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SUSTAINABLE CONSTRUCTION STUDY IN MAURITIUS

LOT 2 : REPORT ON GREEN BUILDING CERTIFICATION SYSTEMS

TECHNICAL ASSISTANCE FOR THE IMPLEMENTATION OF SUNREF III PROGRAMME - MAURITIUS

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Report on green building certification systems

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Report on green building certification system

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Executive Summary

AFD commissioned under the SUNREF program a study on green and sustainable building to better inform project developers and banks on the criteria adopted in the fields of mitigation and adaptation to climate change, in order to facilitate and promote bankable projects. This will allow easier evaluation of the applications, and the eligibility of the expenses using appropriate frameworks and methodologies.

To achieve the goal described here, three deliverables have been produced:

(a) description and comparison of different green certifications schemes applicable to address market demand of building and construction stakeholders,
(b) identification of key professional actors involved at the design and/or project implementation stage. A list of professionals has been established with their skills (Mechanical and electrical engineering), or MEP. The capacity for addressing bioclimatic design of building has been identified, which is a key component for energy optimisation.
(c) a set of case studies carried out in Mauritius but also in other countries (India, South Africa, France (Réunion Island) in particular with detailed data sheets. These case-studies were designed i) for illustrating how the different certification tools are used with their added value and methodology complexity and then ii) to show clearly what kind of information can be collected based on energy optimization (technical orientations covering the scope of solutions for green solutions, performance achieved with a global perspective, cost issues, and illustration on project design with a focus on the main solutions implemented.

In the end, application of green certification will help to confirm optimisation methods that could be used for evaluating eligible expenses of their projects, in conjunction with the SUNREF partner banks. For the study, one of the key deliverables is to make a comparison of green certifications available on the international market and provide the expected contributions of these tools to promote “green” projects. Beyond the costs of implementing the certification itself, which remains the responsibility of the project promoter, the aim is to better understand how these tools can be used to support the SUNREF program in the construction sector.

Certified green buildings can contribute to both climate mitigation and adaptation in several ways as the “credit criteria” that need to be fulfilled take into consideration several key issues such as:

(a) Use of less energy and water
(b) Consideration of life cycle impacts
(c) Support of sustainable strategies
(d) Reduction in the carbon footprint which is an assessment tool to be shared to support green certification.

Several tax incentives have been put in place for the rating and certification of green building using international experts who are dedicated to project assessment (LEED for example) or self-energy assessment like the Edge certification tool for energy optimisation. The scope is quite large and potential end users have the opportunity to make the most relevant choice according to their objectives.

- Inventory and comparison of the green building certification systems available worldwide.

There are eight green building rating systems that have been reviewed in this report, namely:

(1) Leadership in Energy and Environmental Design (LEED)
(2) Green Rating for Integrated Habitat Assessment (GRIHA)
(3) Building Research Establishment Environmental Assessment Method (BREEAM)
(4) Green Star (GS)
(5) WELL building standard
(6) EDGE
(7) Green Star SA
(8) PREBAT used in Reunion Island (not a rating system but a grant) which should be considered as a methodology to address mitigation solutions with their final impacts on energy performance.

A comparison has been done with five of the green building rating and certification systems namely LEED, GRIHA, BREEAM, Green Star, and EDGE. They are the most commonly used systems. LEED, BREEAM and Green Star SA are the three building rating systems which have been used in Mauritius. EDGE has registered interest because of its low cost and simplified framework but has not yet been used for Mauritian projects. GRIHA is a certification widely used in India.

◙ Most of the rating tools have similar credit categories for assessment, except for EDGE.

The categories are:

(a) Sustainable sites/Management/Site aspect
(b) Energy/Energy efficiency/Energy use
(c) Water efficiency
(d) Materials
(e) Indoor environmental quality/Health and wellbeing
(f) Location and transportation
(g) Pollution/Emission

EDGE, on the other hand, focusses only on energy, water, and materials.

The report also provides an analysis of the different processes of each certification systems. All the three main rating systems (LEED, BREEAM and Green Star) have similar processes for certification, in that evidence are submitted for evaluation by either internal assessor (applicable for Green Star and LEED) or an external assessor (applicable for BREEAM). The process is the same for the building project owner. However, for EDGE, the process is simplified as it uses a web-based spreadsheet-based tool. This latest tool is very different in terms of implementation not requiring a validation process at international level (pools of experts). This is a decentralized process which request a local training.
Ultimately, the choice will depend on the following:

i. Target market of the building project (If the target market is South Africans, it may be better to use a South African certification)
ii. Cost of certification.
iii. Client requirements (Client sometimes request the certification they require, to be in line with their international portfolio for instance)
iv. Location requirements (projects in LEED neighbourhood development certified projects are required to be LEED certified)

A separate green building case studies report supplements this section on the choice of green building systems to check their applicability at national levels in different contexts. These case studies highlight the content of the process used, and more important how the results are finalized with data sheets summarizing the key information. These examples can be used to promote the green building certification implementation at the Mauritian level. It seems clear that the need for training sessions to address professionals and project investors needs will be necessary to help promoting these certification tools with examples of success.

The table below (Table 3 in the document) provides a comparison of five certification systems. It shows the different categories and credit criteria. The categories have different names and different weightage in the total score.

◙ The credit categories weightage differs between certification systems.

The categories variation makes it difficult to compare the certification systems. For example, BREEAM and Green Star separates emissions/pollution whist LEED and GRIHA include the same in the Energy category. For Energy, for comparative purpose, LEED and Green Star offer the highest scoring at 33%,

followed by BREEAM 24% and GRIHA 18%. For Water, the range varies from 11 to 16% with GRIHA with the highest weightage and BREEAM the lowest.

For all the main certification systems except for EDGE, energy modelling is required to show compliance with the mandatory minimum requirements, and for calculation of improvement on the minimum requirement.

1. Introduction

Through its green finance label SUNREF (Sustainable Use of Natural Resources and Energy Finance), Agence Française de Développement (AFD) supports the energy and environmental transition in nearly 30 developing countries by helping private sector actors seize opportunities linked to green growth and implement their projects, while encouraging local partner banks to finance them.

SUNREF commissioned a study on green and sustainable building to better inform project developers and banks on the criteria adopted in the fields of mitigation and adaptation to climate change, and to facilitate and promote bankable projects. This will allow easier evaluation of the applications, and the eligibility of the expenses using appropriate frameworks and methodologies. They will be able to apply the methods for evaluating eligible expenses to their projects, in conjunction with the SUNREF partner banks. For the study, one of the key deliverables is to make a comparison of green certifications available on the international market and provide the expected contributions of these tools to promote "green" projects. Beyond the costs of implementing the certification itself, which remains the responsibility of the project leader, the aim is to better understand how these tools can be used to support the SUNREF program in the construction sector.

The report provides:

1) Introduction on green buildings and its benefits
2) Identification of green building certifications systems
3) Synthesis and comparison between the certification systems

A 'green' building is a building that, in its design, construction or operation, reduces or eliminates negative impacts, and can create positive impacts, on our climate and natural environment. Green buildings preserve precious natural resources and improve our quality of life. There are several features which can make a building 'green'. These include:

- Efficient use of energy, water, and other resources
- Use of renewable energy, such as solar energy
- Pollution and waste reduction measures, and the enabling of re-use and recycling.
- Good indoor environmental air quality
- Use of materials that are non-toxic, ethical and sustainable.
- Consideration of the environment in design, construction, and operation
- Consideration of the quality of life of occupants in design, construction, and operation
- A design that enables adaptation to a changing environment

According to the US Green Building Council, certified buildings contribute to climate adaptation and mitigation in several ways:

- **Use less energy and water:** When building projects are rewarded for deeper energy and water efficiency retrofits, there is an opportunity to reduce the consumption of fossil fuel and electricity. Similarly, certifications reward reductions in water use and the "embodied carbon" used to produce, move, and treat that water.
- **Consider life cycle impacts:** Certifications encourage life cycle assessment (LCA) of building materials and products, and, in turn, whole buildings. Assessing alternatives based on life cycle GHG is a critical first step to selecting lower-impact approaches and providing market feedback.
- **Support sustainable strategies:** green buildings provide mechanisms to actively influence inhabitants in ways that support the climate. For example, buildings can create opportunities for more composting and reduced landfill waste and alternative transportation.
- **Shrink carbon footprint:** Certifications reward thoughtful decisions about building location with credits that encourage connection with transit and amenities, as well as retention and creation of natural vegetated land areas and roofs.

For example, 35% of the credits in LEED are related to climate change, 20% of the credits directly impact human health, 15% of the credits impact water resources, 10% of the credits affect biodiversity, 10% of the credits relate to the green economy, 5% of the credits impact community and 5% of the credits impact natural resources.

LEED credit categories address topics such as reduction in energy use, connection with public transportation and the embodied energy associated with materials and water use.

- **Building operations energy use and source**: Credits in the Energy and Atmosphere category not only directly reduce energy use but also address systems that rely on carbon-based energy sources and award the use of low-carbon energy sources. LEED also targets the reduction of potent GHGs associated with refrigerants.
- **Renewables selection:** Credits in the Energy and Atmosphere category recognize the diverse contract mechanisms project teams use to procure renewable energy off-site and articulate a hierarchy for renewable energy generation and procurement that rewards selections that are high value. Establishing LEED criteria addressing the age of renewable energy-generating asset helps to guide project team decision-making and direct investments toward increasing the supply of renewable energy on the grid (versus using existing renewable energy capacity where possible).
- **Transportation energy use**: Credits in the Location and Transportation category enable new buildings to improve land use patterns and position occupants to take advantage of public transportation, which contributes to a reduction of GHG emissions from single-passenger vehicles.
- **Materials-embodied energy use**: Materials and Resources credits address a building's embodied carbon by targeting the energy use and processes required in the extraction, production, transportation, manufacturing, distribution and disposal of materials and products used throughout the entire life cycle of a building.
- **Water-embodied energy use and source**: Water Efficiency credits address the significant use of energy related to the treatment, processing, and distribution of water by requiring a reduction of water used. Efficiencies that reduce the use of potable water, and replace it, when possible, with non-potable water sources, will indirectly reduce energy use and help mitigate GHG emissions.
- **Green infrastructure and siting**: Sustainable Sites credits focus on the non-energy-related drivers of climate change, including land-use changes, heat island effect and pollution through solutions such as green infrastructure and purposeful decisions on building location and siting.

Some of the top credits in LEED v4 BD+C, ID+C, and O+M that are associated with mitigation and adaptation of global climate change:

- LT Credit: Surrounding Density and Diverse Uses
- LT Credit: Access to Quality Transit / Alternative Transportation
- WE Credit: Outdoor Water Use Reduction
- WE Credit: Indoor Water Use Reduction
- EA Credit: Optimize Energy Performance
- EA Credit: Renewable Energy Production / Renewable Energy and Carbon Offsets
- EA Credit: Enhanced Refrigerant Management
- EA Credit: Green Power and Carbon Offsets
- MR Credit: Building Life-Cycle Impact Reduction / Interiors Life-Cycle Impact Reduction

2. Green building & SDGs

Figure 1 – Green buildings and SDGs

Green buildings can contribute towards meeting the Sustainable Development Goals. Green building is a true catalyst for addressing some of the world's most pressing issues.

