on site (in kW)
100-500	1
500-1000	2
1000-1500	2.5
1500-2000	3
2000-2500	3.5

Part 2: Solar Water Heaters

•In case of solar water heaters, certain benchmarks are established for requirement of hot water per day for different building typologies. These are mentioned in the table 7.2 below.

Hot water requirement for different building types	litres per day
Per residence	100
4/5 star Hotels (lpd/room)	150
3 star hotel (lpd/room)	125
2 or lesser star hotel (lpd/room)	50
Small hospitals/dispensaries (lpd/bed)	30
Restaurants (lpd/table/meal)	25
Hostels (lpd/student)	30

Commitment

7.1.1 The minimum size of the renewable energy systems installed on site should be equivalent to the thresholds as established in table 7.1.

7.1.2 Ensure that 50% of the daily hot water requirement is met through solar water heaters

Additional point to be awarded if more than 75% of the total daily hot requirement is being met through solar water heaters

Compliance documents

7.2.1 Submit roof plan/site plan highlighting the location of renewable energy systems in site

7.2.2 Submit purchase order/BOQ for the renewable energy system procured

7.2.3 Submit details of calculation of total hot water requirement

7.2.4 Submit sizing details of the renewable energy systems procured and its efficiency document

7.2.5 Upload photographs in the online photo-library, of the systems installed on site

Appraisal

7.3.1 Rated capacity of the renewable energy system installed on site conforms to or exceeds the thresholds as established in Table 7.1 – 2 points

7.3.2 Installed capacity of solar water heaters on site is equivalent to 50% or more of the daily hot water requirement – 1 point

7.3.3 Installed capacity of solar water heaters on site is equivalent to 75% or more of the daily hot water requirement – 2 points

Non-applicability: Office buildings can opt out of installing Solar Water Heaters

Criterion 8

Reduction in building and landscape water demand

Objective

To reduce the overall water demand of the building through use of low-flow fixtures; and to reduce the landscape water demand through the use of native species of flora and efficient irrigation systems

Design Guidelines

Part 1: Reduction in building water demand

•This can be achieved through the use of low-flow fixtures. Low flow fixtures consume significanlty lesser water as compared to conventional fixtures. Use low-flow fixtures to reduce the building water demand.

Part 2: Reduction in landscape water demand

•Reduction in landscape water demand is possible through the use of native trees and shrubs. Trees and shrubs consume significantly lesser water as compared to grass/lawns. Therefore it is recommended to avoid the use of too much grass and plant as many native trees and shrubs on site as possible. These promote the local fauna and require limited maintenance over their lifespan.

Commitment

8.1.1 Reduce the total water requirement in the building by use of low-flow fixtures. The base case assumes conventional flow rates at 80PSi/5.6 kg/cm^2.

8.1.2 Reduce the landscape water demand by use of native species of trees and shrubs, reducing the area under grass and use of efficient irrigation technologies. The base case assumes that the entire landscape area is grass.

Compliance documents

8.2.1 Submit the landscape plan highlighting the landscape design and area under various plant types, species, etc.

8.2.2 Submit purchase order/BOQ highlighting the purchase of low-flow fixtures and high-efficiency irrigation system

8.2.3 Submit specification details of the low-flow fixtures and irrigation systems procured

8.2.4 Upload photographs in the online photo-library, of the systems installed

Appraisal

8.3.1 Reduce the total water requirement in the building by at least 25% or more over the base case - 1 point

8.3.2 Reduce the total water requirement in the building by 33% or more over the base case- 2 points

8.3.3 Reduce the total water requirement in the building by 50% or moreover the base case- 3 points

8.3.4 Reduce the landscape water demand by more than 25% over the base case - 1 point

8.3.5 Reduce the landscape water demand by more than 50% over the base case- 2 points

Non-applicability: In case the difference between the level of the faucet, at a given level, and the outlet of the overhead water tank is less than 4.6 m (15 feet), then the project can avoid the use of low-flow faucets on that particular level.)

Criterion 9

Rainwater harvesting

Objective

To promote rainwater harvesting on site for reuse in building as well as recharge into the ground water aquifer

Design Guidelines

•The intent of this criterion is to promote the use of rainwater for meeting daily water demands as well as recharging the ground water aquifer in order to help restore the depleting ground water table levels.

