GREEN$^{SL®}$ RATING SYSTEM

FOR BUILT ENVIRONMENT

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Green Building Council Sri Lanka

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PREFACE FROM GBCSL

The natural environment together with our economy, health and productivity are immensely affected by the performance of built environments. Built environment's lifespan contribution to global CO_2 emissions is forty per cent - the largest single contributor to global warming (UNEP).The building sector is responsible for more than one third of total energy use. Thus efficient design, construction and maintenance of our built environment are the responsibility of all stakeholders.

The GREEN$^{SL®}$Rating System of Green Building Council Sri Lanka (GBCSL) offers the valuable opportunity to respond positively to the greatest challenge of the day. It is a voluntary scheme where designers, builders and owners can achieve recognition for their valuable interest to build green.

History shows how our forefathers built great cities, irrigation systems and religious monuments that coexisted with nature and yet provided a sustainable economy and lifestyle to the citizens. This initiative of the GBCSL is one humble step towards taking our society to that glorious past which we are still proud of as Sri Lankans.

We believe our effort will make a zero energy built environment by the year 2050.

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FOREWORD

Sri Lanka, like other countries around the world, is facing an immense challenge, to create sustainable buildings for the future. Buildings are the major source of demand for energy and construction materials produce significant amount of by-product greenhouse gases. Studies show that the building sector accounts for over 40 percent of world's energy requirements and a large percentage of the present energy consumption and carbon dioxide generation could be saved by applying certification standards such as the one presented in this document, to new and refurbished buildings.

The public's perception of the importance of sustainable green design is dramatically increasing and the demand has followed. Developers of buildings of all types (and the consultants involved in design of those buildings) now recognise that sustainable design must be used because it adds value to their investment. Design for the sake of design alone is no longer an option. Design for higher performance is our pathway to a better future.

A green building is designed to use less energy and water, improved indoor air quality and to reduce the life-cycle environmental impacts of the materials used. This well-qualified committee led by Mr.Shiromal Fernando has worked very hard to produce the green rating system for Sri Lanka, with the main aim of fundamentally changing the built environment by creating energy-efficient, healthy, productive buildings that reduce or minimise the significant impacts of buildings on the environment. This is achieved through the allocation of different credits to the selection of a proper site, better and efficient design, material selection, construction, operation, maintenance, removal, and possible reuse, etc Although the rating system is based on world's best practice for Green Buildings, the committee has very efficiently incorporated local conditions. A local certification system will be definitely less expensive and will attract more local developers. A

number of independent studies confirm that buildings certified by green building councils around the world can consume up to 85 per cent less energy and 60 per cent less potable water, and send 69 per cent less waste to landfill than non-certified buildings. This rating system for Sri Lanka provides a rigorous road map to building green and there is no doubt that it will receive support from both public and private sectors and become the rating tool of choice.

Prof. PriyanMendis

Chairman, GBCSL

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GBCSL acknowledge the support of Eng.KasunShanaka,Ms.DayaniNayantha,Eng.K.M.P.Perera,Eng. H.A.A.P. Peiris,Eng.P.S.Panditharathneand Eng.TharakaGunawardena in preparing the draft.

A special word of thanks is to Building economic department, University of Moratuwa for sharing their work with the GBCSL technical team.

We mention with gratitude the technical committee members for the expert advice and reviews given to the draft;

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  Department of Building Economics, University of Moratuwa

GREEN$^{SL®}$RATING SYSTEM FOR BUILT ENVIRONMENT CHECKLIST

100 Total Points Available

Criteria		Points
1.0 MANAGEMENT		**4 Total Points Available**
☑ Prerequisite 1	Green Building Accredited Professional	Required
☑ Prerequisite 2	Commissioning Clauses	Required
☐Credit 1.1	Building Tuning [1 Point]	
	Credit 1.1.1 Optimizing occupant comfort and Energy Efficiency	1 Point
☐Credit 1.2	1.2 Building User's Guide [1 Point]	
	Credit 1.2.1 Building User's Guide	1 Point
☐ Credit 1.3	1.3 Environmental Management [2Points]	
	Credit 1.3.1 Environmental Management Plan	1 Point
	Credit 1.3.2 Environment Management System (Complying with ISO 14001)	1 Point
2.0 SUSTAINABLE SITES		**25 Total Points Available**
☑ Prerequisite 1	Erosion and Sedimentation Control	Required
☐ Credit 2.1	Site Selection	5 Points
☐ Credit 2.2	Development Density and Community Connectivity	4 Points
☐ Credit 2.3	Brownfield Redevelopment	1 Point

☐ Credit 2.4	Alternative Transportation [3 Points]	
	Credit 2.4.1 Public Transportation Access	2 Points
	Credit 2.4.2 Parking Capacity	1 Point
☐ Credit 2.5	Reduced Site Disturbance [4 Points]	
	Credit 2.6.1 Protect or Restore Habitat	2 Points
	Credit 2.6.2 Development Footprint	2 Points
☐ Credit 2.6	Storm Water Design, Quantity Control - I	3 Points
☐ Credit 2.7	Storm Water Design, Quantity Control - II	2 Points
☐ Credit 2.8	Heat Island Effect, Non – Roof	1 Point
☐ Credit 2.9	Heat Island Effect, Roof	1 Point
☐ Credit 2.10	Light Pollution Reduction	1 Point

3.0 WATER EFFICIENCY **14 Total Points Available**

☐ Credit 3.1	Water Efficient Landscaping [1-4 Points]	
	Credit 3.1.1 Reduce Potable Water Consumption	2 Points
	Credit 3.1.2 Eliminate Potable Water Consumption	2 Points
☐ Credit 3.2	Water Efficiency in Air-conditioning System	1 Point
☐ Credit 3.3	Innovative Wastewater Technologies [1-5 Points]	
	Credit 3.3.1 Reduce Potable Water Use or Treat Wastewater	2 Points

☐ Credit 3.3	Innovative Wastewater Technologies [1-5 Points]	
	Credit 3.3.1 Reduce Potable Water Use or Treat Wastewater	2 Points
	Credit 3.3.2 Harvested Rainwater	3 Points
☐ Credit 3.4	3.4 Water Use Reduction	1-4 Points

4.0 ENERGY & ATMOSPHERE **21 Total Points Available**

☑ Prerequisite 1	Fundamental Building Systems Commissioning	Required
☑ Prerequisite 2	Minimum Energy Performance	Required
☑ Prerequisite 3	CFC Reduction in HVAC&R Equipment	Required
☐ Credit 4.1	Optimize Energy Performance	1-10 Points
☐ Credit 4.2	Renewable Energy	7 Points
☐ Credit 4.3	Additional Commissioning	1 Point
☐ Credit 4.4	Ozone Depletion	1 Point
☐ Credit 4.5	Measurement & Verifications	1 Point
☐ Credit 4.6	Green Power	1 Point

5.0 MATERIALS & RESOURCES **21 Total Points Available**

☑ Prerequisite 1	Storage & Collection of Recyclables	Required
☐ Credit 5.1	Building Reuse [1-3 Points]	
	Credit 5.1.1 Maintaining 50% of Existing Building Structure and Shell	1 Point

	Credit 5.1.2 Maintaining 75% of Existing Building Structure and Shell	2 Points
	Credit 5.1.3 Maintaining 75% of Existing Building Structure and Shell and 25% of Non-shell Areas	3 Points
☐ Credit 5.2	Construction Waste Management [1-2 Points]	
	Credit 5.2.1 For 50% Recycling	1 Point
	Credit 5.2.2 For 75% Recycling	2 Points
☐ Credit 5.3	Resource Reuse [1-2 Points]	
	Credit 5.3.1 For at least 5% of the Building	1 Point
	Credit 5.3.2 For at least 10% of the Building	2 Points
☐ Credit 5.4	Recycled Content [1-2 Points]	
	Credit 5.4.1 For at least 10% of Total Value of Materials	1 Point
	Credit 5.4.2 For at least 20% of Total Value of Materials	1 Point
☐ Credit 5.5	Local / Regional Materials [1-3 Points]	
	Credit 5.5.1 For a Minimum of 20% Usage	1 Point
	Credit 5.5.2 For a Minimum of 50% Usage	3 Points
☐ Credit 5.6	Rapidly Renewable Materials	1 Point
☐ Credit 5.7	Certified Wood	1 Point

6.0 INDOOR ENVIRONMENTAL QUALITY 13 Total Points Available		
☑ Prerequisite 1	Minimum IAQ Performance	Required
☑ Prerequisite 2	Smoke (ETS) Control	Required
☐ Credit 6.1	Outdoor Air Delivery Monitoring	1 Point
☐ Credit 6.2	Increased Ventilation	1 Point
☐ Credit 6.3	Construction IAQ Management Plan [1 Point]	
	Credit 6.3.1Construction IAQ Management Plan Before and After Construction	1 Point
☐ Credit 6.4	Low - Emitting Materials [1-3 Points]	
	Credit 6.4.1Paints and Coatings	1 Point
	Credit 6.4.2 Carpet Systems	1 Point
	Credit 6.4.3Composite Wood and Agrifiber Products	1 Point
☐ Credit 6.5	Indoor Chemical & Pollutant Source Control	1 Point
☐ Credit 6.6	Controllability of Systems [1-2 Points]	
	Credit 6.6.1Lighting Controls	1 Point
	Credit 6.6.2 Comfort Controls	1 Point
☐ Credit 6.7	Thermal Comfort, Design	1 Point
☐ Credit 6.8	Thermal Comfort, Verification	1 Point

☐ Credit 6.9	Daylight & Views [2 Points]	
	Credit 6.9.1Daylight	1 Point
	Credit 6.9.2 Views	1 Point

7.0 INNOVATION & DESIGN PROCESS **4 Total Points Available**

☐ Credit 7.1	Innovation in Design [1-4 Points]	
	Credit 7.1.1 Innovation in Design	1-2Points
	Credit 7.1.2Exemplary Performance	1-2 Points

8.0 SOCIAL & CULTURAL AWARENESS **3 Total Points Available**

☑ Prerequisite 1	Archeological Sites & Heritage Buildings	Required
☐ Credit 8.1	Social Wellbeing, Public Health & Safety	1-2 Points
☐ Credit 8.2	Cultural Identity	1-2 Points

Ratings given will be as follows;

- Certified 40–49 points
- Silver 50–59 points
- Gold 60–69points
- Platinum 70 points and above

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INTRODUCTION TO GREEN BUILDING COUNCIL OF SRI LANKA (GBCSL)

The concept of “Green Buildings” aims at increasing the efficiency with which buildings use resources such as energy, water and materials while reducing the impact of buildings on human health and its surrounding environment during its lifecycle, through better design, construction, operation, maintenance and removal and recycling of waste.

Going green is no strange concept to us Sri Lankans having a proud history of great civilisations with structures and monuments together with irrigation systems that impress the entire world even today. The balanced lifestyle and coexistence with nature, which it provided to the human society is the ultimate goal of *GBCSL*’s endeavour.

The *Green Building Council of Sri Lanka (GBCSL)* came into existence as a result of an emerging trend towards applying the greener concepts for built environment.

GBCSL launched in November 2009as a non-profit organization that is committed to developing a sustainable building industry for Sri Lanka by encouraging the adoption of green building practices. It is uniquely supported by both industry and government institutions across the country.

The *GBCSL* is now granted with “Emerging Member Status” by the *World Green Building Council*, which represents about 80 countries ranging from developed to developing nations world-wide.

Prof. PriyanMendis lead the *GBCSL* as the chairperson while the board comprise of expert academic advisors and industry agents.

