GRIHA Version 3.0

Summary of all the changes:

Criterion	*Change in Points* *Max Points in GRIHA ver 3 (Max points in GRIHA ver 2)*	*Changes made in the Criterion*
2	4 (5)	• The commitment and appraisal clauses for preservation of top soil have been removed from Criterion 2 and shifted to Criterion 3. • The maximum number of points for this criterion has reduced to 4.
3	2 (2)	• The commitment and appraisal clauses for preservation of top soil have been added to this criterion. • There is no change in the maximum points available in this criterion.
6	1 (3)	• The commitment and appraisal for installation of automatic controls for outdoor lighting has been made mandatory. There are no points awarded for this in Version 3. • The commitment and appraisal for installation of renewable energy for outdoor lighting has been removed from this criterion. • The total points in this criterion have reduced to 1.
10	3 (3)	• New plant factors added.
11	2 (2)	• The appraisal for reducing building water demand by minimum 25% has been made mandatory. • The base case flow-rates of the fixtures have been revised. • The pressure at which flow-rates are required is 45 PSi (3.1 bar). • A non-applicability clause has been introduced in the criterion. All faucets (in a gravity fed system) which have been installed in spaces with water head heights less than 15 feet (4.6m) are exempt from calculations in this criterion.
13	8 (8)	• In GRIHA version 3, shading has been introduced as an alternative compliance method for SHGC of fenestrations. Shading design should comply with either SP-41 or GRIHA commitment 13.1.5. • For residential buildings, with operable windows, the SHGC values have been revised and updated.
14	16 (16)	• Few exemptions have been added to the mandatory ECBC compliance. ECBC 7.2.1.1 (installation of occupancy sensors in cabins and rooms less than 30 sqm in size) and ECBC 8.2.5.1 (power distribution system losses) are not mandatory under GRIHA. • The EPI for residential buildings have been revised and updated. • Thermal comfort compliance in GRIHA can now be demonstrated through compliance with either NBC 2005 or

		ASHRAE 55-2010. • Air-conditioned as well as non-air-conditioned spaces/buildings now have a single, common EPI. • It is mandatory now to demonstrate at least 10% reduction below the GRIHA benchmark EPI.
15	6 (6)	• In this criterion, the thresholds for award of points in Appraisal 15.3.1 and 15.3.3 have been lowered. • In Appraisal 15.3.1, 1 point is awarded for 15% replacement of OPC by flay ash (or any other BIS approved waste). 2 points are awarded if 25% or more OPC is replaced by fly ash (or any BIS recommended waste). • In Appraisal 15.3.3, 1 point is awarded for 15% replacement of OPC by flay ash (or any other BIS approved waste). 2 points are awarded if 25% or more OPC is replaced by fly ash (or any BIS recommended waste).
16	4 (4)	• Intermediate thresholds have been introduced in both the appraisals of the criterion.
17	4 (4)	• A non-applicability clause has been introduced in the criterion. If a project does not use any materials for any of the 3 clauses, the final points shall be awarded based on the discretion of ADaRSH and GRIHA evaluator.
18	8 (5)	• In the first appraisal, the connected load to be considered for the – 1% mandatory installation of renewable energy – will now include internal and external artificial lighting and space conditioning. Projects can demonstrate compliance through any of the following four renewable energy systems: solar photovoltaic, wind, geothermal and biomass. If a project is installing an organic waste to biogas plant for compliance with Criterion 25, then it can be counted in this appraisal as well. • For buildings with more than 80% built-up area (both FSI and non-FSI) falling under residential use, Appraisal 18.3.1 is not mandatory. It will be applicable but optional. The Appraisal 18.3.1 will also be non-mandatory for any large complex with more than 80% of total built-up area (both FSI and non-FSI) under residential use. If in a large complex, the total built-up area (both FSI and non-FSI), under residential use, is less than 80%, then the Appraisal 18.3.1 will be mandatory. • Off-site installation of renewable energy is now accepted in this criterion in a newly added appraisal clause.
32	0 (0)	• A project can now attempt to improve its performance in 4 specific areas and improve its rating in from provisional rating stage to the final rating stage. These 4 areas are: ○ Noise levels – Criterion 29 ○ Renewable energy installation – Criterion 18 and 19 ○ Hard/soft paved area - Criterion 5 ○ Innovation – Criterion 34.

