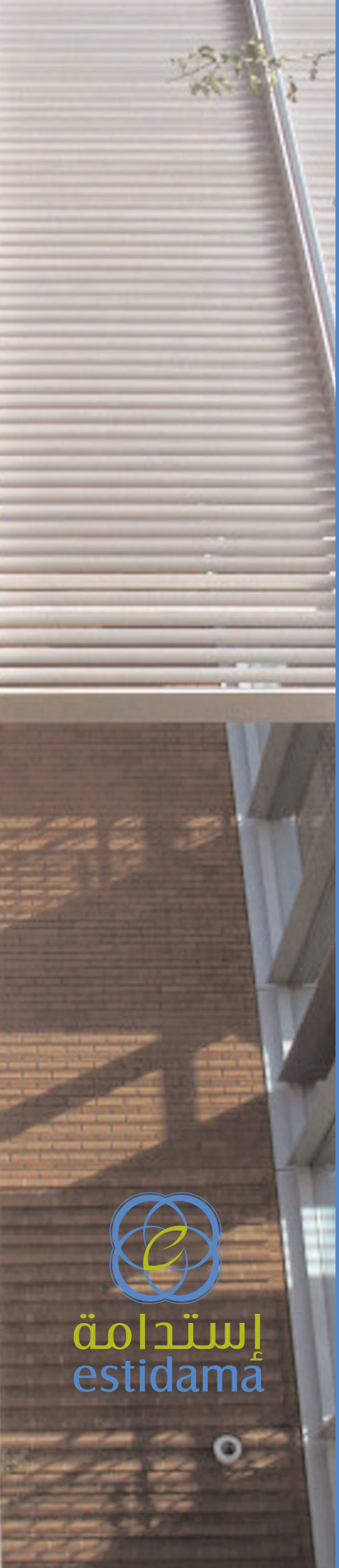

The Pearls Design System

NEW BUILDINGS

Rating Method

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MAY 2009 | UPDATE RELEASE

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The Pearls Design System for the Emirate of Abu Dhabi

RATING METHOD for NEW BUILDINGS

May 2009: Update Release

Prepared by:
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His Highness Sheikh Khalifa bin Zayed Al Nahyan
President of the United Arab Emirates and Ruler of Abu Dhabi

His Highness General Sheikh Mohamed bin Zayed Al Nahyan
Crown Prince of Abu Dhabi, Deputy Supreme Commander of the UAE Armed Forces

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Important Reader Note:

THIS IS AN UPDATE OF THE PREVIEW DRAFT
of the RATING METHOD for NEW BUILDINGS

THIS IS SHARED FOR INDUSTRY REVIEW AND COMMENT ONLY- THE PILOT VERSION WILL BE RELEASED EARLY JUNE

This document is the first public issue of the Rating Method for New Buildings, as part of the overall Pearls Design System. As a working draft, it has been written to *convey the ultimate approach and structure of the rating method.* This means that certain time sensitive elements may read as if they are complete or adopted, vs. the reality that they are in process (for example, the Building Code for the city of Abu Dhabi is being redrafted, while this document refers to it in its final state).

Additionally, this document is the first part of a two part 'suite' of documents – a ***Rating Method*** and a ***Design Guide***. The Design Guide is a helpful companion to the Rating Method providing explanations, strategies and technologies to fulfill the technical requirements of the Rating Method. The Design Guide is currently in development. We anticipate that comments received on the Rating Method will provide further guidance as to the key issues and technical concerns that need to be more fully explained in the Design Guide.

We encourage you to review this document carefully and provide feedback to the UPC no later than 14 August 2009. Comments and questions should be sent to:

Greg Acker
Senior Planning Manager – Estidama
Abu Dhabi Urban Planning Council

Gregory.Acker@upc.gov.ae

The Pearls Development Schedule

The Rating Method for New Buildings and its companion Design Guide are one set of documents for a more complex set of tools that comprise the Pearls Design System (PDS). Please see page 26, for more detailed information on the complete family of documents that will make up the Pearls Design System over the next 2-3 years.

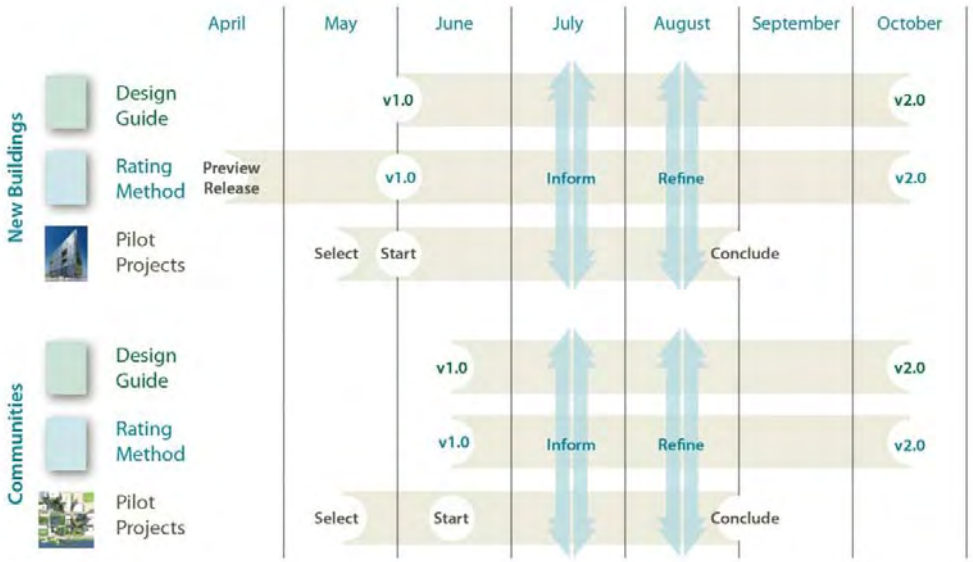
In the immediate future, the process is to complete the Rating Method and Design Guide for New Buildings to a Version 1.0 Stage (working draft), to be primarily used for select group of Pilot Project Testing during summer of 2009.

Following the Pilot Testing phase, lessons learned will be incorporated into the final documents, and the Rating Method and Design Guide will be released for public use as Version 2.0.

The Rating Method and Design Guide for New Buildings is being developed concurrently with a similar set of tools called the Rating Method and Design Guide for Urban Centres, Communities and Neighborhoods.

The following figure graphically displays the 2009 work plan and key milestones for the Pearls Design System:

Figure 1: Pearls Design System Development 2009



Foreword

Abu Dhabi's Plan 2030 demands a clear course for sustainability for any new development occurring in the emirate and Capital city of Abu Dhabi. The tenets of sustainable living in the Middle East are the guiding force behind Estidama. More than just a sustainability program, Estidama is the symbol of an inspired vision for governance and community development. It aspires to create a new mindset for building THE forward thinking global capital.

At the Abu Dhabi Urban Planning Council (UPC), the Pearls Design System is the first tangible outcome of our vision for Estidama. This innovative system has benefited from years of trial and error by other governments and Non-Governmental Organizations (NGOs). While we have sought to listen carefully to what others have learned, we have committed ourselves to creating a sustainable design approach that offers the region a a higher level of building standard that is uniquely tailored to our climate, culture and available resources. This document – ***New Buildings Rating Method*** – is offered for your review and constructive comment.

In developing this rating tool, we have sought to bring forward several innovations.

This New Buildings Rating Method and the forthcoming Communities Rating Method will emanate from a consistent foundation – addressing complex urban and natural system issues concurrently with resource conservation. We present a system that recognizes the adopted currency of measuring sustainability – carbon- with the holistic view of sustainability embedded in living systems strategies.

We have created a tiered approach to recognizing innovation, success and performance. These tiers start with the most basic improvements in conservation and design, and move through increasingly challenging requirements. Ultimately the top tier of achievement is our Fifth Pearl, which offers one of the first systems to reward any initiative that contributes to enhancing the local ecosystem.

Finally, as the Pearls Design System describes actions and performance standards for achieving Estidama, it also provides clear guidance for how we can transform the *process of design and construction*. With this objective in mind, the Estidama Integrative Design Process (EIDP) is another global innovation for the Pearls Design System.

One of the most important legacies of the late Sheikh Zayed bin Sultan Al Nahyan, "Father of the Nation" was the preservation of the Emirates natural environment for future generations. This ***Preview Release*** of the New Buildings Rating Method offers a valuable, practical example of how UPC is partnering with our property development industry, to make Plan 2030's vision - a reality.

Falah Mohamed Al Ahbabi
General Manager
Abu Dhabi Urban Planning Council

Acknowledgements

The Abu Dhabi Urban Planning Council and the staff of the Estidama Program gratefully acknowledge the contributions, comments and suggestions provided by the following organizations and individuals in the development of these documents.

Government Organisations

Executive Affairs Authority
Regulation and Supervision Bureau (RSB)
Department of Municipal Affairs (DMA)
Environment Agency of Abu Dhabi (EAD)
Abu Dhabi Department of Transport (DOT)
Abu Dhabi Authority for Cultural and Heritage (ADACH)
Abu Dhabi Municipality (ADM)

Private Organisations

ARUP
WSP
Atkins
Emirates Green Building Council
Interface Engineering
IES Engineering
EcoSmart Foundation
Wintech Limited
DC Pro Engineering LLC

Finally, we would like to recognise those organizations who have pioneered the development, refined the use of, and created global awareness for high performance buildings and sustainable community development. Without their leadership and contributions, the next generation of thinking represented by the Pearls Design System would not have been possible.

Building Research Establishment, U.K.
U.S. Green Building Council, Washington, D.C., U.S.A.
Green Building Council of Australia.
American Society for Heating Air Conditioning and Refrigeration Engineers U.S.A.
Green Building Challenge

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Section One

THE PEARLS DESIGN SYSTEM BACKGROUND

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The Vision for Estidama

"We cherish our environment because it is an integral part of our country, our history and our heritage. On land and in the sea, our forefathers lived and survived in this environment. They were able to do so only because they recognized the need to conserve it, to take from it only what they needed to live, and to preserve it for succeeding generations.

With God's will, we shall continue to work to protect our environment and our wildlife, as did our forefathers before us. It is a duty, and, if we fail, our children, rightly, will reproach us for squandering an essential part of their inheritance, and of our heritage."

Sheikh Zayed Bin Sultan Al Nahyan, 1998

'Estidama addresses the unique environmental, cultural, social and economic needs of the Middle East today while working to assure all living systems will continue to thrive for generations to come.'

Estidama - Arabic for Sustainability

Twenty years after the Bruntland Commission defined the term sustainability as development that 'meets the needs of the present without compromising the ability of future generations to meet their own needs,'1 many refined definitions, indicators and practices have evolved. In an era where the world's leaders are continually being called upon to address climate change with deliberate actions, Abu Dhabi is no exception. In 2006, Abu Dhabi issued the Initial National Communication to the United Nations Framework Convention on Climate Change as a statement and commitment of the leadership's vision and commitment to sustainability.

In 2008 the leadership of Abu Dhabi seized upon the principles and power of sustainability, while recognizing that the unique cultural, climatic and economic development needs of the region required a more localized definition of sustainability. From this realization, Estidama was born.

Estidama is an aspiration – a desire to achieve a sustainable way of life in the Arab world. This touches all aspects of life in Abu Dhabi – the way we build, the way we live our daily lives, the choices we make as employers and families – all in an effort to attain a sustainable, or even a regenerative state of living. It is not limited to just a rating method. It represents a way of viewing, and respecting, all aspects of life in the Middle East. Estidama embraces the well known concepts and principles of sustainability, and grounds them in the unique social, cultural, and resource needs of the GCC region.

[1] United Nations. 1987 "Report of the World Commission on Environment and Development"

Plan 2030 – The Foundation for Estidama

In 2007, the leadership of Abu Dhabi embarked on a visionary and progressive journey to create a vision for defining how a contemporary, Arab capital should look, and more importantly, how it could live. The result of this landmark process was Plan Abu Dhabi 2030 and Plan Al Ain 2030 – documents that presented a vision and supporting policies for guiding Abu Dhabi's rapid growth in a more managed and sustainable manner.

Plan 2030 was built upon five core principles. These overarching concepts form the foundation for the Plan's policies. These five principles are:

- Abu Dhabi will be a ***contemporary expression of an Arab city***, which has people living, doing, and thriving in healthy supportive proximity to each other
- Abu Dhabi will continue its ***practice of measured growth*** reflecting a sustainable economy, rather than an uncontrolled growth
- Abu Dhabi will respect, be scaled to, and ***shaped by the natural environment*** of sensitive coastal and desert ecologies
- Abu Dhabi will ***manifest its role and stature as a capital city***
- Abu Dhabi's urban fabric and community infrastructure will ***enable the values, social arrangements, culture and mores of this Arab community***

Figure 2: The Abu Dhabi 2030 and Al Ain 2030 Plans

Measuring Estidama – Key Performance Indicators

These five principles from Plan 2030 are connected to Estidama through a series of key performance indicators that will help Abu Dhabi's leadership continually assess how successfully its policies, investments and management of new development is moving the Emirate towards Estidama.

These indicators provide a snapshot of the performance of the Emirate in recognizable terms that planners, policy makers and even average citizens can use to gauge the level of progress being made toward a more sustainable future. When viewed together, these indicators provide a 'scorecard' for Abu Dhabi's movement towards attaining Estidama. It will also provide a helpful mechanism to assess Abu Dhabi's progress relative to other cities across the globe that leadership considers peer or role model cities. The indicators at this time include:

- Biodiversity index for the emirate, which aggregates species diversity and richness into a single index that is solid indicator of habitat conservation and regeneration
- Water use per person, in liters, per year, averaged over the entire emirate
- Energy use per person, in kwh, per year, averaged over the entire emirate
- Mobility index which includes a combination of km traveled per person, transit usage rates and fuel efficiency of various modes of transport
- Carbon footprint or metric tCO2e per person, per year, averaged over the entire emirate
- Education index which includes a combination of test scores, number of children in public education and degrees conferred within the Emirate
- Health index which includes a combination of environment related disease incidence, obesity rates, lifespan
- Quantity of household waste generated per person per year, in Kg of household waste per person per year.

Depending on the issue, some credits will be provided with alternative compliance paths using either prescriptive or performance assessment options. Prescriptive options provide numerical specifications of acceptable solutions, performance options rely on projects to use more sophisticated modelling evidencing submissions to meet or determine benchmarks

These indicators will be used by the Urban Planning Council of Abu Dhabi, as well as other agencies[2] to continually monitor progress and assess the potential benefits and/ or impacts of new development proposals.

[2] Three of these indicators are the same KPI's identified by the EAD in their 2007 Sustainability Reporting mechanism for compliance with Global Reporting Initiative.

Partnering for Estidama – Abu Dhabi's Leading Agencies and Organisations

Following release of Plan 2030, a number of programs and initiatives have been undertaken by Abu Dhabi's diverse regulatory and policy agencies. While each agency's scope and focus is slightly different, when their collective efforts are examined together, a clear path for moving the Emirate closer to achieving Estidama is clear.

The programs and initiatives range from practical regulations for water and energy conservation, to qualitative efforts to improve public education or the character of the public realm. Some of the most notable efforts include:

The **Environment Agency of Abu Dhabi's** *Water Resources Master Plan* to reduce growth's impact on precious resources

The **Department of Transportation'**s efforts at developing a world class transit network to reduce automobile dependency through the *Surface Transport Master Plan*

The **Department of Municipal Affairs** redrafting of the local building code to shape the nature of new construction in the region and make even basic construction more energy and water efficient.

The **Abu Dhabi Educational Council's** new schools program that will provide a new generation of state-of-the-art learning centres for future generations.

The **Abu Dhabi Authority for Cultural History** undertaking its *2008-2012 Strategic Plan* for the protection of culture and heritage.

The **Abu Dhabi Department of Planning and Economy'*s*** long-term economic vision: the *Abu Dhabi Vision 2030* to promote the economic diversification away from heavy reliance on oil and gas within the economy.

The **Regulation and Supervision Bureau's** licensing requirements and new standards controlling the use and potential application of reclaimed water

The MASDAR Initiative designed to explore, develop and commercialize future energy sources that will leverage investment globally. This includes the highly awaited carbon free, zero waste, car free city near Abu Dhabi

The **Emirate Wildlife Society's** evocative *Heroes of the UAE* program, to bring awareness and education to families about the potential impact minor lifestyle modifications can bring to resource consumption in the UAE

Achieving Estidama – The Role of the Urban Planning Council

Since 2007, the Abu Dhabi Urban Planning Council has played a leadership role for moving the emirate closer to Estidama, through its mandate for shaping the form and character of the built environment. UPC's has played the leading role for the development of several significant tools that will shape the future character, form and sustainability of new development throughout the emirate. These include:

Plan 2030 for Al Ain and Plan 2030 for the Western Region – following on the significant impact and success of Plan Abu Dhabi 2030, the UPC had led two similar efforts for creating vision plans and urban structure plans for Al Ain, the emirate's second largest city, and the Western Region - a significant area of vast natural resources, small towns and unique potential offerings for long term economic stability

Urban Streets Design Manual - in conjunction with the Department of Transportation, UPC has developed an important manual for the future design of public streets and pedestrian ways. This document provides much needed tools and information to assure that vehicular traffic is accommodated to an appropriate level throughout the emirate's urban environment, without compromising pedestrian safety or convenience or the character of the surrounding neighborhoods

Coastal Development Guidelines – these guidelines provide valuable information for developers seeking to create new development proximate to some of Abu Dhabi's most sensitive natural resource areas - the shoreline ecotone adjoining the Arabian Gulf

Development Management Process (DMaP) – provides strategies, regulations and guidelines for the shape and character of all new development occurring within the Abu Dhabi Urban Growth Boundary

The Pearls Design System for Estidama – The Pearls Design System's central purpose is to create a set of instructive documents available to public and private users seeking to develop real estate consistent with the principles of Estidama. *The document you are currently reading is part of the Pearls Design System, hereinafter referred to as the PDS.*

The Pearls Design System Explained

The PDS was created in 2009. Initial Design Guides and Rating Methods have been developed for three primary types of development. These include:

- Urban Centres, New Communities and Neighborhoods
- New Buildings
- Existing Buildings

The PDS for Estidama is a family of related documents that provide educational guidelines to detailed requirements for rating a project's achievement of sustainability. When all of the documents are used together, they provide a useful toolkit for helping designers and developers make the Emirate of Abu Dhabi a model of sustainability in the Arab world.

Estidama and the Built Environment is an overview document that provides important context regarding sustainability in Abu Dhabi, while offering a deeper understanding of the resource imperatives facing the emirate today. It also describes why contemporary methods of design and construction are unsustainable. The document further explains, using a series of forecasted scenarios, how the standards established by the Pearls Rating Method will lead to a more sustainable future for the emirate.