Board Members

- **Prof. PriyanMendis (Chairman)**
  Dept. of Infrastructure Engineering, University of Melbourne, Australia
- **Prof. RanjithDissanayake (Ex. Vice Chairman)**
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Committees of the Council

- Green Environmental Rating System & Life Cycle Assessment
- Transport Infrastructure in Built Environment
- Nanotechnology for Sustainable Built Environment
- Education & Training
- Awareness & Publicity
- International Relations
- Membership

Representative Organizations in the board

- Central Environment Authority
- Urban Development Authority
- Sri Lanka Sustainable Energy Authority
- National Water Supply & Drainage Board

Institutions that have taken leadership in establishing GBCSL

- Sri Lanka Standards Institute (SLSI)
- Sri Lanka Institute of Architects
- The Institution of Engineers Sri Lanka
- Society of Structural Engineers Sri Lanka
- National Construction Association of Sri Lanka
- Institute of Quantity Surveyors of Sri Lanka
- National Academy of Sciences Sri Lanka
- Sri Lanka Institute of Nanotechnology
- Institute of Town Planners Sri Lanka
- Faculty of Civil Engineering - University of Moratuwa
- Faculty of Mechanical Engineering - University of Moratuwa
- Faculty of Civil Engineering - University of Peradeniya
- Faculty of Architecture - University of Moratuwa
- Faculty of Civil & Environmental Engineering - University of Melbourne
- Leading Business Organizations in Sri Lanka

VISION OF GBCSL

Our Vision is to transform the construction industry in Sri Lanka with traditional building practices and fully adopt sustainability as the means by which our environment flourishes, economy prospers and society grows to ensure the future wellbeing of our motherland.

MISSION OF GBCSL

The Mission is to develop the sustainability of the built environment by transforming the way it is planned, designed, constructed, maintained and operated and drive the adoption of green building practices through market-based solutions, while helping to forge a new partnership between government, industry and other stakeholders.

WORLD EMPHASIS ON THE GREEN BUILDING CONCEPT

The World Green Building Council is the union of national Green Building Councils from around the world, making it the largest international organisation influencing the green building marketplace.

Where we are now…

The green building concept is quite new to the current Sri Lankan context but it is rapidly expanding all over different industries as they are searching for more energy efficient buildings for their usage. The most recent and innovative example is MAS Intimates THURULIE factory at Thulhiriyawhich became the winner of *Globe Award for Sustainability Innovation 2010.* Further it is being awarded the LEED Platinum Certification by the U.S. Green Building Council, making it the World's first LEED Platinum newly built factory.

As this concept in acceptable to majority of the society, people try to grab and hold this concept. Since Sri Lanka didn't have a clear framework and governing body for green rated buildings in the past there is an extreme necessity for such an institution for Sri Lanka.

Where we want to be…

Most of the leading countries have their own green building councils to govern their green rating for building structures. The different state councils of these countries follow a standardised rating system to assess the environmental acceptability of these buildings through green rating. United States of America's governing body United States Green

Building Council uses *LEED* (Leadership in Energy and Environmental Design) rating system and Australia's governing bodyGreen Building Council of Australia uses *Green Star* rating system and United Kingdom's governing body UK Accreditation Service (UKAS) uses *BREEAM* rating system to assess and rate the environmental acceptability and sustainability of building solutions. Therefore it is an essential and timely need for Sri Lanka to build such a rating system to assess the environmental acceptability of buildings. The main purpose ofthe existence of *GBCSL*is to develop such a rating system and manage it effectively and efficiently to provide a remarkable service in assessing the buildings in terms of environmental acceptability while providing leadership to develop green solutions in the future for new developments and incorporate such concepts to existing buildings by retrofitting them to make them sustainable.

Further, it is important to note that from country to country the considerations for those rating systems will change as the environmental conditions; level of development and the availability of resources vary from place to place.

Why GREEN Rating is important for Sri Lanka...

The main purpose of the GREEN$^{SL®}$ Rating System is to encourage the design of buildings in an environmentally acceptable manner. This will be a major step towards adopting a sustainable practice in development of buildings to utilize the natural resources and make efficient designs to utilise nature for the betterment of the mankind.

Most of the resources that are being using today account for environmental pollution. Therefore it is the time to search for new materials and designs to reduce the impact to the environment. Hence this concept will encourage development of environmentally friendly building solutions for the use.

How the GREEN Rating System works...

In normal context when GREEN$^{SL®}$ Rating System is used as a tool to evaluate efficiency of the built environment in the following aspects, such as Management, Energy, Indoor Environmental Quality, Materials etc and points are assigned for each category and the rating is given upon the total marks earned by each design or building solution.

What we need to do to bridge the gap...

In the development process of making Sri Lanka sustainable, the establishment of theGREEN$^{SL®}$ rating system is a critical milestone. Accordingly the rating system has to develop for Sri Lanka to ensure that construction of buildings is conforming to the environment.

Future with GREEN Rating System...

GBCSL is the governing body of Sri Lanka responsible for developing, implementing and maintaining the GREEN$^{SL®}$ Rating System. The governing body comprises of experts inmany different disciplines who effectively contribute to the functioning of the system. Further, through GBCSL the GREEN$^{SL®}$ Accreditation Certificate will be issued for building designers which then will be followed with continuous monitoring to ensure that the originally agreed design work is carried out. The Government will give incentives to builders and the building products solutions which achieve the bench marks set by GREEN$^{SL®}$ rating system. GBCSL will appoint authorised personnel who have the authority to rate the buildings. Such authorisation may be granted to a person who has completed the necessary technical qualification acceptable to GBCSL.

Goals of the GREEN Rating System

- Sustainable Site Planning
- Safeguarding water and water efficiency
- Energy efficiency and usage of renewable energy
- Conservation of materials and resources
- Indoor environmental quality
- Enhancing social and cultural Values
- Show Leadership
- Educate End Users

Benefits to Owners

- Lower operating costs
- Higher return on investment
- Provides healthy interior spaces for occupants
- Greater tenant attraction
- Reduced liability and risk
- Enhanced marketability
- Demonstration of Corporate Social Responsibility
- Future proofed assets
- Competitive advantage

GREEN$^{SL®}$ RATING SYSTEM FOR BUILT ENVIRONMENT

The GREEN$^{SL®}$ Rating System for Built Environment is a set of performance standards for certifying Built Environmentsin the form of commercial or institutional buildings and high-rise residential buildings of all sizes, both public and private. The intent is to promote high performance, healthy, durable, affordable, and environmentally sound practices for new and existing buildings.

Prerequisites and credits in the GREEN$^{SL®}$ Rating Systemfor Built Environment addresseight aspects;

- Management (MN)
- Sustainable Sites (SS)
- Water Efficiency (WE)
- Energy and Atmosphere (EA)
- Materials and Resources (MR)
- Indoor Environmental Quality (EQ)
- Innovation and Design Process (ID)
- Social and Cultural Awareness (SC)

The Certifications from the GREEN$^{SL®}$ Rating System for Built Environment will be awarded according to the following scales;

- Certified 40–49 points
- Silver 50–59 points
- Gold 60–69points
- Platinum 70 points and above

GBCSL will recognize buildings that achieve one of these rating levels with a formal letter of certification.

All structures defined as Built Environments in standard building codes, are eligible for certification under the GREEN$^{SL®}$ Rating System for Built Environment and includeoffices, retail and service establishments, institutional buildings (libraries, schools, museums, churches, etc.), hotels, and residential buildings of 4 or more habitable stories.

The GREEN$^{SL®}$ Rating System for Built Environment encourages owners and operators of buildings to implement sustainable practices and reduce the environmental impacts of their buildings over their functional lifetime. The rating system specifically addresses building site maintenance programmes, water and energy use, usage of environmentally preferred products and practices for cleaning and alterations, sustainable purchasing policies, waste stream management, and ongoing indoor environmental quality.

The GREEN$^{SL®}$ Rating System for Built Environment provides owners and operators of buildings an entry point into the GREEN$^{SL®}$ certification process and is applicable to the following;

- Building designs, processes, systems upgrades, minor space-use changes, and minor facility alterations or additions; and
- Building designs new to GREEN$^{SL®}$ certification as well as buildings previously certified under GREEN$^{SL®}$ Accreditation for major renovations, Schools or Core & Shell; these may be either ground up new constructions or buildings that have undergone major renovations.

BACKGROUND TO THE GREEN$^{SL®}$ RATING SYSTEM

The term sustainable development was coined and offered to the world a new perspective on how to address the dilemma of advancing economic development while protecting environmental systems and enriching the quality of life for the present generation and future ones. The concept of sustainable development slowly leached its way to number of disciplines and has been speedily accepted by the world as it has holistic idea of protecting environment for the survival of mankind. However, the main obstruction remains the conversion of sustainable development from a theoretical model to an outfitted one.

The sustainability frameworks have evolved throughout the past starting with the neo-classical economics, where it has used dollars as the unit of measurement. Later it was recognized the inadequacy of conventional economic knowledge tools when it comes to the use of environmental resources and the need of “special indicators” was highlighted.This is because such indicators are outside of the worldview of conventional economics. In the next phase of evolution, ecological economics, the human economy is considered as an open sub-system of the biosphere, which itself are materially closed but open to energy transfers. The third phase of the evolution considered triple bottom line; economic, social and environmental sustainability.

The latest phase of frameworks are sector, domain and issue based, where sectors such as transportation, commercial, industrial and residential etc were concerned and in case of domains divisions like energy, water, land etc were concerned. Based on this framework more than six hundred sustainable accreditation systems are there in the world.

The evolution of frameworks is shown in figure 01. Along the X-axis the amount of information presented by the frameworks are increasing and those represented by increased number of indicators. The Y-axis

shows the simplicity of frameworks where increased information results in complexity in their use.

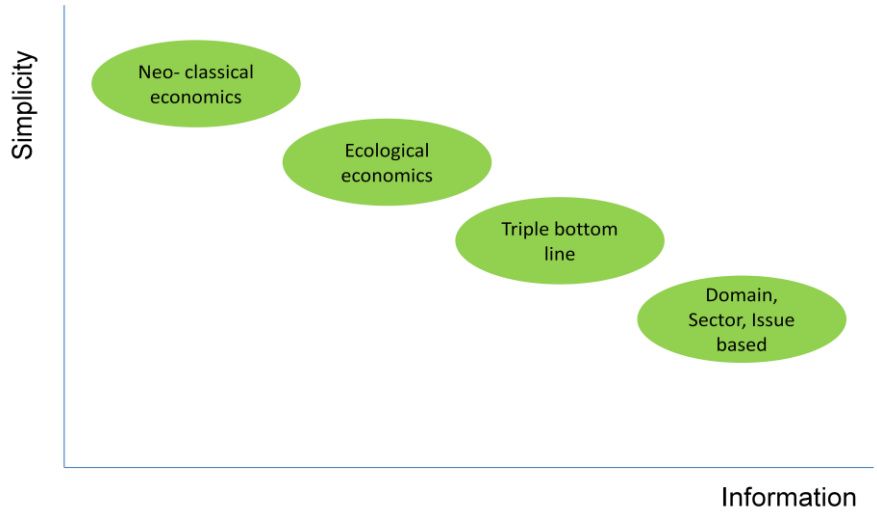

Figure 01: Evolution of sustainability indicators (Chandratilake, S.R. and Dias, W.P. S, 2010)

Even though still it has not became a major and pressing problem for Sri Lanka, in construction, especially buildings, is beginning to show signs of cumulative issues in sustainability. Many countries have developed sustainability guidelines and accreditation systems based on issues that those countries are facing in the present context.

