GREEN$^{SL®}$ RATING SYSTEM

FOR EXISTING BUILDINGS

Version 1.0

Green Building Council of Sri Lanka

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PREFACE FROM GREEN BUILDING COUNCIL OF SRI LANKA

The natural environment together with our economy, health and productivity are immensely affected by the performance of built environments. The lifespan contribution to global CO_2 emission from built environments can be high as 40 percent - the largest single contributor to global warming (UNEP-SBCI, 2009).The building sector is responsible for more than one third of total energy use. Thus, efficient design, construction and maintenance of our built environments are the responsibility of all stakeholders.

The GREEN$^{SL®}$ Rating System of Green Building Council of Sri Lanka (GBCSL) offers the valuable opportunity to respond positively to the greatest challenge of the day. It is a voluntary scheme where owners, designers, developers, builders and facilities managers can achieve recognition for their valuable interest to build and operate 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 carbon 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 the world's energy requirements and that a large percentage of the present energy consumption and carbon dioxide generation could be saved by applying certification standards. GBCSL took a giant step towards helping that process in Sri Lanka by introducing the Green Rating System for Built Environment in May 2011. The introduction of this dedicated document for existing buildings is the continuation of that initiative by GBCSL.

The public's perception on the importance of sustainable buildings is dramatically increasing followed by a great demand. Designers, builders, operators and owners of buildings of all types now recognise that sustainable management of building life cycle is essential as it adds value to their investment. Better environmental and economic performance of buildings is our pathway to a better future.

A green building is designed and managed to use less energy and water, to improve indoor air quality and to reduce the life-cycle environmental impacts of materials used. This well-qualified committee led by Eng Shiromal Fernando, together with Mr. Lionel Nawagamuwa, Archt. Ravihansa Chandratilake, Ms. Vindyani Jayasinghe, Ms. Damitha Rajini and Ms. Tharusha Ranadewa 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 designs, material selection, construction,

operation, maintenance, removal and possible reuse, etc. Although the rating system is based on the world's best practices 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 percent less potable water. Moreover, waste to landfills is reduced by 69 percent than non-certified buildings. This document provides a rigorous road map for greening the existing built environment in Sri Lanka Thus, there is no doubt that it will receive support from both public and private sectors and become the rating tool of choice for existing buildings.

Prof. Priyan Mendis

Chairman,
Green Building Council of Sri Lanka

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The GBCSL acknowledges the support of Eng Tharaka Gunawardena, Ms. Vindyani Jayasinghe, Ms. Damitha Rajini and Ms. Tharusha Ranadewa in preparing the draft.

A special word of thanks goes to the Building Economics Department, University of Moratuwa, for sharing their work with the GBCSL Technical Team.

We mention with gratitude the technical committee members for their expertise and reviews in perfecting the draft.

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  Former (Hon.) Secretary, Society of Structural Engineers, Sri Lanka; Representative for Sri Lanka, World Council of Tall Buildings and Urban Habitat (CTBUH)
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  Executive Director, Green Building Council of Sri Lanka
- **Prof. Anul Perera**
  Dept. of Chemical and Process Engineering,
  University of Moratuwa

GREEN[SL®] RATING SYSTEM FOR EXISTING BUILDINGS CHECKLIST

100 Total Points Available

Criteria		Points
1.0 MANAGEMENT		**4 Total Points Available**
☑ **Prerequisite 1**	Green Building Accredited Professional	Required
☐ **Credit 1.1**	Building Users' Guide	2 Points
☐ **Credit 1.2**	Environmental Management	2 Points
2.0 SUSTAINABLE SITES		**21 Total Points Available**
☐ **Credit 2.1**	GREEN[SL®] Rated Design and Construction	4 Points
☐ **Credit 2.2**	Facility Management – Building Exterior and Hardscape Management	2 Points
☐ **Credit 2.3**	Facility Management – Outdoor Integrated Pest Management, Erosion Control and Landscape Management	2 Points
☐ **Credit 2.4**	Alternative Transportation [2-3 Points]	
	Credit 2.4.1 Low-Emitting and Fuel Efficient Vehicles	2 Points
	Credit 2.4.2 Parking Capacity	1 Point
☐ **Credit 2.5**	Protect or Restore Open Habitat	1 Point
☐ **Credit 2.6**	Storm Water Design – Quantity Control	2 Points
☐ **Credit 2.7**	Storm Water Design – Quality Control	2 Points

☐ **Credit 2.8**	Heat Island Effect – Non-Roof	2 Points
☐ **Credit 2.9**	Heat Island Effect – Roof	2 Points
☐ **Credit 2.10**	Light Pollution Reduction	1 Point

3.0 WATER EFFICIENCY **16 Total Points Available**

☐ **Credit 3.1**	Water Performance Measurement [1-2 Points]	
	Credit 3.1.1 Measure Total Water Consumption of the Building	1 Point
	Credit 3.1.2 Measure Water Usage of Building Subsystems	1 Point
☐ **Credit 3.2**	Water Efficient Landscaping [2-4 Points]	
	Credit 3.2.1 Reduce Potable Water Consumption	2 Points
	Credit 3.2.2 Eliminate Potable Water Consumption	2 Points
☐ **Credit 3.3**	Water Efficiency in Air-conditioning System	1 Point
☐ **Credit 3.4**	Innovative Wastewater Technologies [2-4 Points]	
	Credit 3.4.1 Reduce Potable Water Use or Treat Wastewater	2 Points
	Credit 3.4.2 Harvested Rainwater	2 Points
☐ **Credit 3.5**	Water Use Reduction	2-4 Points
☐ **Credit 3.6**	Innovative Water Transmission	1 Point

4.0 ENERGY & ATMOSPHERE **26 Total Points Available**

☑ **Prerequisite 1**	Minimum Energy Performance	Required
☑ **Prerequisite**	CFC Reduction in HVAC&R Equipment	Required

2		
☐ **Credit 4.1**	Optimise Energy Performance	1-10 Points
☐ **Credit 4.2**	Renewable Energy	1-8 Points
☐ **Credit 4.3**	Existing Building Commissioning [1-2 Points]	
	Credit 4.3.1 Existing Building Commissioning – Investigation and Analysis	1 Point
	Credit 4.3.2 Existing Building Commissioning – Implementation	1 Point
☐ **Credit 4.4**	Ongoing Commissioning	2 Points
☐ **Credit 4.5**	Ozone Depletion	1 Point
☐ **Credit 4.6**	Performance Measurement – Sub-Metering	1 Point
☐ **Credit 4.7**	Performance Measurement – Building Management System	1 Point
☐ **Credit 4.8**	Green Power	1 Point

5.0 MATERIALS & RESOURCES **10 Total Points Available**

☑ **Prerequisite 1**	Solid Waste Management Policy	Required
☑ **Prerequisite 2**	Sustainable Purchasing Policy	Required
☐ **Credit 5.1**	Solid Waste Management – Waste Stream Audit	1 Point
☐ **Credit 5.2**	Solid Waste Management – Ongoing Consumables	1-2 Points
☐ **Credit 5.3**	Solid Waste Management – Durable Goods	1-2 Points
☐ **Credit 5.4**	Solid Waste Management – Facility Alterations and Additions	1 Point
☐ **Credit 5.5**	Sustainable Purchasing – Ongoing	1-2 Points