Changes in Clauses

All changes made in July 2012 are highlighted in blue

All changes made in May 2013 are highlighted in yellow.

Criterion 2:

The top soil preservation clause has been removed from Criterion 2 and shifted to Criterion 3.

- **Updated Commitment clauses:**
  - 2.1.1 Select proper timing for the construction activity to minimize site disturbance such as soil pollution due to spilling of the construction material and its mixing with rainwater.
  - 2.1.2 Use staging and spill prevention and control plan to restrict the spilling of the contaminated material on site.
  - 2.1.3 Specify and limit construction activity in pre-planned/designated areas.
  - 2.1.4 Preserve existing mature trees on-site during the course of construction by preserving and transplanting them.
  - 2.1.5 Compensate the loss of vegetation (trees) due to the construction activity by compensatory plantation. Replant the same number of mature or fully grown trees as eliminated during the construction of the proposed landscape design. Replant the same, native and/or non-invasive species, which existed on the site before elimination in the proportion of 1:3.
  - 2.1.6 Plant in excess of 25% to the minimum required (that is in addition to the requirement prescribed in commitment 2.1.6) within the site premises (plantation to follow same criteria as above).
- **Updated Appraisal clauses:**
  - 2.3.1 Ensure proper timing of construction with respect to rain, as per clause 2.2.1.

    and
  - 2.3.2 Confine construction activity to pre-designated areas, as per clause 2.2.2 (1 point).
  - 2.3.3 Proper implementation of spill prevention plan and
  - 2.3.4 Effective erosion and sedimentation control to prevent erosion, as per clause 2.2.3 (1 point).
  - 2.3.5 Preserve existing vegetation by means of non-disturbance or damage to the trees and other form of vegetation, as per clauses 2.2.6 and 2.2.7

    Or
  - 2.3.6 Trees/plants replanted within site premises in ratio of 1:3, as per clause 2.2.8 (1 point – mandatory).
    - Non Applicability condition: Sites that are devoid of trees.
  - 2.3.7 Trees/plants replanted within site premises in excess of 25% than minimum requirement as per clause 2.2.9 (1 point).
    - Non Applicability condition: Sites that are devoid of trees.

Criterion 3:

- **Updated Commitment clauses:**
  - 3.1.1 Protect the top soil from erosion. Use collection storage and reapplication of the top soil, sediment basin, contour trenching, mulching, soil stabilization methods to protect the top soil from erosion during construction.
  - 3.1.2Ensure adequate fertility of the soil to support vegetative growth.
  - 3.1.3 Ensure adequate topsoil laying for vegetative growth.
  - 3.1.4 Ensure stabilization of soil in the area where the topsoil is vulnerable to erosion.
- **Updated Appraisal clauses:**
  - *3.3.1 Preserve top soil by employing suitable measures*

    And
  - 3.3.2 Proper top soil laying for vegetative growth, as per clauses 3.2.1 (a), 3.2.2, 3.2.3 (1 point)
  - 3.3.3 Proper stabilization of soil, as per clauses 3.2.1 (b), 3.2.2, 3.2.3 (1 point)
    - Non Applicability condition: Contaminated sites/sites that do not have good quality top soil (as per soil test report) that is considered worth storing for reuse. Soil test has to be carried out as per criteria 3 and the test report has to be endorsed by the landscape architect. The landscape architect has to provide certificate that the top soil is not worth storing for landscaping purposes and cannot be restored to applicable standard.

Criterion 6:

- **Updated Commitment clauses:**
  - 6.1.1 Luminous efficacy of external light sources used for outdoor lighting shall equal or exceed as specified.
  - 6.1.2 All outdoor lighting to be fitted with an automatic on/off switch.
- **Updated Appraisal clauses:**
  - 6.3.1 Luminous efficacy of 100% of lamps used in outdoor lighting meets the corresponding lamp luminous efficacy as per clause 6.2.1 (1 point).
  - 6.3.2 Automatic controls for 100% of outdoor lights, as per clause 6.1.2 – Mandatory.