2.1. Goal 3: Good health & wellbeing – ensure healthy lives and promote wellbeing for all at all ages.

Green building features, such as improved lighting, better air quality and greenery, have been proven to positively impact health and wellbeing, and this agenda has gained increasing momentum. The standard is focused on creating a world in which buildings are not only good for the environment, but also support healthier, happier, and more productive lives. And reducing emissions from buildings – particularly in cities – can reduce pollution and improve air quality, benefiting the health of city dwellers.

2.2. Goal 7: Affordable & clean energy – Ensure access to affordable, reliable, sustainable, and modern energy for all.

The cheapest energy is the energy we don't use, and energy savings from efficient, green buildings - whether commercial office buildings or homes - are often one of the most talked about benefits. Green buildings also use renewables energy, which can be cheaper than fossil fuel alternatives.

2.3. Goal 8: Decent work & economic growth – Promote inclusive and sustainable economic growth, employment, and decent work for all.

As the demand for green building grows globally, so does the workforce required to deliver them, and this is another goal that green building can significantly contribute to.

2.4. Goal 9: Industry, innovation & infrastructure - Build resilient infrastructure, promote sustainable industrialisation, and foster innovation.

Green buildings must be designed in a way that ensures they are resilient and adaptable in the face of our changing global climate.

2.5. Goal 11: Sustainable cities & communities - Make cities inclusive, safe, resilient, and sustainable.

Buildings are the foundations of cities, and green buildings are therefore key to their long-term sustainability. Whether it's homes, offices, schools, shops, or green spaces – the built environment contributes to the make-up of communities, which must be sustainable to ensure a high quality of life for all. In fact, in many countries, Green Building Councils have moved beyond the certification of single green buildings and have developed tools that facilitate the formation of green neighbourhoods and districts.

2.6. Goal 12: Responsible consumption & production - Ensure sustainable consumption and production patterns.

This goal focuses on promoting resource and energy efficiency, sustainable infrastructure, and providing access to basic services and green jobs. The building industry has a major role to play in preventing waste through reduction, recycling, and reuse – 'circular economy' principles where resources are not wasted.

2.7. Goal 13: Climate action - Take urgent action to combat climate change and its impacts.

Buildings are responsible for an estimated 40 per cent of global greenhouse gas emissions and are therefore a major contributor to climate change. But by the same token, green buildings have huge potential to combat it, offering one of the most cost-effective ways to do so, through measures such as energy efficiency.

2.8. Goal 15: Life on land - Sustainably manage forests, combat desertification, halt and reverse land degradation, halt biodiversity loss.

The materials that make up a building are key to determining its sustainability. And so, the building industry and its supply chains have a major role to play in using responsibly sourced materials such as timber. Green building certification tools also recognise the need to reduce water use, and the value of biodiversity and the importance of ensuring it is protected and incorporate this into the space they build on both during and after construction - minimising damage and designing ways to enhance biodiversity, such as through landscaping with local flora.

2.9. Goal 17: Partnerships for the goals - Revitalise the global partnership for sustainable development.

Historically, the building industry has lacked a collective voice on the world stage at major climate change conferences and has often not been recognised for the huge opportunities it presents. In 2015, a significant milestone was achieved when World GBC, UNEP, the French government, and several other organisations came together to host the first ever "Buildings Day" as part of the official COP21 agenda.

When it comes to the remaining SDGs, direct links between them and green buildings may be less explicit, but that's not to say they don't exist at all.

3. Methodology

Qualitative and quantitative research were both employed for this report.

4. Green building certification systems

Around the globe, it exists numerous green building rating and certifications systems which are used to rate how effective and how sustainable a building is. The table below lists some of the rating systems and regulations for buildings.

International Building Certification		
Certification	Supported	Link
BREEAM International	BREEAM Int'l NC 2016, BREEAM Int'l RFO 2015, BREEAM Int'l NC 2013, Commercial EU 2009, Int'l Bespoke 2010	BREEAM
LEED	LEED v4.1, v4, v3 (both BD+C & ID+C credits)	LEED
DGNB Level(s)	DGNB Int'l, DE, DK Most macro-objectives	DGNB Level(s)
Zero Carbon Certification & Living Building Challenge	Can be done in most carbon tools.	LCB & Zero Carbon Certification

Nordic Building Certification	
Country	Supported
Norway	NS3720, FutureBuilt, BREEAM NOR
Finland	YM Method, RTS, GBCF: Performance Metrics
Sewden	Klimatdeklaration, Miljöbygnad, NollCO2, BREEAM SE
Denmark	DGNB DK

European Building Certifications	
Country	Supported

France	Energie Carbone, HQE, Batiment Bas Carbone, RE2020
Netherlands	Milieu Prestatie Gebouwen (using NMD 3.0), BREEAM NL
Germany	DGNB DE, BNB, BREEAM DE
Austria	Ögni
Spain	VERDE Omega & Residential, VERDE Edificios 2020, BREEAM ES
Switzerland	Minergie-A and Minergie-Eco: Graue Energie

United Kingdom Building	
Country	Supported
United Kingdom	GLA (London Plan), RICS, HQM, IMPACT, TM65 for MEP
Ireland	Home performance index EN10.0: Embodied Impact of materials

North American Building Certifications	
Country	Supported
United States	Living Building Challenge, LEED
Canada	LEED, CaGBC Zero Carbon, Zero Carbon, Toronto Green Standard, Waterfront Toronto Green Building Requirements

Asia-Pacific & African Building Certifications	
Country	Supported
Australia	Green Star Australia, EnviroDevelopment
New Zealand	Green Star New Zealand
South Africa	Green Star South Africa

Infrastructure Certification	
Certification	Supported
CEEQUAL	CEEQUAL
Envision	Support Envision v3 credits CR1.1, CR1.2, and RA1.1.
PAS2080	PAS2080 (worlds first specialization for managing whole life carbon in infrastructure)
HS2	Carbon footprinting and life cycle assessment, P06 LCA and P02 requirements

Table 1 - Ratings, certifications and regulations for green buildings

4.1. 4.1 Selected certifications

For our study, the certifications that are most widely used and suited for Mauritian context have been selected for the study are as follows:

- Leadership in energy and environmental design (LEED)
- Green rating for integrated habitat assessment (GRIHA)
- Building research environment assessment method (BREEAM)
- Green Star
- WELL building standard
- EDGE
- Green Star SA
- PREBAT used in Reunion Island (not a rating system but a grant)

4.1.1. Leadership in energy and environmental design (LEED)

LEED (Leadership in Energy and Environmental Design) is the most widely used green building rating system in the world. Available for virtually all building types, LEED provides a framework for healthy, efficient, and cost-saving green buildings. LEED certification is a globally recognized symbol of sustainability achievement and leadership.

LEED is a holistic system that doesn't simply focus on one element of a building such as energy, water, or health, rather it looks at the big picture factoring in all the critical elements that work together to create the best building possible.

4.1.2. Green Rating for Integrated Habitat Assessment (GRIHA)

The Energy and Resources Institute (TERI) developed the Green Rating for Integrated Habitat Assessment (GRIHA). It has specifically been designed to use in the context of India's varied climate and building practices.

The salient features of the GRIHA rating are as follows:

- Performance-based rating system designed for different climatic zones and incorporating regional variations.
- Unifies multiple national and state-level codes and norms, such as NBC, ECBC, CPCB, and CGWB, into a simple set of criteria.
- Common sense oriented with non-applicability clauses, that is, every project is unique, and its rating is evaluated only based on attempted criteria.
- Emphasizes using the integrated design approach and implementation of cost-effective strategies.
- Emphasis on strategies to identify and reduce losses in energy consumption » Ensures the acoustic, thermal, and visual comfort for all building occupants.
- Recommends taking a realistic approach towards indoor air quality through the usage of low VOC paints, adhesives, and sealants.
- Construction stage linked due diligence visits to ensure that the commitments made during the design stage are being implemented.

4.1.3. Building Research Establishment Environmental Assessment Method (BREEAM)

BREEAM (Building Research Establishment Environmental Assessment Method) is a British certification standard for the environmental assessment of buildings. BREEAM is the world's leading science-based suite of validation and certification systems for a sustainable built environment.

Since 1990, BREEAM's third-party certified standards have helped improve asset performance at every stage, from design through construction, to use and refurbishment. Millions of buildings across the world are registered to work towards BREEAM's holistic approach to achieve ESG (Environmental Social Governance), health, and net-zero goals. It is owned by BRE (Building Research Establishment) a profit-for-purpose organisation with over 100 years of building science and research background. (BRE, n.d.)

4.1.4. Green Star

Green Star is an internationally recognised Australian sustainability rating and certification system. There are four Green Star rating tools, these provide a means of certification for building design and construction, operation, fit outs, and communities. These tools have been developed by the Green Building Council of Australia (GBCA), in close consultation with industry and government, and continue to evolve.

Green Star is a Certification Trademark registered by GBCA. Only projects that have been assessed and certified by us can use the Green Star Trademark or claim to be Green Star projects. We have strict rules and licensing arrangements for the use of the Green Star Trademark. (Australia, 2022)

4.1.5. WELL Building Standard

WELL, created by Delos is managed and administered by the International WELL Building Institute (IWBI), a public benefit corporation whose mission is to improve human health and wellbeing through the built environment. The goal behind WELL was to create a certification based on improving human health and well-being while integrating existing green building standards like LEED and Living Building Challenge.

WELL, considers seven aspects of space: air, water, nourishment, light, fitness, comfort, and mind. For a building to be WELL certified, it must receive passing scores in every concept, indicating that each feature meets the standard's requirements for human well-being.

WELL, is third-party certified by Green Business Certification Inc., the same company that administers LEED certifications. WELL, certification is valid for three years, a timeline that encourages a vigilant commitment to the standard. In addition, each WELL certified building is required to submit annual performance data for "select features that require more frequent reporting." Other ongoing requirements may apply; for example, a WELL certified building may need to furnish proof of maintenance or continual parameter measurements. (Briburn, 2022)

4.1.6. EDGE

EDGE is a green building standard and a certification system that empowers building professionals to quickly and easily determine the most cost-effective ways to build green based on building type and the local climate. Available worldwide, EDGE was created in response to the need for a measurable solution to prove the financial case for building green. (EDGE, n.d.)

4.1.7. Green Star South Africa

The Green Star rating system is a natural touch point for green building movements and councils in other parts of Africa.

The Green Building Council South Africa works in collaboration with emerging Green Building Councils throughout Africa and allows the adaptation of the Green Star tools for certification in the respective countries.

Green Star tools are created for each building type and support design professionals and developers in creating a better-built environment for people and the planet. The tools are based on 9 different categories, each with a range of credits that address environmental and sustainability aspects of designing, constructing, and operating a building.

Each country develops a Local Context Report which is then reviewed by the Green Building Council of South Africa. Once approved, this allows for projects within the specific countries to be certified using a Green Star tool, with some adaptations identified in the Local Context Report.

Projects in Africa can register for Green Star certification where a Green Star Local Context Report has been prepared for that tool in that country and where the approved report is available on the GBCSA website. (GBCSA, n.d.).

4.1.8. PREBAT

PREBAT (Programme national de Recherche et d'expérimentation sur l'Énergie dans les Bâtiments) was first launched in 2005 in France and the first phase of projects was put in place in 2009 (Futura-sciences, 2009).