Improper understanding and misinterpretation of different domains and aspects in different localities have created inadequate measure of sustainability, which would not reflect the magnitude of the local depiction of sustainability. In most cases this is arising due to use of popular or common accreditation systems without considering the local variations.

There are number of researches and publications on assessment of sustainability considering various domains with different sustainability approaches. For instance the Malaysian Green Building Index assessment has identified six domains considering requirements of the local context. Whereas LEED (US) has identified seven domains, BREEAM (UK) has identified ten domains, GREEN STAR (Australia) has identified nine domains and GRIHA (India) has identified four domains.

After thorough study of the existing rating systems and the and considering local experts' views, eight domains, namely; management, sustainable sites, water efficiency, energy and atmosphere, materials and resources, indoor environmental quality, innovation and design, and social and cultural awareness, were identified for GREEN$^{SL®}$Rating System for Sri Lanka. Each domain category has number of aspects. The number and nature of aspects varies from one category to another according to the category itself and its importance matching the local context. The importance of these domains and aspects were identified by a survey (Chandratilake, S.R. and Dias, W.P. S, 2010, Sustainability Rating Systems for Buildings: Comparisons and Correlations) and it was found that 'sustainable sites' is the most important domain. And, energy and atmosphere, materials and resources, water efficiency and indoor environmental quality are respectively in the top order. Those weights were employed as the basis of scoring criterion used in this document.

GBCSL technical committee decided to follow the LEED (US) Model considering the fact that, it is the most popular rating system is the world. GREEN$^{SL®}$ Rating System will follow similar procedures when rating building in Sri Lanka. Initially LEED accredited professionals will be given the GBCSL accreditation; subsequently GBCSL will conduct her own accreditation process. Thus GREEN Rated building by GBCSL will have an equivalent efficiency as a LEED rated building.

GREEN$^{SL®}$ RATING SYSTEM

FOR BUILT ENVIRONMENT

1.0 MANAGEMENT

Prerequisite 1 – Green Building Accredited Professional

Required

Intent

To encourage and recognize the engagement of professionals who can assist the project team with the integration of Green Building aims and processes throughout design and construction phases

Requirements

A principal participant in the design team is a Green Building Accredited Professional engaged by the building owner to provide sustainability advice from the schematic design phase through to construction completion.

Ensure that the submission adhere to all provisions of the submission requirements document found on the GBCSL website.

To be deemed engaged, in line with the aim of credit, the Green Building accredited professional must contribute substantially. Theattendance at least50% of all project design meetings and 75% of all building services meetings.

Potential Technologies & Strategies

The Green Building accredited professional must remain assigned to the project, from the schematic design stage to construction completion.

Should the role of the Green Building accredited professional be fulfilled by different individuals throughout the project based on their expertise, the evidence above must be submitted for each accredited professional. As the certified assessor will seek to validate that the value to the project was not compromised by the handover, project must also provide a description of the handover procedures for all of the roles of the original Green Building accredited professional (Qualified Architect, Engineer, Planer and Quantity Surveyor, or any other professionals recognised by the Institute for Construction Training and Development - ICTAD).

Prerequisite 2 – Commissioning Clauses

Required

Intent

To encourage and recognize commissioning and handover initiatives those ensure that all building services can operate to optimum design potential.

Requirements

1. Commissioning and Quality Monitoring

Comprehensive pre-commissioning, and quality monitoring are contractually required to be performed for all building services (BMS, mechanical, electrical and hydraulic); and the works outlined above to be carried out in exact accordance with CIBSE codes or ASHRAE commissioning guidelines (for services only) and CIBSE commissioning codes for the other services

2. Collaboration of Design Team and Contractor

The design team and the Contractor are required to transfer project knowledge to the building owner/manager through all of the following;

- Documented design intent
- As-built drawings
- Operations and Maintenance Manual

- Commissioning Report
- Training of building management staff

Potential Technologies &Strategies

Where appropriate, information transferred to the building owner may be in the form of a comprehensive Building User's Guide. Whilst this is not required by the referenced standards, project team are strongly encouraged to consider the implications of commissioning on indoor air quality, e.g. through establishing an indoor air quality commissioning plan at the design stage with specific provisions for ensuring that this plan is met during and after commissioning.

For Shell and Core projects

Design

If any component of the project is delivered as shell and core or an integrated fitout, the scope of commissioning must cover the entire traditional scope of fitout provide by the base building (e.g. electrical, mechanical, hydraulic and BMS systems even if some elements will be installed by the tenant). Therefore, it may need to be deffered until the completion of the relevant fitout works. Commissioning must check against the documented base building design and ensure that the building operates to its design potential

As Built

If any component of the project is delivered as shell and core or integrated fitout, the scope of commissioning must cover the entire traditional scope of fitout provided by the base building (e.g. electrical, mechanical, hydraulic and BMS systems even if some elements were installed by the tenant). Therefore, it may need to be deferred until the completion of the relevant fitout works. Commissioning must check against the documented base building design and confirm that the building operates to its design potential.

References

www.ashrae.org/ publications/ page/683

www.cibse.org

Credit 1.1– Building Tuning

1 Point

Intent

To encourage and recognize commissioning initiatives that ensure optimum occupant comfort and energy efficient services performances throughout the year.

Requirements

Credit 1.1.1 Optimizing occupant comfort and Energy Efficiency (1 Point)

- After handover, the building owner implements tuning of all the building systems.
- A relevant member of the design team is involved in the tuning process.
- Monthly monitoring is undertaken and the outcomes are reported to the building owner quarterly;
- Full re-commissioning is undertaken 12 months after practical completion.
- A building tuning report on the outcomes of the tuning process is provided to the building owner and made available to the design team.

Potential Technologies & Strategies

The building tuning process must include;

- Verification that systems are performing to their design potential during all variances in climate and occupancy
- Optimization of time schedules to best match occupant needs and system performance;
- Alignment of the systems operation to the attributes of the built space they serve

Re-commissioning refers to the process of undertaking a review of all systems to the scope of the initial pre-occupancy commissioning. Re-commissioning is intended to incorporate any modifications identified as necessary or beneficial during the building tuning period and to improve the performance of building operation. The term does not refer to the re-setting of the systems to the initial commissioning settings.

Credit 1.2– Building User's Guide

1 Point

Intent

Encourage and recognize information management that enables building users to optimize the building's environmental performance

Requirements

Credit 1.2.1 Building User's Guide(1 Point)

A simple and easy-to-use Building User's Guide, which includes information relevant for the building users, occupants and tenants' representatives, is developed and made available to the building owner. It may contains some useful information that will allow the building users to understand the reason for some procedures included in the Building User's Guide

Potential Technologies & Strategies

Ensure that the submission is according to all provisions of the submission requirements document found on the GBCSL web site.

The Building Users' Guide must include the following information:

- Energy and Environmental Strategy
- Monitoring and Targeting

- Building Services (Ventilation, Heating and cooling system, Electrical systems, Lighting, Domestic hot water)
- Transport facilities
- Materials and Waste Policies
- Expansion/Re-fit Consideration (Include list if environment recommendations for consideration, highlighting in particular the areas covered in the Building Users' Guide).
- References and Further Information

Credit 1.3– Environmental Management

2 Points

Intent

Encourage and recognize the adoption of a formal environmental management system in line established guidelines during construction.

Requirements

Credit 1.3.1 Environmental Management Plan(Point 1)

The contractor implements a comprehensive, project-specific environmental management plan (EMP)

Credit 1.3.2 Environment Management System (Complying with ISO 14001) (Point 1)

The Contractor has valid ISO 14001 Environmental Management System (EMS) accreditation prior to and throughout the project

Potential Technologies & Strategies

The commitment to future provision of the EMP does not meet the credit criteria. The EMP must be fully comprehensive and project specified. The GBCSL expect that EMP has been correctly

implemented, and internal audit trail tracking compliance will be evident to ensure that there is ongoing compliance during construction.

2.0 SUSTAINABLE SITES

Prerequisite 1 – Erosion and Sedimentation Control

Required

Intent

To Control reduce soil erosion to and to minimize negative impacts waterway sedimentation and airborne dust generation.

Requirements

Implement sediment and erosion control plan that conforms to the best engineering practices specified by The Institute for Construction Training and Development (ICTAD) – Protection of Landscape during Construction. The plan shall meet the following objectives:

- Prevent loss of soil during construction by storm water run-off and or wind erosion, including protecting topsoil by stock-piling for reuse
- Prevent sedimentation of storm sewer or receiving streams and/ or air pollution with dust and particulate matter

Potential Technologies & Strategies

Create an erosion and sedimentation control plan during the design phase of the project. Consider employing strategies such as temporary and permanent seeding, mulching, earth dikes, silt fencing, sediment traps and sediment basins.

Credit 2.1– Site Selection

5 Points

Intent

To avoid development of inappropriate sites and reduce the environmental impact from the location of a building on a site.

Requirements

Do not develop buildings, roads or parking areas on portions of sites that meet any one of the following criteria:

- Land that is a prime agricultural land
- Land whose elevation is lower than 1.5m above the elevation of the 50-year flood level
- Land use along the coastal belt shall be complied with the guidelines of Coast Conservation Department (www.coastal.gov.lk)
- Land which is specifically identified as habitat for any species threatened or endangered species by the Department of Wildlife Conservation – Ministry of Environment
- Land is within the specified distance of any wetland as defined by Central Environmental Authority, or as defined by local or state rule or law, or the Ramsar Convention, which is the only global environmental treaty. The most stringent condition will apply
  - http://www.cea.lk
  - http://www.ramsar.org
  - http://dw.iwmi.org/wetland

- Land which prior to acquisition for the project was public parkland

Potential Technologies & Strategies

During the site selection process, give preference to those sites that do not include sensitive site elements and restricted land types. Select a suitable building location and design the building with the minimal footprint to minimize site disruption of those environmentally sensitive areas identified above.

Credit 2.2 –Development Density and Community Connectivity

4 Points

Intent

To channel development to urban areas with existing infrastructure, protect green fields, and preserve habitat and natural recourses.

Requirements

Option1- Development Density

Construct a building on a previously developed site and in a community with a minimum density of 20,000 square feet per acre net.

OR

Option 2 – Community Connectivity

Construct a building on a previously developed site within 0.8 km of a residential or industrial zone or neighborhood with an average density of 10 units per acre net and with pedestrian access between the building and the services.

The Basic services include, but not limited to:

Places of Worship, Hospitals, Pharmacy, Post office, Police Station, Schools, Banks, Super Markets, Parks, Grocery stores, Day-care

Centres, Theatre, Laundry, Library, Restaurants, Community Centres etc.

Potential Technologies & Strategies

During the site selection process, give preference to urban sites or planed industrial zones with pedestrian access to a variety of services.

Credit 2.3 –Brownfield Redevelopment

1 Point

Intent

To rehabilitate damaged sites where development is complicated by real or perceived environmental contamination, reducing pressure on undeveloped land.

Requirements

Develop on a site classified as a Brownfield and provide remediation as required.

Potential Technologies & Strategies

During the site selection process, give preference to brown field sites. Identify tax incentives and property cost savings by selecting a Brownfield site. Adopt a site remediation plan and cleanup the site using remediation strategies such as pump-and-treat, bioreactors, land farming and in-situ remediation.

Credit 2.4– Alternative Transportation

3 Points

Intent

Reduce pollution and land development impacts from automobile use.

Requirements

Credit 2.4.1 Public Transportation Access(2 Points)

Locate project within 0.8 km of a railway station or 0.4 km of two or more public bus route usable by building occupants.