Criterion 11:

- **Updated Commitment clauses:**
  - Reduce the total water consumption in the building (by 25% or more) by using low-flow fixtures.
- **Updated Appraisal clauses:**
  - 11.3.1 Reduction in water consumption by 25%. (1 point) - Mandatory
  - 11.3.2 Water-use reduction by 50%. (additional 1 point)
    - Non Applicability condition: All faucets, which are installed in spaces with water head heights less than 15 feet (4.6 m), in a gravity fed plumbing system, can be exempt for calculations in Criterion 11.

GRIHA base Case flow rates have been revised in version 3. The testing pressure will now be 45Psi or 3.1 bar.

Fixture	GRIHA Base Case lpm/lpf
WCs (solid/liquid)	9 / 9
Kitchen faucets	10
Lavatory faucets	10
Urinals	4
Showers	10

Criterion 13:

- **Updated Commitment clauses:**

13.1 Commitment

13.1.1 In order to optimize the building design appropriate climate responsive design strategies should be adopted, such as-

1. Optimize the orientation of the building; and/ or
2. Place the buffer spaces (such as- toilets, corridors, staircases, lifts and service areas etc.) along western and eastern facades and/ or
3. Provide maximum openings on North and South; and/or
4. Shade the building surfaces getting maximum solar exposure (such as– wall, roof, courtyard) with the use of external shading devices; eg. space frame, jallis, pergola, trees, green wall, terrace garden etc. and/ or
5. Design appropriate shading for all fenestrations getting direct solar radiation by using sun path analysis or shading norms (prescribed in the table-9 & 10 of Handbook on functional requirements of buildings other than industrial buildings or SP41) etc.

13.1.2 The WWR (window to wall ratio) shall be limited to a maximum of 60% of gross wall area and the SRR (skylight to roof ratio) shall be limited to a maximum of 5% of gross roof area as prescribed in Energy Conservation Building Code (ECBC)-2007.

13.1.3 Demonstrate that the effective SHGC (Solar Heat Gain Coefficient)* of the fenestration (accounting for glazing, overhangs and/ or vertical fins) is compliant with the maximum SHGC requirement prescribed by ECBC-2007. (Refer Table-13.1)

Table-13.1 SHGC Requirement for vertical fenestration & skylight

Climate	Maximum SHGC			
	WWR < 40%	40% < WWR < 60%	0% < SRR < 2%	2.1% < SRR < 5%
Composite	0.25	0.2	0.4	0.25
Hot and Dry	0.25	0.2	0.4	0.25
Warm and Humid	0.25	0.2	0.4	0.25
Moderate	0.4	0.3	0.61	0.4
Cold	0.51	0.51	0.61	0.4

Source: ***Table-4.3 & Table 4.6; ECBC-2007***

For residential buildings with operable windows, the ECBC thresholds have been revised as follows (based on maximum shading dimensions as permitted under the building bye-laws):

Table-13.2 SHGC Requirement for vertical fenestration & skylight

Climate	Maximum SHGC
Composite	0.45
Hot and Dry	0.45
Warm and Humid	0.45
Moderate	0.45
Cold	0.51

The effective SHGC is calculated by multiplying the SHGC of the un-shaded fenestration product by a multiplication (M) factor. The M-factor for the proposed fenestration is derived for each window dimension, orientation and unique shading condition.

*** SHGC** (Solar heat gain coefficient) is the ratio of the solar heat gain entering the space through the fenestration area to the incident solar radiation, typically ranging from 0.9 to 0.1, where lower value indicates lower solar gain. Solar heat includes directly transmitted solar heat and absorbed solar radiation, which is then reradiated, conducted or convected in to the space. *(Source: Appendix-A of ECBC-2007)*

13.1.4 Demonstrate that the shading design of the fenestrations is in compliance with Tables 9 & 10 of SP 41 to design the shading device for the windows. Northern region comprises of latitudes more than 20 degrees North and latitudes less than 20 degrees North are Southern region.

13.1.5 Demonstrate through sun path analysis that the fenestrations are completely shaded between 10:00 am to 3:00 pm for the duration of 1st April to 30th September.

Note: Windows of non-living spaces like toilets, store rooms etc. are exempt from compliance with clauses 13.1.3, 13.1.4 and 13.1.5.

13.1.6 Ensure that the total daylighted area* (as defined in the Appendix-A of ECBC-2007) of the proposed building is ≥ 25% of the total living area* (areas listed in table-2, SP41); and achieve the recommended DF* (as prescribed in table-2, SP41) at the centre of the daylighted area* or the average on the daylighted area/analysis zone in a design sky condition* (as recommended in Part-8 of National Building Code -2005).