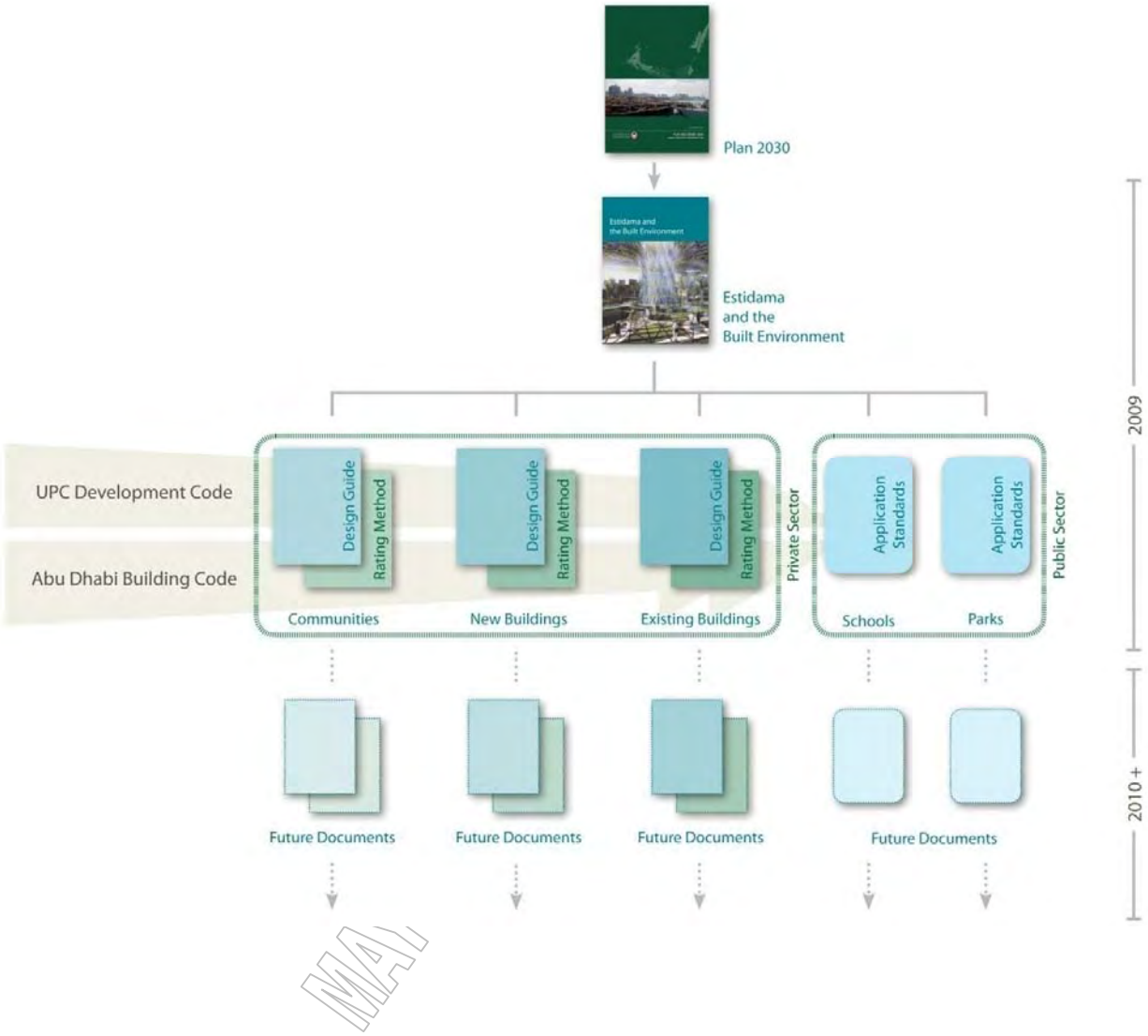
The **Design Guide** contains detailed information on how to design in a more sustainable manner and important resources and references to assist in your work. It is meant to serve as a valuable resource for designers, developers and even review agencies in understanding the essential elements of creating more sustainable buildings. While the Design Guide provides a valuable companion to the Rating Method (see below), the information it contains is relevant to anyone involved in design or real estate development, regardless of whether or not they are pursuing a Pearl Rating.

This **Rating Method** (the document you are reading now) provides the specific information necessary to prepare an application for a Pearl Rating (see p56.). Pursuing a Pearls Rating between 2 and 5 Pearls is completely voluntary.

Application Guides provide an additional resource for the Pearls Design System. These are tools to provide guidance for future public works such as government buildings, parks and infrastructure. They are intended to provide specific guidance to assure public investment is consistent with the principles of Estidama, without requiring the rating process.

Over the next few years, other product tools will be developed as required by the pace and nature of future development.

Figure 3: The Pearls Family of Documents



The Pearls Rating Process

The Pearls Rating Method and process is designed to facilitate an efficient, educational way to assess the sustainability of a development. A conscious decision has been made in constructing these documents to create a tool that will drive market transformation.

Based on this philosophy, the Pearls Rating Method will be an interactive and dialogue oriented effort. You and your team will work alongside an appointed Pearls assessor, who will stay with you for the duration of your project. This will provide many benefits including:

- Providing a 'go to' resource for answering questions and clarifying credit requirements in the system's early years of use.
- Allow for exchange of ideas and best practices to advance the most appropriate solutions as opposed to simply 'obtaining a score.'
- Provide real time feedback to the Pearls Design System, for how it can be improved while also testing metrics and benchmarks.

Step 1: Register Your Project - A project proponent will register their project with UPC's Estidama team as a *Pearl Targeted Project.*

Step 2: Appointment of a Pearls Assessor - UPC will assign a PDS Assessor to work with the design team throughout the rating process.

Step 3: Create Pearls Rating Submissions- The Proponent will work with the Design Guide and Rating Method to determine which Credits to apply for and create a submission that meets the Ratings Method submission requirements.

Step 4: Dialogue and Support to Proponent – as the Credit Submissions are made, the Assessor will provide guidance, credit interpretation and answers to the Proponent regarding Estidama and the Pearls Rating

Step 5: Review and Assess Submissions The proponent, working with technical specialists, will prepare and the PDS team will review, project submissions as required by the Rating Method. A PDS Assessore will undertake an initial review to assess the completeness of the submission and determine whether the design solution has fulfilled the intent of the Credits and to ensure correctness and completeness of the submission.

Step 6: Determine Rating - Upon submission of Final Application, the Assessor will calculate the total number of credits in compliance with the Rating Method's standards, assign the appropriate value to each credit based on performance, and generate the project's total Credit Points to be awarded.

Step 6: Award Pearls

Based on the final tally of Credit Points, the project will be awarded a Pearls rating consistent with thresholds identified on p41.

Figure 4: The Pearls Rating Process

Pearls Rating Stages

There are two stages of rating, both of which must be completed. This two stage approach recognizes the branding and additional market value a Pearl Rating will afford a project in its early sales or lease up phases. However, to preserve the integrity of the certification process, it is important to provide a review and rating confirmation – (or adjustment as appropriate) after the building has been occupied and operating for a period of time.

To achieve these objectives, a Pearls Rating will be granted at 3 stages:

A ***Pearls Design Target Rating*** is used to confirm that the proposed project design and supporting technical strategies are consistent with the goals of Estidama. This is an iterative process, which can be completed concurrent with UPC Development Review process. Upon lodgement and assessment of the Pearl Rating Method Application, a Pearls Design Rating can be awarded to a project *concurrent with UPC Planning Approval*[3]*, at the earliest*, ***but never before***. Due to the length of submittal preparation and Estidama review time, the confirmation of the PDS Commitment rating may in fact occur after UPC Planning Approval.

The final ***Pearls Certified Rating*** will be provided *once construction is completed*, **and** necessary *construction stage submittals* have been made *and final site inspection has occurred*.

A Pearls Certification Rating will only valid for a limited period of time after designation (possibly 2 years). Based on the project's nature and schedule, it will need to either be reviewed and re-issued by a PDS Assessor, or the developer may be directed to proceed for a *Living Rating* (see below).

A ***Pearls Living Rating*** is made *after project occupancy.*[4] Upon completion of the post-construction assessment a formal Estidama Achievement Designation is given, validating or confirming the Pearl Design Rating. In some cases, it may be possible that the rating may decline or increase after completion of the project. The rating given will be based on the confirmation that commitments made during design have been transposed through to construction.

The application, registration and certification process to achieve these ratings is being developed concurrently with the Estidama family of documents. The Pilot testing stage will be invaluable for helping to refine the process of submissions, review requirements and associated time requirements.

[3] UPC Planning Approval is a separate application process

[4] For New Buildings this is defined as two years after at least 80% occupancy of all available GLA.

Pearls Rating Outcomes

Upon completion of the Rating Method process and by submitting an Estidama Summary Achievement Report, a percentage score is awarded to the project. This provides an indication of the projects achievement relative to the Estidama goal. The score is then translated into an official Pearl Rating as defined below.

One Pearl – *A Higher Level of Code Compliance*

The Pearls Rating Method was created concurrently with Abu Dhabi's Building and Development Codes. As such, many requirements for higher performing development are encoded in the basic minimums for new development approval. This means that base award levels for performance in many voluntary rating systems are a requirement of basic codes for development in Abu Dhabi. As a result, every new development in Abu Dhabi, starting 2010, will be working with a performance level equivalent to One Pearl**.**

Two, Three and Four Pearls – *Increasing Performance*

Two, Three and Four Pearl designations will be made based on overall Credit Point totals after detailed submission review by the Pearls Assessor. Each level will have an increasing level of performance and rigor, with Four Pearls meant to be equivalent to the highest levels of rating system attainment available across the globe today.

The Fifth Pearl - *Restorative Development*

Estidama aspires to do more than simply 'sustain' life - by its very definition Estidama seeks to help all living systems to thrive. As such, the Pearls Rating System offers an achievement level for projects that go beyond the commonly accepted standards of sustainability. The Fifth Pearl will offer the region and the world, recognition for projects that provide net positive benefits to the human and natural environment. Some of the Fifth Pearl credits start developing and collecting key life cycle performance indicators to help us understand the journey we need to take to reach this goal.

The requirements associated with the Fifth Pearl are meant to challenge design teams and their project sponsors to create developments that will put back – or actually create- more resources than they use. These net positive benefits can be achieved in either the local context (by producing more power on site that will actually be consumed), or by working with recognised groups offshore to achieve a net positive outcome within the larger global setting of living systems[5].

[5] Facilitated by recognised NGOs over time.

For More Information

Please visit the Estidama website www.estidama.org for regular updates and new releases of documents. To send inquiries or ask questions, please feel free to use the portal on the Estidama website or send comments to:

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Section Two

USING THE PEARLS RATING METHOD

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Organisation of the Pearls Credits

The PDS is organized around five core concepts that are commonly held as fundamental to more sustainable real estate development – conserving our natural systems, improving the quality of urban settlements, being responsible with our limited resources as characterized by energy, water and material flows. These five areas form the heart of the PDS.

However, more than simply driving towards a better outcome, the PDS is also intended to facilitate market and industry transformation, by advancing both the design process and the practice of real estate development.

Rating methods typically tell us 'what' issues should be measured. The Pearls Rating Method is no exception and provides this information in each of the five core areas. But it also provides guidance on how to most effectively achieve these measurements – in terms of both cost and environmental performance. The 'how to' is enabled by a concept called the Estidama Integrative Design Process or EIDP.

As you read both the Design Guide and Rating Method, keep in mind this structure - five core elements of sustainability,

- Living Systems
- Livable City
- Precious Water
- Resourceful Energy
- Stewarding Materials

These five are 'bookended' by the two market transformational sections:

- Integrating Process
- Innovating Practice

Under this structure, the PDS is meant help designers, students, developers and agencies think about sustainable development as an integrated process of design, construction and operation.

Understanding the Pearls Credits

This Rating Method includes three components that relate to the Credit methodology:

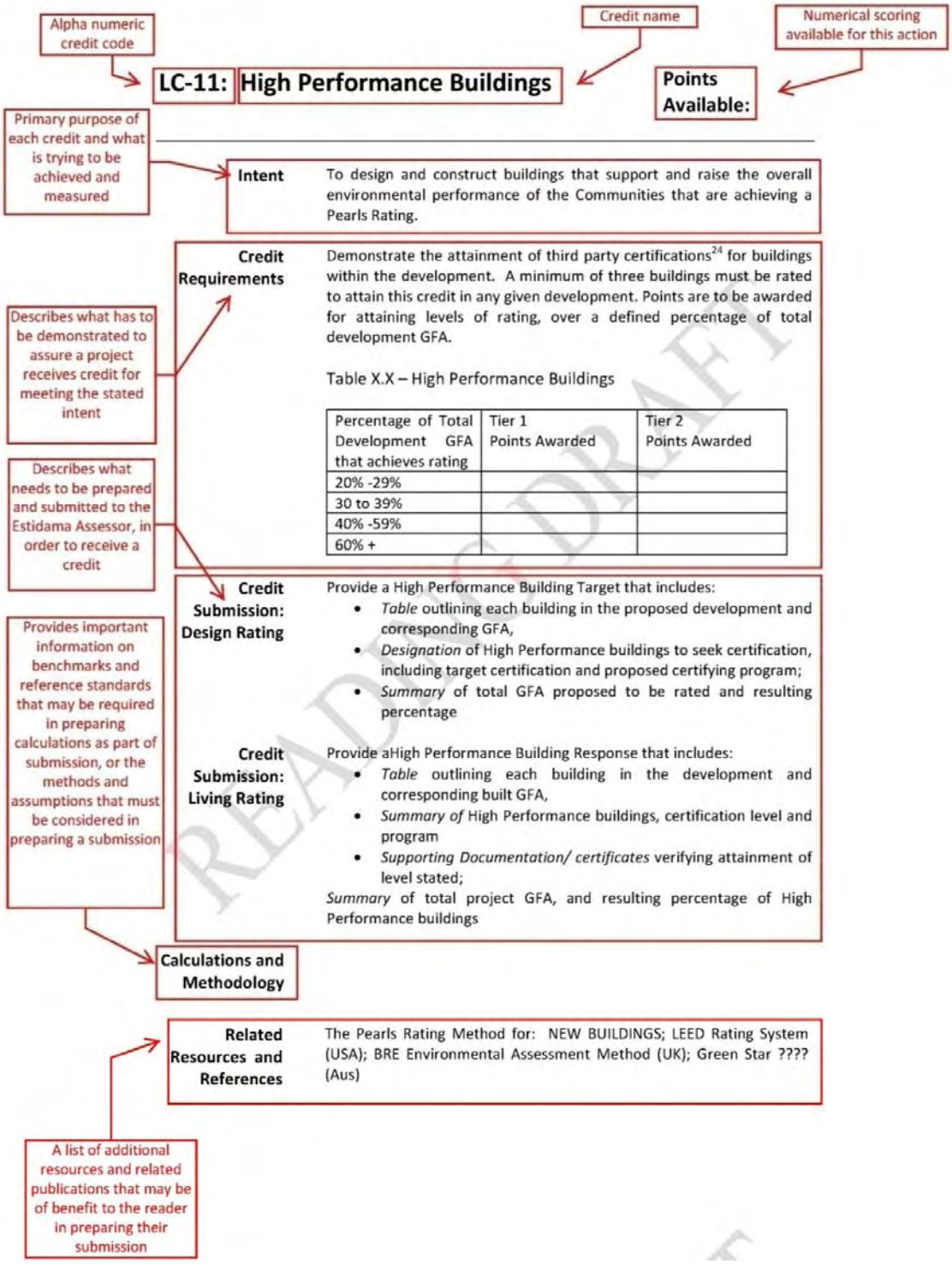
Code Requirements – these are portions of either the Building Code or Development Code that support the principles of Estidama. They form the foundation for the voluntary credits in this document, and are the basis of the One Pearl designation. They are summarized in this document so that users can fully appreciate the integration of concepts and ideas across multiple documents. By completing a UPC Planning Approval, or Municipality Building Code review you will have fulfilled these requirements.

Requirements – are absolute performance requirements that must be met by every project submitting for a Pearl Rating. All projects to be rated must comply with the Pearl Requirements. These occur at the front of each section and are designated with an 'r'.

Credits – these are credits that form the backbone of the Pearls Rating method. Depending on the Pearl Rating level being pursued by a design team, the number of credits and the level of achievement will vary from project to project.

Reading Each Credit
For Pearls Credits, the adjoining page describes the components of each credit. This diagram should provide the reader with a helpful guide to determine the purpose of each line and how to use the credits effectively.

Figure 4: Reading a Pearls Credit



The Design Guide: Helpful Companion to the Rating Method

The companion document to the Rating Method is the Pearls Design Guide for Communities and Neighborhoods. This document, which can be obtained separately, contains detailed 'how-to information' for designing land development in a more sustainable manner.

The document is meant to serve as a resource for designers, developers and even review agencies in understanding the essential elements of creating more sustainable communities and neighborhoods. While the Design Guide is meant to be used in conjunction with the Rating Method, it contains information relevant to all developers regardless of whether or not they are pursuing a Pearl Rating. Key components of the Design Guide include:

Intent: The primary purpose of any design strategy. This relates directly to the credits outlined in the Rating Method.

Background: This describes the environmental, social and economic issues surrounding a design strategy. This may also explain how successful implementation will benefit the environment, or describe the unique conditions within Abu Dhabi that make this credit important.

Processes and Strategies: This provides helpful information on techniques, tools, and design strategies that will help designers achieve a more sustainable outcome, as defined by the Rating Method Credit Requirements.

Products and Technologies: This is an evolving list of technologies, materials and products that can be used in conjunction with the design strategy to achieve a preferred outcome. Because 'green' and sustainable products and technologies are evolving rapidly, this section may be provided on the Estidama website so it can be updated on a regular basis.

Additional Guidance: This is a list of additional resources and related publications that may be of interest to the reader, should they desire more detailed information or background information.

Category Weighting

The Pearls rating strategy places an emphasis Liveable Buildings to support individual health and the productivity of Abu Dhabi's commercial sector as well as on water and energy conservation due to the current resource limitations and growth of Abu Dhabi.

Other critical issues such as living systems and resource conservation are integrated into a variety of criteria and weighted accordingly.

Both the number of credits and credit points in each category create the relative weighting of each category. The weightings represent the relative impacts of each category in the context of Abu Dhabi and are presented in Table 1 below.

Each of the three building use typologies has a slightly different emphasis or weighting, to reinforce the critical issues that should be addressed for its unique development type and to accommodate issues not relevant to the use. As a result, the weightings for each typology may vary slightly from Table 1.