	Consumables	
☐ **Credit 5.6**	Sustainable Purchasing – Durable Goods	1 Point
☐ **Credit 5.7**	Sustainable Purchasing – Facility Alterations and Additions	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**	Low-Emitting Materials for Facility Alterations and Additions	1 Point
☐ **Credit 6.4**	Green Cleaning Program	2 Points
☐ **Credit 6.5**	Indoor Integrated Pest Management	1 Point
☐ **Credit 6.6**	Indoor Chemical & Pollutant Source Control	1 Point
☐ **Credit 6.7**	Controllability of Systems [1-2 Points]	
	Credit 6.7.1 Lighting Controls	1 Point
	Credit 6.7.2 Comfort Controls	1 Point
☐ **Credit 6.8**	Thermal Comfort Monitoring	1 Point
☐ **Credit 6.9**	Occupancy Comfort Surveys	1 Point
☐ **Credit 6.10**	Daylight & Views [1-2 Points]	
	Credit 6.10.1 Daylight	1 Point
	Credit 6.10.2 Views	1 Point

7.0 INNOVATION & DESIGN PROCESS **6 Total Points Available**

☐ **Credit 7.1**	Innovation in Design [1-6 Points]	
	Credit 7.1.1 Innovation in Design	1-3 Points
	Credit 7.1.2 Exemplary Performance	1-3 Points

8.0 SOCIAL & CULTURAL AWARENESS **4 Total Points Available**

☑ **Prerequisite 1**	Archaeological 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 60–69 points
- Platinum 70 points and above

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INTRODUCTION TO GREEN BUILDING COUNCIL OF SRI LANKA

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 through the 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 is provided to the human society, is the ultimate goal of GBCSL’s endeavour.

The GBCSL came into existence as a result of an emerging trend towards applying the greener concepts for built environment.

The GBCSL launched in November 2009 as a non-profit organisation is committed to develop a sustainable building industry for Sri Lanka by encouraging the adoption of green building practices. It is uniquely supported by both industries 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. Priyan Mendis leads the GBCSL as the chairperson while the board comprises of expert academic advisors and industrial agents.

Board of Directors

- **Prof. Priyan Mendis (Chairman)**
  Dept. of Civil and Environmental Engineering, University of Melbourne, Australia
- **Dr. LN Senaweera (Vice Chairman)**
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- **Mr. Lionel Nawagamuwa (Executive Director)**
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- **Prof. Ajith de Alwis (Director)**
  Sri Lanka Institute of Nanotechnology
- **Archt. Plnr. B M J Piyal Silva (Director)**
  Secretary, Institute of Town Planners Sri Lanka

Committees of the Council

- Accreditation Board
- Rating Tools and Green Technology
- Infrastructure Development
- Nanotechnology for Sustainable Built Environment
- Education & Training
- Awareness & Publicity
- International Relations
- Public Relations
- Membership

Institutions that have taken Leadership in Establishing GBCSL

- Sri Lanka Standards Institute
- 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
- Dept. of Civil Engineering - University of Moratuwa
- Dept. of Civil and Environmental Engineering – University of Ruhuna
- Dept. of Mechanical Engineering - University of Moratuwa
- Dept. of Civil Engineering - University of Peradeniya
- Dept. of Architecture - University of Moratuwa
- Dept. of Building Economics - University of Moratuwa
- Dept. of Civil & Environmental Engineering - University of Melbourne, Australia

VISION OF GREEN BUILDING COUNCIL OF SRI LANKA

Our Vision is to transform the construction industry in Sri Lanka with green building practices and to 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 GREEN BUILDING COUNCIL OF SRI LANKA

The Mission is to develop the sustainability of built environment by transforming the way it is planned, designed, constructed, maintained and operated, and to 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 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. However, it is rapidly expanding all over different industries, as they are searching for more efficient buildings for their usage.

As the green building concept becomes acceptable to majority of the society, people try to adapt 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 in Sri Lanka.

Where we want to be…

Most of the leading countries have their own green building councils to govern their green rating for built environments. The different state councils of these countries follow a standardised green rating system to assess the environmental acceptability of built environments. The United States of America's governing body, the United States Green Building Council, uses *LEED* (Leadership in Energy and Environmental Design) rating system and Australia's governing body, the Green Building Council of Australia, uses *Green Star* rating system while the United Kingdom's governing body, the UK Accreditation Service (UKAS), uses *BREEAM* rating system to assess and rate the environmental acceptability and sustainability of built environment. Therefore, it is an essential and timely need for Sri Lanka to build such a rating system to assess the environmental acceptability of our built

environment. The main purpose of GBCSL is to develop and manage a rating system effectively and efficiently. This will provides a remarkable service in assessing the built environment in terms of environmental acceptability. Furthermore, GBCSL will provide leadership to develop green solutions in the future for new developments and incorporate such concepts to existing built environment by retrofitting to make them sustainable.

It is important to note that from country to country, the considerations for rating systems will change as the environmental stresses 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, construction, operations and maintenance of buildings in an environmentally acceptable manner. This will be a major step towards adopting a sustainable practice in managing buildings to utilise the natural resources and make efficient designs to utilise nature for the betterment of mankind.

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

How the GREEN Rating System Works...

The GREEN$^{SL®}$ Rating System is used to evaluate efficiency of the built environment in the following aspects: Management, Site Development, Energy, Water, Indoor Environmental Quality, Materials, Innovation, and Social and Cultural Awareness. Points are assigned for each category. The rating is given upon the total marks earned by the

building solution. The GREEN$^{SL®}$ Rating System for Built Environment, Version 1.0 focuses on evaluating new building designs and constructions while the GREEN$^{SL®}$ Rating System for Existing Buildings, Version 1.0 presented in this document aims at assessing the operations and maintenance performance of existing buildings.

What we need to do to Bridge the Gap...

In the development process of making Sri Lanka sustainable, the establishment of the GREEN$^{SL®}$ Rating System is an important milestone. Accordingly, the rating system has to be developed for Sri Lanka to ensure that construction, operations and maintenance of buildings will reduce the environment stresses.

Future with GREEN Rating System...

GBCSL is the governing body in Sri Lanka, responsible for developing, implementing and maintaining the GREEN$^{SL®}$ Rating System. The governing body comprises of experts in many 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. 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.

The Government will give incentives to builders and the building product solutions which achieve the benchmarks set by GREEN$^{SL®}$ Rating System.

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
- Encourage innovations
- 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 EXISTING BUILDINGS

The GREEN$^{SL®}$ Rating System for Existing Buildings is a set of performance standards used to certify the operations and maintenance of built environments in the form of commercial or institutional buildings and residential buildings of all sizes, both public and private. The intent is to promote high performance, healthy, durable and affordable environmentally sound practices in existing buildings.

Prerequisites and credits in the GREEN$^{SL®}$ Rating System for Existing Buildings address eight 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 Existing Buildings will be awarded according to the following scales;

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

GBCSL will recognise 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 Existing Buildings and include offices, factories, retail and service establishments, institutional buildings (libraries, schools, museums, etc.), hotels and residential buildings.

The GREEN$^{SL®}$ Rating System for Existing Buildings encourages owners and operators of buildings to implement sustainable practices and reduce the negative environmental impacts of their buildings over the 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 indoor environmental quality.

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

- Building operations, processes, systems upgrades, minor space-use changes, and minor facility alterations and/or additions; and
- Buildings new to GREEN$^{SL®}$ certification as well as buildings previously certified under GREEN$^{SL®}$ Rating System for Built Environment; these may be either new constructions or buildings that have undergone major renovations.

An existing building which has been fully operational for a minimum of 3 years can apply for certification under the GREEN$^{SL®}$ Rating System for Existing Buildings.

In addition to ongoing operations and maintenance, GREEN$^{SL®}$ Rating System for Existing Buildings covers sustainable alterations and additions to existing buildings. Alterations and additions refer to changes that affect usable space in the building and exclude mechanical, electrical or plumbing system upgrades that involve no disruption to usable space.