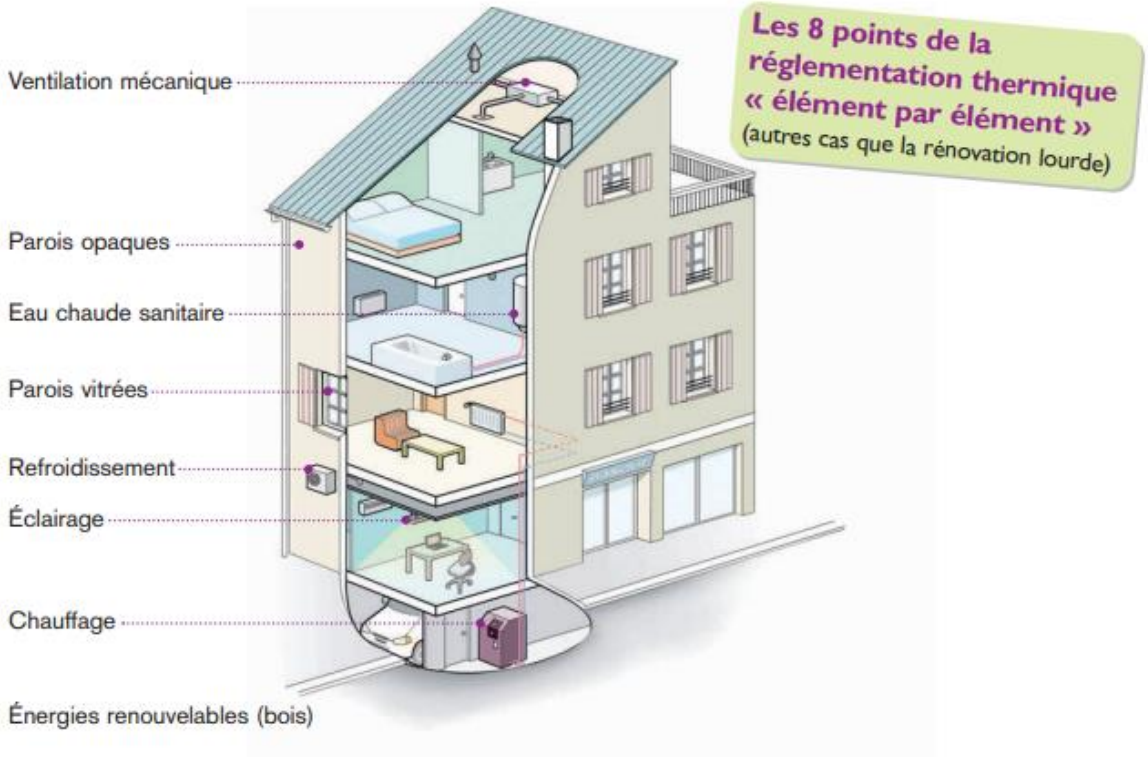


Figure 2: Main energy sources (ADEME, Les Économies D'énergie Dans le Batiment, 2008)

4.1.8.1. How the grant works

Firstly, there is a call for tenders which is based on the requirements of the PREBAT standard. The requirements are mainly based on research made on material, products, constituents, and their final integration in the designed building. The retained projects are then financed by either the ANR (Agence Nationale de la Recherche) or the ADEME (Agence de l'Environnement et de la Maîtrise de l'Energie).

The projects should be followed up by a coordinator who will be the main point of contact between the builder and the organisation (ANR or ADEME) working on the project.

5. Building rating systems and their categories/credits

The main rating systems have similar categories. EDGE provides a simpler framework looking at only three components and WELL has a stronger focus on wellbeing of occupants.

The table below provides both the focus areas of the certification system and the credit categories/performance parameters.

Building rating or certification system				
S. N	**Country of origin**	**Rating System/Programme**	**Focus Area**	**Performance Parameters**
1	United States	Leadership in Energy and Environmental Design (LEED)	» New construction » Existing buildings, operations and maintenance » Commercial interiors » Core and shell » Schools » Retail » Healthcare » Homes » Neighbourhood development	» Sustainable sites » Water efficiency » Energy and atmosphere » Materials and resources » Indoor environmental quality » Locations and linkages » Awareness and education » Innovation in design » Regional priority through a set of prerequisites and credits
2	Australia	Green Star	» Office » Retail » multi-unit residential	» Management » Indoor environmental quality » Energy » Transport » Water » Materials » Land use and ecology » Emissions » Innovation
3	United Kingdom	Building Research Environment Assessment Method Consultancy (BREEAM)	» New construction » In-use » Refurbishment and fit out » Communities	» Energy » Health and well-being » Transport » Water » Materials » Waste » Land use and ecology » Management » Pollution

4	United States	WELL Building Standard	» New and Existing Buildings » New and Existing Interiors » Core and Shell Retail » Education Facilities » Restaurant » Commercial Kitchen » Multifamily Residential	» Air » Water » Nourishment » Light » Movement » Thermal Comfort » Sound » Materials » Mind » Community
5	United States	EDGE	A universal standard and a certification system for residential and commercial structures.	Assessment areas include: » Energy » Water » Materials
6	South Africa	Green Star SA	Green building rating system for: » Office » Retail » multi-unit residential	» Management » Indoor Environmental Quality » Energy » Transport » Water » Materials » Land Use & Ecology » Emissions » Innovation
7	India	GRIHA	» New construction » Existing buildings » Schools » Cities	» Sustainable Site Planning » Construction Management » Energy Optimization » Occupant Comfort » Water Management » Solid Waste Management » Sustainable Building Materials » Life Cycle Costing » Socio-Economic Strategies » Performance Metering & Monitoring

8	Reunion Island	PREBAT	» New construction » Schools » Office » Retail » multi-unit residential	»Site analysis »Master plan »Structure »Equipment »Performance »Programme of works on site »Sustainable performance

Table 2 – Comparison of focus areas and credit categories

6. Certification process

The certification processes vary from certification to certifications. They are provided below.

6.1. LEED certification process

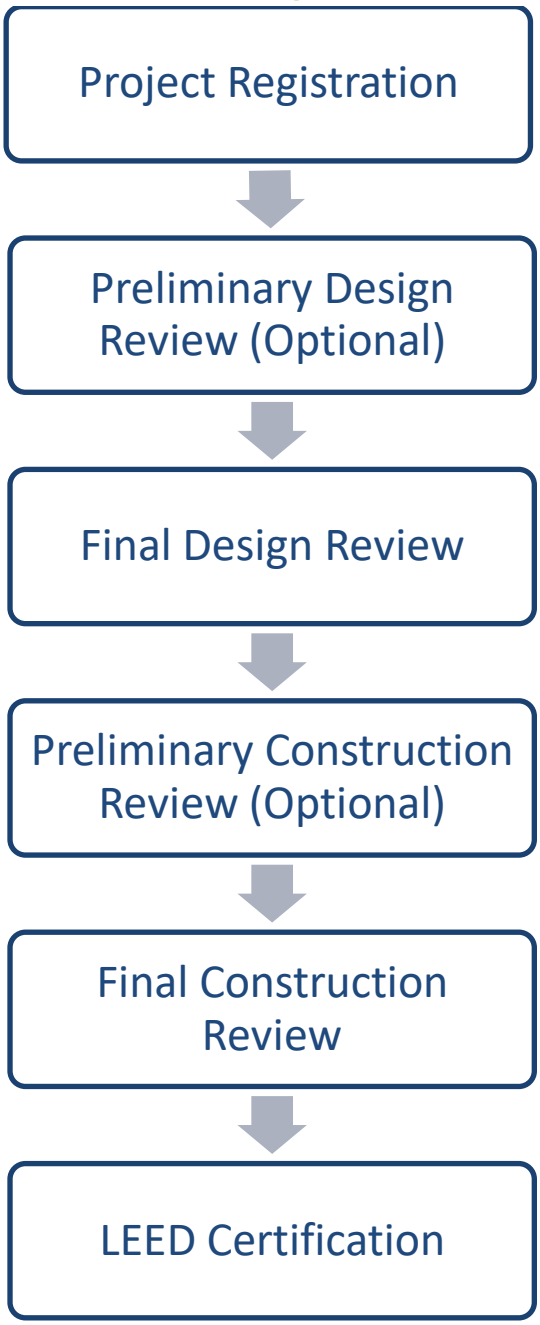


Figure 3 - LEED process

To earn LEED certification, the applicant project must satisfy all the prerequisites and qualify for a minimum number of points to attain the established project ratings as listed below. Having satisfied the basic prerequisites of the program, applicant projects are then rated according to their degree of compliance within the rating system.

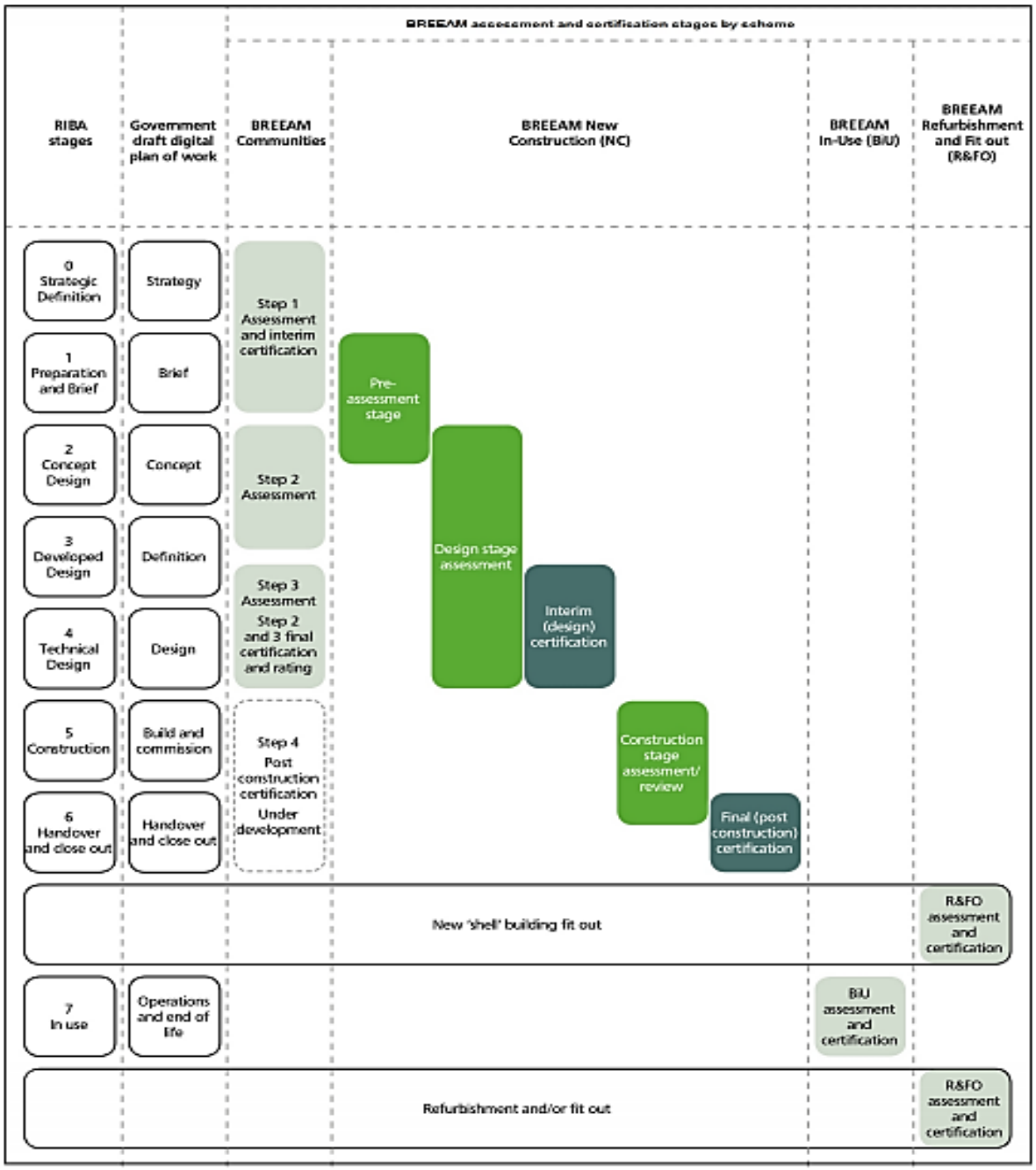
LEED for Core and Shell provides the option of splitting a certification application into two phases: design and construction. Documentation for design phase credits, identified in LEED-Online, can be submitted for review at the end of the design phase; the submittals for these credits can be fully

evaluated based on documentation available during this phase of the project. For example, if a project site meets the requirements of LEED for New Construction SS Credit 3, Brownfield Redevelopment, the likelihood of credit achievement can be assessed before construction is complete. The LEED credit itself, however, is not awarded at the design review stage.