- For every 25% increase (up to a maximum of 75%) in the total area which means the daylight factors upon the total living area shall fetch one additional point on each. This shall however be non-mandatory.

Note: The daylight clause is not mandatory for all other living spaces that are not listed in the table-2 (Sp41). Projects are however encouraged to apply daylight integration even if not mandated. Similar points shall be awarded for respective daylighted area as mentioned above and DF can be decided based on project specific daylight requirement.

Table-13.2: Recommended Daylight Factors for various living areas

Sl. No.	Location	Daylight Factor
1	Dwellings	
	Kitchen	2.5
	Living Room	0.625
	Study room	1.9
	Circulation	0.313
2	Schools	
	Class room desk top, black board	1.9—-3.8
	Laboratory	2.5—3.8
3	Offices	
	General	1.9
	Drawing, typing	3.75
	Enquiry	0.625—1.9
4	Hospitals	
	General wards	1.25

	Pathological laboratory	2.5-3.75
5	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

Source: Table-2, SP41& IS: 2440-1975.

***Design Sky Condition:** The recommended design sky illuminance for different climatic zone is as follows –

1. Cold Climate - 6800 lux
2. Composite Climate – 8000 lux
3. Warm-Humid – 9000 lux
4. Temperate – 9000 lux
5. Hot-Dry – 10500 lux

For integration with artificial lighting during daytime working hours an increase of 500 lux in the recommended sky design illuminance for daylighting is suggested. (*Source: NBC-2005).*

13.1.7 Perform artificial lighting simulation to demonstrate that the lighting levels in indoor spaces are maintained as recommended in NBC 2005 (BIS 2005d).

- **Updated Appraisal clauses:**

13.3.1 By adopting appropriate climate responsive building design with the limited WWR and/ or SRR as mentioned above as per clause 13.1.2

AND

EITHER

All the fenestrations to meet the SHGC requirement of ECBC-2007, as per clause 13.1.3

OR

Alternatively use Tables 9 & 10 of SP 41 to design the shading device for the windows. Northern region comprises of latitudes more than 20 degrees North and latitudes less than 20 degrees North are Southern region, as per clause 13.1.4

OR

Conduct solar path analysis for windows of AC as well as non-AC spaces, to ensure that the window is completely shaded for the duration between 10:00 am to 3:00 pm for the duration of 1st April to 30th September as per clause 13.1.5

OR

Any combination of the above strategies on 100% of the fenestrations, as per clauses 13.1.3, 13.1.4 and 13.1.5. **(2 points - Mandatory)**

13.3.2 Minimum of 25% of the living area (as mentioned above) should be daylighted and adequate level of daylight is provided as prescribed by IS code as per clause 13.1.6 **(2 points- Mandatory)** and/ or

- If the adequate daylight factors are achieved in $\geq$ 50% of total living area **(1 point)** and/ or

- If the adequate daylight factors are achieved in $\geq$ 75% of total living area **(2 point)**

13.2.3 Over-design of lighting system is avoided as per clause 13.1.7 **(2 points - mandatory).**

Criterion 14:

- **Updated Commitment clauses:**

14.1.1 Follow mandatory compliance measures (for all applicable buildings) as recommended in the Energy Conservation Building Code 2007 of the BEE, Government of India.

Note:

- *Installation of occupancy sensors in rooms/cabins with less than 30 sqm area is a recommended practice, as per ECBC 7.2.1.1, however it is not a mandate under GRIHA.*
- *ECBC 6.2.1 and 8.2.5.1 are not mandatory under GRIHA.*

14.1.2 Show that utilization of energy systems in a building, under a specified category, is less than the benchmarked energy consumption figure, through a simulation exercise. The energy systems include air conditioners, indoor lighting systems, water heaters, air heaters, and air circulation devices.

14.1.3 The annual energy consumption of energy systems in a building (for day and 24 × 7 use) should not exceed the limits mentioned in Table 14.1 (benchmarked energy consumption figure).

Table 14.1: Energy performance Index for buildings in GRIHA.