Only alterations and additions within the following limits are eligible for inclusion in GREEN$^{SL®}$ Rating System for Existing Buildings certification:

Maximum - Alterations that affect no more than 50% of the total building floor area or cause relocation of no more than 50% of regular building occupants are eligible. Additions that increase the total building floor area by no more than 50% are eligible. Buildings with alterations or additions exceeding these limits should pursue certification under the GREEN$^{SL®}$ Rating System for Built Environment.

Minimum - Alterations that include construction activity by more than 1 trade specialty, make substantial changes to at least 1 entire room in the building, and require isolation of the work site from regular building occupants for the duration of construction are eligible. Additions that increase the total building floor area by at least 5% are eligible. Alterations or additions below these limits are considered repairs, routine replacements, or minor upgrades and are ineligible to earn points under the GREEN$^{SL®}$ Rating System for Existing Buildings. The minimum applies to Materials and Resources (MR) Credits 5.4 and 5.7 and Indoor Environmental Quality (EQ) Credit 6.3.

Furthermore, the GREEN$^{SL®}$ Rating System for Existing Buildings requires building operations data to be submitted for a performance period – a continuous, unbroken time during which the sustainable operations performance is being measured, which is a minimum of 06 months preceding certification application for all prerequisites and credits.

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

The term sustainable development was coined and offered 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 and future generations. The concept of sustainable development slowly leached its way to a number of disciplines and has been speedily accepted by the world as it has holistic ideas of protecting the environment for the survival of mankind. However, the main obstruction remains to be 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. Thereafter, the inadequacy of conventional economic knowledge tools, when it comes to the use of environmental resources and the need of “special indicators”, were highlighted. This is because such indicators were outside of the worldview of conventional economics. In the next phase of evolution, ecological economics or the human economy is considered as an open sub-system of the biosphere which is 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 is sector, domain and issue based, where sectors such as transportation, commercial, industrial, residential etc. is concerned. In the case of domains, energy, water and land etc. were concerned. Based on these frameworks, there are more than six hundred sustainable accreditation systems in the world.

The evolution of sustainability frameworks is shown in the following figure. In the figure, the amount of information presented by the frameworks increases due to the increase in number of indicators which results in complexity in its use.

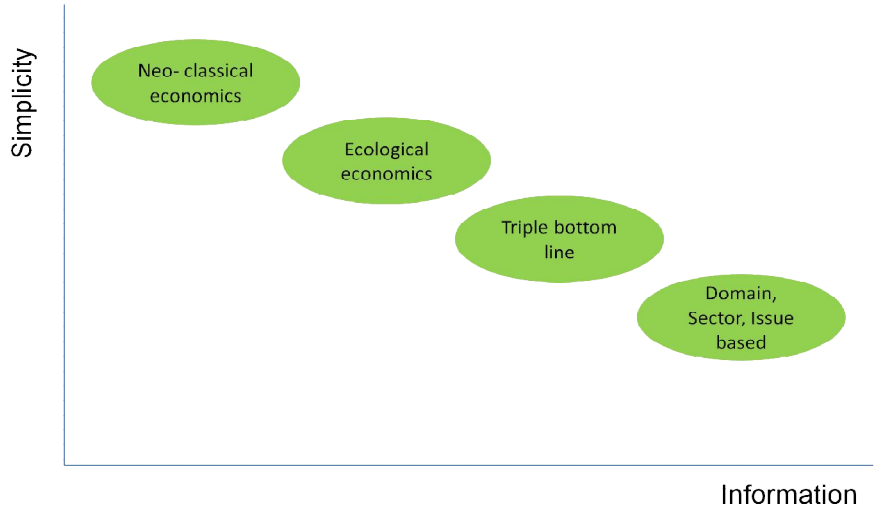

Figure: Evolution of sustainability frameworks (Chandratilake and Dias, 2010)

Even though the magnitude has not been quantified, recent studies clearly indicate issues in sustainability in Sri Lankan built environment. Many countries, based on their present issues, have developed sustainability guidelines and accreditation systems.

Improper understanding and misinterpretation of different domains and aspects in different localities will create inadequate measures of sustainability. This would not reflect the magnitude of the local depiction of sustainability. In most cases this arises due to the use of popular or common accreditation systems neglecting the local context.

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

ten and nine domains respectively while GRIHA (India), one of the recent green rating systems, has identified only four domains.

After a thorough study of the existing rating systems and considering local environment issues, 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 the GREEN$^{SL®}$ Rating System in Sri Lanka. Each domain has a number of different aspects. The rating for each domain is based on the local environmental issues. The importance of these domains and aspects were identified by Chandratilake and Dias (2010). The study revealed that 'sustainable sites' is the most important domain for Sri Lanka for new constructions. This was followed by domains; energy and atmosphere, materials and resources, water efficiency and indoor environmental quality are respectively in the top order. However, in the case of existing buildings, energy and atmosphere was identified to be the most significant domain as operational energy efficiency is vital for existing buildings. Relative importance of these domains was employed as the basis of scoring criterion for the document.

GBCSL technical committee decided to follow the LEED (USA) model, considering the fact that, it is the most widely used rating system in the world. GREEN$^{SL®}$ Rating System has followed a similar procedure. Initially, LEED accredited professionals will be given the GBCSL accreditation; subsequently GBCSL will conduct its own accreditation process. Thus, a GREEN$^{SL®}$ rated building by GBCSL will have an equivalent efficiency as a LEED rated building.

GLOSSARY

ASHRAE – American Society of Heating, Refrigeration and Air-conditioning Engineers; *See* www.ashrae.org

ASTM - American Society of Testing and Materials; *See* www.astm.org

Biodiversity – The degree of variety of life forms within a given ecosystem

Biomass - All materials of recent plant or animal origin such as trees, grass etc.

Black water – Water which has been contaminated with toilet waste

BREEAM – BRE (Building Research Establishment, UK) Environmental Assessment Method; *See* www.breeam.org

Brownfield site - Abandoned or underused industrial and commercial facilities available for re-use

Building envelope - Outer structure of a building (walls, doors, windows, roof and floor), also called building shell

Built environment - The man-made surroundings that provide the setting for human activity, ranging from personal shelter to neighbourhoods to the large-scale civic surroundings

Carbon dioxide (CO_2) – Odourless gas which is commonly created by respiration and combustion and is created by the oxidation of carbon based substances; a principal greenhouse gas

Certified assessor – A GREEN$^{SL®}$ Accredited Professional who is independent of the Client, Designer and Contractor engaged directly by GBCSL to undertake the certification of a GREEN$^{SL®}$ Rating Application

CFCs – Chlorofluorocarbons; refrigerants which cause depletion of the Ozone layer when released to the atmosphere

CIBSE - Chartered Institution of Building Services Engineers; *See* www.cibse.org

Climate change – The change which is expected to happen to earth's climate due to human activities such as releasing greenhouse gases to the atmosphere and deforestation

Commissioning – The process of putting Building Services Systems into active service; includes testing and adjusting systems such as HVAC, plumbing and electrical systems and ensuring proper functionality and adherence to design guidelines/standards

Constructed wetlands - Artificial marshes or swamps, created for anthropogenic discharge such as wastewater, storm water runoff or sewage treatment, also commonly as habitat for wildlife

Contaminant – A substance that is not naturally present in the considered environment or that is present in unnatural concentrations or quantities and which can adversely alter such environment

Daylight Factor (DF) – The proportion of internal illuminance compared to the external illuminance, expressed as a percentage; represents the percentage of external which illuminates a given internal surface

Greenfield site – A land which has not been previously used for developments; undeveloped land

Greenhouse Gases (GHG) – Gases that create Greenhouse Effect by trapping lower energy infrared radiation; CO_2, Methane (CH_4), Water vapour, CFCs etc.