•The total rainwater that can be harvested, every day, for use can be derived using the following equation:

Rainwater harvested = daily average rainfall (for the location) x surface area x run-off coefficient of the surface Eq 4

•For the project calculate the total surface area of the roof from which run-off would be collected to be used and estimate the total potential that can be harvested.

•Depending upon the size of the storage tank and rainwater harvesting potential from the roof, the total quantity of rainwater that is being harvested for use can be estimated and compared with the building water demand.

•Additionally, the rainwater can be recharged into the ground water aquifer. This can be done through creating recharge borewells or recharge pits on site and creating a drainage which captures the rainwater, directs it to the storage tank and the overflow can be directed towards the recharge pits.

•The thresholds to be assumed for calculating water requirement is as follows:

- **Residential – 140 lpcd**
- **Commercial– 45 lpcd**
- **Hostels – 135 lpcd**
- **Hotels (up to 4 stars) – 180 lpcd**
- **Restaurants – 70 lp/seat/d**
- **Hospitals (less than 100 beds) – 340 lpcd**
- **Visitors – 15 lpcd**

Commitment

9.1.1 Capture rainwater for use on site

9.1.2 Recharge rainwater into the ground water aquifer

Mandatory: When rainwater is being channeled towards ground water recharge, then installation of a filtration system is mandatory in order to prevent contamination of ground water aquifer

Compliance documents

9.2.1 Submit water balance table highlighting monthly break-up of annual rainfall, quantity of rainwater being captured for use and quantity of surplus rainwater

9.2.2 Submit drawings of the rainwater storage tank, ground water recharge pit and filtration system

9.2.3 Submit plumbing layout

Appraisal

9.3.1 The total rainwater harvesting potential for the project (from the roof only) is equivalent to at least 75% of the total building water demand over 2 days – 3 points

9.3.2 Rainwater is recharged into the ground water aquifer and has a filtration system installed– 1 point

Non-applicability: For sites with high ground water tables where recharge is not advisable as per the Central Ground Water Board norms can claim an exemption from the 1 point dedicated to ground water recharge.

Criterion 10

Generate resource from waste

Objective

The intent of the criterion is to promote measures on site which help in recycling and conversion of waste into a resource

Design Guidelines

Use strategies like the TERI-TEAM process, vermicomposting or other local composting techniques to convert organic waste into a resource like manure and/or biogas on site.

Commitment

10.1.1 Adopt strategies on site which help in recycling organic waste into a resource

Compliance documents

10.2.1 Narrative highlighting the measures being taken on site to convert waste into a resource

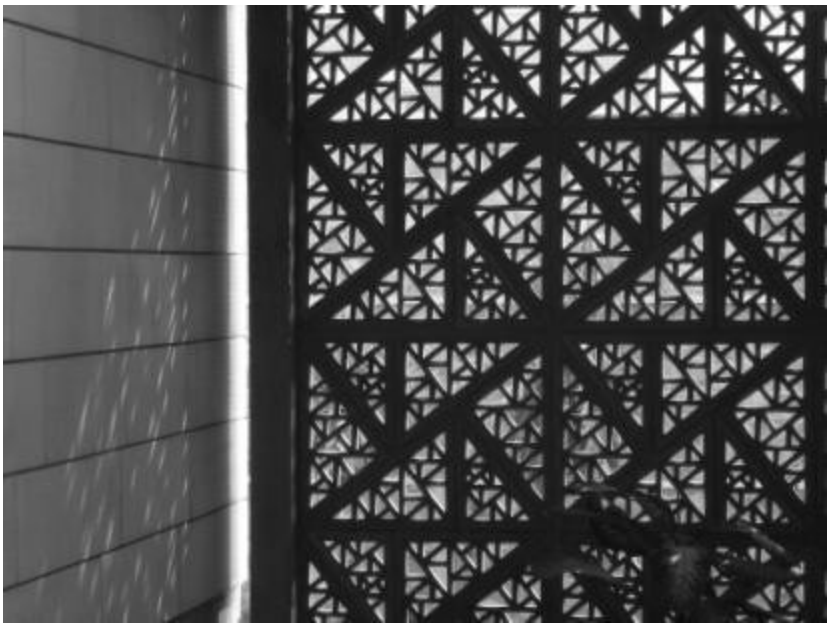
Appraisal

10.3.1 Zero waste generation through adoption of requisite strategies – 2 points

Non-applicability: Office buildings can opt out of using strategies for organic waste conversion

Criterion 11

Reduce the embodied energy of building



Objective

Reduce the overall embodied energy of building structure and reduce the use of OPC

Design Guidelines

Part 1: Use of PPC

•PPC (Pozzolona Portland Cement) contains fly ash mixed with cement. The use of PPC ensures that fly-ash which is a waste by-product of thermal power plants, is used in construction as an effective replacement of Ordinary Portland Cement. This helps in reducing the overall embodied energy of cement as well as preventing mounds of fly ash waste which can cause air and water pollution.