Energy Performance Index (EPI) for buildings		
Climate Classification	**EPI (kWh/ M2/year)**	
	Day time occupancy	**24 hours Occupancy**
Commercial/Institutional buildings	**5 Days a week**	**7 Days a week**
Moderate	120	350
Composite / Warm and humid / hot and dry	140	450
Residential buildings	**EPI (kWh/ M2/year)**	
Composite / Warm and humid / hot and dry	100	
Moderate	85	

14.1.4 In a building that includes both air–conditioned and non-air-conditioned areas, the annual energy consumption of energy systems of each type of space (air-conditioned and/or non-air-conditioned) should not exceed the respective benchmarked energy consumption limits listed in Table 14.1.

- ❑ In a project where there are more than one type of building/space, the annual energy consumption of energy systems should not exceed benchmarked energy consumption limits

Table 14.2: Format for calculation of Energy performance Index

Annual Energy consumption data for the building			
Type of space	**Area (M2)**	**GRIHA Benchmark Energy Consumption (kWh/m2/year)**	**Design Case Energy Consumption (kWh/m2/year)**
Building Type 1	A1	E1	E4
Building Type 2	A2	E2	E5
Building Type 3	A3	E3	E6

- **Benchmark Energy consumption (kWh/m2/year) = (E1 x A1)+(E2 x A2)+(E3 x A3)/ (A1+A2+A3)**
- **Building Energy Consumption (kWh/m2/year) = (E4 x A1)+(E5 x A2)+(E6 x A3)/ (A1+A2+A3)**

14.1.5 Quantify energy usage for all electrical, mechanical, and thermal systems for which either electrical or thermal energy is used. Quantify energy usage for each system used in providing lighting, air conditioning, ventilation, heating (water and air), and air circulation. The necessary energy conversion factors are listed in Table 14.3.

Table 14.3 - Energy Conversion factors	
Energy Unit	**Conversion factors for kWh**
Liters of LDO (Light Diesel Oil)	8.3
Liters of HSD (High Speed Diesel)	8.5
Kilogram of LPG (Liquefied Petroleum gas)	13.9
SCM (Standard Cubic meters of PNG (Pepe natural gas)	7

14.1.6 Perform hourly calculations to show that in non-air-conditioned areas, the thermal comfort conditions as specified in NBC 2005 (BIS 2005d)/ASHRAE 55-2010 are met for 90% of all occupied hours for buildings in composite, moderate, and hot and dry climate and for 60% of all occupied hours for buildings in warm and humid climate.

Thermal Comfort conditions for Non AC building – Summer Conditions	
Temperature	less than 33 deg C
Relative Humidity	less than 70%

14.1.7 Perform hourly calculations to show that in air-conditioned areas, the thermal comfort conditions as specified in NBC 2005 (BIS 2005e)/ASHRAE 55 - 2010 are met for 100% of all occupied hours.

Table 14.5: Thermal comfort standards for different spaces inside the buildings as per NBC 2005

Sr.	**Category**	**Inside Design Conditions**		
		Summer		**Winter**
(1)	(2)	(3)		(4)
1	Restaurants	DB 23 to 26° C		DB 21 to 23° C
		RH 55 to 60%		RH not less than 40%
2	Office buildings	DB 23 to 26 C		DB 21 to 23° C
		RH 50 to 60%		RH not less than 40%
3	Radio and television studios	DB 23 to 26° C		DB 21 to 23° C
		RH 45 to 55%		RH not less than 40%
4	Departmental stores	DB 23 to 26° C		DB 21 to 23° C
		RH 50 to 60%		RH not less than 40%
5	Hotel guest rooms	DB 23 to 26° C		DB 23 to 24° C
		RH 50 to 60%		RH not less than 40%
6	Class rooms	DB 23 to 26° C		DB 23 to 24° C
		RH 50 to 60%		RH not less than 40%
7	Auditoriums	DB 23 to 26° C		DB 23 to 24° C

		RH 50 to 60%		RH not less than 40%
8	Recovery rooms		DB 24 to 26° C	
			RH 45 to 55%	
9	Patient rooms		DB 24 to 26° C	
			RH 45 to 55%	
10	Operation theatres		DB 17 to 27° C	
			RH 45 to 55%	