Grey water – Waste water which is recovered from showers, washing machines, sinks etc. that does not contain human waste or food

Ground water – Generally used to describe the water that is beneath the earth's surface

Habitat - The area or environment where an organism (animal or plant) or ecological community normally lives or occurs

Hazardous – The nature of a substance that poses substantial or potential threats to public health or the environment; ignitable, corrosive, reactive or toxic

HCFCs - Hydrochlorofluorocarbons; refrigerants which cause depletion of the Ozone layer when released to the atmosphere

Holistic - Relating to or concerned with wholes or with complete systems rather than with the analysis of, treatment of, or dissection into parts; complete

HVAC – Heating, ventilation and air-conditioning

IESNA - Illuminating Engineering Society of North America; *See* www.iesna.org

Integrated fitout – A fitout in which the tenancy design and construction is fully coordinated with the base building design and construction

Kyoto Protocol – An international agreement reached in 1997 in Kyoto, Japan to address issues of climate change

Landfill – (1) An area where solid waste is deposited; (2) The disposal of refuse and other waste material by burying it and covering it over with soil

LEED – Leadership in Energy and Environmental Design; Rating system adopted by USGBC (United States Green Building Council); *See* www.usgbc.org

Life cycle – All stages associated with the life of a product or substance; i.e. design, creation, distribution/sale, installation, use, disposal/reuse/recycle etc.

Life cycle assessment – A holistic assessment of the environmental effects of a product or activity by analysing its full lifecycle

Light pollution – Excess waste light given off by external sources at night

Mechanical ventilation – Ventilation systems which use electrically/mechanically operated air movement devices such as fans to provide ventilation to a building

Natural ventilation – Ventilation carried out by natural means; through windows, louvers, openings in façade etc.

Non-potable water – Water which is not of drinking quality

Non-renewable energy – Energy generated from resources such as fossil fuels which cannot be replaced or restored once it has been used

Ozone (O_3) – A naturally occurring gas made out of tri-oxygen molecules, has an irritating trace and is highly reactive; molecules formed by recombination of oxygen in the presence of ultraviolet radiation

Ozone depletion – Destruction of the ozone layer caused mostly by the photolytic breakdown of certain chlorine and/or bromine containing compounds such as CFCs that catalytically decompose O_3 molecules

Ozone layer – A protective layer in earth's stratosphere made up of ozone and at a level of approximately 24km above earth's surface; absorbs most harmful radiation coming from the sun such as ultraviolet rays and prevents them from reaching the earth's surface

Pollution – The presence in the environment of a substance, which through its chemical composition or quantity, prevents the proper functioning of natural processes and produces undesired health and environmental effects

Post-consumer recycled content – The composition of a product that contains some proportion of material diverted from the waste stream of the product users; excludes re-utilisation of materials such as re-work, re-grind or scrap generated in a process and capable of being reclaimed within the same process that generated it

Potable water – Water that is safe to be consumed; drinking quality water

PVC – Polyvinylchloride

Recyclables – Products or materials which possess the ability to be recovered from or otherwise be diverted from the solid waste stream for the purpose of being recycled

Recycled content – Materials which have been recovered or otherwise diverted from the solid waste stream, either during the manufacturing process (pre-consumer) or after being used by the consumer (post-consumer)

Recycling - The process of collection, separation and often reprocessing of discarded materials for reuse in the form of raw materials or finished goods. “Horizontal Recycling” refers to a process where majority of the original product is recycled into similar products as the original. “Down-cycling” refers to creation of a product of lesser intrinsic value manufactured from a material that had a higher initial end-use value and which is at the end of its service life. “Up-cycling” is a term used to describe the creation of a product with higher intrinsic value manufactured from a material which is at the end of its service life and which had a lower initial end-use value.

Refurbishment - The upgrading of either or both a building’s fabric and/or services with the intention of increasing its ability to attract tenants and to improve its market value; this may happen fully or partially

Relative Humidity (RH) – Ratio as a percentage of the amount of water vapour in the air at a specific temperature to the maximum capacity of the air to hold moisture at that temperature

Remediation – Efforts taken to counteract some or all the effects of a problem (such as pollution) once such problem has occurred

Renewable energy – Energy generated from a source that is continually replenished at a rate greater than or equal to its rate of depletion

SEA – Sri Lanka Sustainable Energy Authority; *See* www.energy.gov.lk

Shell and core – A project where the building is provided to the client in its basic structure and finishes without detailed amenities

SLSI – Sri Lanka Standards Institution; *See* www.slsi.lk

SMACNA - Sheet Metal and Air Conditioning National Contractors Association; *See* www.smacna.org

Sustainable development – An approach to development which caters to the needs of the present without compromising the ability for future generations to be catered for their needs

Thermal comfort – A means of describing occupant comfort taking into consideration factors such as air temperature, radiant temperature, humidity, draught, clothing value and activity rates

Ventilation – The process of supply and removal of air to and from a building space through natural or mechanical means

Virgin materials – Materials that are previously unprocessed

VOC – Volatile organic compounds; organic compounds capable of converting to gaseous phase from either liquid or solid phase

GREEN$^{SL®}$ RATING SYSTEM

FOR EXISTING BUILDINGS

1.0 MANAGEMENT

Prerequisite 1 – Green Building Accredited Professional

Required

Intent

To encourage and recognise the engagement of professionals who can assist the project team with the integration of green building aims and practices into the operations, maintenance and upgrades of existing buildings

Requirements

A principal participant in the certification team is a Green Building Accredited Professional engaged by the building owner, to provide sustainability advice throughout the assessment process.

Ensure that the submission for GREEN$^{SL®}$ certification adheres to all provisions of the submission requirements of GREEN$^{SL®}$ Rating System.

To be deemed engaged, in line with the aim of credit, the Green Building accredited professional must contribute substantially. 100% attendance at all assessment meetings is required.

Potential Technologies & Strategies

The Green Building Accredited Professional must remain assigned to the project throughout the assessment process.

Credit 1.1 – Building Users' Guide

2 Points

Intent

Encourages and recognises information management that enables building users to optimise the building's environmental performance

Requirements

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. It may contain some useful information that will allow the building users to understand features and strategies of green building operation.

Potential Technologies & Strategies

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, Water supply, Sewerage)
- Transport facilities
- Materials and Waste Policies
- Expansion/Re-fit Considerations
- References and Further Information

Credit 1.2 – Environmental Management

2 Points

Intent

Encourages and recognises the adoption of a formal environmental management system in line with the established guidelines during operations of the building

Requirements

The building management team implements a comprehensive, building-specific environmental management plan (EMP).

Potential Technologies & Strategies

The commitment to future provision of the EMP does not meet the credit criteria. The EMP must be fully comprehensive and specified to the building. The GBCSL expect that EMP has been correctly implemented and internal audit trail tracking compliance is evident to ensure that there is ongoing compliance during building operations.

2.0 SUSTAINABLE SITES

Credit 2.1 – GREEN$^{SL®}$ Rated Design and Construction

4 Points

Intent

To reward sustainable building design and construction, thereby facilitating enhanced performance in building operations

Requirements

Demonstrate that the building has been previously rated under GREEN$^{SL®}$ Rating System for Built Environment which facilitates sustainable design and construction of buildings.

Potential Technologies & Strategies

Pursue and achieve GREEN$^{SL®}$ Rating System for Built Environment certification for building design and construction.