Credit 2.4.2 Parking Capacity(1 Point)

Size parking capacity to meet, but not exceed, minimum local zoning requirements and provide preferred parking for carpools and/or van pools capable of serving 10% of the total provided parking spaces

Potential Technologies & Strategies

Perform a transportation survey of future building occupants to identify transportation needs. Locate the building near to public transport and design the building with transportation amenities such as, considering the cost and benefits by shearing vehicles with neighbors, encourage the use of public transport and use of cycles. Minimize the parking

lot/garage size. Consider sharing parking facilities with adjacent buildings and alternatives that will limit the use of single occupied vehicles.

Credit 2.5 – Reduced Site Disturbance

4 Points

Intent

Conserve existing natural areas and restore damaged areas to provide habitat and promote biodiversity.

Requirements

Credit 2.5.1 Protect or Restore Habitat(2 Points)

On Greenfield sites, limit site disturbance including earthwork and clearing of vegetation to 15m beyond the building perimeter, 1.5m beyond primary roadway curbs, walkways, and main utility branch trenches, and 8m beyond constructed areas with permeable surfaces (such as pervious paving areas, storm water detention facilities and playing fields) that require additional staging areas in order to limit compaction in the constructed area

OR

On previously developed sites, restore a minimum of 50% of the site area (excluding the building footprint) by replacing impervious surfaces with native or adapted vegetation.

Credit 2.5.2 Development Footprint(2 Points)

Reduce the development footprint (defined as entire building footprint, access roads and parking) to exceed the local zoning's open space requirement for the site by 25%. For areas with no local zoning requirements (e.g. some university campuses, military bases), designate open space area adjacent to the building that is equal to the building footprint.

Potential Technologies & Strategies

Perform a site survey to identify site elements and adopt a master plan for development of the project site. Select a suitable building location and design the building with the minimal footprint to minimize site disruption. Strategies include stacking the building program, tuck under parking and sharing facilities with neighbors to maximize open space on the site. Establish clearly marked construction boundaries to minimize disturbance of existing site and restore previously degraded areas to their natural state.

Credit 2.6 –Storm Water Design, Quantity Control – I

3 Points

Intent

To limit disruption of natural water hydrology by reducing impervious cover, increasing on-site infiltration, and managing storm water runoff.

Requirements

If existing imperviousness is less than or equal to 50%:

Implement a storm water management plan that prevents the post-development 1.5 year, 24 hour peak discharge rate from exceeding the pre-development 1.5 year, 24-hour peak discharge rate.

OR

If existing imperviousness is greater than 50%:

Implement a storm water management plan that results in a 25% decrease in the rate & quantity of storm water runoff.

Potential Technologies & Strategies

Design the project site to maintain natural storm water flows by promoting infiltration. Specify vegetated roofs, pervious paving, and other measures to minimize impervious surfaces. Reuse storm water

volumes generated for non-potable uses such as landscape irrigation, toilet, urinal flushing and other uses

Credit 2.7– Storm Water Design, Quantity Control – II

2 Points

Intent

To limit disruption and pollution of natural water flows by managing storm water runoff.

Requirements

Implement a storm water management plan that reduces impervious cover, promotes infiltration and captures and treats the storm water runoff from 70% of the average annual rainfall using best management practices.

The storm water treatment systems shall be designed to remove 80% of the average annual post-development total suspended solids (TSS) based on the average annual loadings from all storms less than or equal to the 2-year/24-hour storm.

Potential Technologies & Strategies

Use alternative surfaces (e.g., vegetated roofs, pervious pavement or grid pavers) and nonstructural techniques (e.g., rain gardens, vegetated swales, disconnection of imperviousness, rainwater recycling) to reduce imperviousness and promote infiltration, thereby reducing pollutant loadings. Use sustainable design strategies (e.g., low impact development, environmentally sensitive design) to design integrated natural and mechanical treatment systems such as

constructed wetlands, vegetated filters, and open channels to treat storm water runoff.

Credit 2.8 –Heat Island Effect, Non – Roof

1 Point

Intent

To reduce heat islands (thermal gradient differences between developed and undeveloped areas), minimise impact on microclimate and human and wildlife habitat.

Requirements

Option 1

Use any combination of the following strategies for 50% of the site hardscape (Including roads, sidewalks, courtyards and parking lots):

- Provide shade from the existing tree canopy or within 5 years of landscaping (trees) must be placed at the time of occupancy.
- Provide shade from architectural devices or structures that have solar reflectance index (SRI) of at least 29.

OR

Option 2

Place a minimum of 50% of parking spaces underground or covered by structured parking;

OR

Option 3

Use an open-grid pavement system (less than 50% impervious) for a minimum of 50% of the parking lot area.

Potential Technologies & Strategies

Shade constructed surfaces on the site with landscape features and utilize high-reflectance materials for hardscape. Consider replacing constructed surfaces (i.e. roof, roads, sidewalks, etc.) with vegetated surfaces such as vegetated roofs and open grid paving or specify high-albedo materials to reduce the heat absorption.

Credit 2.9 – Heat Island Effect, Roof

1 Point

Intent

To reduce heat islands (thermal gradient differences between developed and undeveloped areas) to minimize impact on microclimate and human and wildlife habitats.

Requirements

Option 1

Use roofing materials having a Solar Reflectance Index (SRI) equal to or greater than the values in the table below for a minimum of 75% of the roof surface.

$$\frac{\text{Area of Roof meeting Minimum SRI}}{\text{Total Roof Area}} + \frac{\text{SRI of Installed Roof}}{\text{Required SRI}} \geq 75\%$$

Table 2.1

Roof Type	Slope	SRI
Low-Sloped Roof Slope	**≤ 2:12**	**78**
Steep-Sloped Roof	**≥ 2:12**	**29**

OR

Option 2

Install a vegetated roof for at least 50% of the roof area.

OR

Option 3

Install high-albedo and vegetated roof surfaces that, in combination, meet the following criteria:

$$\frac{\text{Area of SRI Roof}}{0.75} + \frac{\text{Area of vegetated Roof}}{0.5} \geq \text{Roof Area}$$

Potential Technologies & Strategies

Consider installing high-albedo and vegetated roofs to reduce heat absorption. SRI is calculated according to ASTM E 1980. Reflectance is measured according to ASTM E 903, ASTM E 1918, or ASTM C 1549. Emittance is measured according to ASTM E 408 or ASTM C 1371.

Credit 2.10– Light Pollution Reduction

1 Point

Intent

Minimize light trespass from the building and site, reduce sky-glow to increase night sky access, improve nighttime visibility through glare reduction, and reduce development impact on nocturnal environments.

Requirements

Project team must comply with one of the 2 options for the interior for interior lighting and the requirement for exterior lighting.

For Interior Lighting

Option 1

Reduce the input power (by automatic device of) all nonemergency interior luminaries with a direct line of sight to any openings in the envelope (translucent or transparent) by at least 50% between 10p.m. and 5 a.m. After-hours override may be provided by a manual or occupant-sensing device provided the override lasts no more than 30 minutes.

OR

Option 2

All non-emergency interior lighting shall be turned off during non-business hours.

AND

For Exterior Lighting

Only light areas as required for safety and comfort. Do not exceed 80% of the lighting power densities for exterior areas and 50% for building facades and landscape features as defined in ASHRAE/IESNA Standard 90.1-2004, Exterior Lighting Section, without amendments.

All projects shall be classified under one of the following zones, as defined in IESNA RP-33, and shall follow all of the requirements for that specific light zone (LZ):

LZ1 - Dark (Park and Rural Settings)

Design exterior lighting so that all site and building mounted luminaries produce a maximum initial luminance value no greater than 0.1 horizontal and vertical lux at the site boundary and beyond

LZ1 - Dark (Park and Rural Settings)

Design exterior lighting so that all site and building mounted luminaries produce a maximum initial luminance value no greater than 0.1 horizontal and vertical lux at the site boundary and beyond. Document

that 0% of the total initial designed fixture lumens are emitted at an angle of 90 degrees or higher from nadir (straight down).

LZ2 - Low (Residential Areas)

Design exterior lighting so that all site and building mounted luminaries produce a maximum initial luminancevalue no greater than 1.0 horizontal and vertical lux at the site boundary and no greater than 0.1 horizontal lux3m beyond the site boundary. Document that no more than 2% of the total initial designed fixture lumens are emitted at an angle of 90 degrees or higher from nadir (straight down). For site boundaries that abut public rights-of-way, light trespass requirements may be met relative to the curb line instead of the site boundary.

LZ3 - Medium (Commercial / Industrial, High-Density Residential)

Design exterior lighting so that all site and building mounted luminaries produce a maximum initial luminance value no greater than 2.0 horizontal and vertical lux at the site boundary and no greater than 0.1 horizontal lux 5m beyond the site. Document that no more than 5% of the total initial designed fixture lumens are emitted at an angle of 90 degrees or higher from nadir (straight down). For site boundaries that abut public rights-of- way, light trespass requirements maybe met relative to the curb line instead of the site boundary.

LZ4 - High (Major City Centres)

Design exterior lighting so that all site and building mounted luminaries produce a maximum initial illuminance value no greater than 6.0 horizontal and vertical lux at the site boundary and no greater than 0.1

horizontal lux 5m beyond the site. Document that no more than 10% of the total initial designed site lumens are emitted at an angle of 90 degrees or higher from nadir (straight down). For site boundaries that abut public rights-of-way, light trespass requirements may be met relative to the curb line instead of the site boundary.

Potential Technologies & Strategies

Adopt site lighting criteria to maintain safe light levels while avoiding off-site lighting and night sky pollution. Minimize site lighting where possible. Technologies to reduce light pollution include full cut-off luminaries, low-reflectance surfaces and low-angle spotlights.

3.0 WATER EFFICIENCY

Credit 3.1 – Water Efficient Landscaping

1-4 Points

Intent

To Limit or eliminate the use of potable water for landscape irrigation.

Requirements

Credit 3.1.1 Reduce Potable Water Consumption (2 Points)

Use high efficiency irrigation technologies, OR, use captured rain or treated grey water, to reduce potable water consumption for irrigation by 50% over conventional means.

Credit 3.1.2 Eliminate Potable Water Consumption (2 Points)

Use only captured rain or treated grey water to eliminate all potable water use for site irrigation (except for initial watering to establish plants), OR do not install permanent landscape irrigation systems.

Potential Technologies & Strategies

Perform a soil/climate analysis to determine appropriate landscape types and design the landscape with indigenous plants to reduce or

eliminate irrigation requirements. Use high efficiency irrigation systems and consider using of storm water or treated grey water, and / or air conditioner condensate water for irrigation. Note that invasive plants may grow due to the use of grey water for irrigation. Thus under no circumstances should encourage colonization of non-indigenous and/or invasive plants.

Credit 3.2 – Water Efficiency in Air-conditioning System

1 Point

Intent

Limit or eliminate the use of potable water for Air-conditioning make-up. Use of condense water for irrigation.

Requirements

Reduce potable water consumption for air-conditioning make-up by 50%.Uses of at least 50% of Air conditioning condense water for irrigation.

Potential Technologies & Strategies

Select water efficient chillers to reduce water requirement for cooling tower make-up. Estimate potable water requirement for cooling tower make-up in the water cooled chillers. Consider use of treated rain water or gray water generated within the site for air-conditioning make-up.

Credit 3.3 –Innovative Wastewater Technologies

1-5 Points

Intent

To reduce the generation of wastewater and potable water demand, while increasing the local aquifer recharge.