- **Updated Appraisal clauses:**

14.3.1 Compliance with Energy conservation building code-2007as per clause 14.1.1. **(6 points mandatory) -**

14.3.2 Compliance with thermal comfort conditions as per National building code-2005/ASHRAE 55 - 2010;

AND

The design EPI for air-conditioned and non-air-conditioned space should not exceed the respective GRIHA Benchmark EPI as mentioned in Table 14.1

AND

Demonstrate minimum 10% reduction below the benchmark for energy performance index (EPI) as per GRIHA. (Refer Tables 14.1 and 14.2) **(2 points mandatory)**

14.3.2 Every 10% reduction in EPI of the building under a specified category shall fetch additional 2 points to a maximum of 8 points (50% reductions in EPI from the benchmark). **(2 – 8 points)**

Notes

- An hourly calculation shall be performed using standard building energy simulation software (such as DOE 2, TRNSYS, and Carrier). An hourly weather file shall be generated using weather data, acceptable by the ISHRAE (Indian Society for Heating Refrigeration and Air-conditioning Engineers).
- The sizing conditions being assumed for the HVAC/hybrid cooling/heating system and the operating conditions being assumed by the energy analyst during energy simulations must be the same.
- ADaRSH shall vet all the calculations carried out by the energy consultant.
- Day use buildings perform between 9 a.m. to 5 p.m., for five days a week.
- The NBC 2005 will be referred to for the definition of climatic zones.
- Please consider the following assumptions during the energy modelling for the residential buildings:
  - In a given apartment typology, the drawing-cum-dining room and all bedrooms will be considered to be air conditioned. In projects where the internal artificial lighting and air-conditioning systems are not installed by the developer, for the purposes of analysis, please consider the following:
    - Efficiency of the air-conditioning system to be equivalent to BEE -1 star.
    - Internal artificial lighting power density to be equivalent to ECBC baseline. Please refer to ECBC 7.3.2 and/or 7.3.3 for the same.
  - The NHB IT Toolkit (ittoolkit.com) maybe used to conduct the energy consumption simulation. The thermal comfort simulation must be carried out separately. Weblink for the toolkit: http://www.ittoolkitindia.com/

Criterion 15:

- **Updated Commitment clauses:**
  - 15.1.1 RC (reinforced concrete) (including ready-mix concrete) to make use of fly ash or slag, by using PPC (Portland Pozzolona cement) containing fly ash. A minimum of 15% replacement of cement with fly ash in PPC (by weight of the cement used) in the overall RC for meeting the equivalent strength requirements.
  - 15.1.2 Use fly ash or equivalent waste as recommended by BIS, in building blocks for the walls.
  - 15.1.3 Use fly ash or slag, in Plaster/masonry mortar by employing PPC. Use plaster and/or masonry mortar, which utilizes a minimum 15% of fly ash in PPC, in 100% wall/ceiling finishes and wall construction, meeting the required structural properties.
- **Updated Appraisal clauses:**
  - 15.3.1 Minimum 15% replacement of Portland cement with fly ash, or equivalent industrial/agricultural waste as recommended by BIS, by weight of cement used in structural concrete, as per clause 15.2.1 – 1 point (additional 1 point if more than 25%).
  - 15.3.2 Minimum 40% usage of fly ash, or equivalent industrial/agricultural waste as recommended by BIS, by volume of materials used for 100% load bearing and non-load bearing walls, as per clause 15.2.2 – (2 points)
  - 15.3.3 Certify minimum 15% replacement of OPC with fly ash, or equivalent industrial/agricultural waste as recommended by BIS, by weight of cement used in plaster/ masonry mortar, as per clause 15.2.3 - 1 point (additional 1 point is more than 25%)

Criterion 16:

- **Updated Commitment clauses:**
  - 16.1.1 Structural application: Use of low-energy materials or light weight material technologies (not based on the utilization of fly ash), such as roofing/ flooring, columns, and load-bearing walls, for structural applications. Use such technologies to demonstrate a minimum 2.5% reduction in the overall embodied energy, when compared to equivalent products for the same application, for a 100% structural system used in a building, thus meeting the equivalent strength requirements.
    - Examples of low-energy products and technologies used in structural applications Technologies such as pre-stressed slab, extruded structural clay joist and filler slab, hollow floor/ roof slabs, burned clay filler pots with RCC structure, micro-concrete roofing, precast hollow plank roofing, funicular shells, zipbloc system, composite columns, reinforced grouted brick masonry, stone masonry, precast stone blocks, pre-cast concrete blocks, pre-cast finished concrete blocks, light-weight concrete blocks over dense concrete blocks, and rat trap masonry.
  - 16.1.2 Non-structural application: masonry/infill wall system: Use of low-energy materials or light-weight materials (not based on the utilization of fly ash) for non-structural applications. Use such technologies to demonstrate a minimum 5% reduction in the embodied energy, when compared to equivalent products for the same application, for 100% infill wall system used in a building, meeting the equivalent strength requirements.
    - Examples of low-energy product and technologies in non-structural applications Infill wall system using traditional mud walling system, stabilized adobe walling, compressed earth blocks, hollow, perforated/ modular bricks, interlocking bricks, traditional stone masonry, pre-cast non-load-bearing concrete blocks, finished concrete blocks, light weight concrete blocks over dense concrete blocks, pre-cast brick panels, composite ferrocement walling, interlocking concrete blocks, rat trap masonry, and so on.
- **Updated Appraisal clauses:**
  - Appraisal 16.3.1: Use of low-energy materials or light weight material technologies in structural as well as non-structural application clearly demonstrating a minimum 2.5% reduction in the embodied energy, when compared with equivalent products for the same application, for 100% structural system used in a building, meeting the equivalent strength requirement, as per all compliance clauses – 1 point (2 points if the reduction exceeds 5%)
  - Appraisal 16.3.2: Use of low-energy materials or light-weight materials in structural as well as non-structural application clearly demonstrating a minimum 5% reduction in the embodied energy, when compared with equivalent products for the same application, for 100% structural system used in a building, meeting the equivalent strength requirement, as per all compliance clauses – 1 point (2 points if the reduction exceeds 10%)

Criterion 17:

- **Updated Commitment clauses:**
  - A minimum of 70% of the total quantity of all interior finishes and products used in each of the categories mentioned above should be low-energy finishes/materials/products, which minimize wood as a natural resource or utilize industrial waste by using products in any category.
- **Updated Appraisal clauses:**

  Minimum 70% of the total quantity (gross area) of all interior finishes and products used for each of the category, as applicable to the applicant, to be low- energy finishes, for each of the following category.

  - 17.3.1 Sub-assembly/internal partitions/panelling/false ceiling/in-built furniture (2 points) – as per clauses 17.2.1–17.2.5.
  - 17.3.2 Flooring (1 point) as per clauses 17.2.1–17.2.5
  - 17.3.3 Doors/windows, frames (1 point) as per clauses 17.2.1–17.2.5.
    - Non-applicability: In case of zero material consumption for any of the 3 clauses, the final points will rest upon the discretion of ADaRSH and the GRIHA evaluator.

Criterion 18:

- **Updated Commitment clauses:**
- **18.3.1** Rated capacity of proposed renewable energy system is equal to or more than 1% of artificial lighting (internal and external) and space conditioning connected loads or its equivalent in the building (2 points – mandatory), as per all compliance clauses. For this Appraisal, the project may demonstrate compliance through installation of renewable energy (equivalent to 1% of total connected load for internal artificial lighting and space conditioning) as part of Criterion 18, and 25 together (Use of waste heat recovery systems will not be counted as renewable energy).
    - *Non-mandate: The Commitment 18.3.1 is non-mandatory for residential buildings (over 80% of the built-up area (both FSI and non-FSI area) to be under residential use).*
- **18.3.2** Rated capacity of proposed renewable energy system meets annual energy requirements of equal to or more than 5% of internal lighting consumption or its equivalent in the building (1 point), as per all compliance clauses.
- **18.3.3** Rated capacity of proposed renewable energy system meets annual energy requirements of equal to or more than 10% of internal lighting consumption or its equivalent in the building (2 point), as per all compliance clauses.
- **18.3.4** Rated capacity of proposed renewable energy meets annual energy requirements of equal to or more than 20% of internal lighting consumption or its equivalent in the building, as per all compliance clauses (3 points).
- **18.3.5** Rated capacity of proposed renewable energy system meets annual energy requirements of equal to or more than 30% of internal lighting consumption or its equivalent in the building, as per all compliance clauses (4 points).