Table 1: PDS New Building Rating Method Category Weightings

Criteria	Weighting
Integrative Process	Required
Living Systems	10%
Liveable Buildings	33%
Precious Water	20%
Resourceful Energy	20%
Materials Stewardship	16%
Innovating Practice	1%

Where the Pearls is Different: Carbon *and* Living Systems

Achieving a sustainable human and natural condition is impossible if we only try to be more efficient with our current resources. Protecting our future condition can only occur if we deliberately slow down the planetary damage we have caused by years of industrialization. Greater efficiency will not, however, change the long term outcome. For this to occur we need a deeper understanding of the how human and natural systems are interconnected, and how to reverse years of impact on our environment.

When we speak of sustainability we are using shorthand to describe all the issues necessary to sustain life. The health of the soil, the cleanliness of the air, the quality and purity of water, enriched and spiritually fulfilling human and natural communities - just some of the essential elements to allow the complexities of living systems to keep functioning, and more importantly, thrive.

Reducing carbon through energy efficiency and reducing environmental impact through technological possible mitigations are becoming an essential element for achieving a sustainable condition.

But this is only half the story.

The other half requires restoring the health of our broken living systems and regenerating our collective awareness and appreciation for the whole web of life.

Gaining this appreciation is practical and hands on work. It is as real and tactical as developing an energy model or a recycling program. Reintegrating ourselves with the processes of how life works and how we, can be better stewards is vital.

Embracing the healthy tension that occurs between technological solutions (i.e. carbon reduction) and the need to foster larger living connections of our communities (living systems) is how we will create a healthier planet. The real goal of "sustainable design" is not to merely mitigate the impacts of development but to re-engage people in understanding they are a necessary part of nurturing and assuring vital and healthy living systems.

Summarising the detail, the differences are:

- Prerequisites are to be included in the building code (buildings) and planning development code (communities). A development or building permit approval will automatically signify achievement of 1st Pearl level (although this will not be able to be used in marketing).

- The Estidama Integrative Design Process is a prerequisite to all project types and requires initial systems and contextual analyses, preliminary energy modeling, water budgeting, simple material strategies, and potential for habitat connectivity BEFORE the design process is permitted to begin.

- Living Systems and Livable Communities (Buildings) are two of the major sections in the document – emphasizing that healthy living systems are the objective of a sustainable condition – Estidama. The system addresses Carbon reduction and Living Systems as a Whole System.

- Two levels and three stages of Certification are required. An initial Design Target Rating for use in marketing and project positioning AND a post construction stage Pearls Certification Rating to ensure the targetted credits have been achieved.

- After two years, a Living Certification will be available to validate that the performance levels identified during design have actually been achieved. While this increases the integrity of the overall system, it also provides a critical element of program feedback over its evolution – providing actual performance data into the basic metrics and credits.

- The 5th Pearl is the highest certification level and represents an extremely advanced level that is intentionally high. This 5th Pearl requires a net positive benefit to the environment in terms of net positive energy, water, and improving diversity and health of living systems and/or the whole building measurement of carbon as well as other whole of life (WoL) , whole of environment (WoE), impacts. At this stage, no particular level of outcome is required for WoL/WoE measurement, although over time this will change as data becomes available to be able to set benchmarks.

Application of the Rating Method for New Buildings

This document, and the tool it provides, is meant to help assess projects through the lens of Estidama.

A range of issues heavily influences the nature of building design, construction and development, and its ultimate sustainability. This document is meant to address 3 broad categories of buildings and their sites and associated facilities and combinations thereof including carparking:

Residential: Multi-unit residential development over 2 dwellings. Includes base building plus integrated residential fitout.

Commercial Office Shell & Core: Commercial offices and associated spaces including car parking and all directly associated uses, including foyers, meeting rooms etc. Includes finishes typically included in base building fitout within commercial market e.g. floors, walls, ceilings, wet area joinery and finished and any other finishes provided within the base building contract.

Retail: Retail spaces integrated within mixed-use development. Does not extend to isolated single use 'big box' warehouse type retail development. Includes base building plus integrated retail fitout to common areas. Does not include tenant fitout (generally although there are some exceptions in the energy and water modelling assumptions).

Mixed-use and Podium Development: Any development with mixed uses (including any combination of the above) or over developments on or with a podium style parking strategy.

Non-Eligible Projects

Project characteristics that will not be suitable for use with this tool

1. A project that does not meet the designated Required Credits;
2. A project other than residential, offices (commercial or governmental), retail or mixed use combinations of any of these types.

If an applicant believes a project outside this scope is relevant to this tool, an application can be made to the PDS Team for acceptance. If the application is accepted by the PDS Team, the applicant will need to submit and have accepted, proposals for the relevant benchmarks needed by the tool for their specific building typology.

Equivalent Standards

This document references a variety of Standards from the US, UK, EU, Australia and other countries. In each case, it is permissible to suggest alternative standards. If a project is suggesting an alternative standard, the applicant must do a 'Key Issues' comparison to show in broad part the standard or test protocol is equivalent or better than the referenced standards. Estidama reserves the right to verify and then accept or reject the submission in its absolute discretion.

Rating Thresholds

Upon completion of the assessment, a percentage score is awarded which provides an indication of the environmental performance of the building. This score is then translated into an official rating as per Table 2.

Table 2: Estidama Pearls Rating Scale

REQUIRED SCORE	SCORE	RATING
Mandatory	1 Pearl	
45%	2 Pearl	
60%	3 Pearl	
75%	4 Pearl	
90% **Restorative Development**	5 Pearl	

Universe of Credits

The following table provides an overview of the New Building Credit Titles and available points for each Credit.

CREDIT TITLE			Office	Retail	Resid
INTEGRATING PROCESS (IDP					
IDP	Estidama Integrated Design Prerequisite				
LIVING SYSTEMS (LS)					
LS-r1	Living Systems Analysis and Assessment		Code Requirement		
LS-r2	Ecosystem Services Protection		Code Requirement		
LS-1	**Site Selection**				
	A: Reuse of Land		2	2	2
	B: Remediation of Contaminated Land		1	1	1
	C: Pearl Rated New Community		1	1	1
LS-2	**Ecological Services Restoration**	**5th Pearl**	**12**	**12**	**12**
LS-3	**Soil Health**				
	A: Soil Improvement		2	2	2
	B: Soil Health: Soil Regeneration		2	2	2
LS-4	**Cumulative Impacts: Carbon & Life Cycle**	**5th Pearl**	**4**	**4**	**4**
Total			**24**	**24**	**24**
LIVEABLE BUILDINGS (LB)					
LB-r1	Outdoor Thermal Comfort		Code Requirement		
LB-r2	Dark Skies Strategies		Code Requirement		
LB-r3	Formaldehyde Reduction		Code Requirement		
LB-r4	Daylighting		Code Requirement		
LB-r5	Healthy Ventilation Air Sources		Code Requirement		
LB-r6	Building Ventilation for Comfort		Code Requirement		
LB-r1	**Plan 2030**				
LB-r2	**Liveable Cities Analysis**				
LB-r3	**Indoor Smoking Elimination**				
LB-1	**Community Walkability and Character**		4	4	4
LB-2	**Transit Nodes and Connectivity**				
	A: Access to Transit and Services		4	4	4
	B: Building Integrated Transit		2	2	2
LB-3	**Vehicle Trip Reduction**				
	A: Development Density		2	4	
	B: Proximity to a Mix of Uses		1		1
	C: Integrated Uses				1
	D: Bicycle Facilities		3	3	3
LB-4	**Equitable Development**				
	A: Public Benefit		1	1	1
	B: Guest Worker Accommodation		2	2	2
LB-5	**Urban Heat Reduction**		2	2	2
LB-6	**Parking**				
	A: Provision of Parking		4	4	4
	B: Preferred Parking		1	1	
LB-7	**Community Space**				
	A: Indoor Community Space		1		1
	B: Outdoor Community Space				2
LB-8	**Private Outdoor Space**				1
LB-9	**Views**		1		1
LB-10	**Natural Lighting**				

	A: Improved Daylighting Performance	3	3	
	B: Daylight Glare Control	1		
LB-11	**Electric Lighting Quality**			
	A: Lighting Glare Control	1		
	B: High Frequency Lighting	1	1	1
LB-12	**Healthy Ventilation**			
	A: Outside Air Ventilation	3	3	3
	B: Air Change Effectiveness	1	1	1
	C: Microbial and Humidity Control	1	1	1
LB-13	**Thermal Comfort and Control**			
	A: Thermal Zones	2	2	2
	B: Occupant Comfort and Control	2		
	C: Thermal Comfort Modelling	2	2	2
LB-14	**Materials Emissions**			
	A: Adhesives and Sealants	1	1	2
	B: Paints and Coatings	2	2	3
	C: Carpets and Floor Finishes	2	2	3
	D: Ceiling Systems	2		
	E. Cleaning Methods	1	1	1
LB-15	**Indoor Air Quality Management**			
	A: Pollution Exhaust	1		
	B: Indoor CO2 Management	1	1	1
	C: Car Park Air Quality Management	1	1	1
LB-16	**Legionella Prevention**	1	1	1
LB-17	**Indoor Noise Pollution**	1	1	1
LB-18	**Outdoor Noise Pollution**	1	1	1
LB-19	**Construction Indoor Air Quality Management**	1	1	1
LB-20	**Construction Site Management**	3	3	3
LB-21	**Sustainability Communication**	2	2	2
LB-22	**Life Cycle Costing** **5th Pearl**	**3**	**3**	**3**
LB-23	**Commissioning**			
	A: Commissioning Requirements	2	2	2
	B: Ongoing Commissioning	1	1	1
	C: Commissioning Agent	1	1	1
Total		**72**	**64**	**67**
PRECIOUS WATER				
PW-r1	Minimum Water Performance	Code Requirement		
PW-r2	Exterior Water Metering	Code Requirement		
PW-r3	Water Model	Code Requirement		
PW-1	**Enhanced Potable Water Reduction**	19	19	19
PW-2	**Water Generation** **5th Pearl**	**10**	**10**	**10**
PW-3	**Reduced Carbon Impact of Water**	5	5	5
PW-4	**Water Management**			
	A: Indoor Water Meters	2	2	2
	B: Water Use Reporting	1	1	1
PW-5	**Stormwater**	4	4	4
Total		44	44	44
RESOURCEFUL ENERGY				
RE-r1	Minimum Energy Performance	Code Requirement		
RE-r2	Energy Metering	Code Requirement		
RE-r3	Cool Building Strategies	Code Requirement		
RE-r4	Energy-Efficient Appliances	Code Requirement		
RE-r5	Ozone Impacts of Refrigerants and Systems	Code Requirement		
RE-r6	District Cooling System	Code Requirement		
RE-r7	Energy Model	Code Requirement		

RE-1	**Energy Use and Carbon Reduction**		20	20	20
RE-2	**Energy Generation -**	**5th Pearl**	**12**	**12**	**12**
RE-3	**District Cooling-Connection**		4	4	4
RE-4	**Easily Accessible Stairs**		1	1	1
RE-5	**Energy Use Reporting**		1	1	1
RE-6	**Peak Load Reduction**		4	4	4
RE-7	**Global Warming Impacts of Refrigerants**		2	2	2
Total			44	44	44
STEWARDING MATERIALS (SM)					
SM-r1	Certified Timber		Code Requirement		
SM-r2	Construction & Demolition Waste Recycling		Code Requirement		
SM-r3	Storage for Collection of Waste & Recyclables		Code Requirement		
SM-r4	Asbestos Elimination				
SM-1 to SM-5	**Alternative Compliance Path: Lifecycle Impacts of Materials**	**5th Pearl**	**17**	**17**	**17**
SM-1	**Carbon Intensity of Materials**				
	A: Recycled Steel		1	1	1
	B: Replacement of High Carbon Intensity Materials		1	1	1
	C: Cement Replacement		2	2	2
	D: Transport of Materials		2	2	2
SM-2	**Virtual Water**		1	1	1
SM-3	**Non-polluting Materials**		2	2	2
SM-4	**Ecological Impact of Materials**				
	A: FSC-Certified Timber		2	2	2
	B: Recycled Aggregate		2	2	2
SM-5	**Resource Conservation**				
	A: Reused Materials		1	1	1
	B: Recycled and Recyclable Materials		2	2	2
	C: Modular Materials		1		
	D: Rapidly Renewable Materials		1	1	1
SM-6	**Socially Sustainable Materials**				
	A: Community Benefits in Emerging Economies		1	1	1
	B: Labour Practices		1	1	1
	C: Sustainable Timber		2	2	2
SM-7	**Dematerialisation**		1	1	1
SM-8	**Building Reuse**		1	1	1
SM-9	**Spatial Efficiency**		2	2	2
SM-10	**Design for Disassembly**		1	1	1
SM-11	**Building Durability**				
	A: Design for Appropriate Durability		1	1	1
	B: Durability Management During Construction		1	1	1
SM-12	**Design for Flexibility**		1	1	1
SM-13	**Design for Adaptability**		1	1	1
SM-14	**Recycling and Resource Recovery**				
	A: Construction & Demolition Waste Management & Recycling		2	2	2
	B: Green Waste		1	1	1
Total			**34**	**33**	**33**
INNOVATING PRACTICE (IP)					
	Advancing Practice		1	1	1
	Exceeding Practice		1	1	1
	Transforming Practice		1	1	1
Total			**3**	**3**	**3**
TOTAL FOR RATING METHOD			**220**	**211**	**214**

Section Three

THE PEARLS RATING CRITERIA and the UPC DEVELOPMENT APPLICATION PROCESS

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Background

The Pearls Rating Method is a separate process from the UPC Development Review Process. Compliance with the UPC DMaP Development Review process and DMA Building Code requirements (due for completion by the third quarter 2009), will however, in a one Pearl equivalent attainment.

As part of your UPC Planning Review Application, you will be required to complete a range of submission documents. These are spelled out in four primary documents:

- Form A: Development Review (Overview)
- Form B: Submission Requirements
- Form C: Concept Planning Review Application
- Form D: Detailed Planning Review Application
- Form E: Integrative Design Process Development Planning Application Requirements

All of these are available from UPC, or on line at www.upc.ae.gov

This Rating Method has been developed in close coordination with UPC's Development Review process. As a result your Development Review submissions will create a solid foundation for your Pearls Rating application. **By fulfilling the mandatory UPC submission requirements in a thoughtful and complete manner, you will have efficiently completed, or developed the basic information necessary for a number of credit requirements associated with the Pearls Rating**.

As you read this Rating Method you will see that the first Requirement for each section is directly correlated to the Development Review Application submission requirements.

As part of your initial review with your Pearls Assessor, be prepared to share this information with attention given to those elements that relate directly to the Credits defined in this document.

The following 6 pages provide a detailed map of the Planning Review Application requirements and how they relate to your Pearls Rating Submission preparation.

Habitat Restoration and Connectivity Opportunities:

This should be identified as a function of LSr-1 (Living Systems Analysis)
This can be further supported by LS-3a (Ecosystems Services- Restoration), LS-3b (Ecosystems Services – Regeneration) and LS4a (Green Infrastructure – Parks and Open Space)

Solar Analysis and Orientation Studies

These studies will assist with obtaining credit for RE-1 (Energy Use and Carbon Reduction), RE-2 (Energy Generation)

Energy Efficiency Design Strategies

This fulfills Resourceful Energy section Code Requirement for Energy Model and supports your response to REr-2 (Energy Use and Carbon Reduction)

Water Balance Model

This fulfills NB- Precious Water (PW) Code Requirement for Water Model.
and supports PW-1 Reduced Potable Water Consumption.

Materials Strategy

This supports the development of SM-14 Stewarding Materials (SM): Recycling and Resource Recovery

Form C
Concept Planning Review Application

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4. Application Requirements Cont.

D. Estidama (See form E)

1. **Estidama Integrated Design Process (EIDP):** Document EIDP's role in the project design to date. Document key consultants and design team members that have been involved, key work session dates and document in graphic format, programming of project development and information exchange including integration of the EIDP process – including, but not limited to the below topics: ☐

A. **Habitat Restoration and Connectivity opportunities** ☐

- This especially applies to sites near significant natural resources and areas of habitat value

B. **Solar Analysis and Orientation Studies: Conduct solar studies and analysis on the project and illustrate in several diagrams the following:** ☐

- Building faces with optimal solar orientation
- Shading of public spaces at 10 am and 2 pm on solstice and equinox

C. **Energy efficiency design strategies to be explored and method of analysis to be used to address the following:**

- Anticipated Base Case energy loads as required by Building Code minimums in kW/year or tons of carbon ☐
- Generally targeted energy and cooling load reductions based on anticipated solar load reduction, orientation improvements, building envelope, improved building material, daylighting techniques, operation scheduling, equipment efficiencies, and so on. ☐
- Submit a summary table showing the adopted power and gas and cooling load demand for every phase of the development. ☐

D. **Water Balance Model:**

- Provide a high level analysis of potable water demand before and after conservation measures. ☐
- Optimize the irrigation water and district cooling external water demand and target a balance with the Treated Sewerage Effluent (TSE). ☐
- Analysis of potential impact of using on-site recycled water. ☐
- Submit a summary table showing the adopted potable water, irrigation and external water demand for every phase of the development. ☐
- Submit a summary table of the estimated wastewater flow and the amount reused for every phase ☐

E. **Materials Strategy**

- This is to address both provisions for material procurement and selection for the proposed project, as well as methodologies for reducing waste production and diverting the most significant proportion of the remaining waste from landfills ☐

2. **Estidama Summary:** written objectives, anticipated performance targets and strategies for achieving Estidama. Identify if you will be seeking a Pearls Rating for Communities or Buildings. Provide the site-wide average building rating commitment to be targeted where relevant.

FORM D
Detailed Planning and Review Application
From Page D2

Site and Surrounding Context Plan:
This fulfills NB –LBr2 Livable Cities Analysis

FORM D
Detailed Planning Review Application

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4. Application Requirements

A. Site and Affection Plan

Site and affection plan, indicating existing legal boundaries, existing land use and total area of subject plot (in square meters or hectares) ☐

B. Site and Surrounding Context Plan

An aerial or satellite image outlining the site showing its relation and location with the site taking up no more than 25% of the map area, showing:

1. Surrounding neighborhood characteristics and existing development features of the surrounding locality (i.e. hospital, local park, mosque, shopping centers, etc). ☐
2. Surrounding land use of adjacent plots. ☐
3. Existing buildings or structures on the subject site. ☐
4. Location of existing rights-of-way and dedicated corridors or utility reservations. ☐
5. Existing street and pedestrian circulation routes on area of proposal. ☐
6. Existing mature vegetation or trees. ☐
7. Existing and planned public transit stops within vicinity and existing taxi drop off/pick up slip lanes. ☐
8. Habitat Conservation, Restoration or Regeneration and Connectivity opportunities ☐

For site subject to UPC-approved masterplan guidelines, submit a copy of the guidelines.