Requirements

Credit 3.3.1 Reduce Potable Water Use or Treat Wastewater (2 Points)

Option - 1

Reduce the use of NWS&DB provided potable water for building sewage conveyance by a minimum of 50%

OR

Option - 2

Treat 100% of wastewater on-site to tertiary standards.

Credit 3.3.2 Harvested Rainwater (3 Points)

Harvested rainwater use in toilet flushing and reduce 75% the use of portable water for toilet flushing.

Potential Technologies & Strategies

Consider reusing storm water or grey water for sewage conveyance or on-site wastewater treatment systems (mechanical or natural). Options for on-site wastewater treatment include packaged biological pollutant removal systems, constructed wetlands (with indigenous plants and plants that can bind pollutants in [redox insensitive] forms), and high-efficiency filtration systems (aerobic or anaerobic).

Treated wastewater can be directed to wetlands, recharge wells, recharge pits etc to increase the local aquifer recharge.

The plumbing system should be designed to incorporate the separation of grey water from black water.

Credit 3.4– Water Use Reduction

1-4 Points

Intent

To further increase the water efficiency within buildings to reduce the burden on NWS&DB water supply and wastewater systems.

Requirements

Employ strategies that in aggregate use less water than the water use baseline calculated for the building (not including irrigation). The minimum water savings percentage for each point threshold is as follows;

Table 3.1

Percentage Reduction	Points
30%	2
40%	3
50%	4

Calculate the baseline according to the commercial and/or residential baseline outlined below. Calculations are based on estimated occupant usage and must include only the following fixtures and fixture fittings (as applicable to the project scope): water closets, urinals, lavatory faucets, showers, kitchen sink faucets and pre-rinse spray valves.

Table 3.2

Commercial Fixtures, Fittings and Appliances	Current Baseline
Commercial toilet	6 liters per flush(lpf) Except blow-out fixtures: 12 (lpf)
Commercial urinals	4.0(lpf)
Commercial toilet (restroom) faucets	9 liters per minute(lpm) at 4 bar, private applications only (hotel or motel guest rooms, hospital patient rooms) 2 (lpm) at 4bar all others except private applications 1 liter per cycle for metering faucets
Commercial pre-rinse spray valves(for food service applications)	Flow rate ≤ 6 (lpm) (no pressure specified; no performance requirement)

Table 3.3

Commercial Fixtures, Fittings and Appliances	Current Baseline
Residential toilet	6 (lpf)
Residential kitchen faucet	8 (lpm) at 4bar
Residential toilet (restroom) faucets	
Residential showerhead	9(lpm) at 5.5bar per shower stall

The following fixtures, fittings and appliances are outside the scope of the water use reduction calculation;

- Commercial Steam Cooker
- Commercial Dishwasher
- Automatic Commercial Ice Maker
- Commercial (family-sized) Clothes Washer
- Residential Clothes Washer
- Standard and Compact Residential Dishwashers

Potential Technologies & Strategies

Use high-efficiency fixtures.(e.g. water closets and urinals) and dry fixtures, such as toilets attached to composting systems, to reduce the potable water demand. Consider using alternative on-site sources of water.(e.g. rainwater, and air conditioner condensate, gray water) for non-potable applications (e.g., toilet and urinal flushing, custodial uses). The quality of any alternative source of water being used must be taken into consideration based on its application or use.

4.0 ENERGY & ATMOSPHERE

Prerequisite 1 – Fundamental Building Systems Commissioning

Required

Intent

Verify and ensure that fundamental building elements and systems are designed, installed and calibrated to operate as intended.

Requirements

Implement or have a contract in place to implement the following fundamental best practice commissioning procedures;

- Engage a commissioning team that does not include individuals directly responsible for project design or construction management
- Review design intent and basis of design documentation
- Incorporate commissioning requirements in to the construction documents
- Develop and utilize a commissioning plan
- Verify installation, functional performance, training and operation and maintenance documentation
- Complete a commissioning report

Potential Technologies & Strategies

Engage a Commissioning Authority and adopt a commissioning plan. Include commissioning requirements in bid documents and task the

commissioning agent to produce a commissioning report once commissioning activities are completed.

.

Prerequisite 2 – Minimum Energy Performance

Required

Intent

Establish the minimum level of energy efficiency for the base building and systems.

Requirements

Design the building project to comply with both –

- The mandatory provisions (Sections 5.4, 6.4, 7.4, 8.4, 9.4 and 10.4) of ASHRAE / IESNA Standard 90.1 – 2004(without amendments)

AND

- The prescriptive requirements (Sections 5.5, 6.5, 7.5, and 9.5) or performance requirements (Section 11) of ASHRAE / IESNA Standard 90.1 - 2004 / (without amendments)

Project should comply with the final version of Code of Practice on Energy Efficient Buildings of the Sri Lanka, published by Sustainable Energy Authority (SEA), as and when it is released.

Potential Technologies & Strategies

Design the building envelope, HVAC, lighting and other systems to maximize energy performance. The ASHRAE 90.1-2004 User's manual contains worksheets that can be used to document compliance with

this prerequisite. For projects pursuing points under EA Credit 1, the computer simulation model may be used to confirm satisfaction of this prerequisite.

Code of practice on Energy Efficient Buildings of the Sri Lanka, published by Sustainable Energy Authority (SEA) may be used to satisfy this prerequisite in lieu of ASHRAE 90.1-2004. Details on the DOE process for commercial energy code determination can be found online atwww.energycodes.gov/implement/determinations_com.stm, and SEA code of practice on energy efficient building can be found at http://www.energy.gov.lk/

Prerequisite 3 – CFC Reduction in HVAC&R Equipment

Required

Intent

To reduce ozone layer depletion.

Requirements

Zero use of CFC-based refrigerants in new building HVAC & R base building systems. When reusing existing base building HVAC equipment, complete a comprehensive CFC phase-out conversion.

Potential Technologies & Strategies

When reusing existing HVAC systems, conduct an inventory to identify equipment that uses CFC refrigerants and adopt a replacement schedule for these refrigerants. For new buildings, specify new HVAC equipment that uses no CFC refrigerants.

Credit 4.1– Optimize Energy Performance

1-10 Points

Intent

Achieve increasing levels of energy performance above the prerequisite standard to reduce environmental impacts associated with excessiveenergy use.

Requirements

Select one of the three compliance path options described below. Project teams documenting achievement usingany of the three options are assumed to be in compliance with EA Prerequisite 2.

Option 1 - Whole Building Energy Simulation (1–10 Points)

Demonstrate a percentage improvement in the proposed building performance rating compared to the baseline building performance rating per ASHRAE/IESNA Standard 90.1-2004 (without amendments) by a whole building project simulation using the Building Performance Rating Method in Appendix G of the Standard.

Project should comply with the final version of Code of Practice on Energy Efficient Buildings published by the Sri Lanka Sustainable Energy Authority, as and when it is released.

The minimum energy cost savings percentage for each point threshold is as follows (Table 4.1);

Table 4.1

New Building	Existing Building	Renovation Points
7.5%	5%	1
12.5%	10%	2
17.5%	15%	3
22.5%	20%	4
27.5%	25%	5
32.5%	30%	6
37.5%	35%	7
42.5%	40%	8
47.5%	45%	9
52.5%	50%	10

Appendix G of ASHRAE/IESNA Standard 90.1-2004 requires that the energy analysis done for the Building Performance Rating Method include all of the energy costs within and associated with the building project. To achieve points using this credit, the proposed design— (Appendix G of Standard 90.1-2004)

- Must comply with the mandatory provisions (Sections 5.4, 6.4, 7.4,8.4, 9.4 and 10.4) in Standard 90.1-2004 (without amendments)
- Must include all the energy costs within and associated with the building project

AND

- Must be compared against a baseline building that complies with Appendix G to Standard 90-1-2004 (without amendments). The default process energy cost is 25% of the total energy cost for the baseline building. For buildings, where the process energy cost is less than 25% of the baseline building energy cost, the GREEN submittal must include supporting documentation substantiating that process energy inputs are appropriate.

For the purpose of this analysis, process energy is considered to include, but is not limited to, office and general miscellaneous equipment, computers, elevators and escalators, kitchen cooking and refrigeration, laundry washing and drying, lighting exempt from the lighting power allowance(e.g., lighting integral to medical equipment) and other (e.g., waterfall pumps). Regulated (non-process) energy includes lighting (such as for the interior, parking garage, surface parking, façade, or building grounds, except as noted above), HVAC (suchas for space heating, space cooling, fans, pumps, toilet exhaust, parking garage ventilation, kitchen hood exhaust, etc.), and service water heating for domestic or space heating purposes.

For EA Credit 1, process loads shall be identical for both the baseline building performance rating and for the proposed building performance rating. However, project teams may follow the Exceptional Calculation Method (ASHRAE 90.1-2004 G 2.5) to document measures that reduce process loads. Documentation of process load energy savings shall include a list of the assumptions made for both the base and proposed design, and theoretical or empirical information supporting these assumptions.

OR

Option 2 — Prescriptive Compliance Path (4 Points)

Comply with the prescriptive measures of the ASHRAE Advanced Energy Design Guide for Small Office Buildings 2004. The following restrictions apply:

- Buildings must be less than 20,000 square feet
- Buildings must be office occupancy
- Project teams must fully comply with all applicable criteria as established in the Advanced Energy Design Guide for the climate zone in which the building is located

OR

Option 3 - Prescriptive Compliance Path (1 Point)

Comply with the Basic Criteria and Prescriptive Measures of the Advanced Buildings Benchmark™ Version 1.1 with the exception of the following sections: 1.7 Monitoring and Trend-logging, 1.11 Indoor Air Quality, and 1.14 Networked Computer Monitor Control. The following restrictions apply:

- Project teams must fully comply with all applicable criteria as established in AdvancedBuildings Benchmark for the climate zone in which the building is located.

Potential Technologies & Strategies

Design the building envelope and building systems to maximize energy performance. Use a computer simulation model to assess the energy

performance and identify the most costeffective energy efficiency measures. Quantify energy performance as compared to a baseline building.

If a local code has demonstrated quantitative and textual equivalence following, at a minimum, the U.S. Department of Energy standard process for commercial energy code determination, then the results of that analysis may be used to correlate local code performance with ASHRAE 90.1-2004. Details on the DOE process for commercial energy code determination can be found online at www.energycodes.gov/implement/deter-minations.com.stm.

Credit 4.2– Renewable Energy

7 Points

Intent

Encourage and recognize increasing levels of self-supply through renewable technologies to reduce environmental impacts associated with fossil fuel energy use.

Requirements

Supply at least 5.0% of the building's total energy use (as expressed as a fraction of annual energy cost) through the use of on-site renewable energy systems.

Table 4.2

Percentage of Renewable Energy	Points
10%	1
20%	2
30%	3
40%	4
50%	5
75%	6
100%	7

Potential Technologies & Strategies

Assess the project for renewable energy potential including solar, wind, geothermal, biomass, hydro, and bio-gas strategies, when applying these strategies, take advantage of net metering with the local utility.

Credit 4.3 – Additional Commissioning

1 Point

Intent

Verify and ensure that the entire building is designed, constructed, and calibrated to operate as intended.

Requirements

In addition to the Fundamental Building Systems Commissioning prerequisite, implement the following additional commissioning tasks;

- Conduct a focused review of the design prior to the construction documents phase
- Conduct a focused review of the construction documents when close to completion
- Conduct a selective review of contractor submittals of commissioned equipment. The above three reviews must be performed by a firm other than the designer
- Develop a re-commissioning management manual
- Have a contract in place for a near-warranty end or post occupancy review

Potential Technologies & Strategies

Engage the Commissioning Authority (CA) early in project design phases. Task the commissioning agent to conduct project reviews

before and after construction documents are complete. The CA must also create a re-commissioning manual for the building and review the project at near-warranty end.