6.2. BREEAM certification process

The figure below shows the BREEAM assessment and certification stages and how these link to the project work stage (the letters in the diagram refer to the Royal Institute of British Architects (RIBA) Outline Plan of Works).

Figure 4 - BREAM process



This scheme can be used to assess and rate the environmental impacts arising from a newly constructed building development (including external site areas), at the following life cycle stages:

1. Newbuild design stage (DS1) – leading to an interim BREEAM rating and certificate of assessment

2. Newbuild post-construction stage (PCS2) – leading to a final BREEAM rating and certificate of assessment Design Stage (DS)

The design stage (DS) assessment and interim BREEAM rating confirms the proposed newbuilding's performance at the design stage of the life cycle. Assessment and ideally certification will occur prior to the beginning of operations on site. The BREEAM rating at this stage is labelled as 'interim' because it does not represent the building's final, new construction BREEAM performance.

To complete an assessment at this stage, the design must be advanced to a point where the relevant design information is available to enable the BREEAM Assessor to evaluate and verify the building's performance against the criteria defined in this scheme document. The interim DS assessment will therefore be completed and certified at the scheme design or detailed design stages Post-Construction Stage (PCS)

The post-construction stage (PCS) assessment and BREEAM rating confirms the final as-built performance of the building at the new construction stage of the life cycle. A final PCS assessment is completed and certified after practical completion of the building works. There are two approaches to assessment at the post-construction stage:

1. A post-construction review (PCR) based on a completed interim design stage assessment
2. A post-construction assessment (PCA).

A PCR serves to confirm that the building's as-built performance and rating is in accordance with the assessment certified at the interim design stage. Where an interim DS assessment has not been carried out, i.e., certified, and a BREEAM assessment and rating is required, a full post-construction stage assessment can be conducted.

6.3. Green star SA certification process

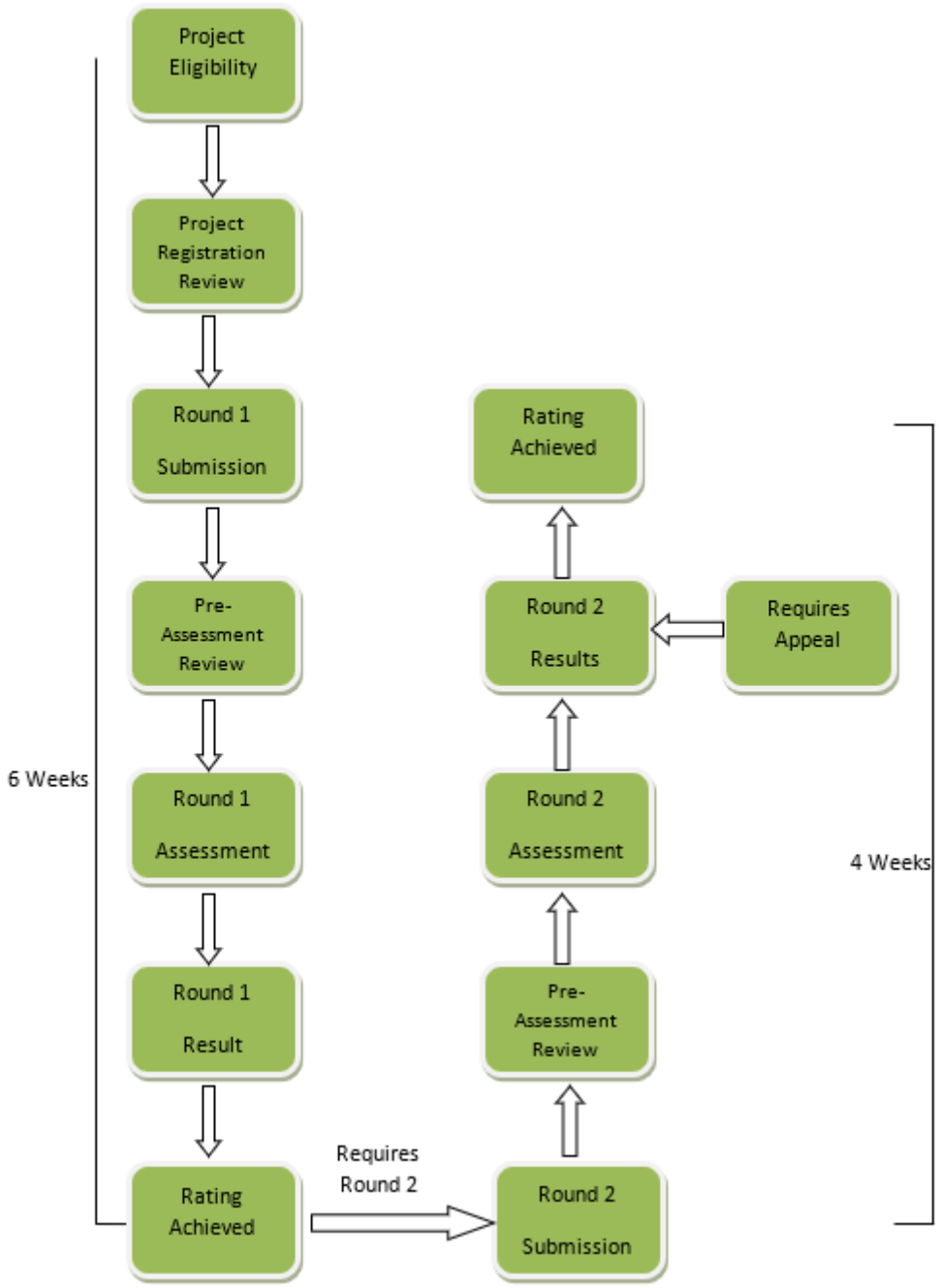


Figure 5 - Green Star SA process

First Round Submissions

The consultant determines with the design team and client, baseline targets and inspirational targets in respect of the assessment criteria. The consultant guides the design team through the assessment process.

i. Carrying out Preliminary Assessment to obtain an initial estimated potential rating based on the assessment criteria.

ii. Score to be achieved is set.

iii. Determination of baseline targets and aspirational targets.

iv. Discussion of criteria and targets at design charettes.

v. Finalisation of targets.

vi. Notification of the documents, calculations etc required from various parties for submittals.

vii. Management of collection of documents and data for submittals.

viii. Preparation of Credit Interpretation Requests. Response to queries regarding the CIR.

ix. Submission to certification body

Second round submissions

The consultant reviews the first assessment from the Certification Body. The consultant re-iterates the process for the first round to re-adjust the submission to achieve set score.

i. Review of score obtained.

ii. Review of clarifications needed.

iii. Review of changes to design requirements to meet the rejected criterion/criteria.

iv. Notification of the documents required from various parties for submittals.

v. Management of collection of documents and data for submittals.

vi. Preparation of Credit Interpretation Requests. Response to queries regarding the CIR.