C. Proposed Development Plan

1. With the site taking up no less than 75% of the map area, one plan, showing the following information:

- Land uses of proposed development ☐
- Proposed building or structure locations with setback distances clearly marked from all plot boundaries and adjacent roads (between buildings and structures). ☐
- Building footprints and site coverage (indicated in square metres) of all proposed buildings or structures. ☐
- Building entrances and exits (indicating disability features, emergency evacuation measures and accessibility to parking). ☐
- Ground floor activity (land use) of each building. ☐
- Finished floor elevation and natural land elevation of proposed structures. ☐
- Elevation at finished-grade centerline ("wearing course") of road in half-metre vertical intervals. ☐
- All public facilities and amenities and community services if applicable. ☐
- All Section and Elevation cut-lines, as requested below, in Section H, located and labeled. ☐

2. Density map showing all building footprints and heights in number of floors and meters. ☐
3. Floor Plans: Provide basement, ground floor, mezzanine, typical upper floor (for towers), penthouse floor, and roof plans to a specified scale. Label all proposed uses. ☐

D2

FORM D

Detailed Planning and Review Application

From Page D3

Energy Budget:

This supports the development of RE-1 Energy Use and Carbon Reduction

Water Budget:

This supports the development of PW-1 Reduced Potable Water Consumption

Materials Budget:

This supports the development of SM 14 Recycling and Resource Recovery

Stormwater Management:

This supports the development of PW4a and 4b

Energy Consumption:

This supports the development of RE-1 Energy Use and Carbon Reduction

Solid Waste Disposal:

This supports the development of SM-5: Resource Conservation, 5a, 5b and 5c

FORM D
Detailed Planning Review Application

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4. Application Requirements Cont.

D. Estidama Strategy (see Form E)

1. Estidama Integrated Design Process (EIDP): Updated document showing EIDP's outcomes in the project design to date, highlighting how the process has influenced the design. Update key consultants and design team members involved, , key work session dates and updated diagram of EIDP, and its impact on the project program ☐
2. Energy Budget – Initial parametric studies: provide summary outputs of initial energy model to test implications of building massing and orientation for optimizing energy performance. Show base case assumptions and improvements obtained. Establish clear performance and energy consumption budgets for all aspects of the project based on these results. Submit summary tables of the finial power, gas and cooling demand for every phase of the development. ☐
3. Water Budget: provide an updated and refined summary of the site and building water balance model. Establish clear performance and energy consumption budgets for all aspects of the project based on these results. Submit summary tables of the final potable water, irrigation, district cooling external water (if applicable) demand and wastewater flow for every phase of the development. ☐
4. Materials Budget: provide an update to materials selection strategy resulting in budgets for materials by embedded carbon or energy, distance traveled, or source. Also include budgets for waste produced and diverted during construction and ongoing life of the project. ☐

E. Grading Plan

With the site taking up no less than 75% of the map area, one plan, showing the following information in half-meter elevation intervals:

- Natural topography of the site ☐
- Any proposed gradient or slope changes to topography of plot. ☐

F. Utilities Plan

With the site taking up no less than 75% of the map area, one plan per utility , showing the following information with design elevations:

- Storm water management systems including all inlets and infrastructure as well as any facilities for water recycling, recharge of underground aquifers, storm water detention basins or rain water tanks. ☐
- Approved plan and cross section of service and utility corridors (water, storm water, sewer, electricity, telephone, and any other major service corridors). ☐
- Layout and dimension of the main lines/cables for water, sewerage, electricity, television, district cooling, storm, telecom ducting networks and all other belowground utilities, including the connection to the existing system as agreed with the utility providers. (The applicant may be required to submit a backup calculation and computer modeling upon request by the utility providers). ☐
- The proposed reinforcement/ replacement of the existing utility networks as agreed with the utility providers. ☐
- Utility plot allocation plan showing the type of utility and plot dimensions. ☐
- Energy consumption mitigation features (this could include solar power, grey water re-usage, district cooling plants, electricity generators, recyclable materials, non-absorbent sun materials for exterior, building rating, etc). ☐
- Solid waste disposal and recycling collection (location of collection areas and receptacles and loading and removal access for vehicles). ☐

Section Four

THE PEARLS RATING CREDITS

Credit Section **IDP**

INTEGRATIVE PROCESS

"In the real world, the social, ecological, and economic realms interact with one another in complex and unpredictable ways. The integrated design process can accept this multitude of often conflicting objectives without being paralyzed by complexity."

Adapted from 'Charette Theory for People in a Hurry' Patrick [illegible]

An essential part of the PDS strategy is to fundamentally change the way we approach design, building and real estate development. The Rating Method and Design Guide are meant to provide developers and their consultants with more than just another check list for green buildings and projects. The PDS is conceived as tool to inform design teams in what makes land development more sustainable, while advocating to managers and decision makers on how a better process will result in more cost effective, higher performing outcomes.

This process is called EIDP, the Estidama Integrative Design Process.

While it is hard to prescribe a process, the Pearls Rating system has identified a series of indicators that emerge from properly organizing the design process that is more fully explained in the Design Guide These indicators are supported by a series of decision support tools that will assist design teams and their clients to make more informed decisions during EIDP, which in turn will produce better results. These tools – Strategies, Analyses and Budgets – all provide tangible outcomes that are now a part of the UPC Development Code review process.

The following pages include direct excerpts from the UPC Planning Application with specific explanations that will assist your design team in maximizing the value of these requirements, in pursuit of their Pearls Rating.

Estidama Integrative Design Process (IDP)

Code Requirement

Intent	To ensure that all development benefits from an Integrative Design Process as a means to achieve higher performance with reduced costs and greater synergy in the solutions, as compared to a conventional design and building processes.
Code Requirements	Demonstrate that the project team, and project process is organized to fully leverage an Integrative Design Process from its inception, through to final construction.
Code Submission:	Provide narratives, diagrams and supporting documentation consistent with the UPC Planning Approval Application Form E. Note: If these documents are prepared correctly from the start, they can be used effectively for both review processes, making efficient use of time and effort.
Calculations and Methodology	Not Applicable
Related Resources and References	See Design Guide for New Buildings for helpful examples, process guidance and detailed descriptions of each requirement.

FORM E
Integrative Design Process
From Page E1

Living Systems:

See LSr-1, Page X for further information on requirements.
Refer to Design Guide for Urban Centres, Communities and Neighborhoods pages X-X for more explanation.

In order to create cost effective *and* environmentally effective solutions our buildings and infrastructure shall be located in such a way that natural systems are allowed to flourish. This is an basic requirement in Critical Natural Resource areas.

Before the master plan or design process a Living Systems Analysis and Assessment is required. This is an analysis of the natural resources and life forces. An isolated site analysis will not uncover these systems unless seen in the context of the larger patterns that formed over millennia: surface water drainage patterns, topography, groundwater flows, soil types, geological structure, plant and animal habitat, possible human support of these forces and relationships, human needs, and how these can be harmonized.

Liveable City

See LCr-1, Page X for further information on requirements.
Refer to Design Guide for Urban Centres, Communities and Neighborhoods pages X-X for more explanation

Concept Review and Detailed Planning Review Submissions will need to demonstrate that these site forces, habitat resources, and human activity and construction can support the reconnection of these living systems so they can thrive and become integrated with human habitation.

Indicators of species diversity and a greater opportunity for inter-relationships between them help a living system to be more resilient and therefore healthy and able to handle a range of stresses that oversimplified systems cannot

FORM E
Integrative Design Process
Development Planning Application
Submission requirements

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estidamá
V1.0 February 2009

Issue	Pre-Concept Review Submission requirements	Concept Review Submission requirements	Detailed Planning Review Submission requirements
Natural Systems	**Contextual Natural Systems Analysis** Demonstrate compliance with Coastal Development Guidelines where appropriate. For sites outside of CDG mapping, illustrate site relationship with existing or proposed public realm amenities and natural resources or systems. 1 page narrative explaining the ways in which the project engages natural systems to both minimise harm and positively enhance local ecosystems An initial site environmental survey including flora and fauna including assessment for the existence of or potential impacts on threatened, rare or endangered species. Context Plan including linkages to surrounding natural systems and potential habitat linkages. Site Analysis developed on an aerial photograph showing significant vegetation, topography and site features. Site contour plan to minimum 1 metre contour interval showing all site boundaries, easements and encumbrances generalized soil mapping	**Living Systems/ Livable City Concept Composite** Diagram, simple narrative and images/ sketches that demonstrate the inter relationships of: • site development • stormwater management techniques • increased habitat techniques • heat island reduction strategies (material SRI, shading, cool roofs) • outdoor thermal comfort (**shaded pedestrian realm, reflectivity studies, radiant** temperature studies, natural ventilation) • circulation and mobility strategies • layered, multi-use open space and public realm	**Living Systems/ Livable City Plan + Targets** Framework Plan with specific annotations and outlines specifications (as appropriate) that document the inter-relationships of: • site development • stormwater management techniques • increased habitat techniques • heat island reduction strategies (material SRI, shading, cool roofs) • outdoor thermal comfort (**shaded pedestrian realm, reflectivity studies, radiant** temperature studies, natural ventilation) • circulation and mobility strategies • layered, multi-use open space and public realm in an integrated fashion
Natural Systems Livable City	**Contextual Urban Systems Analysis** Provide a 1 page narrative plus plan to illustrate site relationship with existing circulation (pedestrian, vehicular and transit) routes, surrounding land uses and built form including figure ground studies. **Mobility Assumptions** Provide a 1 page narrative and diagrams as necessary to discuss issues including vehicular, transit, pedestrian and bicycle assumptions. **Demographic Snapshot** Provide a summary narrative demonstrating target market, proposed development program and its relationship to market trends and analyses.		

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FORM E
Integrative Design Process
From Page E2

Resourceful Energy:

See REr-1

The typical process of building and community design is to start design from only a human function and aesthetic perspective. However, when it comes to addressing energy efficiency, the conventional design process assumes that efficient technology specified after the concept is complete, will address energy efficiency issues. A very large percentage of air conditioning load could be eliminated if direct sun was kept off of the windows and façade of the buildings by use of shading devices, or properly orienting the buildings to minimize the intense sun exposure on the east and wet facades.

EIDP requires early energy modeling to test the implications and benefits of reduced glazing, shading, orientation, daylighting techniques, more efficient mechanical systems, and other Energy Efficiency Measures (EEMs). Through early testing of various building shapes and options, informed decisions can be made to drastically reduce energy use and cost *before* committing to the building form and façade design.

Precious Water

See PWr-1

Before the building is designed the design team and owner be looking at a water budget and schematic water flow design. Through the process of understanding potential water flows and multiple use benefits (cascading) before the design is locked into place, the design can harness these opportunities.

The buildings, roadways, walkways and plant habitat can be effectively integrated to capture and redirect rainwater. Reclaimed water (in accordance with RSB's proposed regulations for treated wastewater re-use) can be effectively used for gardens and landscape as well as potentially re-circulated for non-potable reuse. In addition, air conditioning condensate is a plentiful source of water in the hot months and should be considered a resource to be captured.

The indicators of success are very simple, reduced annual litres per person and total litres per SM for property development.

FORM E
Integrative Design Process
Development Planning Application
Submission requirements

estidama
V1.0 February 2009

Issue	Pre-Concept Review Submission requirements	Concept Review Submission requirements	Detailed Planning Review Submission requirements
Resourceful Energy	**Energy Strategy** Provide 1 page narrative describing the initial energy strategy, initial targets, tools, processes and techniques for energy modelling proposed and potential variables for conducting energy modeling on the project, during the concept planning stage. Identify potential conservation measures to be considered, as well as renewable offset options to be explored and tested.	**Energy Analysis** Provide 2-3 page summary analysis including the results of 'Shoe Box' or indicative energy modelling studies that explore the implications of orientation, massing, shading strategies on building energy consumption, urban heat island and outdoor thermal comfort. Narrative to show how analysis influenced building siting and massing. Provide overall project energy budget and targets for each proposed building, use type and overall site development. **Metering, Sub-metering** and monitoring strategy to be presented.	**Energy Budget** Provide Summary analysis to demonstrate a systemic and progressive improvement analysis of building elements and aspects. Show how iterative analysis determined building massing, shading, apertures, envelope performance, etc. Show overall improvement using scenario alternatives. Analyses should include both actual figures and percentage improvements over commencement modelling or Estidama benchmark (TBC). Indicate how this analysis was used to integrate and optimise key project outcomes and/or informed the building or project design decisions. Provide final energy budget for individual building/s and uses as a total and per m2. If a multi-building development, update overall Energy Budget and confirm total provided in Concept Design has not been exceeded. Provide a summary of all envelope materials thermal specifications.
Precious Water	**Water Strategy** Provide a 1 page commentary on the process, tools and technologies to be employed and potential variables for conducting water budgeting on the project, during the concept planning stage. Identify potential conservation measures to be considered, as well as non-potable water options to be explored and tested.	**Water Analysis** Provide a 2-3 page summary analysis that explores the implications of landscape strategies, non-potable water use (reclaimed, treated water or harvested stormwater) on project water consumption. Provide an overall project Preliminary Water Budget with targets for each proposed building, target for all site development and illustration of percentage of potable and non-potable water use. **Metering, Sub-metering** and monitoring strategy to be presented.	**Water Budget** Demonstrate a systemic comparison of building elements and initial phase site development aspects on water. Show how iterative analysis determined building fixture and appliance assumptions, water recapture strategies and landscape approach and budgets for all major individual uses. Show overall improvement using scenario alternatives. Analyses should include both actual figures and percentage improvements over Estidama benchmark/s(TBC). Provide final water budget for building as a total and per m2. If a multi-building development, update overall Water Budget and confirm total provided in Concept Design has not been exceeded. Also show individual targets for individual major uses e.g. retail, hotel, office etc. **Metering, Sub-metering** and monitoring strategy and feedback commitments.

E 2

مجلس أبوظبي للتخطيط العمراني
ABU DHABI URBAN PLANNING COUNCIL

Integrative Design Process
From Page E3

Stewarding Materials:

See SMr-1

Understanding and responding to the issues of a selected materials embodied energy, carbon, toxicity, or its impacts through resource extraction and manufacturing processes can have a global impact. The materials you choose can send a clear, economic message that will help save endangered forests, eliminate child labor in material production, and reduce global greenhouse gasses. By researching the least impactful materials and considering them as the basic palette for the project, designs solutions can be created that are more uniquely indigenous.

Waste is the 'other side' of the materials issue. The most effective action we can take to reduce our impact is through dematerialization. In other words, use less, make sure materials do double duty as both structural and finish materials.

Indicators of success are embodied carbon, reduced toxicants, ease of recycling for future reuse, and more.

Issue	Pre-Concept Review Submission requirements	Concept Review Submission requirements	Detailed Planning Review Submission requirements
Healthy Materials	**Materials Strategy** Submit a 1 page narrative describing potential materials to be considered for the proposed project that would fulfill the objectives of healthy materials. **Waste Strategy** - 1 page narrative describing Demolition and Construction waste diversion strategies that will be explored for the project.	**Materials Analysis** Submit a 2-3 page narrative of potential site material requirements and percentage of total project that may comply with Healthy Materials standards (TBD) **Waste Analysis** narrative and supporting calculations on projected Demolition and Construction waste for project, and potential diversion rates and downstream opportunities for reuse of materials. **Recycling Support Facilities** Concept showing location of support facilities for collecting recyclable materials during construction and post occupancy.	**Materials Budget** Submit summary narrative and outline specifications for building materials that meet Healthy Materials standards (TBD) Provide calculations in summary as to what percentage of total building and site development will meet this criteria. **Waste Budget** narrative and calculations demonstrating percentage of waste diversion during demolition, construction and post occupancy at sitewide and building level as appropriate. **Recycling Support Facilities** Commitments showing preferred location of support facilities for collecting recyclable materials post occupancy. Site plan to show staging area for construction waste separation and collection with diversion target.

Credit Section LS

LIVING SYSTEMS

"It is simply inept or poor-quality work to consider {land} ~ isolated from its surroundings…moreover, because we know this is wro…the practice is unethical".

Richard Forman, Land Mosaics

One of the fundamental building blocks of Plan Abu Dhabi (PAD) 2030 is the need to foster careful, sensitive growth that will conserve, preserve and restore the critical natural environments and habitats. These various ecological services make the marine, archipelago, and desert ecosystems unique, valuable and desirable for a high quality of life. Beyond restoration, the regeneration of even more diverse and rich interrelationships between natural and human habitat is possible. A continuous process of regeneration characterises a truly sustainable condition — Estidama.

The PAD 2030 plan calls for the creation of a National Park System to preserve key areas, but goes beyond that with the concept of a 'green gradient' that denotes appropriate levels of conservation, preservation and restoration, and development for each of five zones ranging from the most intense urban core to the undevelopable natural areas. This concept and the policy objectives are more clearly defined in the Conservation Development Guidelines issued by UPC in January 0f 2009.

PAD 2030 also establishes an open space framework that provides a system of formal and informal spaces throughout communities, while connecting and honouring a broader National Park System and the resources it protects. This 'green infrastructure' strategy should be reflected not only in plan and form, but also in the detailed systems thinking that leads to healthier ecosystems, habitats and ultimately communities.

Proper initial analysis of a project site and its context will reveal opportunities and challenges that must be addressed in the planning and design process. Detailed inventory and analysis work will also help reveal a site's potential to increase its capacity to support life. Starting the planning

process using a 'permaculture' lens will add to a development's ability to go beyond mitigation and increase its overall environmental contribution to the region.

The following components of the Pearls Rating Method for Living Systems, is organised to create a logical path in the evolution of a master plan leading to an outcome closer to our goal of Estidama:

Important information:
Given the complexity and relative newness of this credit section, the following will help define some of the relevant concepts.

Restoration: Altering an area in such a way as to reestablish an ecosystem's structure and function, usually bringing it back to its original (pre-disturbance) functioning.

Regeneration: To create human developments that enable the inhabitants to continually engage in the improvement of the biological functioning of the natural and human systems upon which they depend. Regeneration differs from restoration through engaging in processes that will enable larger and larger ecological systems (far beyond the site) to provide ever-increasing ecological services. An additional attribute of regeneration is that stakeholders — both onsite and offsite (as appropriate) — participate in the process gaining long-term understanding of and participation with the system's value and inter-relationships.

Critical Natural Resources: Elements, materials or habitat that are essential for the life of humans, flora and fauna.

Valuable Natural Systems: Communities or assemblies of plants and animals and the landforms and waterways that support them. These are identified as systems that provide important ecosystem services or include unique habitats or species.