Credit 2.2 – Facility Management – Building Exterior and Hardscape Management

2 Points

Intent

To encourage environmentally sensitive building exterior and hardscape management processes to provide a clean and safe building exterior which facilitate high-performance building operations

Requirements

Employ an environmentally sensitive, low-impact management process which minimises the usage of harmful chemicals and reduces energy use, water use and solid waste output. The following operational elements must be addressed:

- Maintenance equipment
- Cleaning of building exterior
- Cleaning of pavements and other hardscapes
- Paints and sealants used for building exterior

Potential Technologies & Strategies

During the performance period, have in place a low-impact site and building exterior management plan that addresses building exterior cleaning and maintenance covering maintenance equipment, cleaning equipment, etc.

Credit 2.3 – Facility Management – Outdoor Integrated Pest Management, Erosion Control and Landscape Management

2 Points

Intent

To preserve natural integrity, enhance natural diversity and protect wildlife while facilitating high-performance building operations and integration into the surrounding landscape

Requirements

Employ an environmentally sensitive management process to preserve the site's natural components. Minimise the usage of harmful chemicals, energy use, water use, air pollution, solid waste and/or chemical runoff (e.g. oil, gasoline). The following operational elements must be addressed:

- Outdoor integrated pest management which requires the use of least toxic chemical pesticides, minimum use of chemicals, use only in targeted locations and only for targeted species together with routine inspection and monitoring
- Sediment and erosion control for ongoing landscape operations and future construction activities which conforms to the best engineering practices specified by The Institute for Construction Training and Development (ICTAD) – Protection of Landscape during Construction. Measures to prevent erosion, sedimentation and air pollution from dust or particulate matter and to restore eroded areas should be included
- Chemical fertiliser use which can be minimised by using locally adapted plants that require no artificial fertiliser, less-polluting

alternatives to artificial chemicals or other low-impact maintenance practices.

Potential Technologies & Strategies

During the performance period, have in place a low-impact site and building exterior management plan that addresses overall site management, chemicals, fertilisers, landscape waste and pest management. Include green landscape management practices such as reducing the use of power equipment, improving storm water control, using fertiliser only as needed, composting landscape waste, applying integrated pest management, creating wildlife habitat, removing or not installing invasive plants, protecting natural areas and using plants to reduce heating and cooling needs.

Credit 2.4 – Alternative Transportation

2-3 Points

Intent

To reduce pollution from automobile use by encouraging green vehicles and discouraging over-provision of car parking capacity

Requirements

Credit 2.4.1 Low-Emitting and Fuel Efficient Vehicles (2 Points)

Provide preferred parking for low-emitting and fuel efficient vehicles for 5% of the total car parking spaces.

"Preferred parking" refers to the parking spaces which are closest to the main entrance (exclusive of spaces designated for disabled or parking permits provided at a discounted price).

Credit 2.4.2 Parking Capacity (1 Point)

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

Potential Technologies & Strategies

Encourage the use of public transport, fuel efficient vehicles (e.g. hybrid vehicles) and the use of cycles. Consider sharing parking facilities with adjacent buildings and alternatives that will limit the use of single occupied vehicles. Provide preferred parking spaces for fuel efficient vehicles and car pools. Make use of organisational resources to

communicate with building occupants about alternative transportation options and benefits, and facilitate communication among building occupants for coordinating ride sharing.

Credit 2.5 – Protect or Restore Open Habitat

1 Point

Intent

To conserve existing natural areas and restore damaged areas that provide habitat and promote biodiversity

Requirements

Ensure native or adapted vegetation covering of 25% of the total site area (excluding the building footprint) or 5% of the total site area (including the building footprint), whichever is greater.

Improving and/or maintaining off-site areas with native or adapted plants can contribute toward earning this credit provided the improvement and maintenance are documented in a contract with the owner of the off-site area. Every 2 square meters off-site can be counted as 1 square meter on-site.

Potential Technologies & Strategies

Perform a site survey to identify site elements and adopt a master plan for development of the building site. Excessive paved areas can be replaced with landscaped areas and/or natural landscaped features. Select and maintain indigenous plant species for site restoration and landscaping.

Credit 2.6 – Storm Water Design – Quantity Control

2 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 discharge rate to 40mm per hour[1].

OR

If existing imperviousness is greater than 50%:

Implement a storm water management plan that prevents the post-development discharge rate to 50mm per hour.

Potential Technologies & Strategies

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, car washing and other uses.

[1] Peak rainfall intensity of 75mm per hour shall be considered for storm water design

Credit 2.7 – Storm Water Design – Quality Control

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 non-structural 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

2 Points

Intent

To reduce heat islands (thermal gradient differences between developed and undeveloped areas) to minimise impacts on microclimates and human and wildlife habitats

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 landscape installation, landscaping (trees) must be placed at the time of application for GREEN$^{SL®}$ certification
- 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

2 Points

Intent

To reduce heat islands (thermal gradient differences between developed and undeveloped areas) to minimise impacts on microclimates and human and wildlife habitats

Requirements

Option 1

Use roofing materials having an 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

Minimise light trespass from the building and site, reduce sky-glow to increase night sky access, improve night time 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 10 p.m. and 5 a.m. After-hours override may be provided by a manual or occupant-sensing device, provided that 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 lux (both horizontal and vertical) 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 luminance value no greater than 1.0 horizontal and vertical lux at the site boundary and no greater than 0.1 horizontal lux 3m 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 lux (both horizontal and vertical) 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 lux (horizontal and vertical) 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. Minimise 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 Performance Measurement

1-2 Points

Intent

To encourage measuring and monitoring of building and subsystem water performance to understand consumption patterns and identify opportunities for additional water savings

Requirements

Credit 3.1.1 Measure Total Water Consumption of the Building

(1 point)

Have in place permanent water metering to measure the total potable water use for the entire building and site. Meter data must be recorded on a regular basis and compiled into monthly and annual summaries. Metering grey or reclaimed water supplied to the building is also encouraged.

Credit 3.1.2 Measure Water Usage of Building Subsystems

(1 point)

Have in place permanent metering for water systems serving at least 80% of the following subsystems.

- Irrigation
- Indoor plumbing fixtures and fittings
- Cooling towers

- Domestic hot water
- Other process water such as humidification systems, dishwashers, clothes washers, pools, etc.

Meters must measure potable water use, but grey or reclaimed water use may also be measured to meet the requirements of this credit. Metering must be continuous and data should be logged for analysis. Monthly and annual summaries of records for each subsystem metered must be compiled.

Potential Technologies & Strategies

Install building-level and subsystem level water meters to measure and track total potable water consumed by the facility and by specific subsystems. Prioritise subsystems that consume largest amounts of potable water and identify measures for water savings.

Credit 3.2 – Water Efficient Landscaping

2-4 Points

Intent

To limit or eliminate the use of potable water for landscape irrigation

Requirements

Credit 3.2.1 Reduce Potable Water Consumption (2 Points)

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

Credit 3.2.2 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 storm water or treated grey water, and/or condensed air condition water for irrigation. Note that invasive plants may grow due to the use of grey water for irrigation. Thus, under no circumstance should colonization of non-indigenous and/or invasive plants be encouraged.

Credit 3.3 – Water Efficiency in Air-conditioning System

1 Point

Intent

To limit or eliminate the use of potable water for Air-conditioning make-up while using of condense water for irrigation

Requirements

Reduce potable water consumption for air-conditioning make-up by 50%. Use at least 50% of condensed air conditioning water for irrigation.

Potential Technologies & Strategies

Select water efficient chillers and cooling towers 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 grey water generated within the site for air-conditioning make-up.