vii. Submission to certification body

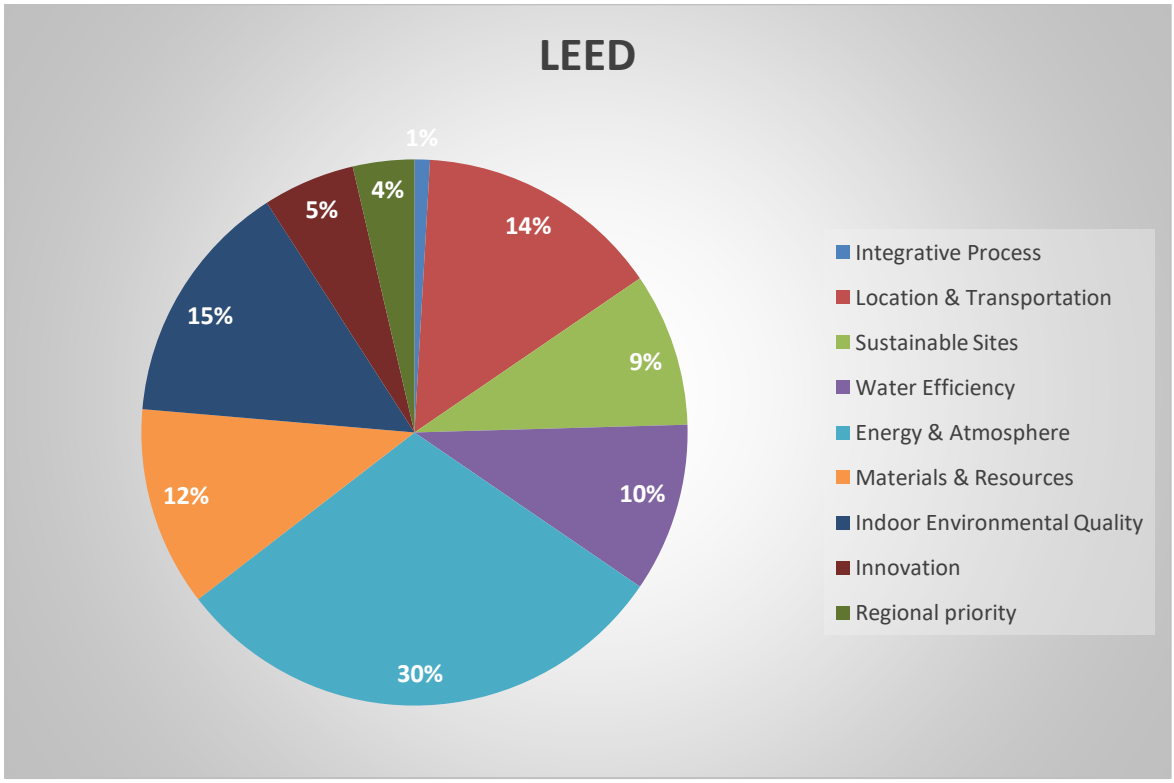
6.4. EDGE certification process

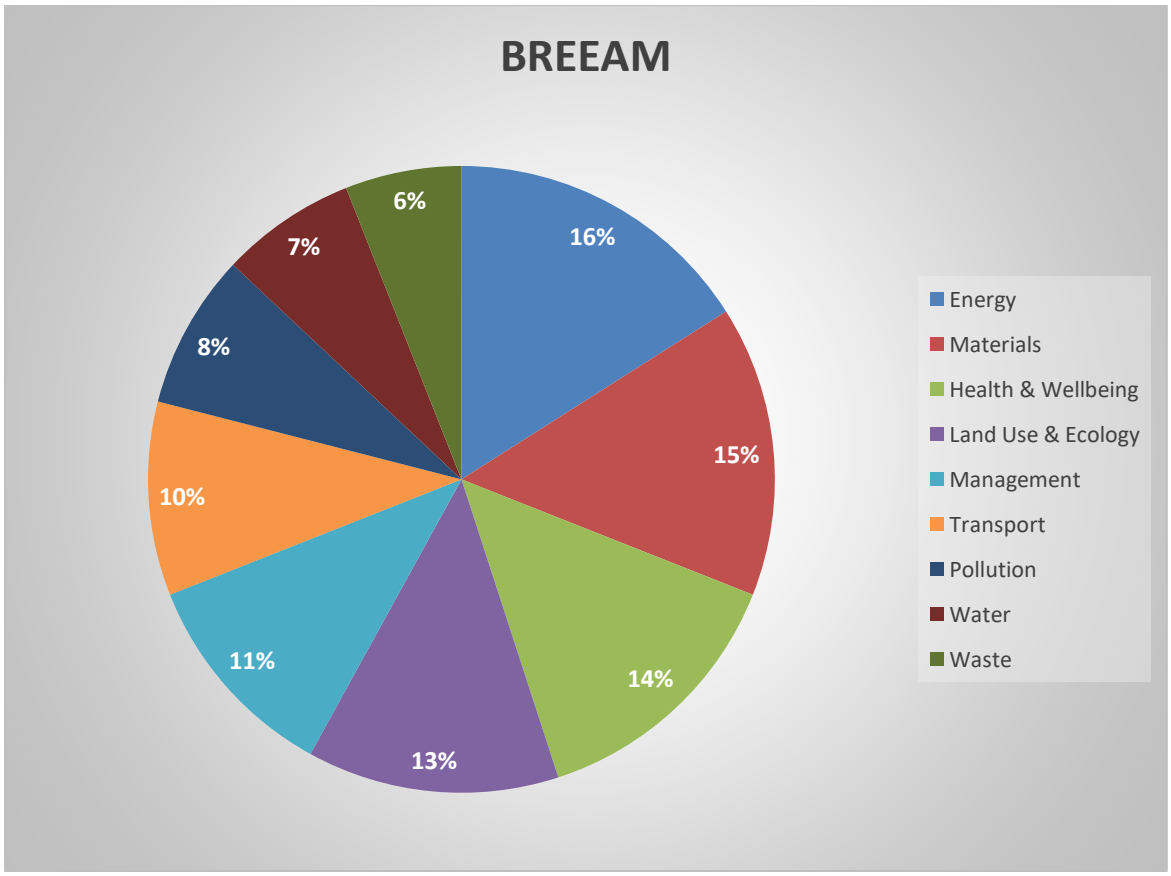
The first step is to register the project.

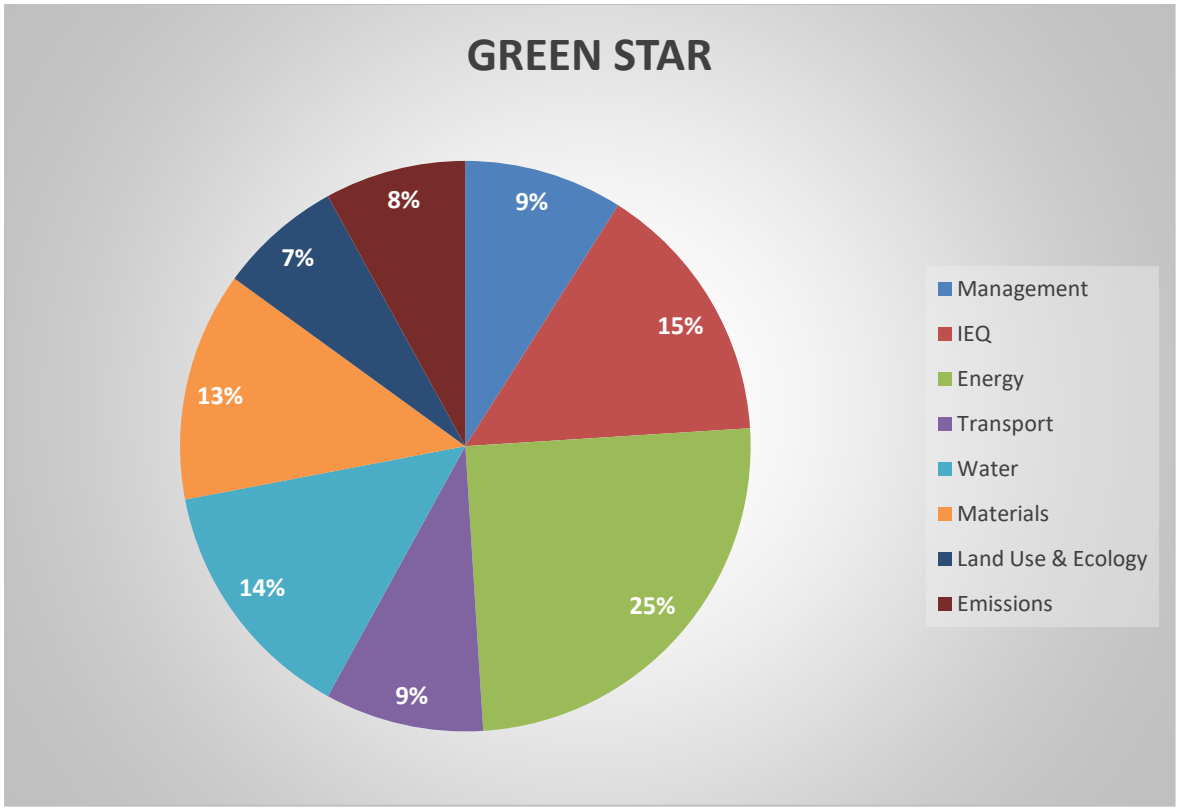
All the submission is done through a platform online. A relatively lesser number of documents and evidence are required for EDGE.

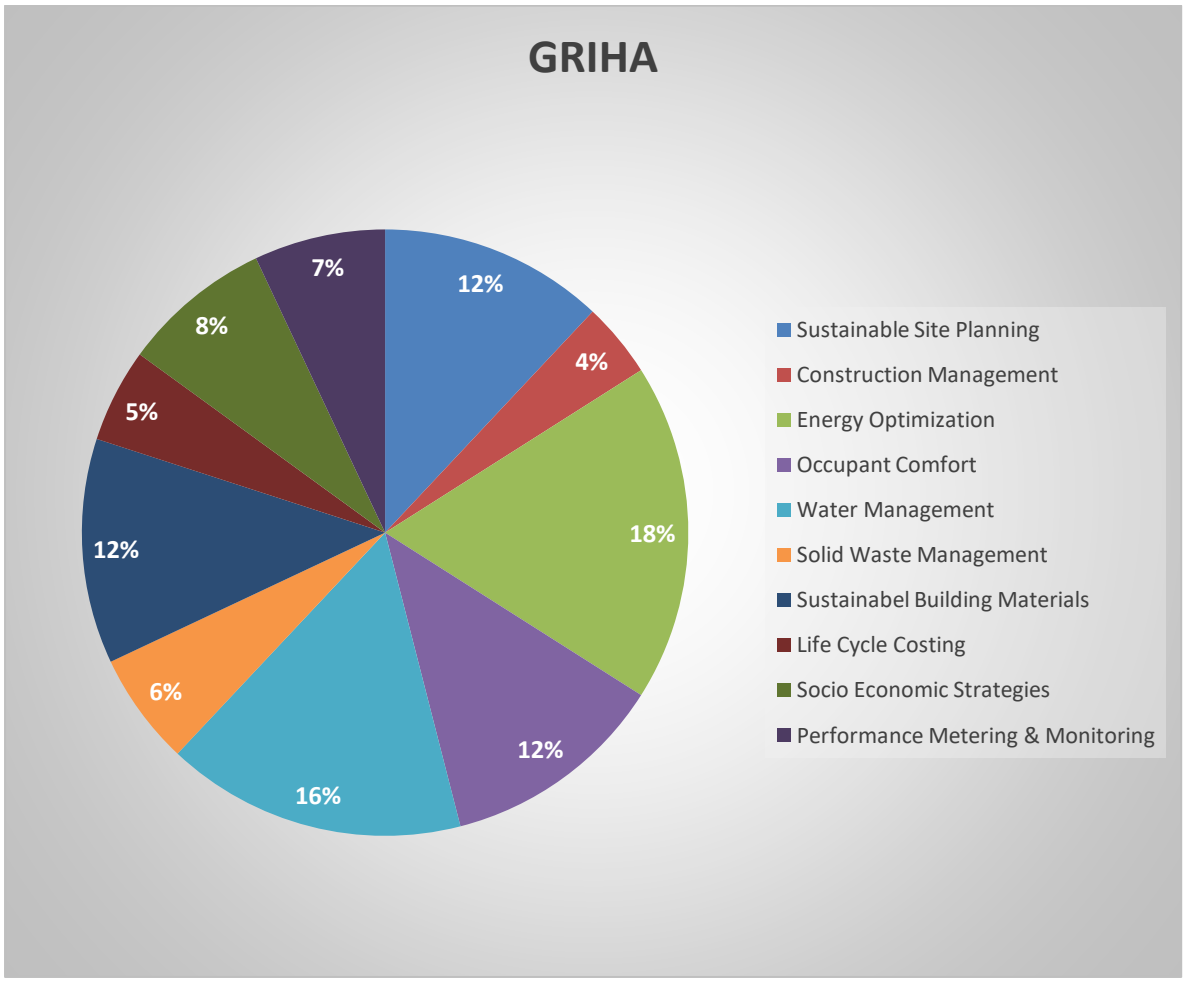
A preliminary EDGE certificate is received at the design stage, then the process is repeated at the post-construction stage to earn a final EDGE certification. Existing buildings can go straight to final certification (Edge, 2022).