Ecosystem services: Benefits that the human species derives from resources and processes supplied by natural ecosystems. These include products like clean drinking water and processes, such as the decomposition of wastes. Services can be subdivided into five categories:

- *provisioning* (e.g. the production of food and water);
- *regulating* (e.g. the control of climate and disease);
- *supporting* (e.g. nutrient cycles and crop pollination);
- *cultural* (e.g. spiritual and recreational benefits) and
- *preserving* (e.g. guarding against uncertainty through the maintenance of diversity).

An expanded list of potential Ecosystem Services is in Appendix 3.

LS-r1: Living Systems Analysis and Assessment

Code Requirement

Intent:

To ensure that before design processes begin, a thorough understanding of the natural systems on, surrounding, and influencing the site, is clearly developed and used to inform the project's potential design alternatives.

Credit Requirements:

Demonstrate that the project has conducted a Living Systems Analysis that examines and documents the following characteristics of the site and its larger context - as appropriate: (Note: This also fulfills the requirements of the Contextual Natural Analysis required as part of Form E of the UPC Development Approval Process)

- Topography
- Soils
- Geology/Geomorphology
- Hydrology (including drainage patterns and watershed source to sink)
- Existing flora and fauna (including wildlife corridors and seasonal uses/life-cycle roles)
- Natural history (Including human influence and impact)
- Climactic patterns and energies (including winds)
- Significant views (to and from property)
- Significant species, habitat, and ecosystems (both onsite and influenced by the site)
- Coastal condition
- Social, cultural, and economic context
- Food systems and provision analysis
- Cultural resources

Credit Submission:

Provide a copy of a Site and Contextual Systems Connectivity Pattern Assessment, including accompanying narrative and maps. These narratives and maps document and describe Living Systems patterns and interrelationships.

It is strongly recommended that overlay maps of the forces and resources of the site be created at three scales (site, neighbourhood, region or watershed) to aid and communicate the analysis of the site. Note that while overlay maps and GIS are an important analysis/ communication tool, overlay maps on their own are insufficient. Documentation needs to illuminate the patterns, connections and dynamics of the systems.

Provide Key Performance Indicators necessary to demonstrate the current state of the characteristics listed in the Requirements. Compare the state of the characteristics relative to comparison data from a previous point in time, not less than 10 years prior.

Calculations and Methodology:

The study area should be defined by natural boundaries that occur as a result of natural systems evolution and development, vs. political, plot or man-made limitations. Natural systems discernable boundaries are typically watershed boundaries, including the immediate marine environment fed by that watershed. The site should be studied at three scales: the site scale, the neighborhood and the region/watershed. At a minimum, the site context should be documented up to 5 km from the property's perimeter boundary.

Narratives, maps and documents describing Living System patterns and interrelationships are to be prepared by a qualified professional trained to complete such analysis and assessments.

Related Resources and References:

Permaculture a Designer's Manual, Bill Mollison, Tagari Press
Permaculture Principles and Pathways Beyond Sustainability, David Holmgren
Design with Nature, Ian McHarg

LS-r2: Ecosystem Services Protection

Pearls Requirement

Intent: To direct, design and develop in a manner that does not compromise critical or significant natural resources, on or surrounding site, its adjoining context or overall regional setting.

Credit Requirements: Demonstrate the following:

Protection of Resources

For sites that contain a species (flora or fauna) or ecological community determined to be imperiled by the Environmental Agency of Abu Dhabi (EAD) or for sites containing habitat critical to such species, and / or for sites that are contiguous to habitat identified as critical at the initial Planning Review Meeting:

Demonstrate that the proposed development is organized in compliance with established standards to avoid damage or impact to Critical Natural Resource areas and Valuable Natural Systems as identified by either the EAD, the UPC's Coastal Development Guidelines, or the Living Systems Analysis & Assessment (credit LS-r1).

In absence of specific design guidelines for the site resource:

Demonstrate that development is setback at least 100 metres from identified wetlands, estuaries, and significant ecological areas and at least 30 metres from existing water bodies.

For projects utilizing reclaimed land from the marine environment of the Gulf, Bays, and/ or Estuaries:

Demonstrate that no Critical Natural Resource Areas in Terrestrial or Marine environments are impacted by the project itself and/or dredging operations;
and/ or only 25% of the project's total land area consists of reclaimed land

For projects that identify stands of vegetation to be deemed significant as a result of the Living Systems Analysis and Assessment (LS –r1):

Demonstrate preservation of at least 80% of all existing trees and vegetation of significance.

Mitigation

(Mitigation does not apply to Critical Natural Resource areas)

If Avoidance is impractical (as determined through consultation with UPC):

Demonstrate impacts to no greater than 50% of the total sensitive land area as identified.

For projects that develop land adjacent to existing water bodies:

Demonstrate that no more than 25% of the adjacent edge will be

impacted by human activity (as determined through consultation with UPC). Where encroachment or edge development is encountered, demonstrate that this impact has been mitigated by on -site restoration of similar areas using a *no-net loss* construct (refer to Calculation and Methodology below). Where on-site restoration is not possible, offsite restoration can be utilized where approved by UPC.

For projects where more than 20% of existing vegetation will be impacted by development:

Demonstrate on-site replacement of trees > 10 cm calliper on a 2:1 aggregated calliper basis, trees that are climate appropriate, low water use and from native seed stock. The aggregated plant schedule must include a diversity sizes consisting of small diameter to larger diameter in a ratio of 1:1:1

To qualify the credit, the project must submit a Ecosystems Services Protection Plan and/or a Habitat Conservation and Mitigation Strategy, as appropriate. The Plans must be prepared by a qualified ecologist with demonstrated experience with the species and/or habitats covered by the Plan(s).

Credit Submission:

Provide the following elements to illustrate and convey compliance with the Credit Requirements:

Protection of Resources

- Summary report describing how the project meets the Credit Requirements.
- Ecosystems Services Protection Plan clearly showing:
  - Identification of areas containing imperiled species, critical habitats, or areas of contiguous habitat identified as important.
  - Limits of all proposed development and disturbance.
  - Setback zones and buffer areas.
  - Restoration or mitigation areas, with supporting calculations of land area total.
  - Vegetative impacts identifying trees or vegetation to be lost to construction.

Mitigation

Habitat Conservation and Mitigation Strategy that includes:

- Estimates of existing population numbers, dependent species, threats to the habitat, and long-term potential of the species and/or habitat(s) with and without the proposed development.
- Specific strategies to be implemented during the development of the project to protect the species and/or habitats, including construction practices.
- Specific habitat management strategies to be implemented for at least five years after final construction.

- Funding mechanisms and operating budgets required to fulfill habitat management strategies.
- Performance monitoring requirements including key performance indicators to determine success.
- A process mechanism to change operating program should key performance indicators not be met.

When Offsite Biodiversity Offset Arrangements (BOAs) are employed, provide plans, identification of ecological communities impacted and area calculations of project site impacts compared with offsite BOAs demonstrating increased offsite benefits at a ratio of 2:1.

Calculations and Methodology:

"No net loss" - As a minimum, an amount equal to two times the ecological processing value (not land area) disturbed or damaged must be restored, conserved or preserved elsewhere. This area is to be approved by UPC planning staff.

Related Resources and References:

See Design Guide

LS-1a: Site Selection: Reuse of Land

Credit Points Available: 2

Intent:

To encourage new development to reuse and infill existing urban areas.

Credit Requirements:

Demonstrate that at least 75% of the site has been previously built on.

Credit Submission:

Provide the following documentation:

- Plan drawing of the existing or previous development on the site, including scale, site dimensions and area calculations for both the total site area and the previously built upon area.
- Calculations demonstrating that the previous development covered at least 75% of the new development site.

Calculations and Methodology:

All roads and paved areas can be included in the calculation of the amount of previously developed area.

Related Resources and References:

See Design Guide

LS-1b: Site Selection: Remediation of Contaminated Land

Credit Points Available: 1

Intent:

To reward the decontamination of land for building development.

Credit Requirements:

Demonstrate that the land, prior to development, was defined or identified by EAD as contaminated and that adequate remedial steps have been taken to decontaminate or safely encapsulate the site prior to construction.

Suitably qualified geotechnical and/or environmental consultants qualified for a minimum of five years and practicing regularly in the field must prepare the report and plans.

Credit Submission:

Provide the following documentation:

- Site contamination assessment report which clearly documents the pre-existing contamination onsite
- Certificate of decontamination from a qualified geotechnical engineer responsible for overseeing operation from commencement to completion, or an equivalent chain of documentation properly executed by geotechnical or organic chemistry qualified company officers confirming that the site has been correctly and appropriately decontaminated and is now suitable for development.

Suitably qualified geotechnical and/or environmental consultants qualified for a minimum of five years and practicing regularly in the field must prepare the report and plans.

Calculations and Methodology:

Use a Site Assessment protocol, commonly used in various countries, to evaluate hazardous material pollution, including but not limited to ASTM E 1903 – 97 Phase II Environmental Site Assessment.

Related Resources and References:

See Design Guide

LS-1c: Site Selection: Estidama Pearl Rated New Community

Credit Points Available: 1

Intent:	To encourage new development within Pearl-rated communities in preference to non-Pearl-rated sites.
Credit Requirements:	Demonstrate that the development location is within a new Pearl-rated community. This credit applies to both projects on previously undeveloped land and projects on previously developed land.
Credit Submission:	Provide a copy of Certificate of Award for the Estidama PDS-rated community in which the project is located.
Calculations and Methodology:	Not applicable
Related Resources and References:	See Design Guide

LS-2: Ecosystems Services Restoration

Credit Points Available: 12

Intent:

To restore, enhance and/or expand the self-organising capacity and resiliency of an ecological sub-system on a site and to connect this system to other systems offsite to achieve connected corridor(s) of healthy biodiversity.

5th Pearl Credit

Credit Requirements:

Demonstrate measurable strategies to increase developed ecosystem capacity through restoration of pre-existing, degraded natural areas. Credit points are awarded based on comparison of site's predevelopment or predisturbance ecosystem services provision and those of the proposed restoration. as follows:

6 CREDIT POINTS = restoration of minimum 90% of the non developed site area with min 50% of original site ecosystem services

12 CREDIT POINTS = restoration of minimum 90% of the non developed site area with min 80% of original site ecosystem services

In order to qualify for this credit, the non-developed site area must be at least 100m2 in size.

The proposed strategies must include on-site monitoring to confirm the level of ecosystem services restoration as per these requirements.

Appropriate candidates for restoration include but are not limited to:

- A portion of a wetland
- Waddi
- Desert wildlife habitat
- Dune system
- Estuary
- Mangrove remnant
- Grove of trees
- Patch of native vegetation.

As part of this credit, the following must be developed:

- Restoration Report that defines the proposed strategies and plans for successful restoration. The report should include calculations, photographs and maps illustrating pre-existing degraded natural resource areas requiring mitigation, methodology for restoration of biologically functional habitat and key strategies for assuring performance of the plan.

  The report must include the ecosystem services proposed for monitoring and restoring as well as calculations of the site

predevelopment or predisturbance ecosystem services provision as compared to those of the proposed restoration.

In addition, the report must define how the process of Living Systems Analysis and Assessment (as defined by LS-r1) influenced and shaped the site design's final form and any ecological connectivity on the site or off the site with other ecological systems.

- Living System Key Performance Indicators (LS-KPIs) defining measurable performance benchmarks for determining how well the system will be functioning and creating more resilient interrelationships. With each LS-KPI, establish a performance target for the system within three (3) years of establishment.
- KPIs may be based on the Ecosystems Services and functions in Calculations and Methodology (Appendix 3) or others deemed appropriate by suitably qualified design team personnel.
- Restoration Operating Mechanism that includes:
  - MOUs with the relevant authorities/stakeholders defining how restoration will be enacted and maintained.
  - Funding mechanisms and operating budgets required to fulfill the habitat management strategies.
  - Process mechanism to change operating program should KPI's not be met.

The report and plans must be prepared by a suitably qualified system permaculturists, system ecologists, biologists, and/or environmental consultants qualified for a minimum of five years and practicing regularly in the field.

Credit Submission:

Provide the following documentation:

- Restoration Report as per the Credit Requirements. The report must include relevant calculations, photographs, and maps illustrating pre-existing degraded natural resource areas requiring mitigation, methodology for restoration of biologically functional habitat and key strategies for assuring performance of the plan.

  In addition, the report must define how the process of Living Systems Analysis and Assessment (as defined by LS-r1) influenced and shaped the site design's final form and any ecological connectivity on the site or off the site with other ecological systems.

- Living System Key Performance Indicators as per the Credit Requirements.
- Restoration Operating Mechanism as per the Credit Requirements.

Calculations and

Calculations may be required in the reports and plans to demonstrate

Methodology: compliance with Credit Requirements. PDS Assessors reserve the right to request additional calculations or information where not provided in the original reports.

A list of potential services area functions to be used for Ecosystems Services and functions KPI calculations is located in Appendix 3. KPIs derived from sources other than Appendix 3 deemed appropriate by suitably qualified design team personnel can be submitted and are to be approved by the project PDS Assessor.

The assessment of this credit will acknowledge that all sites provide different kinds as well as amounts of services and will have different baseline and potential outcomes as a result.

Related Resources and References:

www.uvm.edu/giee/publications/Nature_Paper.pdf
www.wri.org/project/**ecosystem**-**services**-review
www.actionbioscience.org/environment/esa.html

See Design Guide

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LS-3a: Soil Health: Soil Improvement

Credit Points Available: 2

Intent:

To develop strategies and regimens that will increase the capacity of soil to support more vital plant life, hold moisture and increase carbon sequestration while not increasing toxicity levels of soil.

Credit Requirements:

Demonstrate an integrated strategy to achieve onsite soil improvement including:

- Ensure that the application of Reclaimed Water and other fertilisers do not negatively impact soil (both can contain salts) and plant health over time, or become transported to the ecosystem during storm events.
- Protect soils by limiting vehicular impact to immediate building envelope, laying infrastructure within road right-of- ways, stockpiling topsoils separate from subsoils, and providing controlled washouts for trades.
- Nutrient Management Strategy (NMS) that outlines techniques for salt flushing from soils (where relevant) and fertilisation scheme(s) over the course of development and occupation.

1 CREDIT POINTS = two of the above strategies
2 CREDIT POINTS = three of the above strategies

The credit does not apply to projects where no more than 10% of the site is landscaped, including either on-grade or on structure (including green roofs).

Credit Submission:

Provide a narrative report including relevant content - depending on what aspects are appropriate; with the exception of toxicity and salting, all of these measures of soil health apply *only* to landscaped areas and may not be appropriate for existing native plant communities. The report should include but is not limited to:

- Include the methodology for each strategy and procedure to be enacted and maintained.
- Include identification of responsible parties and legal mechanisms to ensure ongoing continuity of program (s).
- Provide Consultant Agreements and/ or Standard Operating Procedures (SOPs) for Reclaimed Water, NMS, and IPM requirements.
- Demonstrate the fulfilment of the requirements with a design narrative for each requirement and a sample plan detail and specification where applicable.

Suitably qualified system permaculturist/s, system ecologist/s, geotechnical scientist/s, biologist/s, and/or environmental consultants qualified for a minimum of five years and practicing regularly in the

field must prepare the report and plans.

Calculations and Methodology: A meeting with the UPC staff will be required to validate proposed activities and processes.

Related Resources and References: See Design Guide

LS-3b: Soil Health: Soil Regeneration

Credit Points Available: 2

Intent:

To develop strategies and regimens that will increase the capacity of the soil to function as a self-organising and healthy system — therefore minimising maintenance, supporting more vital plant life, holding moisture and increasing carbon sequestration capability.

Credit Requirements:

Demonstrate an integrated strategy to achieve a continuously improving quality of onsite soil as evidenced by increased organic matter content (carbon), moisture retention capability, increased soil biological activity (micro-organisms — flora and fauna) and reduced or ongoing low salt levels.

The credit does not apply to a project where no more than 10% of the site is landscaped, including either on grade or on structure (including green roofs).

Credit Submission:

Provide a narrative report including relevant content — depending on what aspects are appropriate; these measures of soil health apply *only* to landscaped areas and may not be appropriate for existing native plant communities. At a minimum, the report must include the following:

- Methodology and procedure to be enacted and maintained.
- Identification of responsible parties and legal mechanisms to ensure ongoing continuity of program(s).
- Design narrative for each requirement and a sample plan detail and specification where applicable.
- Consultant Agreements and/ or SOPs for Reclaimed Water, NMS, and IPM requirements.

Suitably qualified system permaculturist/s, system ecologist/s, geotechnical scientist/s, biologist/s, and/or environmental consultants qualified for a minimum of five years and practicing regularly in the field must prepare the report and plans.

Calculations and Methodology:

A meeting with the UPC staff will be required to validate proposed activities and processes.

Related Resources and References:

See Design Guide

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LS-4: Cumulative Impacts: Carbon & Life Cycle

Credit Points Available: 4

Intent: To minimise 'cradle to cradle' embodied environmental and greenhouse impacts of the building from construction through operations.

5th Pearl Credit

Credit Requirements: Demonstrate that a comprehensive whole building life cycle assessment (LCA) has been developed and used to make design and construction decisions for the project resulting in an improved and more efficient performance over a baseline building using either $kg/C0_2e/m^2$ or LCA Eco-indicator 99 Eco-points as a proxy metric.

1 CREDIT POINTS is available if the project assesses as a minimum:

- Building energy use: CO_2 from building energy use and any on-site energy generation (data must correspond to findings in RE-2)
- Water: CO_2 impacts of water use (data must correspond to findings in PW-3)
- Materials: CO_2 impacts associated with building materials choices (data must correspond to materials LCA findings in the Alternative Compliance Path for SM- 1 to SM-5).

3 ADDITIONAL CREDIT POINTS are also available if the project assesses as a minimum:

- Building whole of life, whole of environment impacts
- Water: WOL impacts of water use (data must correspond to findings in PW-3)
- Materials: WOL impacts associated with building materials choices.

1 CREDIT POINT TOTAL = $kg/C0_2e/m^2$ metric calculated or
3 CREDIT POINTS TOTAL = WOL Ecopoint Calculated

Credit Submission: Provide a summary report including narrative and graphic representation of integrated whole-of-life (WOL) LCA modelling of the building structure, components and operational impacts including maintenance and cleaning requirements over 60-year life including deconstruction and resource recovery value (i.e. a 'cradle to cradle' analysis) in accordance with overall approach in SM 1-5 Alternative Compliance Path: Lifecycle Impacts of Materials.

The report should break down and illustrate graphically, impacts and savings compared to benchmark of each major building element, group and stage as well as overall totals. It should also show history of how LCA modelling was used to scenario test construction and component

options to minimise overall building ecological footprint.
In addition to providing the Ecopoint, reports should also provide individual performance data for Human Health, Environmental Quality and Resource Depletion impacts.