Part 2: Reduction in embodied energy

•Embodied energy is the total energy consumed in the mining, processing, manufacturing, transportation and installation of each unit of a material. The higher the embodied energy of a building structure, the more the emissions. Therefore lower embodied energy materials and construction practices help in reducing the emissions.

•In the design case, select the type of material that you have used in the building roof and walls. The embodied energy of those materials might be lower than the base case. Calculate the total embodied energy of the design case using the equation below:

D.C. E.E. = (Area L.E.S X E.E. L.E.S.) + (Area R.S. X E.E.RCC) + (Area L.E.W X E.E.L.E.W.) + (Area R.W. X E.E. C.B.) Eq 5

B.C.E.E = (Area S X E.E.RCC) + (Area W X E.E.C.B.) Eq 6

where;

D.C.E.E. = Design Case Embodied Energy

Area L.E.S = Area under Low-Energy Slabs

E.E.L.E.S. = Embodied Energy of Low-Energy Slabs

Area R.S. = Area under Remaining Slabs

E.E. RCC = Embodied Energy of Conventional RCC slabs

Area L.E.W = Area of walls under Low-Energy Walling

E.E.L.E.W = Embodied Energy of Low-Energy Walling

Area R.W. = Area under Remaining Walls

E.E.C.B = Embodied Energy of Conventional fired clay Bricks

B.C.E.E. = Base Case Embodied Energy

Area S = Total Area under Slabs

Area W = Total Area under Walls

Through the above calculations demonstrate a net reduction in the overall embodied energy in the design case by at least 5% or more over the base case.

Note: Embodied energy numbers of key materials commonly used in construction are embedded into the calculators.

Commitment

11.1.1 Use PPC in place of OPC in the building structure

11.1.2 Use low-energy strategies/materials for constructing floor slabs, roof slabs and walling systems in order to reduce the overall embodied energy of the building structure as compared to a conventional RCC structure and fired-clay bricks

Compliance documents

11.2.1 Submit drawings highlighting areas in the building where low-energy slab construction and walling blocks have been used

11.2.2 Submit purchase order/BOQ highlighting the procurement of the afore-mentioned materials as well as PPC

11.2.3 Submit manufacturer specifications for the afore-mentioned products

11.2.4 Upload photographs in the online photo-library, demonstrating the installation of the afore-mentioned materials

Appraisal

11.3.1 100% of OPC is replaced by PPC (including building structure and masonry and plaster mortar) – 2 points

11.3.2 The overall embodied energy of the floor slabs, roof slabs and walls is reduced by 5% or more over the base case - 1 point

11.3.3 The overall embodied energy of the floor slabs, roof slabs and walls is reduced by 10% or more over the base case - 2 points

Criterion 12

Use of low-energy materials in interiors

Objective

The intent of the criterion is to promote the use of low-energy materials in interiors and to maintain indoor air quality through the use of low-VOC and lead-free paints

Design Guidelines

Part 1 & 2: Use of low-energy materials in flooring/door/windows/false ceiling/in-built furniture/internal partitions/panelling

•More than 70% of the total materials used in the building interiors should be low-energy. The following materials qualify as low-energy:

•Wood is not considered here as a low-energy material. This is because the core idea is not to cut more forests and allow them to thrive.

•Bamboo and rubber wood are acceptable as low-energy materials.

•Materials created using agricultural waste products like coir etc will be considered low-energy.

•Regionally mined stones (regional to the project) without mirror finish shall be considered low-energy.

•Manufactured materials which have a certain amount of post-consumer/post-industrial recycled content in them are considered low-energy.

Part 3: Low-VOC and lead-free paints

•Use of high-VOC paints in interiors can be a major health hazard for the building occupants. Lead in paints can also be detrimental to the health of building occupants. Therefore, use paints which are low-VOC and lead-free.

•Paints can also be replaced by whitewash/dry distempers/cement paint/exposed brick finish.