Credit 3.4 – Innovative Wastewater Technologies

2-4 Points

Intent

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

Requirements

Credit 3.4.1 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 3.4.2 Harvested Rainwater (2 Points)

Use harvested rainwater in toilet flushing and reduce 50% of potable water use 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 septic tanks,

soak-away systems, 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 3.5 – Water Use Reduction

2-4 Points

Intent

To further increase the water efficiency within buildings in order to reduce the burden on National Water Supply and Drainage Board NWS&DB water supply and wastewater systems

Requirements

Employ strategies that 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 litres per flush (litres/flush) Except blow-out fixtures: 12 (lpf)
Commercial urinals	4.0 (lpf)
Commercial toilet (restroom) faucets	9 litres per minute(l/min) at 4 bar, private applications only (hotel or motel guest rooms, hospital patient rooms) 2 (lpm) at 4bar all others except private applications 1 litres 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, grey 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. Use foot operated or electronic sensing valves for water fixtures.

Credit 3.6 – Innovative Water Transmission

1 Point

Intent

To limit the use of non-renewable energy for water transmission

Requirements

Reduce 50% of non-renewable energy consumption in water transmission by using renewable energy including solar, wind, low-impact hydro, and bio gas strategies.

Potential Technologies & Strategies

Select localised water sources such as springs, streams, groundwater for water transmissions which are low energy systems compared with systems having long water transmission pipelines.

Optimise the energy use in water distribution by adopting direct pressure boosting systems incorporating variable speed drives, multiple pump systems, etc.

Use wind pumps, ramp pumps and solar powered pumps for smaller installations, especially for ground water abstraction.

4.0 ENERGY & ATMOSPHERE

Prerequisite 1 – Minimum Energy Performance

Required

Intent

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

Requirements

The building must 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)

Building 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

Adopt energy saving techniques to maximize energy performance of the building envelope, HVAC, lighting and other systems. 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 Sri Lanka, published by the 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 at www.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 2 – CFC Reduction in HVAC&R Equipment

Required

Intent

To reduce ozone layer depletion

Requirements

Zero use of CFC-based refrigerants in newly installed HVAC & R base building systems. When reusing existing base building HVAC equipment, demonstrate a comprehensive CFC phase-out plan.

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.

Credit 4.1 – Optimise Energy Performance

1-10 Points

Intent

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

Requirements

Select one of the three compliance path options described below. Project teams documenting achievement using any 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

Reduction	Points
5%	1
10%	2
15%	3
20%	4
25%	5
30%	6
35%	7
40%	8
45%	9
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 (such as 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 while 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 Advanced Buildings 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 cost effective 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 United States 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

1-8 Points

Intent

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

Requirements

Supply at least 1% 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
1%	1
2%	2
3%	3
4%	4
6%	5
8%	6
10%	8

Potential Technologies & Strategies

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

Credit 4.3 – Existing Building Commissioning

1-2 Points

Intent

To understand the operation of major energy-utilising systems, to identify major energy saving projects and to implement minor operational improvements in order to ensure optimised energy performance of the building

Requirements

4.3.1 Existing Building Commissioning – Investigation and Analysis (1 Point)

- Conduct an energy audit which meets the requirements of ASHRAE, Level II, Energy Survey and Analysis
- Develop a breakdown of energy consumption in the building
- Identify and evaluate (e.g. cost-benefit analysis) minor and capital improvements which will provide cost-effective energy savings

4.3.2 Existing Building Commissioning – Implementation (1 Point)

- Implement no or low cost operational improvements for optimising energy performance
- Demonstrate the costs and benefits of implemented measures
- Develop a capital plan for major retrofits and upgrades
- Provide training for management staff to improve awareness and skills related to sustainable building operations including energy efficiency, operations and maintenance of systems and equipment, etc.

- Incorporate necessary updates to the building operating plan to reflect any changes in the occupancy schedule equipment run-time schedule, design set points, lighting levels, etc.

Potential Technologies & Strategies

Conduct an energy audit to understand the energy consumption of building systems and equipment. Identify opportunities for operational and capital improvements for energy saving. Implement no or low cost operational improvements and develop a plan for major upgrades.

Credit 4.4 – Ongoing Commissioning

2 Points

Intent

To use commissioning to address changes in building occupancy, use, maintenance and repair, thereby facilitating periodic adjustments to the building operating systems and procedures for optimal energy efficiency and service provision

Requirements

Create a written plan and implement an ongoing commissioning program covering major building systems. The program should include elements of planning, system testing, performance measurement and verification, preventive maintenance and corrective actions to address operating issues.

Update the building operating plan and system details to reflect any changes in the occupancy schedule equipment run-time schedule, design set points, lighting levels, system specification, etc.

Potential Technologies & Strategies

Develop an ongoing commission program which addresses the ongoing changes and maintenance needs in an existing building.

Credit 4.5 – Ozone Depletion

1 Point

Intent

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

Requirements

Availability of 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, utilise base building HVAC and refrigeration systems for the refrigeration cycle that minimises 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. Utilise fire suppression systems that do not contain HCFCs or Halons.

Credit 4.6 – Performance Measurement – Sub-Metering

1 Point

Intent

To provide the energy consumption details of sub systems and tenants in order to facilitate energy management and identify opportunities for energy saving

Requirements

Provide system/floor/tenancy level sub-metering for at least 60% of the total expected energy consumption. Permanent metering and recording are required.

Develop a breakdown of energy consumed by the major mechanical systems and other end-use utilising energy bills data, energy audits, spot metering, etc. and make sure that the largest energy-use categories are covered by at least 60% from sub-metering.

Potential Technologies & Strategies

Identify the energy consumption of key sub-systems of the building and develop a metering plan to capture the most significant energy loads. Use the metering output to identify any changes in consumption and opportunities for energy-saving improvements.

Credit 4.7 – Performance Measurement – Building Management System

1 Point

Intent

Provide the building energy consumption information for ongoing accountability and to identify opportunities for energy savings

Requirements

Have in place a computer-based building management system (BMS) to monitor and control major building systems, including at a minimum, heating, cooling, ventilation and lighting. Demonstrate that the BMS is being used to inform decisions regarding changes in building operations and energy-saving investments.

Potential Technologies & Strategies

Install and/or maintain a BMS to automatically control key building systems. Ensure that relevant staff are adequately trained to use the system, analyse output, make necessary adjustments and identify investment opportunities to improve energy performance.

Credit 4.8 – Green Power

1 Point

Intent

To encourage investments in off-site renewable energy technologies for export purposes 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 because of the rated building and should be 50 % of the building consumption. Therefore, the green power 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 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 – Solid Waste Management Policy

Required

Intent

To facilitate the reduction of waste generated by building occupants that are hauled to and disposed in landfills

Requirements

Have in place a solid waste management policy for the building addressing the requirements of the credits for solid waste management.

This prerequisite requires only policies, not ongoing actual sustainable performance.

Potential Technologies & Strategies

Evaluate the waste output of the building and establish policies to minimise the amount of waste disposed in landfills by encouraging waste reduction, reuse and recycling, where possible.

Prerequisite 2 – Sustainable Purchasing Policy

Required

Intent

To encourage the use of low-impact materials in the operations and maintenance of buildings

Requirements

Develop an environmentally preferable purchasing policy that covers product purchases within the building and site management's control addressing the requirements of the credits for sustainable purchasing.

This prerequisite requires only policies, not ongoing actual sustainable performance.

Potential Technologies & Strategies

Evaluate the purchasing requirements of the building, identify more environmentally friendly alternatives and establish a policy to purchase such products when economically feasible.

Credit 5.1 – Solid Waste Management – Waste Stream Audit

1 Point

Intent

To facilitate the reduction of waste generated by building occupants and building operations that are hauled to and disposed in landfills

Requirements

Conduct a waste stream audit of the ongoing consumable waste generated during the occupancy stage of a building in order to identify and quantify types of waste generated. Establish baselines for different waste streams and recognise opportunities for recycling and waste diversion.