Calculations and Methodology:

RE-r6 Energy Model
PW-r3 Water Model
PW-3 Reduced Carbon Impact of Water
RE-1 Energy Use and Carbon Reduction
RE-2 Energy Generation
SM 1-5 Alternative Compliance Path: Lifecycle Impacts of Materials

Related Resources and References:

See Design Guide

Credit Section LB

LIVEABLE BUILDINGS

"…air pollution was found to be the leading environmental risk to public health. This includes both indoor and outdoor pollution. Second to that is exposure to hazardous substances in occupational settings."

Dr Jaqueline McDonald Assistant Professor of Environmental Science and Engineering, University of North Carolina, Author UAE National Strategy for Environmental Health, 2007

The importance of healthy, daylit, well ventilated and thermally comfortable buildings and associated areas should be considered the minimum criteria for every building in Abu Dhabi. This section sets out criteria and credits that will assist buildings achieve these minimal requirements as well as improve occupant health and the economical prosperity of Abu Dhabi by promoting productivity gains and reduced healthcare costs.

This section establishes measures and credits that will assist any building to meet these minimum criteria. The recognition of buildings as a major determinant of personal health and wellbeing is long overdue. Many international studies show buildings can negatively affect health via 'sick building syndrome' and specific emissions from products create a range of health impacts including headaches, reduced immune system function, lowered concentration, allergies and other negative impacts. Poor daylighting (both inadequate or too much) and inadequate ventilation increase eyestrain, create headaches and reduce health and productivity.

High performing PDS buildings will reduce or eliminate these issues and create healthy, productive spaces for the occupants.

Tenant and employee productivity gains are one of the most significant drivers of sustainable building design globally. Sustainable buildings demonstrate in many, multi-factor studies to deliver employee productivity gains of between 9 and45% for offices[7,8] and up to 9% increase for

[7] Accessed 12.04.09 at https://www.usgbc.org/FileHandling/show_general_file.asp?DocumentID=742

retail sales[1]. For many projects, these benefits add real value not only in their appeal to tenants, but also to lease extensions, increased lease rates, higher employee retention and higher resale rates[9].

Historically in the UAE, thermal comfort was traditionally delivered during a reasonable part of the year without recourse to any mechanical means. Today however mechanical air conditioning has become the default and 'passive' means of cooling have been forgotten. With the significant global climate change and with the UAE commitment to the Kyoto Protocol, minimising energy consumption in buildings is a significant means to reduce carbon emissions. This can be achieved by utilizing effective 'mixed mode' and hybrid ventilation and cooling strategies. Estidama PDS encourages and recognizes effective cooling strategies in this rating method.

[8] Employee Productivity in a Sustainable Building, Sustainability Victoria, Australia - Accessed 12.04.09 at www.resourcesmart.vic.gov.au/for_businesses_3753.html

[9] Green Outlook for Sustainable Buildings in 2009, McGraw Hill 2009 accessed 12.04.09 at http://energypriorities.com/entries/2008/11/greenbuild_2008_mhc.php

LB-r1: Outdoor Thermal Comfort

Code Requirement

Intent:

To reduce heat in urban open space through passive cooling strategies.

Credit Requirements:

Demonstrate that:

- the hard surface trafficable open space areas around buildings (driveways, parking, pedestrian walkways, and courtyards) within the site boundaries are provided with a minimum 75% projected shade measured at 1:00 pm at the Equinox, and semi-enclosed or enclosed areas provided with breeze openings on two approximately opposing sides to allow air movement.

and

- As a minimum, the shortest distance access between the public realm and the building entry/entries should be 100% shaded at 1.00pm (13:00) at the Equinox.

Credit Submission:

Provide the following documentation:

- Plan drawings of the trafficable area, showing shading devices including materials and their colors, and trees and breeze openings
- A report including an architectural three dimensional perspective model calculating shade projections of on site trafficable areas for the dated noted above. The model illustration must include surrounding solar shading from adjoining buildings or built structures and Approved Developments.

Calculations and Methodology:

Shading from trees may be included in the calculation provided the trees installed as part of development are at least three years old and are irrigated if necessary for growth.

Shading affects of trees must consider the trees to have reached 70% of their expected mature size.

Breeze openings must be equivalent to 5% of the total of any semi-enclosed space's perimeter, and between 120 and 240 horizontal degrees of one another (if only two openings).

The required percentage of opening sizes shall be divided between the largest and the smallest to facilitate effective air movement.

Related Resources and References:

See Design Guide. Computational fluid dynamic (CFD) calculations may be suggested when the geometry or height of the semi-enclosed spaces dictate.

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LB-r2: Dark Sky Strategies

Code Requirement

Intent:

To encourage the reduction of nighttime light pollution and its associated impacts on human and ecological health.

Credit Requirements:

Demonstrate that the project meets the following lighting requirements:

Prescriptive Requirement

Demonstrate that all exterior fixtures and interior light sources will cut off spill light at the property boundary where light is greater than 1 lux (1lumen/m^2) at the property boundary. Demonstrate that no direct light beam, from inside or outside the building, is directed beyond the site boundaries or upwards without falling directly onto a non-transparent surface with the explicit purpose of illuminating that surface.

Light reflected off a solid surface should not be more than 1 lumen at the boundary.

Performance Requirement

All site and building interior lighting will be designed to meet the IESNA Recommended Practice 33 Guideline or equivalent. Light levels and uniformity ratios should not exceed recommended values, per IESNA RP-33 or 20.

Credit Submission:

Provide the following documentation:

Prescriptive Requirement

- External lighting report detailing the lighting calculations for the external lighting system and showing all areas of light spill.
- Provide interior lighting photometrics for the building's perimeter areas, demonstrating that the interior lighting is substantially contained within the building and not projected through the windows, skylights, atria and other openings to the exterior.
- Extracts from the building maintenance manual indicating that all future lighting installations or replacements will meet the Credit Requirements (e.g. illuminance maximums, no lights directed upwards).

Performance Requirement

Summary Report showing compliance with IESNA Recommended Practice 33 Guideline or equivalent using Appendix 5, Recommended Illumination Levels for various tasks to show that fugitive light intensity is no more than 1 lumen at any site boundary.

Lighting context relative to Recommended Practice – 33, requirements

must be demonstrated via photos and/or descriptive maps.

Calculations and Methodology:

Calculations only consider lights such as: security, feature, foyer, display, landscape, external signage and advertising, 24 hour office lighting, and any light visible through skylights and atria.

Related Resources and References:

www.darksky.org
See Design Guide

LB-r3: Formaldehyde Reduction

Code Requirement

Intent:

To eliminate the human health risks associated with formaldehyde in building materials and products.

Credit Requirements:

Demonstrate all interior composite timber, agrifibre or other manufactured organic cellulose based fibreboards contain either:

- No added urea formaldehyde content

  OR

- Formaldehyde 'concentration' emission rates of less than or equal to 0.5mg/L (<0.5 parts per million) i.e. E0 rating when tested in accordance with the Reference Standards (see below).

Credit Submission:

Provide the following documentation:

- Final interior finish schedule showing areas where formaldehyde containing products have been used OR avoided
- Extracts from relevant specifications showing that all composite timber, agrifibre or other manufactured organic cellulose based fibre meets the Credit Requirements.
- Third party evidence showing certification of formaldehyde content provided by one of the following:
  - Reputable certified independent testing laboratory in accordance with referenced standards;
  - Certification from a reputable third party assessment body based on disclosure of detailed composition by manufacture or inspection of laboratory certification as above.

Calculations and Methodology:

This requirement can also be met by specifying materials that by design do not necessitate the use of formaldehyde containing products.

Related Resources and References:

Reference Standards:

- DIN EN 717-2, ASTM D5116, EN 13419, JIS A 1901
- AS/NZS 2269:2004, AS/NZS 2098.11:2005 method 10 for plywood;
- AS/NZS 1859.1:2004 - particle board
- AS/NZS 1859.2:2004 - dry processed fibreboards (MDF) both using testing procedure AS/NZS 4266.16:2004 method 16;
- JIS A 5908:2003- Particleboard and Plywood
  JIS A 5905:2003 - dry processed fibreboards (MDF), both using testing procedure JIS A 1460

LB-r4: Daylighting

Code Requirement

Intent: To encourage a holistic examination of site layout as well as building, fenestration and façade design to optimize interior access to daylight for the purposes of improved health and comfort for building users.

Credit Requirements:

Prescriptive Requirement

Office
Demonstrate the building has a minimum 10% ratio of window aperture to total occupied floor area.

Retail
Demonstrate the building has a minimum 25% of horizontal aperture of rooflights or skylights in the public/common areas excluding serviceways and toilet and toilet accessways. These must be provided with external shading devices to prevent direct solar penetration. Openings in each floor should allow light to reach minimum 30% of the most distant floor.

Residential
Demonstrate the 90% of apartments within the building have a minimum 10% window aperture to living space. Living spaces including: bedrooms, lounge/living rooms, dining rooms and kitchen.

Performance Requirement

Office
Demonstrate the building has a 2% minimum Daylight Factor or 200 lux daylight level for at least 30% of the occupied floor area.

Retail
Demonstrate the building has a 2% minimum Daylight Factor or 200 lux daylight level for at least 30% of the common/public space floor area.

Residential
Demonstrate that 90% of apartments within the building's living space have a 2% minimum Daylight Factor or 200 lux daylight level for 20% of the living spaces floor area

Credit Submission: Provide the following documentation:

Prescriptive Requirement

- Short report describing how the project meets the Credit Requirements.
- Schedule of window areas against zone areas
- Reference drawings showing floor area.
- Elevations and floor plans showing all façade and floor areas for

each relevant level, clearly marked-up to show appropriate distances from windows. The distances on the drawings must match those in the accompanying report. Provide wall and floor colors.

Performance Requirement

- Short report describing how the project meets the Requirements and including:
  - Floor plans
  - Façade including shading devices and performance criteria for glazing types
  - Diagrams for each floor showing isolux contours.

See Calculations and Methodology below for more details.

Calculations and Methodology:

Measurement of Average Daylight Factor

Window or skylight area is to be calculated to the outside of frame, (i.e. gross window area including frame, providing frame does not constitute more than 2% of window area.

Measurement of the average DF should use the methods recommended by CIBSE, or equivalent. The following modelling methods are acceptable alternatives.

Estimation of Average Daylight Factor

The average DF shall be estimated according to the method given in the CIBSE design guide, or similar equivalent method. Alternatively, daylighting design software such as RADIANCE can be used to calculate the average DF provided it can be demonstrated that the method of computation employed by the software used is not inconsistent with the preferred calculation method.
The report submitted must identify the key parameters used in the computations/modelling, especially with regard to glazing transmittance, and the reflectance of external and internal surfaces. The values of the parameters shall reflect the nature and type of surfaces on the external vertical obstructions and horizontal surfaces, and likely internal finishes. The room dimensions shall be taken to be a typical perimeter room for the building (measured at 300mm above the floor).

or

Alternative Calculation

Where light shelves have been proposed, an alternative calculation method that is based on Bright Sky calculation can be used. The submittal should include, as a minimum, quarterly calculations with 9.00am/9:00, 1.00pm/13:00 and 5.00pm/17:00 data. Lighting levels should be calculated on the basis on 200lux at the work surface.

Office

No glazed area below 800mm is to be included in the calculations.

Residential
Balconies, laundries, toilets and bathrooms, corridors and common spaces are not considered living spaces.

Related Resources and References:

The Chartered Institution of Building Services Engineers. Applications Manual – Window design.
The Chartered Institution of Building Services Engineers. Lighting Guide LG10 daylighting and window design. CIBSE
Ward Larson, G. and Shakespeare, R. Rendering with RADIANCE. Morgan Kaufmann. San Francisco

See Design Guide.

LB-r5: Healthy Ventilation Air Sources

Code Requirement

Intent:

To protect the quality of air drawn into buildings for ventilation and to ensure the air within the immediate public domain around buildings is not contaminated by local exhaust emissions from buildings or carparks.

Credit Requirements:

Demonstrate that the building mechanical system meets the following requirements:

- Air intakes for supplying outside air to occupied spaces are a minimum of 10 m from exhausts and discharges (i.e. cooling towers and other exhaust points).
- Exhaust points are located outside of defined public realm.
- Exhaust points are a minimum of 10 m above the ground plane.

Credit Submission:

Provide mechanical system drawings marked-up to clearly show distances between air intake points and exhaust air points and the distances from the air exhaust points to the ground plane and public realm areas.

Calculations and Methodology:

Distances should be measure horizontally or vertically and in the aggregate.

Related Resources and References:

See Design Guide

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LB-r6: Building Ventilation for Comfort

Code Requirement

Intent:

To ensure that buildings are capable of using natural ventilation.

Credit Requirements:

Prescriptive Requirement

Office and Residential

Demonstrate the building has a 5% ratio of clear open area of operable windows/grilles to occupied area with individual control operational from within the floorspace.

This credit does not apply to retail buildings.

Performance Requirement

Demonstrate the building is designed in accordance with ASHRAE 62.1:2007 Section 5.1

or

Demonstrate natural ventilation (litres per second per occupant) by computational fluid dynamic modelling.

Credit Submission:

Provide the following documentation:

Prescriptive Requirement

- Short report prepared by a suitably qualified engineer describing how the project meets the Requirements.
- Elevations and floor plans showing all façade and floor areas for each relevant level, clearly marked-up to show all appropriate distances and window control mechanism locations.

Performance Requirement

- Computational fluid dynamic (CFD) modelling report showing how the project meets the Credit Requirements in accordance with required parameters in Calculations and Methodology section below.

Calculations and Methodology:

Residential

Operable windows calculation must apply to overall unit area and each individual occupied spaces excluding: laundries and bathroom/toilets. Kitchens can benefit from shared ventilation via part height walls adjoining other occupied spaces with windows, but kitchen area is to be included in the overall calculation of ventilation requirements.

CFD: Requirements to be determined - Nominally typical conditions for mid March/mid November at 9.00am and 3.00pm for all typologies, and at least 10l/s/person of outside air must be achieved.

Related Resources and References:

See Design Guide

LB-r7: Plan 2030

Pearl Prerequisite

Intent:

To ensure that all new development supports the realisation of Abu Dhabi as envisioned by Plan 2030 and associated code documents.

Credit Requirements:

Demonstrate that the proposed project is located within an Urban Growth Boundary as identified by UPC's adopted Urban Structure Framework Plans.

and

Demonstrate that the proposed project's proposed floor area ratio (FAR), building height, building mass, transportation and open space networks are consistent with Plan 2030 and associated UPC Development Guidelines or Development Codes (adopted or interim).

Credit Submission:

Provide a letter from the Urban Planning Council of Abu Dhabi confirming that the proposed project is:

- Located within an established Urban Growth boundary.
- Did not require any variance or special relief from Plan 2030 for approval.
- Did not require any variance or special relief from detailed Development Codes and standards as adopted by the UPC.

Calculations and Methodology:

Not applicable.

Related Resources and References:

Plan 2030 (Abu Dhabi, Al Ain, Western Region or Eastern Region) Abu Dhabi Coastal Development Guidelines
Abu Dhabi Development Code
Abu Dhabi CBD Detailed Development Regulations.

See Design Guide

LB-r8: Liveable Cities Site and Site Context Assessment

Pearl Prerequisite

Intent:

To ensure that before design processes begin, a thorough understanding of the project site's current state of development and developed context is understood, to better inform project programming, connectivity and built form.

Credit Requirements:

Demonstrate the development of an assessment of the existing site and site context with the following information (as appropriate) at a minimum:

- Significant cultural facilities
- Places of community importance (gathering areas, landmarks; parks and open space)
- Adjoining street patterns
- Transit stops (proposed)
- Shading patterns
- Utility locations or points of connection
- Jobshed/jobs availability
- Amenities and community facilities, including health practitioners, hospitals, medical centres, dentists and educational
- Food provision or food opportunities.

The site context is defined as being within a 400m radius of the project.

Credit Submission:

Provide a report containing elements:

- Site plan including entire context radius, clearly identifying features included in the Credit Requirements above.
- Narrative describing inventory and development suitability analysis and explaining how this informed the final design.

Calculations and Methodology:

Not applicable

Related Resources and References:

Plan 2030 (Abu Dhabi, Al Ain, Western Region or Eastern Region) Abu Dhabi Coastal Development Guidelines

See Design Guide

LB-r9: Indoor Smoking Elimination

Pearl Prerequisite

Intent:

To minimise exposure of building inhabitants to the environmental air pollution associated with tobacco smoking.

Credit Requirements:

Offices and Retail

Demonstrate that smoking is prohibited throughout the entire building including carparks.

Residential

Where smoking is to be permitted within residential units, provide a technical solution proposal to compartmentalize odours and environmental tobacco smoke (ETS) within individual dwellings and eliminate from public areas.

No smoking is to be permitted within common areas including carparks.

Where smoking is permitted outside of the building, demonstrate that there are designated smoking areas at least 10 m from building entrances, operable windows and air intakes.

Credit Submission:

Provide the following documentation:

- Written commitment from the building owner that there will be a strictly no smoking policy operated within the building.
- Extracts from specifications or drawings indicating the locations of posted signage stating that the entire building is a no smoking environment.
- Drawings indicating the location of dedicated outside smoking areas, if any, clearly indicating their distance from entrances, operable windows and air intakes.

Calculations and Methodology:

Establish the 10 m smoking exclusion zone via straight line measurement in any direction.

Related Resources and References:

See Design Guide

LB-1: Community Walkability and Character

Credit Points Available: 4

Intent:

To encourage pedestrian activity and urban vitality by making streetscapes more attractive and pedestrian-friendly.

Credit Requirements:

Demonstrate that the ground floor level of the building is integrated into the surrounding urban fabric and supports a pedestrian-oriented urban environment by achieving three of the following measures:

- At least 75% of the façade incorporates human-scale detailing through using - recessed and transparent windows and doors, material changes and shading.
- At least 75% of the building perimeter at the pedestrian level (typically the ground floor) has a transparency of >70%.
- At least 75% of the ground floor of mixed-use buildings are highlighted and made prominent using floor/ceiling heights of at least 6 metres.
- Provision of clearly defined 'shadeways' and shading of all primary building entries, providing full shade as measured at 1pm on the Equinox.
- All site and primary building entries and exits are universally accessible to pedestrians.

Credit Submission:

Provide the following documentation:

- Short narrative report describing how the project meets the Credit Requirements, including any relevant calculations demonstrating compliance (e.g. 75% of the building perimeter as non-opaque).
- Final elevation drawings showing ground level facades, marked-up to clearly denote:
  - locations of doors, windows, entries, shading devices
  - floor/ceiling heights
  - universal accessibility features

Calculations and Methodology:

To calculate the transparency of the building perimeter at the pedestrian level (typically the ground floor):

1. Calculate the total vertical surface area of the nominated area at the pedestrian level (at least 75% of the building perimeter).
2. Calculate the vertical surface area of the nominated area accounted for by windows, glazing, glass doors and any other non-opaque surfaces (i.e. the transparent area).
3. Divide the surface area of the transparent areas by the total nominated surface area to get the percentage transparency of the nominated area.