Commitment

12.1.1 Minimum 70% of all flooring should be low-energy

12.1.2 Minimum 70% of internal partitions/paneling/false ceiling/in-built furniture/doors & windows-panels & frames should be low-energy

12.1.3 All interior paints (except polishes) should be low-VOC and lead-free

Note: Low-energy materials comprise of the following:

- *Locally mined stones without mirror-finishes*
- *Bamboo/rubber wood products*
- *Particle board, MDF, HDF, agro-fiber based products*
- *Manufactured products with recycled content*

Compliance documents

12.2.1 Submit drawings for each category highlighting the use of low-energy materials

12.2.2 Submit manufacturer documents/cut sheets highlighting the low-energy materials used

12.2.3 Submit purchase order/BOQ of the materials and paints purchased

12.2.4 Submit manufacturer cut-sheets of low-VOC and lead-free paints used in interiors

12.2.5Upload photographs in the online photo-library, from site of the installation of the low-energy materials

Appraisal

12.3.1 At least 70% of the flooring is low-energy – 1 point

12.3.2 At least 70% of internal partitions/paneling/false ceiling/in-built furniture/ doors & window-panels & frames are low-energy – 2 points

12.3.3 All interior paints are low-VOC and lead-free (including no paint/plain mortar finish/whitewash/lime mortar finish) – 1 point

Criterion 13

Adoption of green lifestyle

Objective

Adoption of green lifestyle in order to reduce the carbon footprint of building occupants

Design Guidelines

Part 1:

•A key part of sustainable development includes equitable distribution of resources. This aspect is applicable to buildings as well. A key component of green lifestyles and green buildings is to assess the built up area assigned per capita in a building. The area should not be too high or too little. The space given to each person should be optimal. Given below are the threshold ranges. The per capita space should lie within the range provided:

Built up sqm/capita thresholds	
Residential	12.5 sqm< X < 50 sqm
Commercial (Office)	5 sqm< X < 10 sqm
Nursing Home (per bed)	100 sqm
School	4 sqm< X < 8 sqm
Hotels (per room)	35 sqm< X < 60 sqm

Part 2:

•Another component of green lifestyle is to avoid the use of private vehicles as much as possible. Excessive use of private vehicles, results in air pollution. An alternative to this it to have at least some of the key services/facilities located within the vicinity of the project in order to reduce the travel and use of private vehicles. Ensure that at least 7 of 11 services for residential and 6 of 9 services for non-residential are located close to the building. The total distance travelled annually by an individual should not exceed the thresholds mentioned below:

- –Residential – 2100 km/annum
- –Non-residential – 2000 km/annum

Part 3:

•There are various service staff which work in the buildings like house maids, drivers, cleaners, maintenance staff etc. Often these people have no facilities provided to them. A sustainable building should ensure the comfort of all people living in the building or using it. Therefore, it is advised to have a dedicated toilet facility for service staff as well as a room for their resting (in non-residential spaces)

Part 4:

•Another important component of green lifestyle is to spread the message of preserving the environment to other people in the community. Environmental education and awareness becomes crucial in this aspect. This can be done through various means, by creating posters and panels and installing them on the walls of the building, by creating standees, by using small leaflets/brochures/single-page printouts, by creating a website for the project or any other similar measure which helps in spreading the word on green buildings.

OR

•Organic farming: Urbanization leads to depletion of fertile agricultural land. Food security has been

a growing concern over the past few years, especially in India. Each project can contribute by doing organic farming over a small piece of land within their site/roof.

Commitment

13.1.1 The total built-up area per capita should not exceed the prescribed limits

13.1.2 The site should be located within close proximity of various basic services in order to minimize use of vehicles

13.1.3 Promote awareness of environmental issues and green building technologies in the project

Compliance documents

13.2.1 Submit estimation for built-up area per capita

13.2.2 Submit a satellite images/context drawing highlighting the distances to the closest basic services around the site

13.2.3 Plans/photographs showing resting rooms/toilets for service staff

13.2.4 Submit strategy highlighting environmental awareness strategies or kitchen garden

Appraisal

13.3.1 Built-up area meets the prescribed threshold – 1 points

13.3.2 Total expected distance travelled to basic services in a year is less than 2100 km (residential) or 2000 km (non-residential)– 1 point

13.3.3 Service staff is provided a dedicated toilet and resting room (for non-residential buildings) – 1 point

13.3.4 Environmental awareness is created through panels/brochures/printouts etc.

OR

Organic farming is carried out on site– 1 point

Criterion 14

Innovation

Objective

The intent of awarding points for innovation is to reward additional measures adopted by the project which have not been covered in the previous 13 criterion