Potential Technologies & Strategies

Collect and evaluate information on the types and quantities of waste generated in the building to facilitate waste reduction, recycling and waste diversion.

Credit 5.2 – Solid Waste Management – Ongoing Consumables

1-2 Points

Intent

To facilitate the reduction of waste generated from the use of ongoing consumable products by building occupants and building operations that are hauled to and disposed in landfills

Requirements

Option 1 - For 25% Reuse and Recycling (1 Point)

Reuse, recycle or compost 25% of the ongoing consumables waste stream (by weight or volume).

OR

Option 2 - For 50% Reuse and Recycling (2 Points)

Reuse, recycle or compost 50% of the ongoing consumables waste stream (by weight or volume).

Potential Technologies & Strategies

Maintain a waste reduction, reuse and recycling programme for products which are regularly used and replaced through the course of business. These materials include paper, toner cartridges, glass, plastics, cardboard and old corrugated cardboard, food waste and metals.

Credit 5.3 – Solid Waste Management – Durable Goods

1-2 Points

Intent

To facilitate the reduction of waste generated from the use of durable goods by building occupants and building operations that are hauled to and disposed in landfills

Requirements

Option 1 - For 25% Reuse and Recycling (1 Point)

Reuse, recycle or compost 25% of the waste stream generated from durable goods (by weight or volume).

OR

Option 2 - For 50% Reuse and Recycling (2 Points)

Reuse, recycle or compost 50% of the waste stream generated from durable goods (by weight or volume).

Potential Technologies & Strategies

Maintain a waste reduction, reuse and recycling program for goods which are replaced infrequently and/or may require capital allocations to purchase. Durable goods include office equipment (computers, monitors, copiers, printers, scanners, fax machines), appliances (refrigerators, dishwashers, water coolers), external power adapters, televisions, etc.

Credit 5.4 – Solid Waste Management – Facility Alterations and Additions

1 Point

Intent

To divert construction and demolition debris from disposal to landfills. Redirect recyclable resources back to the manufacturing process and reusable materials to appropriate uses

Requirements

Divert at least 50% of waste (by volume) generated by facility alterations and additions from disposal to landfills. This applies only to base building elements permanently or semi-permanently attached to the building itself that enter the waste stream during facility renovations, demolitions, refits and new construction additions. Base building elements include at a minimum, building components and structures, attached finishings including carpet and other flooring material, adhesives, sealants, paints and coatings.

Furniture, fixtures and equipment, mechanical, electrical and plumbing components and items such as elevators are not considered base building elements and are excluded from this credit.

Potential Technologies & Strategies

Maintain a waste reduction, reuse and recycling program for any facility alterations and additions occurring on the site. Make source reduction an integral part of the plan to reduce solid waste. Identify markets for salvaged materials and employ salvage and recycling strategies and processes. Document the cost for recycling, salvaging and reusing materials.

Credit 5.5 – Sustainable Purchasing – Ongoing Consumables

1-2 Points

Intent

To reduce the environmental impacts of the materials acquired for use in the ongoing operations and maintenance of buildings

Requirements

Maintain a sustainable purchasing program for ongoing consumables, which are regularly used and replaced through the course of business.

Criteria for sustainable purchases include:

- Purchases containing at least 10% postconsumer and/or 20% post-industrial material
- Purchases containing at least 50% rapidly renewable material
- Purchases containing at least 50% locally sourced materials (manufactured in Sri Lanka)
- Purchases consisting of at least 50% of recycled paper products
- Purchases of rechargeable batteries and/or refillable cartridges

Option 1 - For 25% Sustainable Purchases (1 Point)

Achieve sustainable purchases of 25% (by cost) during the performance period.

OR

Option 2 - For 50% Sustainable Purchases (2 Points)

Achieve sustainable purchases of 50% (by cost) during the performance period.

Potential Technologies & Strategies

Specify materials and supplies meeting above criteria when purchases are made.

Credit 5.6 – Sustainable Purchasing – Durable Goods

1 Point

Intent

To reduce the environmental impacts of the materials acquired for use in the long term operations of buildings

Requirements

Maintain a sustainable purchasing program for durable goods, which are replaced infrequently and/or may require capital allocations to purchase, including electric equipment and furniture. Achieve sustainable purchases of 40% (by cost) during the performance period.

Criteria for sustainable purchases include:

- Purchases containing at least 10% postconsumer and/or 20% post-industrial material
- Purchases containing at least 70% material salvaged from off-site or outside the organisation
- Purchases containing at least 70% material salvaged from on-site, through an internal organisation materials and equipment reuse program
- Purchases containing at least 50% rapidly renewable material
- Purchases containing at least 50% certified wood
- Purchases containing at least 50% locally sourced materials (manufactured in Sri Lanka)

Potential Technologies & Strategies

Specify materials and supplies meeting above criteria when purchases are made.

Credit 5.7 – Sustainable Purchasing – Facility Alterations and Additions

1 Point

Intent

To reduce the environmental impacts of the materials acquired to be used in additions and alterations to existing buildings

Requirements

Maintain a sustainable purchasing program to cover materials used for facility renovations, demolitions, refits and new construction additions. This applies only to base building elements permanently or semi-permanently attached to the building itself. Achieve sustainable purchases of 40% (by cost) during the performance period.

Criteria for sustainable purchases include:

- Purchases containing at least 40% GREEN$^{SL®}$ Labelling System (GLS) certified building materials and products
- Purchases containing at least 10% postconsumer and/or 20% post-industrial material
- Purchases containing at least 70% material salvaged from off-site or outside the organisation
- Purchases containing at least 70% material salvaged from on-site, through an internal organisation materials and equipment reuse program
- Purchases containing at least 50% rapidly renewable material
- Purchases containing at least 50% certified wood

- Purchases containing at least 50% locally sourced materials (manufactured in Sri Lanka)

Potential Technologies & Strategies

Specify materials and supplies meeting above criteria when purchases are made.

6.0 INDOOR ENVIRONMENTAL QUALITY

Prerequisite 1 – Minimum IAQ Performance

Required

Intent

To prevent the development of indoor air quality (IAQ) problems in the building in order to establish a minimum IAQ standard, 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 produced 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 health of occupants. 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 area at least 10m 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 area at least 10m 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 sufficient exhaust 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 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 measurements, with a minimum of one measurement every 10 seconds, of the differential 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 in transporting 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 area at least 10m 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,

In the 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). 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 while designing the building envelope and systems to minimise ETS transfer among dwelling units.

Credit 6.1 – Outdoor Air Delivery Monitoring

1 Point

Intent

To provide capacity for ventilation system monitoring in order to help sustain the occupant's comfort and well-being

Requirements

Availability of 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 the 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 $100m^2$). CO_2 monitoring locations shall be between 1m and 2m 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 1m and 2m 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 Management System (BMS) 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

Availability of natural ventilation systems for occupied spaces which 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 Figure 1.18 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
- Analyse 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 – Low-Emitting Materials for Facility Alterations and Additions

1 Point

Intent

To reduce the quantity of indoor air contaminants which are odorous or potentially irritating and harmful to the comfort and well-being of building occupants

Requirements

Adhesives and Sealants

All adhesives and sealants used on the interior of the building during alterations, additions and retrofits (defined as inside of the weatherproofing system and applied on-site) shall comply with the following requirements.