7. Weightage comparison for building rating systems






GREEN STAR
9%
15%
25%
9%
14%
13%
7%
8%
Management
IEQ
Energy
Transport
Water
Materials
Land Use & Ecology
Emissions


GRIHA
12%
4%
18%
12%
16%
6%
12%
5%
8%
7%
Sustainable Site Planning
Construction Management
Energy Optimization
Occupant Comfort
Water Management
Solid Waste Management
Sustainabel Building Materials
Life Cycle Costing
Socio Economic Strategies
Performance Metering & Monitoring

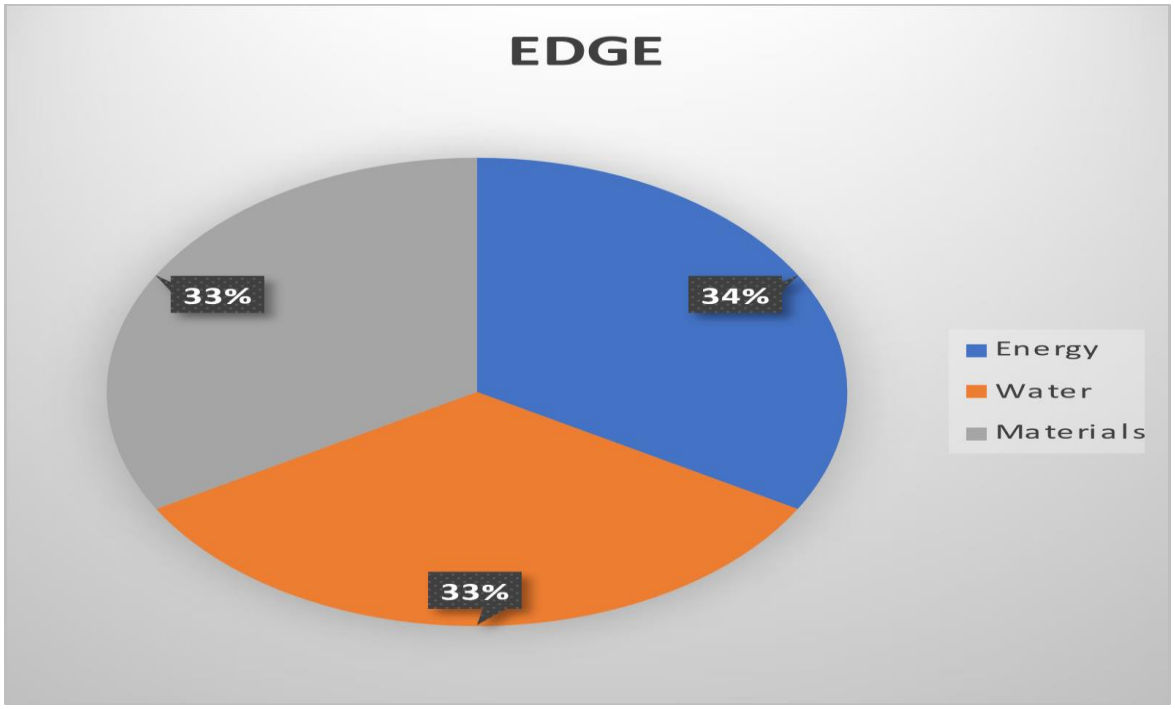

EDGE
34%
33%
33%
Energy
Water
Materials

Figure 6 – Credit categories weightage.

Edge has only three categories and shall not be considered for comparisons.

The credit categories weightage differs between certification systems. The categories also vary which makes it difficult to compare. For example, BREEAM and Green Start separates emissions/pollution whist LEED and GRIHA include the same in the Energy category. For Energy, for comparative purpose, LEED and GREEN STAR offers the highest scoring at 33%, followed by BREEAM 24% and GRIHA 18%. For Water, the range varies from 11 to 16% with GRIHA with the highest weightage and BREEAM the lowest.

For all the main certification systems except for EDGE, energy modelling is required to show compliance with the mandatory minimum requirements, and for calculation of improvement on the minimum requirement.

8. Comparison between the building rating systems

The table below provides a comparison with 5 building rating and certification systems.

Sr. no.	CATEGORY	BREEAM	LEED	GRIHA	EDGE	GS
1	**MANAGEMENT/ SUSTAINABLE SITE/ SITE & PROJECT MGMT/ SITE ASPECT**					
a	Site selection/ Brownfield redevelopment/ Reuse of land/ Reclaimed land/ contaminated land/ sustainable construction	✓	✓	✓	X	✓
b	Erosion & Sedimentation control/ Topsoil & Fill Removal from site	X	✓	✓	X	✓
c	Urban redevelopment/ Reduced site disturbance/ Ecological value of site & protection of ecological features/ Mitigating ecological impact/ Enhancing site ecology/ Ecological value of site/ Greenery provision/ construction site impact/ Long term impact on biodiversity	✓	✓	✓	X	✓
d	Hard Landscaping & Boundary protection/ Environmental mgmt./ Environmental mgmt. practices/ Landscaping & Planters/ Microclimatic around building/ Health, Safety & Environmental mgmt./ Environmental purchasing practices	✓	X	✓	X	✓
e	Responsible Construction practices/ Maintainability/ Commissioning clauses/ Commissioning building Tuning/ Environmental mgmt. Practices (CONQUAS)/ Building & Site Operation &Maintenance	✓	X	✓	X	✓
2	**ENERGY/ ENERGY EFFICIENCY/ ENERGY USE**					
a	Fundamental building system commissioning/ Measurement & verification/ Energy monitoring/ Energy conditional requirement/ Electrical sub-metering/ Testing & commissioning / Metering & monitoring	✓	✓	✓	X	✓
b	Minimum energy performance/ Optimize energy performance/ Energy efficient cold storage/ Energy eff. Lab system/ Energy eff. Transportation system/ Energy eff. Equipment/ Peak energy demand Reduction/ Eff. External lighting/ Lighting zoning & control/ Centralized energy system/ Thermal performance of building envelope/ Natural ventilated design & A/c system/ Energy eff. Features/ Annual energy use in building/ Ventilation system in mechanically ventilated building/ Lighting system in mechanically ventilated building/ Energy eff. Lighting in public areas/ Energy eff. applications/ Energy mgmt./ A/c units	✓	✓	X	✓	✓

Sr. no.	CATEGORY	BREEAM	LEED	GRIHA	EDGE	GS
c	Renewable energy/Green power/Energy improvement/Renewable energy system	X	✓	✓	✓	✓
3	**WATER EFFICIENCY**					
a	Water consumption/Water monitoring/ Water meter/ Water usage monitoring/ Monitoring & Control	✓	✓	✓	✓	✓
b	Water use reduction/ Water eff. Landscaping/ Water leak detection & prevention/ Water eff. Equipment/ Occupant amenity potable water efficiency/ Landscaping irrigation water eff./ Heat rejection water consumption/ Fire system water consumption/ Potable water use in lab/ Water eff. fitting/ Irrigation system & landscaping/ Water consumption of cooling tower/ Annual water use/ Water eff. Irrigation	✓	✓	✓	✓	✓
c	Innovative wastewater technologies/ Storm water mgmt./ Water recycling effluent discharge to foul sewers	X	✓	✓	X	X
4	**MATERIALS**					
a	Building reuse/ Reuse of Façade/ Reuse of structure/ Building Reuse	X	✓	X	✓	✓
b	Storage & collection of recyclables/ construction water mgmt./ Resource reuse/ Recycled content/ Construction waste mgmt./ Recycled aggregates/ Recycled content of concrete/ Recycled content of steel/ Recycled content and Reused products & materials/ Sustainable timber flooring/Loose furniture/ Deconstruction/ Rapidly renewable materials/ Life cycle impacts/ Sustainable procurement/ Recycling waste storage/ Sustainable construction/ Sustainable Products/ Adaptability & Deconstruction/ Sustainable forest products/ Waste Recycling facilities/ Waste mgmt.	✓	✓	✓	✓	✓
c	Local or Regional Materials	X	✓	X	X	✓
5	**INDOOR ENVIRONMENTAL QUALITY/ HEALTH AND WELL BEING**					
a	Minimum IAQ performance/ Construction IAQ mgmt. plan / Air change effectiveness/ IAQ in wet areas/ Construction IAQ mgmt./ IAQ in car parking/ IAQ in public transport interchanges	✓	✓	✓	X	✓
b	Environment tobacco smokes (ETS) control/ CO2 monitoring/ Low-emitting material/ Indoor chemical & pollutant source control/ CO2 & VOC monitoring & control/ Hazardous materials/ Volatile Organic Compounds/ Formaldehyde minimization/ Mould prevention/ Indoor air	X	✓	✓	✓	✓

Sr. no.	CATEGORY	BREEAM	LEED	GRIHA	EDGE	GS
	pollutants/Biological contaminations/ Integrated pest mgmt./ Indoor source of air pollution					
C	Reduced heat island effect/ Thermal comfort/ Thermal Insulation/ Thermal performance of building envelope- RETV/ Thermal comfort in centrally A/c premises/ Thermal comfort in A/c or naturally ventilated premises.	✓	✓	X	✓	✓
d	Ventilation efficiency/ Ventilation rates/ Naturally ventilated design & A/c system/ Ventilation in A/c premises/ Localized ventilation/ Ventilation in common areas	X	✓	✓	✓	✓
e	Day lighting & views/ Visual comfort/ Day lighting/ Day light glare control/ High frequency ballasts/ Electric lighting levels/ External views/ Artificial lighting/ Natural lighting/ Interior lighting in normally occupied areas/ Interior lighting in not occupied areas.	✓	✓	✓	✓	✓
F	Safety and Security/ Fire Safety/ Security	✓	X	X	X	X
g	Acoustic Performance/ Internal noise Level/ Noise Level/ Room Acoustics/ Noise Isolation/ Background Noise	✓	X	✓	X	X
6	TRANSPORTATION					
a	Alternative transportation/ Public transport accessibility/ Commuting mass transport/ Green transport/ Local transport/ Vehicular access	✓	✓	✓	X	✓
b	Alternative transportation/ Cyclist facilities/ Green transport	✓	✓	X	X	✓
c	Alternative transportation/ Travel plan/ Fuel eff. Transport/ Green transport	✓	✓	X	X	✓
d	Alternative transportation/ Maximum car parking capacity/ Car park minimization	✓	✓	✓	X	✓
e	Pedestrian route/ Green transport/Local transport	X	X	✓	X	X
f	Proximity to amenities/ Neighbourhood amenities/ Amenities features	✓	X	X	X	✓
7	POLLUTION/EMISSIONS					
a	Light pollution reduction/ Reduction of night K=Light pollution/ Light pollution	✓	✓	✓	✓	✓

Sr. no.	CATEGORY	BREEAM	LEED	GRIHA	EDGE	GS
b	Ozone protection/ Ozone depletion potential/ Ozone depletion substances/ Impact of refrigerants/ Refrigerant GWP/ Refrigerant leak detection & recovery/ CFC reduction in HVAC & R equipment/ Reduction in CO2 emission/ Low & Zero carbon technology.	✓	✓	✓	✓	✓
c	No emissions	✓	X	X	X	✓

Table 3 - Comparison of credits/performance criteria

9. Building rating systems in the Mauritian context

The choice of green building rating systems depends on several factors. It can depend on the following

i. Target market of the building project (If the target market is South Africans, it may be better to use a South African certification) Cost of certification
ii. Client requirements (Client sometimes request the certification they require, to be in line with their international portfolio for instance)
iii. Location requirements (projects in LEED neighbourhood development certified project are required to be LEED certified)

GRIHA is used primarily in India. LEED, BREEAM and Green Star SA are the three rating systems used in Mauritius. As per the comparison, the criteria are similar. EDGE is a simplified tool and has not been used yet for Mauritian projects.

All the three main rating systems have similar processes for certification, in that evidence are submitted for evaluation by either internal assessor (applicable for Green Star and LEED) or an external assessor (applicable for BREEAM). The process is the same for the building project owner. However, for EDGE, the process is simplified as it uses a web-based spreadsheet-based tool.

10. Conclusion

Eight green building rating systems that have been reviewed in the report namely:

- Leadership in energy and environmental design (LEED)
- Green rating for integrated habitat assessment (GRIHA)
- Building research environment assessment method (BREEAM)
- Green Star (GS)
- WELL building standard
- EDGE
- Green Star SA
- PREBAT used in Reunion Island (not a rating system but a grant)

LEED, BREEAM, and Green Star SA, are the most used systems in Mauritius. EDGE has registered interest because of its low cost and simplified framework but has not yet been used for Mauritian projects.