Commitment

14.1.1 Adopt strategies, independent of the previous 13 criterion, to make the project more sustainable

Compliance documents

14.2.1 Submit documents/narrative highlighting the measures adopted on site

Appraisal

14.1.3 For each innovation – 1 point (maximum 2 points)

Contact information

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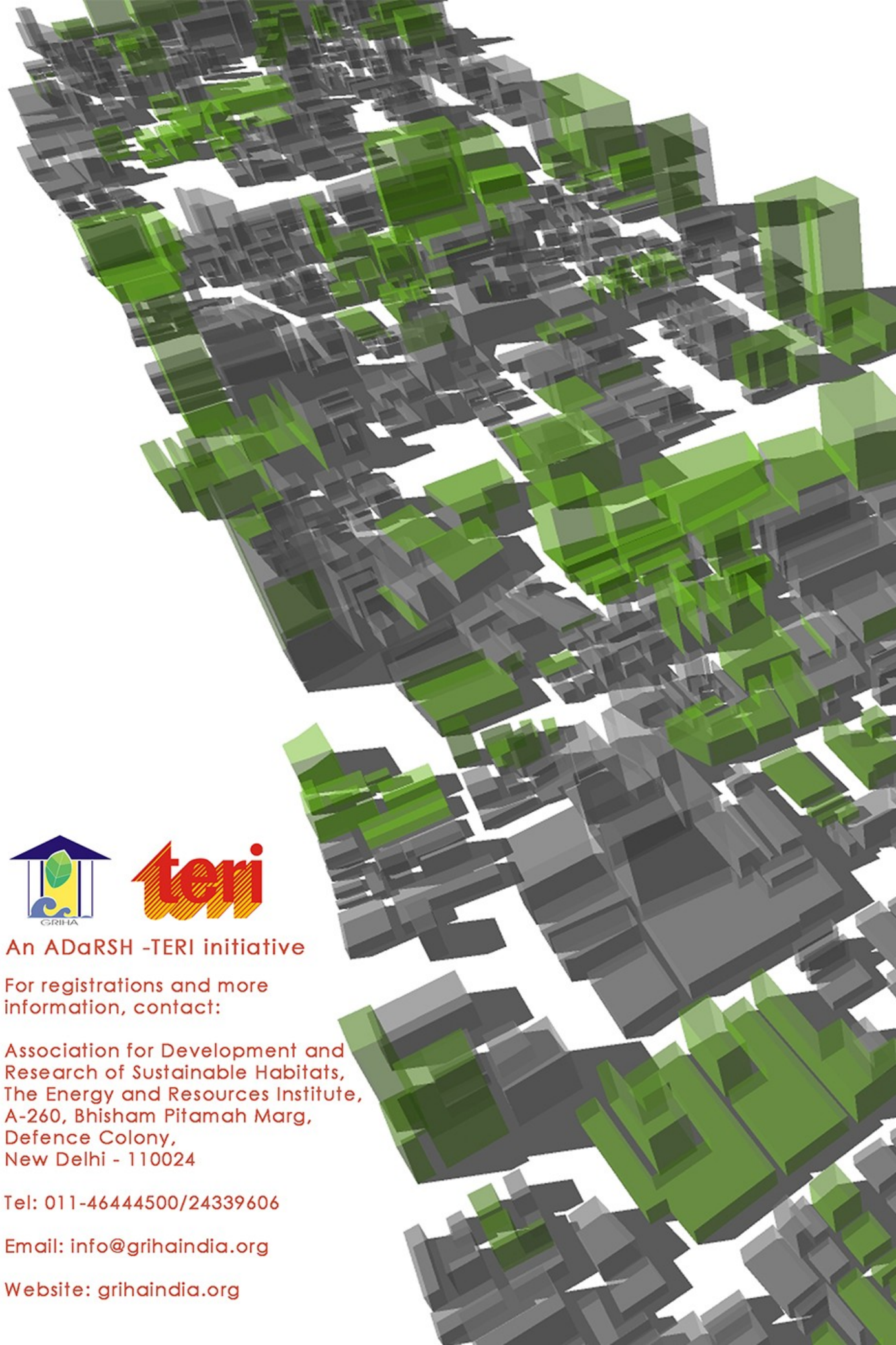

An ADaRSH -TERI initiative

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