Related Resources and References:

See Design Guide

LB-2a: Transit Nodes and Connectivity: Access to Transit Services

Credit Points Available: 4

Intent:

To encourage the use of public transit options by building occupants, thereby improving quality of life while reducing traffic, reducing carbon emissions and air pollution.

Credit Requirements:

Demonstrate that the building is within 300 m of walking distance to a major public transport station(s) as follows:

2 CREDIT POINTS = within 300 m of up to two public transit stations

4 CREDIT POINTS = within 300 m of three or more public transit stations.

Planned and funded metro or light rail transit stations can contribute to the project meeting the Credit Requirements if they are scheduled for opening within three years of construction completion of the project.

Credit Submission:

Provide the following documentation:

- Brief narrative describing how the project meets the Credit Requirements, including the number of transit stops and the distance to each.
- Site plan of building and surrounding environs, clearly marked up to indicate locations of all transit stations, the pedestrian walking routes from the project to the station and the distances of each route.

Calculations and Methodology:

Routes are calculated along the most direct pedestrian route, from main entrance to main entrance and allow for walking distances to connectivity aids such as:

- Traffic lights with pedestrian crossings adequately timed to allow timely walking across the width of road
- Pedestrian overpasses or underpasses within the public domain.

Related Resources and References:

Abu Dhabi Department of Transport: Surface Transport Masterplan April 2009

See Design Guide

LB-2b: Transit Nodes and Connectivity: Building Integrated Transit

Credit Points Available: 2

Intent:

To encourage the use of public transit options by incorporating public transit facilities and access directly into buildings.

Credit Requirements:

Demonstrate that convenient pedestrian access is provided to mainstream public transport, as follows:

1 CREDIT POINTS = provision of thermally comfortable indoor link(s) directly from the building to the nearest transit station

2 CREDIT POINTS = provision of a thermally comfortable, public transit station within the building

To qualify for the credit, the integrated transit station and its access areas must meet the LB-13c Thermal Comfort Modelling Credit Requirements for retail buildings and be universally accessible.

Credit Submission:

Provide the following documentation:

- Final plan drawings of building integrated transit station and/or link to the nearest transit station.
- Final drawing showing compliance with universal accessibility requirements.
- Calculations demonstrating year-round thermal comfort.

Calculations and Methodology:

Transit station for the purposes of this credit relates to planned Metro, Light rail or bus stations. For details on thermal modeling requirements, see LB-13c Thermal Comfort Modelling.

Related Resources and References:

See Design Guide
Abu Dhabi Department of Transport: Surface Transport Masterplan April 2009

LB-3a: Vehicle Trip Reduction: Development Density

Credit Points Available: 2-4

Intent:

To minimise the need for personal automobile by locating buildings in areas with high residential densities.

Credit Requirements:

Demonstrate that the residential development density surrounding the project within a 300m radius is as follows:

Office

1 CREDIT POINTS	= Gross Floor Area Ratio (FAR) of 1:5
2 CREDIT POINTS	= Gross Floor Area Ratio (FAR) of 3:0

Retail

2 CREDIT POINTS	= Gross Floor Area Ratio (FAR) of 1:5
4 CREDIT POINTS	= Gross Floor Area Ratio (FAR) of 3:0

Where the ratio measures [total site area within 300m:floor space area] Residential developments scheduled for opening within three years of the project's construction completion can contribute to the project meeting the Credit Requirements.

Credit Submission:

Provide the following documentation:

- Brief narrative describing how the project meets the Credit Requirements, including relevant calculations.
- Landuse map indicating the locations and densities of all residential developments within a 300 m radius.

Where residential developments not yet built are included in the calculations, include a copy of the development approval with construction completion dates or a statement from the municipality confirming the density of development and construction completion dates.

Calculations and Methodology:

To calculate the density of residential development:

1. Identify all residential developments within a 300 m radius of the project site (where less than 20% of a given development is within the radius, it may be excluded from the calculation).
2. Determine the FAR by dividing the total residential development area by the gross land area.

Related Resources and References:

See Design Guide

LB-3b: Vehicle Trip Reduction: Proximity to a Mix of Uses

Credit Points Available: 1

Intent:

To minimise the need for personal automobile use by locating buildings in areas with a mix of uses and amenities.

Credit Requirements:

Office and Residential

Demonstrate the building is located within 300m walking distance (from the main building entrance) of any five of the following:

- Place of worship
- Retail centre
- Bank/ATM
- School
- Public building (library, government office or post office)
- Dry Cleaner/Laundry
- Medical offices or dental offices or chemist
- Restaurant or food market
- Grocery store or supermarket

Amenities scheduled for opening within three years of the project's construction completion can contribute to the project meeting the Credit Requirements.

Credit Submission:

Provide the following documentation:

- Brief narrative on how the project meets the Credit Requirements, including a list of all qualifying businesses.
- Landuse map indicating the locations of all amenities meeting the criteria and the pedestrian walking routes from the project to these amenities, noting specific distances for each route, OR an extract from the site context assessment from credit LB-r2 indicating amenities and their distances from the project.
- For amenities scheduled for opening within one year of the construction completion date of the project, provide a copy of the development approval or other evidence from the municipality.

Calculations and Methodology:

Walking distances must be calculated using actual pedestrian routes from main entrance to main entrance.

Related Resources and References:

See Design Guide.

LB-3c: Vehicle Trip Reduction: Integrated Uses

Credit Points Available: 1

Intent:

To minimise the need for personal automobile use through the use of home offices and telecommuting.

Credit Requirements:

Residential

Demonstrate the following:

- Zoning approval has been granted for the inclusion of home offices in at least 50% of the building's units.
- Broadband ICT connection in all units to at least the living room and based on the size of the unit, additional rooms, as follows:
    - 1 Bedroom unit = connection in 1 other room
    - 2 Bedroom unit = connection in 1 other room
    - 3 Bedroom unit or larger = connection in 2 other rooms

Credit Submission:

Provide the following:

- Copy of the zoning approval for the building indicating allowances for home offices within 50% of the units.
- Documents demonstrating broadband ICT connection to all units and to required number of rooms:

Calculations and Methodology:

Not applicable

Related Resources and References:

See Design Guide

LB-3d: Vehicle Trip Reduction Bicycle Facilities

Credit Points Available: 3

Intent:

To minimise the need for personal automobile by providing ample bicycle facilities.

Credit Requirements:

Demonstrate that bicycle facilities are provided as follows:

Office and Retail

1 CREDIT POINT	= cyclist facilities, including shower facilities, for 3% of building staff
2 CREDIT POINT	= cyclist facilities, including shower facilities, for 6% of building staff

Staff bicycle facilities are defined as a secured area to lock bicycles.

Shower facilities are defined as showers provided at a ratio of one shower for every 10 staff bicycle parking spaces and including adjacent dedicated clothes changing areas (separate areas for men and women) and clothes lockers provided at a ratio of one locker per bicycle parking space. A minimum of one shower and changing area must be provided.

Where tenants are providing their own bicyclist and shower facilities, these may be deducted from the overall number provided by the building owner.

1 ADDITIONAL CREDIT POINT: Where the above requirements are met, an additional credit point is available for the provision of bicycle parking for visitors within 50m of the main building with one parking space provided for every 1000m of occupied area, including appropriate signage.

Residential

1 CREDIT POINT	= 1 secure bicycle rack per dwelling in a secure, enclosed area
2 CREDIT POINT	= 1 dedicated, enclosed individual bicycle locker per dwelling

1 ADDITIONAL CREDIT POINT: Where the above requirements are met, an additional credit point is awarded for the provision of publicly accessible bicycle parking within 50m of the main building entrance(s), with one space provided for every 10 residential units, including appropriate signage.

Credit Submission:

Provide the following documentation:

Office and Retail

- Brief narrative with calculations showing how the project meets the Credit Requirements, including numbers of bicycle

parking spaces, showers and clothes lockers.

- Plans and/or drawings showing the location of the bicycle and shower facilities, and marked up to indicate distances from main building entrances and locations of signage, as appropriate.
- Evidence of any tenants providing their own bicyclist facilities, if appropriate (including contractual requirements and drawings of proposed or actual location).

Residential

- Brief narrative with calculations showing how the project meets the Credit Requirements.
- Plans and/or drawings showing the location of the secure bicycle parking and showers, marked up to indicate distances from main building entrances and locations of signage, as appropriate.

Calculations and Methodology:

Office

Numbers of staff are calculated at one person for every 18 m^2 of occupied area.

Retail

Numbers of staff are calculated at one person for every 60 m^2 of GFA.

Related Resources and References:

See Design Guide

LB-4a: Equitable Development: Public Benefit

Credit Points Available: 1

Intent:

To promote a sustainable community infrastructure with an enduring economic base.

Credit Requirements:

Demonstrate strategies and commitments to develop and operate the proposed development in a manner that supports both public benefit and equitable development. At a minimum, these strategies must address:

Provision, development, and maintenance of facilities:
Develop a framework for funding the ongoing maintenance of the building and building site.

Funding of infrastructure
Ensure the building makes a beneficial contribution to the surrounding community through the development of public amenities (including but not limited to integrated public transit stations and infrastructure improvements) and contributing or connecting to environmentally beneficial district infrastructure (including but not limited to municipal Reclaimed Water and district cooling plants).

Credit Submission:

Provide the following documentation:

- Short report on how the project meets the Credit Requirements, including a description of specific funding mechanisms and implementation strategies for ongoing maintenance and a description of the public access to on-site amenities, if any.
- Copies of any contracts, agreements or MOUs regarding funding mechanisms, infrastructure access and the like.

Calculations and Methodology:

Not applicable

Related Resources and References:

See Design Guide

LB-4b: Equitable Development: Guest Worker Accommodation

Credit Points Available: 2

Intent:

To promote fair labour practices in building construction..

Credit Requirements:

Develop and implement a Construction Guest Worker Accommodation Plan that, at a minimum, addresses the following:

- The provision of housing facilities for construction guest workers that, at a minimum, meet the requirements of either the Abu Dhabi Municipality standards for guest workers or OHSA Standard 1910.142 for Temporary Labor Camps. Where possible, the facilities should provide dedicated areas for religious services, recreation and entertainment.
- Ongoing maintenance requirements of guest worker housing facilities and total budget allocated to maintenance services.
- Inspection schedules and auditing mechanisms for the guest worker housing facilities.
- Management plan and framework for engaging with facility residents and other stakeholders to address their requests, concerns and petitions.

A minimum of 90% of the construction guest workers working on project that are housed in guest worker accommodation must be in facilities that are addressed under the plan.

Credit Submission:

Provide the following documentation:

- Short report on how the project meets the Credit Requirements, including all maintenance plans, schedules and inspection requirements.
- Copies of agreements with housing contractors and subcontractors stipulating the standards and requirements for the provision of guest worker housing, its ongoing maintenance and engagement with residents and stakeholders.

Calculations and Methodology:

Not applicable

Related Resources and References:

OHSA Standard 1910.142 for Temporary Labor Camps

See Design Guide

LB-5: Urban Heat Reduction

Credit Points Available: 2

Intent:

To minimise microclimate temperatures within urban areas and reduce building cooling loads.

Credit Requirements:

Demonstrate that 50% of the total building surface area (including roof area) meets any combination of the following criteria:

- Shaded at 1pm on 21 at Equinox.
- Covered by materials with a Solar Reflectance Index (SRI) of at least 29
- Vegetated (vegetated roofs and walls must either be non-irrigated or irrigated with sub-surface systems using reclaimed water only).

Credit Submission:

Provide the following documentation:

- Short narrative describing how the project meets the Credit Requirements, including calculations demonstrating the amount of qualifying building surface area.
- Final site plan showing all locations of all-
  - roofing,
  - non-roof structures/surfaces
  - vegetated structures (including walls)

  Plans must indicate which areas meet the Credit Requirements and which strategies have been utilized in the respective areas, including relative percentages of individual and total areas. Locations and materials must correlate to the short narrative.

Calculations and Methodology:

To calculate the total amount of area meeting the Credit Requirements:

1. Create a list or table noting all compliant areas, their size in square metres and their constituent materials.
2. Add the total amount of compliant area.
3. Divide by the total site area to get the percentage of qualifying site area.
4. 100% of the area of vegetated walls facing south, east or west and 50% of walls facing north, can be included in the calculation provided they are sub-soil drip irrigated with Reclaimed or other reused water.

Related Resources and References:

Lawrence Berkeley National Laboratory
www.eetd.lbl.gov/coolroofs
www.greenroofs.org

See Design Guide

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LB-6a: Parking: Provision of Parking

Credit Points Available: 4

Intent

To minimise the land area used, resources consumed and pollution created from personal automobile use and to encourage use of alternative forms of transport.

Credit Requirements

Demonstrate that the project provides parking as follows:

1 CREDIT POINT = provision of 50% (or less) than max allowed parking according to UPC DMaP.

2 CREDIT POINT = provision of 75% (or less) than max allowed parking according to UPC DMaP.

3 CREDIT POINT = provision of the minimum parking requirements only under UPC DMaP.

1 ADDITIONAL CREDIT POINT: An additional point is available where there is a parking strategy in place that allows for parking below the standard minimum requirements.

Credit Submission

Provide the following documentation:

- Brief narrative describing how the project meets the Credit Requirements, including any calculations.
- Floor plans of all parking areas clearly indicating the number of parking spaces.
- Extract from municipal requirements or development approval documentation clearly indicating the required parking minimum or maximum, as appropriate.

Where there is a parking strategy that allows for shared parking facilities and allows for less parking than the standard minimum requirements, provide:

- A short report describing the strategy or a copy of the parking plan.
- Copies of approval from the Abu Dhabi municipality regarding the sharing plan and the amount of parking provided.

Calculations and Methodology

To calculate the percentage relationship between the number of parking spaces provided and the number allowed:

1. Add all parking spaced planned for the site, both internal and external. (Where the project shares a parking area with another building, use the number of spaces allocated to the building or apportion the number of spaces based on proportion of the building sizes to the parking spaces available.)
2. Determine the maximum number of parking spaces allowed by the municipality.
3. Subtract the number of parking spaces provided from the maximum number of spaces allowed, then divide the result by

the number of parking spaces allowed to get the percent of parking provided under the maximum.

Related Resources and References

See Design Guide.

LB-6b: Parking: Preferred Parking

Credit Points Available: 1

Intent

To minimise the resources consumed and pollution created from personal automobile use and to encourage more fuel-efficient forms of personal transport.

Credit Requirements

Demonstrate that 5% of all car park spaces are designated as preferred parking near building entrances for alternative fuel vehicles, hybrids, car sharing programs, carpooling programs and motorbikes/scooters only.

Credit Submission

Provide the following documentation:

- Brief narrative describing the mix of preferential parking and including any calculations demonstrating compliance with the Credit Requirements.
- Floor plans showing locations of all preferential parking spots.
- Extracts from specifications indicating the amounts and location of preferential parking.

Calculations and Methodology

To calculate the percentage of preferred parking spaces provided:

1. Add the total number of parking spaces provided, indoors and outdoors.
2. Add the total number of parking spaces allocated to alternative fuel vehicles, hybrids, car sharing programs, carpooling programs and motorbikes/scooters.
3. Divide the number of preferred parking spaces by the total number of spaces provided to get the percentage of preferred parking spaces.

Related Resources and References

See Design Guide

LB-7a: Community Space: Indoor Community Space

Credit Points Available: 1

Intent:

To provide building occupants with adequate space for common uses, minimising the need for increased sizes of personal spaces and greater areas per person as well as enriching the urban experience.

Credit Requirements:

Office and Residential

Demonstrate the building has a dedicated common space for meetings, events or other occupant uses. In order to qualify, the space must have the following attributes:

- Be equivalent to at least 1% of the GFA or 250 m^2 (whichever is greater),
- Have a Daylight Factor of 2% for at least 75% of the area.
- Be universally accessible.

Childcare centres available to all occupants also qualify for this credit provided there is also an adjoining outdoor space of at least 250 m^2.

Credit Submission:

Office and Residential

Provide the following documentation:

- Short narrative describing the how the project meets the Credit Requirements, including calculations demonstrating compliance with space requirements and if using the performance criteria, daylighting requirements.
- Final plan drawings showing the total area allocated to the community space, how it is it universally accessible, and if using the prescriptive criteria, daylighting requirements.

Where the nominated area is also included in the calculations to satisfy Credit LB-10a Improved Daylighting Performance, then the Daylight Modelling Report for that credit may be submitted for this credit. Where projects are not providing a Credit Submission for LB-10a Improved Daylighting Performance, then a separate DF calculation must be submitted for this credit.

Calculations and Methodology:

See Credit LC-10a Improved Daylighting Performance for details on calculating the Daylight Factor.

Related Resources and References:

See Design Guide

LB-7b: Community Space: Outdoor Community Space

Credit Points Available: 2

Intent:

To provide building occupants with adequate space for common outdoor uses, minimising the need for increased individual areas per person as well as creating opportunities for food cultivation, recreation and community interaction.

Credit Requirements:

Residential

Demonstrate that a proportion of the site area (accessible roof area developed as an amenity may be included) is developed as a dedicated common area for gardening and other outdoor activities, as follows:

1 CREDIT POINT = 25% of the site area dedicated as common use area

2 CREDIT POINT = 50% of the site area dedicated as common use area

To qualify, the common use area must be specifically developed for any combination of the following activities with appropriate seasonal shading devices:

- Gardening and food cultivation
- Green roofs for occupant use (must use reclaimed water),
- Landscaped areas for recreation
- Playground area
- Outdoor entertainment area

In order to qualify for this credit, the common area must be at least 250 m^2 in size and be universally accessible.

Credit Submission:

Provide the following documentation:

- Short narrative describing how the project meets the Credit Requirements, including planned uses for the area.
- Site plans marked up to clearly demonstrate how the area meets the size requirements and the program uses for the common areas.

Calculations and Methodology:

To calculate the amount of qualifying area:

1. Calculate the total site area by using a site plan to measure the amount of site area not occupied by the building footprint. Sidewalks, paths, driveways and any paved areas do NOT count towards the building footprint and are part of the site area.
2. Calculate the total area dedicated for common uses as per the Credit Requirements.
3. Divide by the total site area to get the qualifying percentage.

Related Resources and References:	See Design Guide

LB-8: Private Outdoor Space

Credit Points Available: 1

Intent:

To encourage the well-being of building occupants and the amenity of urban residential environments by providing private outdoor space.