Credit 4.4– Ozone Depletion

1 Point

Intent

Reduce ozone depletion and support early compliance with the Kyoto Protocol while minimize direct contribution to climate change

Requirements

Install base building level HVAC and refrigeration equipment and fire suppression systems that do not contain HCFCs or Halons.

Potential Technologies & Strategies

Design and operate the facility without mechanical cooling and refrigeration equipment. Where mechanical cooling is used, utilize base building HVAC and refrigeration systems for the refrigeration cycle that minimizes direct impact on ozone depletion and global warming. Select HVAC & R equipment with reduced refrigerant charge and increased equipment life. Maintain equipment to prevent leakage of refrigerant to the atmosphere. Utilize fire suppression systems that do not contain HCFCs or Halons.

Credit 4.5– Measurement & Verifications

1 Point

Intent

Provide for the ongoing accountability of building energy consumption performance over time.

Requirements

Develop and implement a Measurement & Verification (M&V) Plan consistent with

Option 1:

Calibrated Simulation (Savings Estimation Method 2)

OR

Option 2:

Energy Conservation Measure Isolation, as specified in the International Performance Measurement & Verification Protocol (IPMVP) Volume III: Concepts and Options for Determining Energy Savings in New Construction, April, 2003

The M&V period shall cover a period of no less than one year of post-construction occupancy

Potential Technologies & Strategies

Develop an M&V Plan to evaluate building and/or energy system performance. Characterize the building and/or energy systems through energy simulation or engineering analysis. Install the necessary metering equipment to measure energy use. Track performance by comparing predicted performance to actual performance, broken down by component or system as appropriate. Evaluate energy efficiency by comparing actual performance to baseline performance.

While the IPMVP describes specific actions for verifying savings associated with energy conservation measures (ECMs) and strategies, this GREEN credit expands upon typical IPMVP M&V objectives. M&V activities should not necessarily be confined to energy systems where ECMs or energy conservation strategies have been implemented. The IPMVP providesguidance on M&V strategies and their appropriate applications for various situations.

These strategies should be used in conjunction with monitoring and trend logging of significant energy systems to provide for the ongoing accountability of building energy performance.

Credit 4.6– Green Power

1 Point

Intent

Encourage investments in off-site renewable energy technologies to be exported to the National Grid.

Requirements

Demonstrate that the company has installed green power equivalent to 50%of the total energy requirement of the building, anywhere in the country. This investment should come becauseof the rated building and should be 50 % of the building consumption. Green power so generated should be counted only once.

Potential Technologies & Strategies

Estimate the energy needs of the building on annual basis. Invest in green power plants in the country, which meets the 50% of the total energy requirement of the building. Green power is derived from solar, wind, geothermal, biomass, or low-impact hydro sources.

5.0 MATERIALS & RESOURCES

Prerequisite 1 – Storage & Collection of Recyclables

Required

Intent

Facilitate the reduction of waste generated by building occupants that is hauled to and disposed of in landfills.

Requirements

Provide an easily accessible area that serves the entire building and is dedicated to the separation, collection and storage of materials for recycling including (at a minimum) paper, corrugated cardboard, glass, plastics, and metals.

Potential Technologies & Strategies

Coordinate the size and functionality of the recycling areas with the anticipated collections services for glass, plastic, office paper, newspaper, cardboard, and organic wastes to maximize the effectiveness of the dedicated areas. Consider employing cardboard balers, aluminium can crushers, recycling chutes, and collection bins at individual workstations to further enhance the recycling programme.

Credit 5.1 –Building Reuse

1-3 Points

Intent

Extend the life cycle of existing building stock, conserve resources, retain cultural resources, reduce waste and reduce environmental impacts of new buildings as they relate to materials manufacturing and transport.

Requirements

Reuse large portions of existing structures during renovation or redevelopment projects:

Option 1

Credit 5.1.1 Maintaining 50% of Existing Building Structure and Shell (1 Point)

Maintain at least 50% of existing building structure and shell (exterior skin and framing excluding window assemblies and non- structural roofing material).

Option 2

Credit 5.1.2 Maintaining 75% of Existing Building Structure and Shell (2 Points)

Maintain at least 75% (100% total) of existing building structure and shell (exterior skin and framing excluding window assemblies and non-structural roofing material).

Option 3

Credit 5.1.3 Maintaining 75% of Existing Building Structure and Shell and 25% of Non-shell Areas (3 Points)

Maintain 75% of existing building structure shell (exterior skin and framing excluding window assemblies and non-structural roofing material) AND at least 25% non-shell areas (interior walls, doors, floor coverings, and ceiling systems).

Potential Technologies & Strategies

Consider reuse of existing, previously occupied buildings, including structure, envelope and interior non-structural elements. Remove elements that pose contamination risk to building occupants and upgrade components that would improve energy and water efficiency, such as mechanical systems and plumbing fixtures. Quantify the extent of building reuse.

Credit 5.2– Construction Waste Management

1-2 Points

Intent

Divert construction, demolition, and land clearing debris from landfill disposal redirect recyclable recovered resources back to the manufacturing process. Redirect reusable materials to appropriate sites.

Requirements

Develop and implement a waste management plan, quantifying material diversion goals.

Credit 5.2.1 For 50% Recycling (1 Point)

Recycle and / or salvage at least 50% of construction, demolition, and land clearing waste. Calculations can be done by weight or volume, but must be consistent throughout.

Credit 5.2.2 For 75% Recycling (2 Points)

Recycle and / or salvage an additional 75% of construction, demolition, and land clearing waste. Calculations can be done by weight or volume, but must be consistent throughout.

Potential Technologies & Strategies

Establish goals for diversion from disposal in landfills and incinerators and adopt a construction waste management plan to achieve these goals. Consider recycling cardboard, metal, brick, acoustical tile, concrete, plastic, clean wood, glass, gypsum wallboard, carpetand insulation. Designate a specific area(s) on the construction site for segregated or commingled collection of recyclable material, and track recycling efforts throughout the construction process. Identify construction haulers and recyclers to handle the designatedmaterials. Note that diversion may include donation of materials to charitable organizations and salvage of materials on-site.

Credit 5.3 Resource Reuse

1-2 Points

Intent

Reuse building materials and products in order to reduce demand for virgin materials and to reduce waste, thereby reducing impacts associated with the extraction and processing of virgin resources.

Requirements

Option 1

Credit 5.3.1For at least 5% of the Building (1 Point)

Use salvaged, refurbished or reused materials, products and furnishings for at least 5% of building materials.

Option 2

Credit 5.3.2 For at least 10% of the Building (2 Points)

Use salvaged, refurbished or reused materials, products and furnishings for at least 10% of building materials.

Potential Technologies & Strategies

Identify opportunities to incorporate salvaged materials into the building design and research on potential material suppliers. Consider salvage materials such as beams and posts, flooring, paneling, doors and frames, cabinetry and furniture, brick and decorative items.

Credit 5.4 – Recycled Content

1-2 Points

Intent

Increase demand for building products that incorporated recycled content materials, therefore reducing impacts resulting from extraction and processing of new virgin materials.

Requirements

Option 1

Credit 5.4.1 For at least 10% of Total Value of Materials (1 Point)

Use materials with recycled content such that the sum of post-consumer recycled content plus one-half of the post-industrial content constitutes at least 10% of the total value of the materials in the project.

Option 2

Credit 5.4.2 For at least 20% of Total Value of Materials (1 Point)

Use materials with recycled content such that the sum of post-consumer recycled content plus one-half of the post-industrial content constitutes at least 20% of the total value of the materials in the project.

The value of the recycled content portion of a material or furnishing shall be determined by dividing the weight of recycled content in the item by the total weight of all material in the item, then multiplying the

resulting percentage by the total value of the item. Mechanical and electrical components shall not be included in this calculation.

Potential Technologies & Strategies

Establish a project goal for recycled content materials and identify material suppliers that can achieve this goal. During construction, ensure that the specified recycled content materials are installed. Consider a range of environmental, economic and performance attributes when selecting products and materials.

Credit 5.5– Local / Regional Materials

1-3 Points

Intent

Increase demand for building materials and products that are extracted and manufactured within the region, thereby supporting the regional economy and reducing the environmental impacts resulting from transportation.

Requirements

Option1

Credit 5.5.1 For a Minimum of 20% Usage(1 Point)

Use a minimum of 20%of building materials and products that are manufactured[1] locally.

Option2

Credit 5.5.2 For a Minimum of 50% Usage (3 Points)

Regionally manufactured materials documented for MR Credit 6.1, use a minimum of 50% of building materials and products that are extracted, harvested or recovered (as well as manufactured) locally.

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1. Manufacturing refers to the final assembly of components into the building product that is furnished and installed by the tradesmen. The final assemble location will be counted for evaluation.

Potential Technologies & Strategies

Establish a project goal for locally sourced materials and identify materials and material suppliers that can achieve this goal. During construction, ensure that the specified local materials are installed and quantify the total percentage of local materials installed. Consider a range of environmental, economic and performance attributes when selecting products and materials.

Credit 5.6– Rapidly Renewable Materials

1 Point

Intent

Reduce the use and depletion of finite raw, and long-cycle renewable materials by replacing them with rapidly renewable materials.

Requirements

Use rapidly renewable building materials and products (made from plants that are typically harvested within a twenty-year cycle or shorter) for 5% of the total value of all building materialsand products used in the project.

Potential Technologies & Strategies

Establish a project goal for rapidly renewable materials and identify products suppliers that can support achievement of this goal. Consider materials such as bamboo, cotton, insulation, agrifiber and strawboard. During construction, ensure that the specified rapidly renewable materials are installed.

Credit 5.7– Certified Wood

1 Point

Intent

Encourage environmentally responsible forest management.

Requirements

Use a minimum of 50% of wood-based materials certified in accordance with the Department of Forest Conservation and State Timber Cooperation of Environment Ministry for wood building components including, but not limited to structural framing and general dimensional framing, flooring, finishes, furnishings, and non-rented temporary construction applications such as bracing, concrete form work and pedestrian barriers.

Potential Technologies & Strategies

Establish a project goal for certified wood products and identify products and & suppliers that can achieve this goal. During construction, ensure that the certified wood products are installed and quantify the total percentage of certified wood products are installed.

Reference

- Ministry of Environment

  www.environmentmin.gov.lk/forest_department.htm
- State Timber Cooperation

  www.timco.lk

6.0 INDOOR ENVIRONMENTAL QUALITY

Prerequisite 1 – Minimum IAQ Performance

Required

Intent

Establish minimum indoor air quality (IAQ) performance to prevent the development of indoor air quality problems in buildings, thus contributing to the comfort and well-being of the occupants.

Requirements

Meet the minimum requirements of voluntary consensus standard ASHRAE 62.1-2004 Ventilation for acceptable indoor sections 4 through 7 of Air Quality. Mechanical ventilation systems shall be designed using the ventilation rate produce or the applicable local code, whichever is more stringent. Naturally ventilated buildings shall comply with ASHRAE 62.1-2004, paragraph 5.1.

Potential Technologies & Strategies

Design ventilation systems to meet or exceed the minimum outdoor air ventilation rates as described in the ASHRAE 62.1-2004 standard. Balance the impacts of ventilation rates on energy use and indoor air quality to optimize for energy efficiency and occupant health. Use the ASHRAE - 62 Users Manual for detailed guidance on meeting the referenced requirements.