Table 6.1

Architectural Applications	VOC Limit
Indoor Carpet Adhesives	50
Carpet Pad Adhesive	50
Timber 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 Timber) (Except Timber)	50
Timber	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

AND

Paints, Coatings and Carpet Systems

Paints and coatings used on the interior of the building defined as inside of the weatherproofing system and applied on-site shall not exceed the VOC (Volatile Organic Compounds) 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 Timber Finishes -	
Varnish	350
Lacquer	550
Floor Coatings	100
Stains	250
Sealers - **Waterproofing Sealer** **Sanding Sealer** **Other Sealers**	 250 275 200

AND

Composite Timber and Agrifiber Products

Composite timber and agrifiber products used on the interior of the building during construction additions and alterations to existing buildings must contain no added urea-formaldehyde resins. Composite timber and agrifiber products are defined as: particleboard, medium density fibreboard (MDF), plywood, strawboard, panel substrates and door cores.

Potential Technologies & Strategies

Provide low-VOC material specifications when purchasing. Ensure that VOC limits are clearly stated where adhesives, sealants, paints, coatings, carpet systems and composite timber are addressed.

Credit 6.4 – Green Cleaning Program

2 Points

Intent

To minimise the exposure of building occupants and maintenance staff to potentially hazardous chemical, biological and particulate contaminants that adversely affect air quality, human health and the environment

Requirements

Have in place a high performance cleaning program that addresses the following.

- Provide an appropriate staffing plan
- Implement training for maintenance staff regarding hazards, use, maintenance, disposal and recycling of cleaning chemicals, dispensing equipment and packaging
- Establish standard operating procedures for effective indoor cleaning
- Promote utilisation of sustainable cleaning materials, products and equipment with minimum environmental and air quality impacts
- Promote the usage of appropriate chemical concentrates to minimise chemical use wherever possible
- Provide guidelines for safe handling and storage of cleaning chemicals used in the building, including a plan for managing hazardous spills or mishandling incidents
- Provide for collecting occupant feedback to evaluate new technologies, procedures and processes for continuous improvement

Potential Technologies & Strategies

Employ a high-performance cleaning program addressing staffing, cleaning procedures and processes, minimising hazardous material usage, safe handling of hazardous materials, etc.

Credit 6.5 – Indoor Integrated Pest Management

1 Point

Intent

To minimise the exposure of building occupants and maintenance staff to potentially hazardous chemical, biological and particulate contaminants

Requirements

Develop, implement and maintain an Indoor Integrated Pest management (IPM) plan for managing indoor pests in a way that protects human health and the surrounding environment using least-toxic chemical pesticides, minimum use of chemicals, using only in targeted locations and only for targeted species. IPM requires routine inspection and monitoring and should be integrated with any outdoor IPM plan used for the site as appropriate.

IPM should include a communications strategy which requires advance notice to building occupants of not less than 72 hours before a pesticide under normal conditions and 24 hours before application of a pesticide in emergencies, other than a least-toxic pesticide, is applied in a building.

Potential Technologies & Strategies

Use an IPM plan as a safer and less costly option for effective pest management which employs strategies to reduce sources of food, water and shelter for pests in buildings and minimises the use of pesticides.

Credit 6.6 – Indoor Chemical & Pollutant Source Control

1 Point

Intent

To minimise the exposure of building occupants to potentially hazardous particulates and chemical pollutants

Requirements

Minimise 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 organisation. 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 isolated exhaust 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 contaminant handling units that 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 6.7 – Controllability of Systems

1-2 Points

Intent

To 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) in order to promote the productivity, comfort and the well-being of building occupants.

Requirements

Credit 6.7.1 Lighting Controls (1 Point)

Availability of individual lighting controls for 90% (minimum) of the building occupants to enable adjustments such that individual task needs and preferences are suited.

AND

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

Credit 6.7.2 Comfort 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 controls for 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 6.8 – Thermal Comfort Monitoring

1 Point

Intent

To provide a comfortable thermal environment that supports the productivity and well-being of building occupants

Requirements

Maintain a system for continuous tracking and optimisation of systems that regulate indoor comfort and conditions (air temperature, humidity, air speed and radiant temperature) in occupied spaces. Have a permanent monitoring system to ensure ongoing building performance to the desired comfort criteria as determined by ASHRAE standard 55-2004, Thermal Comfort Conditions for Human Occupancy. This credit may be earned by meeting the requirements of International Organization for Standardisation (ISO) 7730, Ergonomics of the thermal environment as well.

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 monitoring and corrective action systems.

Credit 6.9 – Occupancy Comfort Survey

1 Point

Intent

To facilitate evaluation of building occupants' comfort in relation to thermal comfort, indoor air quality, acoustics, lighting levels, building cleanliness and other comfort issues

Requirements

Conduct an occupancy comfort survey to collect anonymous responses about thermal comfort, acoustics, IAQ, lighting levels, building cleanliness and other occupant comfort issues. A representative sample of building occupants amounting to at least 30% of the total occupants should participate in the survey. The survey should include an assessment of overall satisfaction with building performance and identification of any comfort-related problems.

Document survey results and develop a plan for corrective actions to address comfort issues identified by more than 20% of occupants.

Potential Technologies & Strategies

Occupancy surveys are essential for identifying and addressing occupants' comfort and building performance issues. Develop a plan for corrective action to address any identified problems or concerns.

Credit 6.10 – Daylight & Views

1-2 Points

Intent

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

Requirements

Credit 6.10.1 Daylight (1 Point)

Ensure 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.

Credit 6.10.2 Views (1 Point)

Ensure a 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 IN OPERATIONS

7.1 Innovation in Operations

1-6 Points

Intent

To provide building operations and maintenance teams the opportunity to be awarded points for exceptional performance above the requirements set by the GREEN$^{SL®}$ Rating System for Existing Buildings and/or innovative performance in green building features not specifically addressed in the GREEN$^{SL®}$ Rating System for Existing Buildings.

Requirements

Credit 7.1.1 Innovation in Operations (1-3 Points)

Achieve significant, measurable environmental performance using a strategy not addressed in GREEN$^{SL®}$ Rating System for Existing Buildings. Each strategy earns 1 point and up to 3 points in total.

Credit 7.1.2 Exemplary Performance (1-3 Points)

Achieve exemplary performance for a prerequisite or a credit in GREEN$^{SL®}$ Rating System for Existing Buildings. 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 and up to 3 points in total.

Potential Technologies & Strategies

Implement and maintain actions capable of providing added environmental benefits. These can be actions which substantially exceed the credit requirements of GREEN$^{SL®}$ Rating System for Existing Buildings or actions which are not addressed in the rating system.

8.0 SOCIAL & CULTURAL AWARENESS

Prerequisite 1 – Archaeological Sites & Heritage Buildings

Required

Intent

To protect archaeological sites and heritage buildings by avoiding building constructions, renovations, additions and alterations which may affect the cultural identity and the heritage value of the site.

Requirements

Do not have buildings, roads or parking areas on sites defined 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 building designs within an archaeological site shall be approved by a panel of Qualified Archaeologist, Chartered Architects and Chartered Engineers, jointly appointed by the Department of Archaeology, Sri Lanka Institute of Architects and The Institution of Engineers Sri Lanka.

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

Potential Technologies & Strategies

Avoid development on archaeologically sensitive sites and 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

Ensure the buildings 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 realised at different levels – buildings, the community, and society in general. At building level, research on the human benefits of sustainable design shall be centred on three primary topics: health, comfort, and satisfaction.

Requirements

Buildings designed and operated considering the health benefits of an urban lifestyle shall possess 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 Sri Lankan agricultural heritage

Potential Technologies & Strategies

A holistic approach considering the societal health, safety and wellbeing should be taken throughout the lifecycle of a building.

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 neighbourhood settings.

In addition to the social benefits, cultural values of a country are 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 Archaeology such as Kandy, Anuradhapura, Polonnaruwa, Dambulla, etc. are to be designed in accordance with local authority, Urban Development Authority (UDA) and Department of Archaeology guidelines.

Development should conform to the urban design guidelines of the respective areas approved by UDA. Manage 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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