Most of the rating tools have similar credit categories for assessment, except for EDGE.

The categories are: (a) Sustainable sites/Management/Site aspect, (b) Energy/Energy efficiency/Energy use, (c) Water efficiency, (d) Materials, (e) Indoor environmental quality/Health and wellbeing, (f) Location and transportation, and (g) Pollution/Emission

EDGE, on the other hand, focusses only on energy, water, and materials.

The report provides an analysis the different certification processes of each certification systems. All the three main rating systems have similar processes for certification, in that evidence are submitted for evaluation by either internal assessor (applicable for Green Star and LEED) or an external assessor (applicable for BREEAM). However, for EDGE, the process is simplified as it uses a web-based spreadsheet-based tool.

The credit categories weightage differs between certification systems. The categories also vary which makes it difficult to compare. For example, BREEAM and Green Start separates emissions/pollution whist LEED and GRIHA include the same in the Energy category. For Energy, for comparative

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The choice of green building rating systems depends on several factors. It can depend on the following:

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ii. Client requirements (Client sometimes request the certification they require, to be in line with their international portfolio for instance)
iii. Location requirements (projects in LEED neighbourhood development certified projects are required to be LEED certified)

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APPENDIX

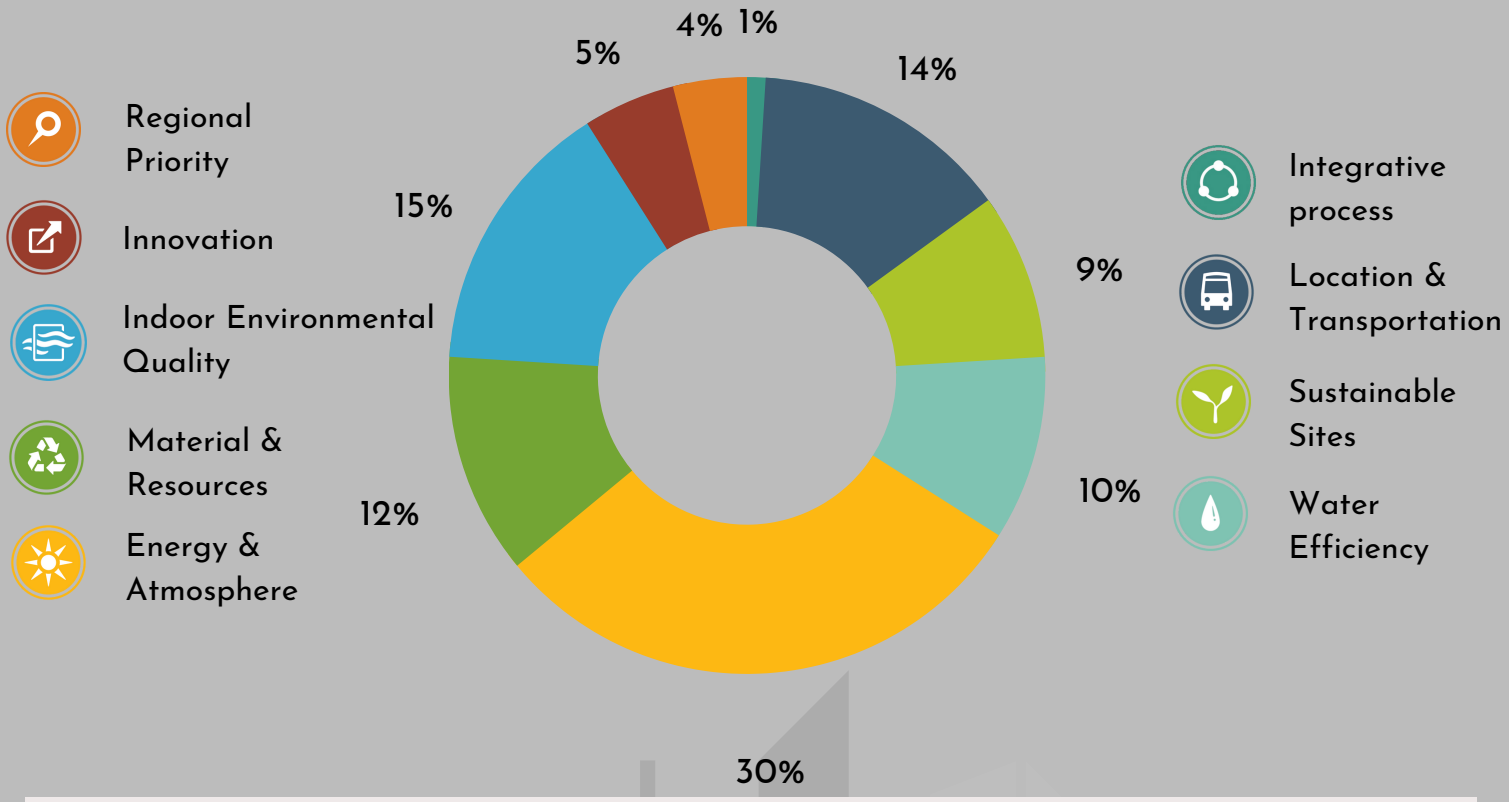
The building rating tools data sheets

Leadership in Energy and Environmental Design

LEED is a green building rating system created by the US Green Building Council. LEED provides a rating system for the following project types:

- New construction
- New interiors
- Existing buildings and spaces
- Neighbourhood development
- Cities and communities
- Residential
- Retail

LEED Categories: Weightings for new construction



Minimum requirements

Category: Energy and Atmosphere

- ASHRAE Guideline 0-2013 for MEP and renewable energy systems
- ASHRAE Guideline 1.1-2007 for HVAC&R Systems
- ASHRAE 90.1 - 2016 for Minimum Energy Performance

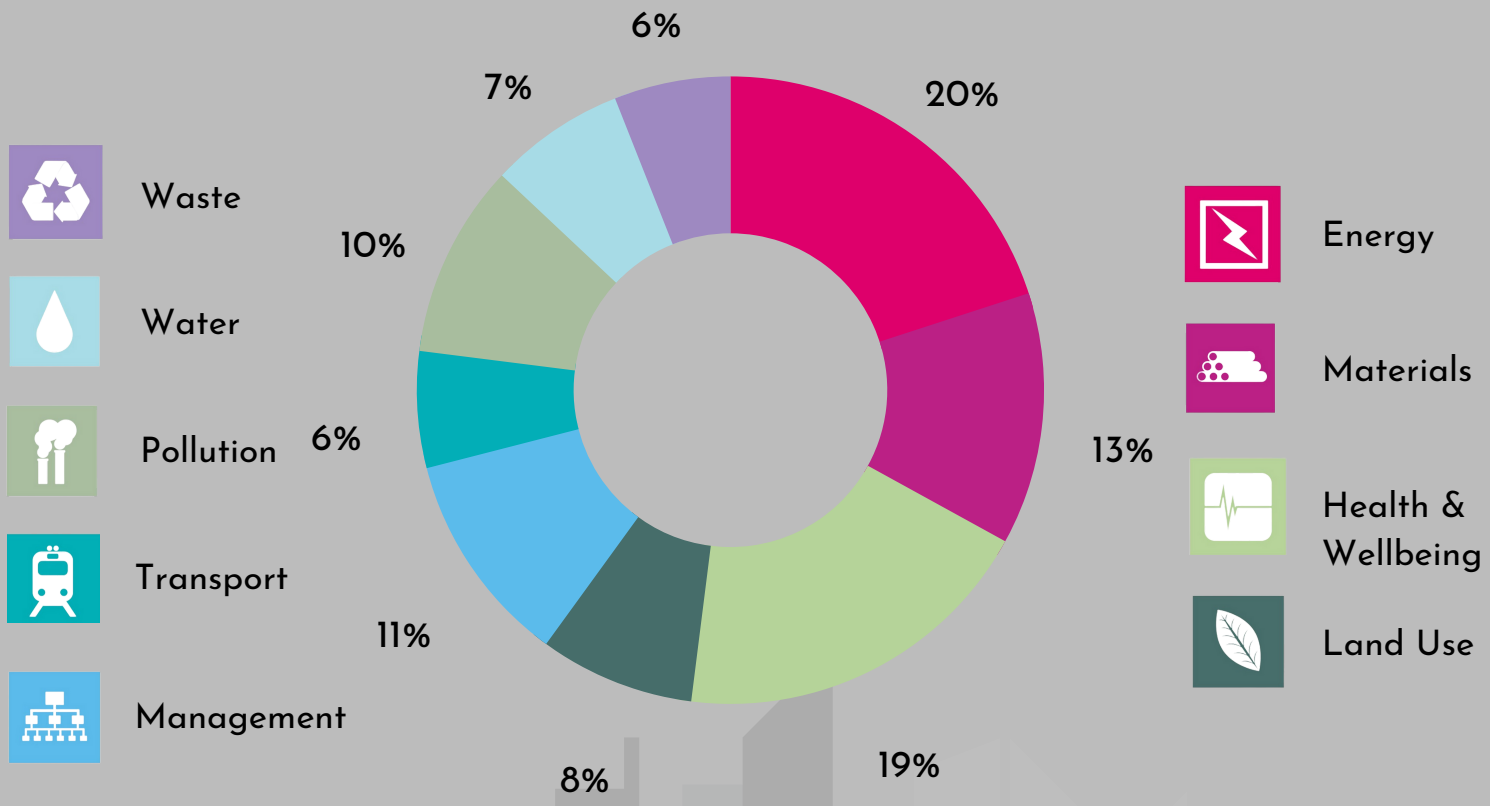
USGBC.org

Building Research Establishment Environmental Assessment Method

BREEAM is a British certification standard for the environmental assessment of buildings. BREEAM certification is applicable to five types of buildings:

- New construction
- In-Use
- Communities
- Refurbishment and fit-out
- International