Prerequisite 2 – Smoke (ETS) Control

Required

Intent

Minimise exposure of building occupants, indoor surfaces and ventilation air distribution systems to Environmental Tobacco Smoke (ETS).

Requirements

Option 1

- Prohibit smoking in the building

- Locate any exterior designated smoking areas at least 25 feet away from entries, outdoor air intakes and operable windows

OR

Option 2

- Prohibit smoking in the building except in designated smoking areas

- Locate any exterior designated smoking areas at least 25 feet away from entries, outdoor air intakes and operable windows

- Locate designated smoking rooms to effectively contain, capture and remove ETS from the building. At a minimum, the smoking room must be directly exhausted to the outdoors with no re-circulation of ETS

containing air to the non-smoking area of the building, and enclosed with impermeable deck-to-deck partitions. With the doors to the smoking room closed, operate exhaust sufficient to create a negative pressure with respect to the adjacent spaces of at least an average of 5 Pa (0.02 inches of water gauge) and with a minimum of 1 Pa (0.004 inches of water gauge)

- Performance of the smoking room differential air pressures shall be verified by conducting 15 minutes of measurement, with a minimum of one measurement every 10 seconds, of thedifferential pressure in the smoking room with respect to each adjacent area and in each adjacent vertical chase with the doors to the smoking room closed. The testing will be conducted with each space configured for worst case conditions of transport of air from the smoking rooms to adjacent spaces with the smoking rooms' doors closed to the adjacent spaces

OR

Option 3

(For residential buildings only)

- Prohibit smoking in all common areas of the building

- Locate any exterior designated smoking areas at least 25 feet away from entries, outdoor air intakes and operable windows opening to common areas

- Minimize uncontrolled pathways for ETS transfer between individual residential units by sealing penetrations in walls, ceilings and floors in the residential units, and by sealing vertical chases adjacent to the units if the common hallways are pressurized with respect to the residential units then doors in the residential units leading to the common hallways need not be weather-stripped provided that the

positive differential pressure is demonstrated as in Option 2 above, considering the residential unit as the smoking room. Acceptable sealing of residential units shall be demonstrated by a blower door test conducted in accordance with ANSI/ASTM-E779-03,

Standard Test Method for Determining Air Leakage Rate by Fan Pressurization, residential units must demonstrate less than 1.25 square inches leakage area per 100 square feet of enclosure area (i.e. sum of all wall, ceiling and floor areas) AND use the progressive sampling methodology defined in Chapter 4 (Compliance Through Quality Construction) of the Residential Manual for Compliance with California's 2001 Energy Efficiency Standards.

Potential Technologies & Strategies

Prohibit smoking in commercial buildings or effectively control the ventilation air in smoking rooms. For residential buildings, prohibit smoking in common areas, design building envelope and systems to minimize ETS transfer among dwelling units.

Credit 6.1– Outdoor Air Delivery Monitoring

1 Point

Intent

Provide capacity for ventilation system monitoring to help sustain occupant comfort and well-being.

Requirements

Install permanent CO_2 monitoring systems that provide feedback on ventilation system performance to ensure that ventilation systems maintain design minimum ventilation requirements. Configure all monitoring equipment to generate an alarm when the conditions vary by 10% or more from set point, via either a building automation system alarm to the building operator or via a visual or audible alert to the building occupants.

For Mechanically Ventilated Spaces

Monitor CO_2 concentrations within all densely occupied spaces (those with a design occupant density greater than or equal to 25 people per 1000 sq.ft.). CO_2 monitoring locations shall be between 3 feet and 6 feet above the floor.

For Naturally Ventilated Spaces

Monitor CO_2 concentrations within all naturally ventilated spaces. CO_2 monitoring shall be located within the room between 3 feet and 6 feet above the floor. One CO_2 sensor may be used to represent multiple spaces if the natural ventilation design uses passive stack(s) or other means to induce airflow through those spaces equally and simultaneously without intervention by building occupants.

Potential Technologies & Strategies

Install CO_2 and airflow measurement equipment and feed the information to the HVAC system and/or Building Automation System (BAS) to trigger corrective action, if applicable. If such automatic controls are not feasible with the building systems, use the measurement equipment to trigger alarms that inform building operators or occupants of a possible deficiency in outdoor air delivery.

Credit 6.2–Increased Ventilation

1 Point

Intent

Provide additional outdoor air ventilation to improve indoor air quality for improved occupant comfort, well-being and productivity.

Requirements

For Mechanically Ventilated Spaces

Increase breathing zone outdoor air ventilation rates to all occupied spaces by at least 30% above the minimum rates required by ASHRAE Standard 62.1-2004 as determined in EQ Prerequisite 1

OR

For Naturally Ventilated Spaces

Design natural ventilation systems for occupied spaces to meet the recommendations set forth in the Carbon Trust “Good Practice Guide 237” [1998]. Determine that natural ventilation is an effective strategy for the project by following the flow diagram process shown in Figure1.18 of the Chartered Institution of Building Services Engineers (CIBSE) Applications Manual 10: 2005, Natural ventilation in non-domestic buildings.

AND

Use diagrams and calculations to show that the design of the natural ventilation systems meets the recommendations set forth in the CIBSE Applications Manual 10:2005, Natural ventilation in non-domestic buildings

OR

Use a macroscopic, multi-zone, analytic model to predict that room-by-room airflows will effectively naturally ventilate, defined as providing the minimum ventilation rates required by ASHRAE 62.1-2004 Chapter 6, for at least 90% of occupied spaces

Potential Technologies & Strategies

For Mechanically ventilated Spaces: Use heat recovery, where appropriate, to minimize the additional energy consumption associated with higher ventilation rates.

For Naturally ventilated Spaces: Follow the eight design steps described in the Carbon Trust Good Practice Guide 237;

- Develop design requirements,
- Plan airflow paths
- Identify building uses and features that might require special attention
- Determine ventilation requirements
- Estimate external driving pressures
- Select types of ventilation devices

- Size ventilation devices
- Analyze the design.

Use public domain software such as NIST's CONTAM, Multi-zone Modelling Software, along with LoopDA, Natural Ventilation Sizing Tool, to analytically predict room-by-room airflows.

Credit 6.3– Construction IAQ Management Plan

1 Point

Intent

Prevent indoor air quality problems resulting from the construction/renovation process in order to help sustain the comfort and well-being of construction workers building occupants.

Requirements

Develop and implement an Indoor Air Quality (IAQ) Management Plan for the construction and preoccupancy phases of the building as follows:

Credit 6.3.1 Construction IAQ Management Plan Before and After Construction (1 Point)

- During construction meet or exceed the recommended Design Approaches of the Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guideline for Occupied Buildings under Construction, 1995, Chapter 3

- Protect stored on-site or installed absorptive materials from moisture damage

- If air handlers must be used during construction, filtration media with a Minimum Efficiency Reporting. Value (MERV) of 8 must be used at each return air grill, as determined by ASHRAE 52.2-1999

AND

After construction ends and prior to occupancy conduct a minimum two-week building flush-out with new Minimum Efficiency Reporting Value (MERV) 8 filtration media at 100% outside air. After flush-out, new filter with a minimum MERV 8 value, must replace all filters except those solely processing outside air. Note these filters must be MERV 13 or better when a project plans to earn EQ credit 5, Indoor Chemical and Pollutant Source Control.

Potential Technologies & Strategies

Adopt an IAQ management plan to protect the HVAC system during construction, control pollutant sources, and interrupt pathways for contamination. Sequence installation of materials to avoid contamination of absorptive materials such as insulation, carpeting, ceiling tile, and gypsum wallboard. Prior to occupancy, perform a two-week building flush out or test the contaminant levels in the building.

Credit 6.4– Low - Emitting Materials

1-3 Points

Intent

Reduce the quantity of indoor air contaminants that are odorous or potentially irritating harmful to the comfort and well-being of installer and building occupants.

Requirements

All adhesives and sealants used on the interior of the building (defined as inside of the weatherproofing system and applied on-site) shall comply with the requirements of the reference guide.

Table 6.1

Architectural Applications	VOC Limit
Indoor Carpet Adhesives	50
Carpet Pad Adhesive	50
Wood Flooring Adhesives	100
Rubber Floor Adhesives	60
Sub Floor Adhesives	50
Ceramic Tile Adhesives	65
VCT And Asphalt Tile Adhesives	50
Dry Wall and Panel Adhesives	50
Cove Base Adhesive	50
Structural Glazing Adhesives	100
Multipurpose Construction	70

Table 6.2

Substrate Specific Application	**VOC Limit (g/L less water)**
Metal to Metal	30
Plastic Foams	50
Porous Material (Except Wood) (Except Wood)	50
Wood	30
Fiber Glass	80

Table 6.3

Specialty Application	VOC Limit (g/L less water)
PVC Welding	510
Top and Trim Adhesive	250
Contact Adhesive	80
Special Purpose Contact Adhesive	250

Table 6.4

Sealants	VOC Limit (g/L less water)
Architectural	250
Non-membrane roof	300
Roadway	250
Single-ply roof membrane	450
other	420

Table 6.5

Sealant Primers	VOC Limit (g/L less water)
Architectural, nonporous	250
Architectural, porous	775
Other	750

Credit 6.4.1 Paints and Coatings (1 Point)

Paints and coatings used on the interior of the building defined as inside of the weatherproofing system and applied on-site shall comply with the requirements of the reference guide.

The VOC (Volatile Organic Compounds) content of paints, coatings and primers used must not exceed the VOC content limits mentioned below;

Table 6.6

Paints	VOC Limit (g/L less water)
Non-flat	150
Mat (fat)	50
Anti Corrosive / Anti Rust	250

Table 6.7

Coatings	VOC Limit (g/L less water)
Clear Wood Finishes-	
Varnish	350
Lacquer	550
Floor Coatings	100
Stains	250
Sealers -	
Waterproofing Sealer	250
Sanding Sealer	275
Other Sealers	200

Credit 6.4.2Carpet Systems (1 Point)

Carpet systems must meet or exceed the requirements of the Carpet and Rug Institute's Green Label Indoor Air Quality Test Program. All carpet cushion installed in the building interior shall meet the requirements of Carpet and Rug Institute's Green Label Indoor Air Quality Test Program. All carpetadhesive shall meet the requirements of EQ Credit 6.4.1: VOC limit of 50 g/L

Credit 6.4.3Composite Wood and Agrifiber Products (1 Point)

Composite wood and agrifiber products used on the interior of the building must contain no added urea-formaldehyde resins. Composite wood and agrifiber products are defined as: particleboard, medium density fibreboard (MDF), plywood, wheatboard, strawboard, panel substrates and door cores.

Potential Technologies & Strategies

Specify low-VOC materials in construction documents. Ensure that VOC limits are clearly stated in each section where adhesives, sealants, paints, coatings, carpet systems, and composite woods are addressed.

Credit 6.5– Indoor Chemical & Pollutant Source Control

1 Point

Intent

Minimize exposure of building occupants to potentially hazardous particulates and chemical pollutants.

Requirements

Design to minimize and control pollutant entry into buildings and later cross-contamination of regularly occupied areas:

- Employ permanent entryway systems at least 6 feet long in the primary direction of travel to capture dirt and particulates from entering the building at all entryways that are directly connected to the outdoors. Acceptable entryway systems include permanently installed grates, grilles, or slotted systems that allow for cleaning underneath. Roll-out mats are only acceptable when maintained on a weekly basis by a contracted service organization. Qualifying entryways are those that serve as regular entry points for building users.