    * Exemptions as per clause 7.3 of ECBC would apply.

    Note Lighting design shall be based on minimum requirements as per NBC 2005 (BIS 2005d) (criterion 13.1.5)

- **18.3.6**: Off-site or on-site renewable energy system meets annual energy requirements of equal to or more than 100% of internal lighting consumption or its equivalent in the building, as per all compliance clauses – 2 points
- **Updated Appraisal clauses:**
    - 18.3.1 Rated capacity of proposed renewable energy system is equal to or more than 1% of artificial lighting (internal and external) and space conditioning connected loads or its equivalent in the building (2 points – mandatory), as per all compliance clauses. For this Appraisal, the project may demonstrate compliance through installation of renewable energy (equivalent to 1% of total connected load for internal artificial lighting and space conditioning) as part of Criterion 18, and 25 together (Use of waste heat recovery systems will not be counted as renewable energy).

        Non-mandate: The Appraisal 18.3.1 is non-mandatory for residential buildings (over 80% of the built-up area (both FSI and non-FSI area) to be under residential use).

    - 18.3.2 Rated capacity of proposed renewable energy system meets annual energy requirements of equal to or more than 5% of internal lighting consumption or its equivalent in the building (1 point), as per all compliance clauses.
    - 18.3.3 Rated capacity of proposed renewable energy system meets annual energy requirements of equal to or more than 10% of internal lighting consumption or its equivalent in the building (2 point), as per all compliance clauses.
    - 18.3.4 Rated capacity of proposed renewable energy meets annual energy requirements of equal to or more than 20% of internal lighting consumption or its equivalent in the building, as per all compliance clauses (3 points).
    - 18.3.5 Rated capacity of proposed renewable energy system meets annual energy requirements of equal to or more than 30% of internal lighting consumption or its equivalent in the building, as per all compliance clauses (4 points).

- * Exemptions as per clause 7.3 of ECBC would apply.
- Note Lighting design shall be based on minimum requirements as per NBC 2005 (BIS 2005d) (criterion 13.1.5)

- 18.3.6: Off-site or on-site renewable energy system meets annual energy requirements of equal to or more than 100% of internal lighting consumption or its equivalent in the building, as per all compliance clauses – 2 points

Criterion 32:

- **Updated Commitment clauses:**
  - 32.1.1 After occupying the building, conduct audits for the following within two years of full occupancy and submit audit data as per the specified format. The energy consumption data submitted should be for at least 12 months.
    - 1. Energy audit
      a. Energy consumption
      b. Thermal comfort
      c. Visual comfort
    - 2. Water and waste audit
      a. Water quality
      b. Solid waste generation
      c. Solid waste disposal process
  - 32.1.2 After occupying the building, conduct sound level audit as specified in Criterion 29, to measure the following:
    a. Indoor noise levels
    b. Outdoor noise levels
    - Note Clause 32.1.2 is only applicable to projects that have attempted GRIHA Criterion 29: Acceptable outdoor and indoor levels. The audit data should be submitted to ADaRSH in the format specified in Criterion 29.
  - These audits should be conducted for typical representative days. The audit reports should be submitted to ADaRSH in the specified format for validation of the information provided at the time of award of provisional rating. In case the audit data is not corresponding with the data and documents provided at the time of award of provisional rating, the provisional GRIHA rating will be taken back from the project. However, if the audited data is corresponding with the data and documents provided at the time of award of provisional rating, the final GRIHA rating will be awarded to the project. 32.1.3 The energy audit should be conducted by an energy auditor approved by the Bureau of Energy Efficiency, Government of India. Water and waste audit should be conducted by a competent authority.
- **Updated Appraisal clauses:**
  - 32.3.1 The energy systems and water and waste management systems of the building are performing as predicted and match the information provided at the time of award of provisional GRIHA rating (mandatory).
  - 32.3.2 Any improvement in the following 4 parameters can be attempted by the project, post-GRIHA Provisional Rating, in order to improve its overall GRIHA points tally:
    - Noise levels – Criterion 29
    - Renewable energy installation – Criterion 18 & 19
    - Hard/soft/shaded paving on site – Criterion 5
    - Innovation – Criterion 34
    - **Please note: *Reattempt/fresh attempt of a criterion will not be allowed in this; only improved performance will be evaluated*.**