BREEAM Categories : Weightings for new construction



Minimum requirements

Category: Energy

ASHRAE Standard 90.1 or UK's National Calculation Methodology

bregroup.com

Green Star South-Africa

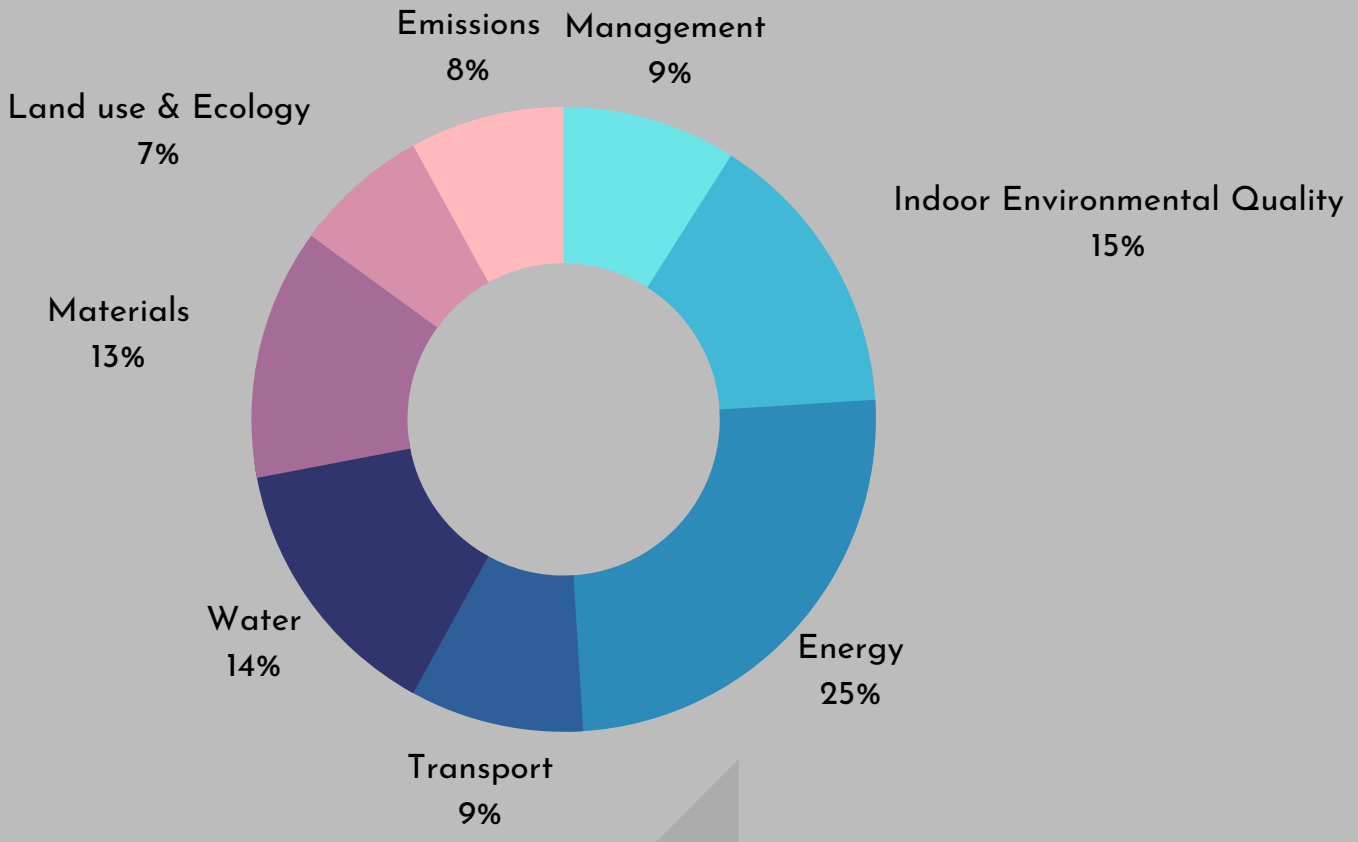
The Green Star South Africa is a rating tool for green buildings in South Africa and Africa . Green Star rating tools are made up of the following focus areas:

- Existing Building Performance
- New Building & Major Refurbishments
- Interiors
- Sustainable Urban Precincts
- Socio-Economic Category
- Green Star Custom

Ratings

4 Stars : "*Best Practices*"
5 Stars: "*South African Excellence*"
6 Stars: "*World Leadership*"

Green Star SA Categories: Weightings for new building



Minimum requirements

Category: Energy
SANS 204:2011 energy efficiency in buildings

Category: Transport
SANS 10246

Category: IEQ
SANS 10400-O:2011 - Ventilation
SANS 10114-1:2005 - Interior Lighting
SANS 10103:2004 - Internal Noise Level

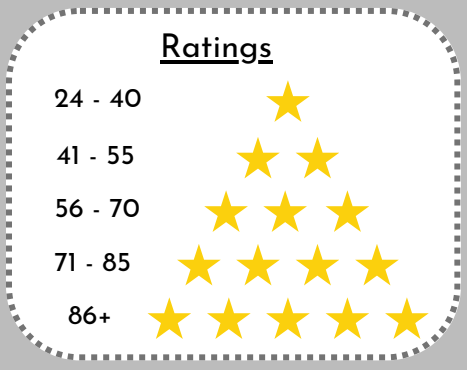
Category: Water
SANS 10400 and NEMA regulations

gbcsa.org.za

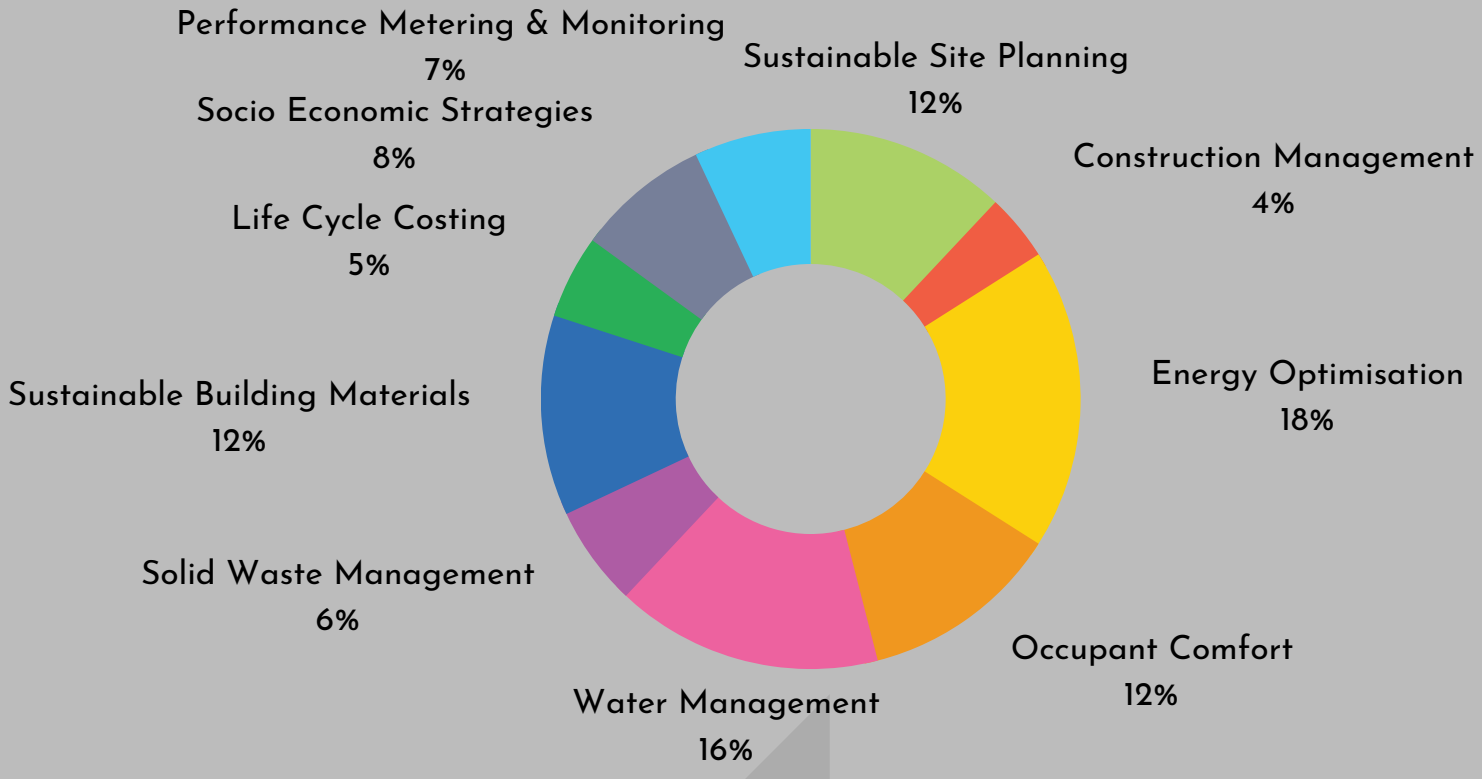
Green Rating for Integrated Habitat Assessment (GRIHA)

GRIHA is a green building rating system in India created by the The Energy and Resources Institute (TERI). GRIHA focuses mainly on:

- New construction
- Existing buildings
- Schools
- Cities



GRIHA Categories: Weightings for new construction



Minimum requirements

1) Category: Energy Optimisation

ASHRAE 90.1 for electrical lighting, HVAC systems and equipment of the project

2) Category: Occupant Comfort

ASHRAE Standard 62.1 - 2010 for ventilation systems

grihaindia.org

Excellence in Design for Greater Efficiencies

EDGE is a green building standard and certification system developed by Green Building Council Institute in US.

EDGE aims to reduce buildings' environmental impact in three areas: direct energy consumption, water consumption, and the energy footprint of construction materials.

EDGE is a certification system for residential and commercial structures.

EDGE Certification Level

EDGE Certified: Projects with at least 20% predicted savings in energy use, water use, and embodied energy in materials

EDGE Advanced: Projects that are certified with 40% or more predicted on-site energy savings, at least 20% predicted savings in water use and embodied energy in materials

EDGE Zero Carbon: Available for projects that already achieved certification at the EDGE Advanced level

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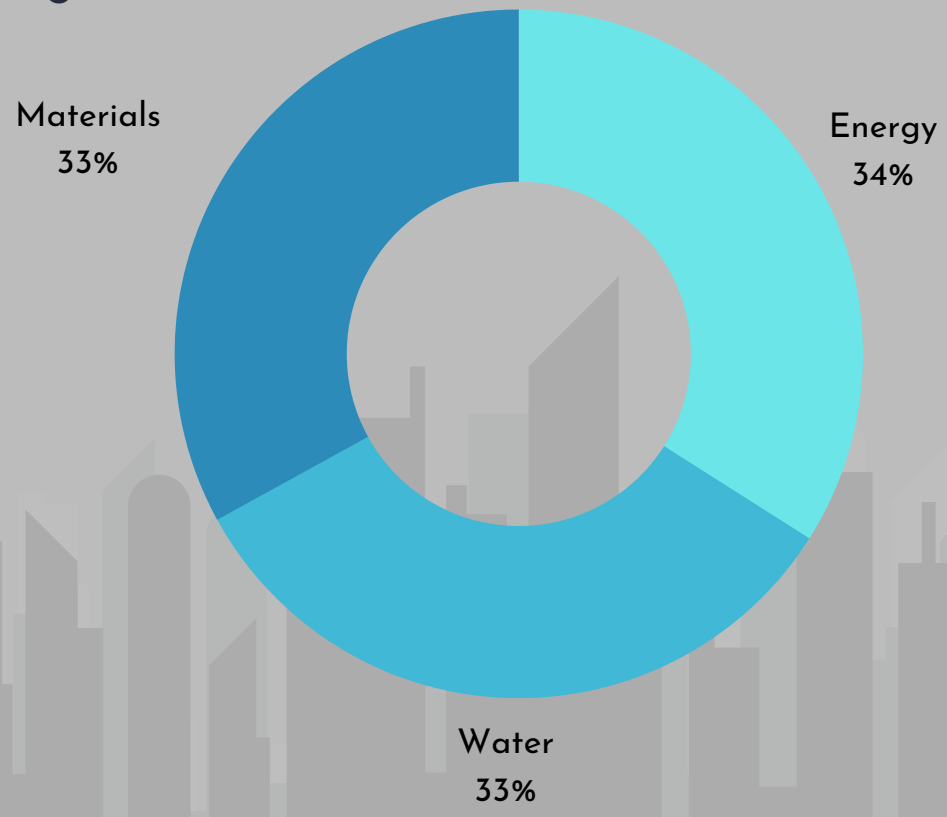
EDGE Categories



edgebuildings.com