- Where hazardous gases or chemicals may be present or used (including garages, housekeeping/laundry areas and copying/printing rooms), exhaust each space sufficiently to create negative pressure with respect to adjacent spaces with the doors to the room closed. For each of these spaces, provide self-closing doors and deck – to - deck partitions or a hard lid ceiling. The exhaust rate shall be at least 0.50 cfm/sq.ft, with no air re-circulation. The pressure differential with the surrounding spaces shall be at least 5 Pa (0.02 inches of water gauge)

on average and 1 Pa (0.004 inches of water) at a minimum when the doors to the rooms are closed.

- In mechanically ventilated buildings, provide regularly occupied areas of the building with air filtration media prior to occupancy that provides a Minimum Efficiency Reporting Value (MERV) of 13 or better. Filtration should be applied to process both return and outside air that is to be delivered as supply air.

Potential Technologies & Strategies

Design facility cleaning and maintenance areas with isolatedexhaust systems for contaminants. Maintain physical isolation from the rest of the regularly occupied areas of the building.

Install permanent architectural entryway systems such as grills or grates to prevent occupant-borne contaminants handling units can accommodate required filter sizes and pressure drops from entering the building. Install high-level filtration systems in air handling units processing both return air and outside air that is to be delivered as supply air.

Credit 6.6– Controllability of Systems

1-2 Points

Intent

Provide a high level of lighting system control by individual occupants or by specific groups in multi-occupant spaces (i.e., classrooms or conference areas) to promote the productivity, comfort and well-being of building occupants.

Requirements

Credit 6.6.1Lighting Controls (1 Point)

Provide individual lighting controls for 90% (minimum) of the building occupants to enable adjustments to suit individual task needs and preferences.

AND

Provide lighting system controllability for all shared multi-occupant spaces to enable lighting adjustment that meets group needs and preferences.

Credit 6.6.2Comfort Controls (1 Point)

Provide individual comfort controls for 50% (minimum) of the building occupants to enable adjustments to suit individual task needs and preferences. Operable windows can be used in lieu of comfort controlsfor occupants of areas that are 20 feet inside of and 10 feet to either side of the operable part of the window. The areas of operable window must meet the requirements of ASHRAE 62.1-2004, paragraph 5.1, Natural Ventilation.

AND

Provide comfort system controls for all shared multi-occupant spaces to enable adjustments to suit group needs and preferences.

Conditions for thermal comfort are described in ASHRAE Standard 55-2004 to include the primary factors of air temperature, radiant temperature, air speed and humidity. Comfort system control, for the purposes of this credit, is defined as the provision of control over at least one of these primary factors in the occupant's local environment.

Potential Technologies & Strategies

Design the building and systems with comfort controls to allow adjustments to suit individual needs or those of groups in shared spaces. ASHRAE Standard 55-2004 identifies the factors of thermal comfort and a process for developing comfort criteria for building spaces that suit the needs of the occupants involved in their daily activities. Control strategies can be developed to expand on the comfort criteria to allow adjustments to suit individual needs and preferences. These may involve system designs incorporating operable

windows, hybrid systems integrating operable windows and mechanical systems, or mechanical systems alone.

Individual adjustments may involve individual thermostat controls, local diffusers at floor, desk or overhead levels, or control of individual radiant panels, or other means integrated into the overall building, thermal comfort systems, and energy systems design. In addition, designers should evaluate the closely tied interactions between thermal comfort (as required by ASHRAE Standard 55-2004) and acceptable indoor air quality (as required by ASHRAE Standard 62.1-2004, whether natural or mechanical ventilation).

Credit 6.7– Thermal Comfort, Design

1 Point

Intent

Provide a comfortable thermal environment that supports the productivity and well-being of building occupants.

Requirements

Design HVAC systems and the building envelope to meet the requirements of ASHRAE Standard 55-2004, Thermal Comfort Conditions for Human Occupancy. Demonstrate design compliance in accordance with the Section 6.1.1 Documentation.

Potential Technologies & Strategies

Establish comfort criteria per ASHRAE Standard 55-2004 that support the desired quality and occupant satisfaction with building performance. Design building envelope and systems with the capability to deliver performance to the comfort criteria under expected environmental and use conditions. Evaluate air temperature, radiant temperature, air speed,and relative humidity in an integrated fashion and coordinate these criteria with EQ Prerequisite 1, EQ Credit 1, and EQ Credit 2.

Credit 6.8– Thermal Comfort, Verification

1 Point

Intent

Provide for the assessment of building thermal comfort over time.

Requirements

Achieve EQ Credit 6.7: Thermal Comfort, Design Agree to implement a thermal comfort survey of building occupants within a period of 6 to 18 months after occupancy. This survey should collect anonymous responses about thermal comfort in the building including an assessment of overall satisfaction with thermal performance and identification of thermal comfort-related problems.

Agree to develop a plan for corrective action if the survey results indicate that more than 20% of occupants are dissatisfied with thermal comfort in the building. This plan should include measurement of relevant environmental variables in problem areas in accordance with ASHRAE Standard 55-2004.

Potential Technologies & Strategies

ASHRAE Standard 55-2004 provides guidance for establishing thermal comfort criteria and the documentation and validation of building performance to the criteria. While the standard is not intended for purposes of continuous monitoring and maintenance of the thermal environment, the principles expressed in the standard provide a basis for design of monitoringand corrective action systems.

Credit 6.9– Daylight & Views

2 Points

Intent

Provide for the building occupants a connection between indoor spaces and the outdoors through the introduction of daylight and views into the regularly occupied areas of the building.

Requirements

Credit 6.9.1 Daylight (1 Point)

Achieve a minimum Daylight Factor of 2% (excluding all direct sunlight penetration) in 75% of all space occupied for critical visual tasks. Spaces excluded from this requirement include copy rooms, storage areas, mechanical plant rooms, laundry and other low occupancy support areas. Other exceptions for spaces where tasks would be hindered by the use of daylight will be considered on their merits.

Table 6.8

Regularly Occupied Spaces	Points
75%	1

Credit 6.9.2Views (1 Point)

Achieve direct line of sight to outdoor environment via vision glazing for building occupants in 90% of all regularly occupied spaces. Examples of exceptions include copy rooms, storage areas, mechanical, laundry and other low occupancy support areas. Other exceptions will be considered on their merits.

Potential Technologies & Strategies

Design the building to maximize day-lighting and view opportunities. Strategies to consider include building orientation, shallow floor plates, increased building perimeter, exterior and interior shading devices, high performance glazing, and photo-integrated light sensors. Model day-lighting strategies with a physical or computer model to assess foot candle levels and daylight factors achieved.

7.0 INNOVATION & DESIGN PROCESS

7.1 Innovation in Design

1-4 Points

Intent

To provide design teams and projects the opportunity to be awarded points for exceptional performance above the requirements set by the GREEN$^{SL®}$ Rating System and/or innovative performance in Green Building categories not specifically addressed by the GREEN$^{SL®}$ Rating System.

Requirements

Credit 7.1.1 Innovation in Design (1-2 Points)

Achieve significant, measurable environmental performance using a strategy not addressed in GREEN$^{SL®}$ Rating System for Built Environment 2010. Each strategy earns 1 point and up to 2 points in total.

Credit 7.1.2 Exemplary Performance (1-2 Points)

Achieve exemplary performance in an existing GREEN$^{SL®}$ Rating System for Built Environment, 2010 prerequisite or credit. An exemplary performance may be earned by achieving double the credit requirements and/or achieving the next incremental percentage

threshold of an existing credit. Each exemplary performance earns 1 point up to 2 points in total.

Potential Technologies & Strategies

Engage a Commissioning Authority and adopt a commissioning plan. Include commissioning requirements in bid documents and task the commissioning agent to produce a commissioning report once commissioning activities are completed.

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8.0 SOCIAL & CULTURAL AWARENESS

Prerequisite 1 – Archeological Sites & Heritage Buildings

Required

Intent

To protect archaeological sites and heritage buildings and to avoid building which may affect the cultural identity of the site and the heritage value of the building.

Requirements

Do not develop buildings, roads or parking areas on sites define as archaeological sites without prior approval of the Department of Archaeology. The architectural aspects of the building shall conform to the context of the site. All the buildings designs within an archaeological site shall be approved by a panel of Qualified Archaeologist and Chartered Architects, jointly appointed by the Department of Archaeology Sri Lanka Institute of Architects.

Do not alter any building identified as heritage buildings by the archaeological department without prior approval. All the buildings design alterations within an archaeological site shall be approved by a panel of Qualified Archaeologist and Chartered Architects, jointly appointed by the Department of Archaeology and Sri Lanka Institute of Architects.

Potential Technologies & Strategies

During site selection avoid developing on archaeologically sensitive sites. Also avoid altering heritage buildings. All development should conform to the respective heritage policies, laws and regulations;

- Antiquities Ordinance
- Central Cultural Fund Act
- Galle Heritage Foundation Act
- Urban Development Authorities Act
- Housing and Town Improvement Ordinance
- http://www.e.galleheritage.lk
- http://www.archaelogy.gov.lk
- http://www.slia.lk

Credit 8.1– Social Wellbeing, Public Health & Safety

1-2 Points

Intent

To ensure the buildings and developments address the aspects of maintaining and improving the public health and social wellbeing. The social benefits of sustainable design are related to improvements in the quality of life, health, and well-being. These benefits can be realized at different levels – buildings, the community, and society in general. At a building level, research on the human benefits of sustainable design has centered on three primary topics: health, comfort, and satisfaction.

Requirements

Buildings designed considering the health benefits of an urban lifestyle shall posses the following characteristics;

- Provide public recreational areas such as parks, lakes etc.
- Buildings especially in residential developments in urban contexts promote walking and cycling for communities.
- The public safety requirements as per the local authority guidelines in individual and multi unit buildings as well as large area developments.
- Building design, layout and planning address the issues of privacy and safety of all types of users.
- Development should address all levels of accessibility requirements.
- Provide vegetable garden spaces, vegetable roof gardens to depict the rural lifestyle and our agricultural heritage.

Potential Technologies & Strategies

During design and planning should have the holistic approach, considering residence's rural and agricultural heritage.

Development should conform to;

- The Accessibility Guidelines of UDA.
- Local Authority Development Guidelines.
- Fire and Safety Regulations of Sri Lanka Fire Department.

References

- http://www.uda.lk
- http://www.slia.lk

Credit 8.2– Cultural Identity

1-2 Points

Intent

To make sure the building designs and developments contribute to the cultural identity of the regional, community, locality or neighborhood settings.

In addition to the social benefits cultural values of a country is also equally important. The culture refers to the cumulative deposit of knowledge, experience, beliefs, values, attitudes, meanings, hierarchies, religion, notions of time, roles, spatial relations, concepts of the universe, and material objects and possessions acquired by a group of people in the course of generations through individual and group striving.

Requirements

- Justify the building/development designs in terms of the reflection of the cultural values, acceptances, aspirations
- Promote/provide spaces as required for culturally based life styles of rural and urban settings
- Create Identity, Sense of Place and Cultural awareness
- Promote social empowerment, community participation and access.

Potential Technologies & Strategies

Development in Cultural cities defined by the Department of Archeology such as Kandy, Anuradhapura, Polonnaruwa, Dambullaetc to be followed. The designshall be in accordance with Local authority, Urban Development Authority (UDA) and Department of Archaeology guide lines.

Development should conform to the urban design guidelines of the respective areas approved by UDA. Design buildings with a strong emphasis on the character of the surrounding communities and neighbourhoods with cultural importance.

- http://www.archaeology.gov.lk
- http://www.uda.lk
- http://www.slia.lk
- http://www.nppd.gov.lk
- http://www.e.galleheritage.lk

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