Credit Requirements:

Residential

Demonstrate that private outdoor space is provided for at least 90% of the building's units. This space must be equal in size to at least 10% of the internal floor space of the unit it is attached to and be a minimum of 2.0m wide x 3.0m long.

To qualify for the credit, the private external spaces must have the following characteristics:

- Be directly adjacent to and directly accessible from the unit
- Not be publicly accessible
- 95% of the balconies must be shaded from direct sunlight for a minimum of three hours between 9am and 5pm, as measured on 21July.
- Include a facility for drying clothes outdoors in a visually shielded area.

Credit Submission:

Provide the following documentation:

- Short narrative describing how the project meets the Credit Requirements, including calculations demonstrating compliance with space requirements and shading requirements.
- Typical floor plan for all unit layouts, indicating size and location of outdoor space, access from unit and design of clothes drying area.
- Drawings of the façade, plans, balconies, projections and shading devices including materials.
- Evidence of any design features to mitigate or control solar penetration or climatic extremes (e.g. double skin envelopes).
- Report including a detailed hour by hour summary including computer model snapshots of each balcony floor by each of the three successful hours;

Calculations and Methodology:

For every unit size, calculations should indicate total indoor unit area in square metres, size of qualifying outdoor area in square metres and the relationship of the size of the outdoor area to the indoor area expressed as a percentage.

External Shading of Balcony Percentage Calculation:

1. Calculate the shade percentage shall be undertaken by measuring the total shaded area of each balcony at each whole hour between the times specified on 21July
2. Compared shaded and unshaded proportions at each whole

hour and convert to a percentage.

3. Calculate simple average of any three hourly results of shaded areas. Any three hour simple average figure must exceed the minimum shade requirements identified above.

Related Resources and References: See Design Guide

LB-9: Views

Credit Points Available: 1

Intent:

To provide building occupant with a visual connection to the outdoors.

Credit Requirements:

Office

Demonstrate that 75% of the occupied area has a direct line of sight through glazed windows, either to the outside of the building or to an adequately sized (see Calculations and Methodology) and naturally lit internal atrium or courtyard.

Residential

Demonstrate that the living spaces of 75% of all apartments have unobstructed external views of at least 25m.

Credit Submission:

Provide the following documentation:

Office

- Short narrative describing the how the project meets the Credit Requirements, including a summary of all areas with access to views and calculations demonstrating that at least 75% of the occupied area meets the criteria.
- Drawing of typical floor plate marked up to clearly show which areas meet the Credit Requirements, including sight lines (external wall thickness must be taken into account).

Where the floor plate or layout varies by floor, provide as many drawings as necessary to demonstrate that the project meets the Credit Requirements.

Residential

- Short narrative describing how the project meets the Credit Requirements, including a summary of all areas with access to views.
- Drawing of typical floor plate marked up to clearly show which areas meet the Credit Requirements, including sight lines (external wall thickness must be taken into account).
- Site plan clearly showing property lines and neighbouring buildings (both existing and planned for development) and marked up to show how the project meets the distance requirements for views.

Where the floor plate or layout varies by floor, provide as many drawings as necessary to demonstrate that the projects meets the Credit Requirements. The project must take into account all project slated for development within the next three years.

Calculations and Methodology:

Residential and Offices:

Where internal rooms rely on adjoining rooms or occupied spaces to achieve compliance the nearest boundary of the internal room must be

within 8 metres of the view window or plane. Such rooms cannot be more than 5 metres deep.

Sight lines can be taken at up to 45 degrees (from perpendicular) to the opening.

Windows must provide at least 8m of unobstructed view to be considered in the assessment.

Atria may be considered as providing views, if they are at least 8m wide, and have a DF over 3% when calculated in accordance with LB Credit Requirement for Daylight and include landscape planting with shrubs and trees to at least 20% of area.

Related Resources and References:

See Design Guide

LB-10a: Natural Lighting: Improved Daylighting Performance

Credit Points Available: 3

Intent:

To reward building designs that maximise the use of natural daylight indoors (while minimising the potential effects of glare associated with daylighting- see LB-10b).

Credit Requirements:

Office

Demonstrate an average DF of 2% for a proportion of the occupied area, as follows:

1 CREDIT POINT	= 45% of the occupied area
2 CREDIT POINT	= 60% of the occupied area
3 CREDIT POINT	= 75% of the occupied area

Retail

Demonstrate an average DF of 2% for a proportion of the GFA:

1 CREDIT POINT	= 35% of the GFA
2 CREDIT POINT	= 45% of the GFA
3 CREDIT POINT	= 55% of the GFA

Credit Submission:

Provide the following documentation:

- Short report describing how the project meets the Requirements and including:
  - floor plans
  - façade including shading devices and performance criteria for glazing types
  - diagrams for each floor showing isolux contours.

See Calculations and Methodology for more details on calculations.

Calculations and Methodology:

Measurement of Average Daylight Factor

Window or skylight area is to be calculated to the outside of frame, ie gross window area including frame, providing the frame constitutes less than 2% of the window area.

Estimate the average DF according to the method given in the CIBSE[10], Design Guide or similar equivalent method. Given that the specified sky conditions can be difficult to obtain in practice the following modelling methods are acceptable alternatives.

Estimation of Average Daylight Factor

The average DF shall be estimated according to method given in the CIBSE design guide, or similar equivalent method. Alternatively, daylighting design software such as RADIANCE can be used to calculate the average DF provided it can be demonstrated that the method of computation employed by the software used is not inconsistent with

[10].

the preferred calculation method. The report submitted must identify the key parameters used in the computations/modelling, especially with regard to glazing transmittance, and the reflectance of external and internal surfaces. The values of the parameters shall indicate the nature and type of surfaces on the external vertical obstructions and horizontal surfaces, and likely internal finishes. The room dimensions shall be taken to be a typical perimeter room for the building to reflect the buildings purpose.

or

Where light shelves have been proposed, an alternative calculation method that is based on Bright Sky calculation can be used. The submittal should include as a minimum quarterly calculations with 9.00am, 1.00pm and 5.00pm data. Lighting levels should be calculated on the basis on 200 lux at the work surface.

Office
No glazed area below 800mm is to be included in the calculations.

Residential
Balconies, laundries, toilets and bathrooms, corridors and common spaces are not considered living spaces.

Related Resources and References:

The Chartered Institution of Building Services Engineers. Applications Manual – Window design
The Chartered Institution of Building Services Engineers. Lighting Guide LG10. daylighting and window design. CIBSE
Ward Larson, G. and Shakespeare, R. Rendering with RADIANCE. Morgan Kaufmann. San Francisco

See Design Guide

LB-10b: Natural Lighting: Daylight Glare Control

Credit Points Available: 1

Intent:

To reward building designs that maximise natural daylight indoors while minimising the potential effects of glare associated with daylighting.

Credit Requirements:

Offices

- Provide automated or manually controlled internal or external blinds to all windows.
- Automated blinds must be connected to the building management systems and have a manual override.
- All manually controlled blinds must be on a chain driven system directly controllable by occupants, with no more than four linear metres of blinds connected to the same control.

Blinds must reduce visual light transmittance by at least 50%.

Credit Submission:

Provide the following documentation:

- Details of Blind and any control, automation and manual override system
- Technical Data sheets of proposed blind fabric showing VLT test data provided by third party specialist testing laboratory;
- Drawing and specification extract detailing the blinds and specifying four metre maximum runs controlled by single manual control.

Calculations and Methodology:

Not required

Related Resources and References:

See Design Guide

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LB-11a: Electric Lighting Quality: Lighting Glare Control

Credit Points Available: 1

Intent:

To ensure the adequacy and maintenance of visual comfort conditions achieved by the provision of electric lighting in occupied spaces.

Credit Requirements:

Offices

Demonstrate that 95% of the occupied space meets the lighting performance requirements with respect to maintained illuminance and illuminance variation, as per one of the following:

- CIE: Lighting of Indoor Work Places
- CIE: Discomfort Glare in Interior Lighting
- CIBSE: Code for Interior Lighting
- IESNA: Lighting Handbook, Reference & Applications

and

Demonstrate the project meets the limiting unified glare rating and appropriate colour rending index, as per the standards referenced above (CIE, CIBSE, IESNA)

Credit Submission:

Provide the following documentation:

- Drawings of the lighting layout and a luminaire schedule identifying fixtures
- Summary report detailing how the illuminance and glare requirements are achieved, design parameters and assumptions (appropriate to the specific situation), including surface reflectance, maintenance and light-loss factors.

Calculations and Methodology:

Not applicable

Related Resources and References:

Commission Internationale de l'Eclairage (CIE), Lighting of Indoor Work Places, CIE Standard S 008/E

Commission Internationale de l'Eclairage (CIE). Maintenance of indoor electric lighting systems. CIE Technical Report – Publication No. 97. Vienna

Commission Internationale de l'Eclairage (CIE), Discomfort Glare in Interior Lighting. CIE 117-1995

The Chartered Institution of Building Services Engineers. Code for interior lighting. London, CIBSE

Illuminating Engineering Society of North America. Lighting Handbook, Reference & Applications. 9th Edition, New York

See Design Guide

LB-11b: Electric Lighting Quality: High Frequency Lighting

Credit Points Available: 1

Intent:

To ensure the adequacy and maintenance of visual comfort conditions achieved by the provision of electric lighting in occupied spaces.

Credit Requirements:

Demonstrate that 95% of fluorescent luminaires are high frequency.

Credit Submission:

Provide the following:

- Extracts from specifications indicating requirements for high frequency electronic or magnetic ballasts

or

- Complete luminaire schedule including ballast specifications

and

- Technical Data Sheets of the luminaires selected showing high frequency specifications of ballasts.

Calculations and Methodology:

Not applicable

Related Resources and References:

See Design Guide

LB-12a: Healthy Ventilation: Outdoor Air Ventilation

Credit Points Available: 3

Intent:

To promote the provision of building systems that support the well-being and comfort of occupants by providing sufficient outside air ventilation.

Credit Requirements:

Demonstrate that 95% of the occupied area meets the following, as appropriate:

Offices, retail and residential buildings over 3 storeys

Mechanical Ventilation

Demonstrate that outdoor air ventilation rates meets or exceeds the minimum thresholds set out in ASHRAE 62.1:2007, as follows:

1 CREDIT POINT = meets the minimum requirements
2 CREDIT POINT = 30% above minimum requirement
3 CREDIT POINT = 60% above minimum requirement

Mixed mode Ventilation

Demonstrate compliance with the Credit Requirements for both mechanically ventilated buildings above as well as CISBE Applications Manual 10:2005 for naturally ventilated buildings. Demonstrate also relevant enthalpy recovery initiatives:

Low rise residential buildings

As per ANSI/ASHRAE 62.2:2007 as it relates to multi-unit residential developments under three storeys, but excepting single dwellings. Demonstrate also relevant enthalpy recovery initiatives:

Credit Submission:

Provide the following documentation:

Mechanical Ventilation

- Summary report describing how the mechanical design systems meets the Credit Requirements, including outside air rates, plant size and ventilation system
- Modelling report
- Drawing of mechanical system, including an air schematic clearly indicating ventilation systems, including air handling units and fans

Mixed mode Ventilation

- All Credit Submissions for mechanically ventilated buildings as noted above.
- Calculations demonstrating the project complies with CISBE Applications Manual 10:2005.
- The calculations/simulations shall cover at least one representative sample of each type of premises (occupied areas only).

Calculations and Methodology:	ANSI/ASHRAE 62.1:2007 Ventilation and Acceptable Indoor Air Quality ANSI/ASHRAE 62.2:2007 Ventilation and Acceptable Indoor Air Quality in Low Rise Residential
Related Resources and References:	See Design Guide

LB-12b: Healthy Ventilation: Air Change Effectiveness

Credit Points Available: 1

Intent:

To promote the provision of building systems that support the wellbeing and comfort of occupants by providing sufficient ventilation delivered in an effective manner.

Credit Requirements:

Demonstrate that occupants are receiving optimum air quality through the air change effectiveness in the occupied spaces, as follows:

Mechanical Ventilation

- Calculations or CFD simulations as per ASHRAE F25-33 & 34 (2005) or IAQ2007-34 (i.e. the air exchange effectiveness in normally occupied spaces is equal to or greater than 0.95)

  or

- Use of a displacement ventilation system meeting the following criteria:
  - The system covers at least 95% of the occupied area.
  - Low level supply outlets are evenly distributed.
  - Outlet diffusers are provided every 10m throughout the occupied area.
  - High level exhaust grilles are provided at least every 50m².

Mixed Mode Ventilation

Demonstrate compliance with requirements for mechanically ventilated spaces above and demonstrate through CFD model a distribution and laminar flow pattern for at least 90% of each area in the direction of air flow.

Credit Submission:

Provide the following documentation:

Mechanical Ventilation

- Report detailing the design criteria that has been adopted for each category of premises included in the development, and the results of calculations and/or simulations in the specified sample of premises to demonstrate compliance with the assessment criteria.
- Drawings showing the mechanical ventilation system
- The modelling locations shall include at least one representative sample of each type of premises (normally occupied spaces) as defined by the type of HVAC system used, design occupancy density, nature of usage, zoning, etc. modelling is required at the occupied zone in each representative test space in accordance with ASHRAE.
- Modelling is required to be undertaken under simulated full

occupancy conditions. All airstreams of the air-side system serving the space shall have a constant flow rate to the degree practical (e.g. the difference between the maximum and minimum should be within 10%). Where the air change effectiveness is demonstrated to be equal or greater than 0.95, and matches the design intent in all sampled premises, the credit shall be awarded.

Mixed mode Ventilation

- All documentation as above for mechanically ventilated buildings
- CFD model demonstrating compliance with the Credit Requirements.

Related Resources and References:

American Society of Heating Refrigeration and Air Conditioning Engineers. ASHRAE Fundamentals Handbook 2005 – Chapters 33 & 34
American Society of Heating Refrigeration and Air Conditioning Engineers. ANSI/ASHRAE Standard 129 (RA 2002). Measuring Air-change Effectiveness. Atlanta 1997
IAQ2007-34 Calculation of Ventilation Effectiveness for the New Californian Academy of Sciences of San Francisco

See Design Guide

LB-12c: Healthy Ventilation: Microbial and Humidity Control

Credit Points Available: 1

Intent:

To promote the provision of building systems that supports the wellbeing and comfort of occupants by controlling humidity in the ventilation system.

Credit Requirements:

Demonstrate that the mechanical ventilation system actively controls humidity as follows:

- 60% relative humidity in the occupied areas
- Less than 80% relative humidity in the supply ductwork.

Credit Submission:

Provide the following documentation:

Mechanical Ventilation

- Short report describing how the project meets the Credit Requirements, including a psychrometric chart showing the air conditions at each stage (room air, outside air, air-on, air-off coil, air from diffuser). This must be completed for two conditions:
  - when the air-on condition has the greatest enthalpy
  - when the air-on conditions have the greatest temperature
- Mechanical drawings showing relative humidity sensors and extract from the BMS control specification detailing how humidity requirements are to be achieved.

Calculations and Methodology:

Not applicable

Related Resources and References:

ANSI/ASHRAE 62.2:2007 Ventilation and Acceptable Indoor Air Quality www.ashrae.org

See Design Guide

LB-13a: Thermal Comfort and Control: Thermal Zones

Credit Points Available: 2

Intent:

To reward projects that use thermal zoning of the ventilation system to provide improved occupant comfort and energy efficiency.

Credit Requirements:

Demonstrate that 95% of the Nett Lettable Area (NLA) has separately controlled thermal zones, as follows:

Offices
Separate zones and controls for every 100m2 of common office space and for individual offices and meeting rooms

Retail
Separate zones for each tenancy.

Residential
Separate controls for living areas and bedrooms.

Credit Submission:

Provide the following documentation:

- Brief narrative describing how the project meets the Credit Requirements. Zoning information provided must match the information provided in Credit RE-r2 Energy Model.
- Plans/drawings of the mechanical ventilation systems, clearly indicating zone boundaries and zone sizes.

Calculations and Methodology:

Not applicable

Related Resources and References:

See Design Guide

LB-13b: Thermal Comfort and Control: Occupant Control

Credit Points Available: 2

Intent:

To reward projects that provide individual control over thermal comfort to occupants.

Credit Requirements:

Office

Demonstrate individual controls for air supply rates, air temperature, or radiant temperature, as follows:

Mechanical Ventilation

The ventilation system allows for individual occupant control of one of the following items:

- Air temperature
- Air flow, humidity
- Mean radiant temperature

as follows:

1 CREDIT POINT = 50% of the occupied area
2 CREDIT POINTS = 95% of the occupied area

User controls are defined as an individually controllable ventilation opening of not less than 0.75m², together with individual temperature control.

Mixed-mode Ventilation

Compliance with requirements above for mechanically ventilated buildings and the provision of operable windows as per ASHRAE 62.1-2004, paragraph 5.1 Natural Ventilation for at least 50% of the occupied area.

Credit Submission:

Provide the following documentation:

Mechanical Ventilation:

- Brief narrative describing how the project meets the Credit Requirements.
- Mechanical system drawings of locations of diffusers and thermostats or other individual control devices
- BMS point schedule

Mixed-mode Ventilation:

- All documentation as above for both mechanical and natural ventilation.
- Brief narrative showing how the project complies with Credit Requirements.
- Drawings and elevations clearly indicating the size and location of ventilation openings and ventilation controls.

Calculations and Methodology:	Not applicable
Related Resources and References:	See Design Guide

LB-13c: Thermal Comfort and Control: Thermal Comfort Modelling

Credit Points Available: 2

Intent:

To reward projects that are designed to provide optimal thermal comfort for their use.

Credit Requirements:

Demonstrate that thermal modelling on the building design has been performed to ensure a thermally comfortable environment for building occupants, as follows:

Office and Residential

Mechanical Ventilation: Demonstrate that the Predicted Mean Vote (PMV) levels, calculated in accordance with ISO7730, are achieved during Standard Operating Hours of Occupancy for 98% of the year using standard clothing and metabolic rate value:

1 CREDIT POINT = PMV levels between -1 and +1
2 CREDIT POINTS = PMV levels are between -0.5 and +0.5

Mixed mode Ventilation: Demonstrate compliance with requirements above for mechanically ventilated buildings and from 21st Nov to 21st March, with ASHRAE 55-2004.

Retail

Mechanical Ventilation: Demonstrate that the Predicted Mean Vote (PMV) levels, calculated in accordance with ISO7730, are achieved during Standard Operating Hours of Occupancy for 98% of the year using standard clothing and metabolic rate value:
1 credit point = PMV levels between -1.5 and +1.5, inclusive
2 credit points = PMV levels are between-1 and +1, inclusive

Mixed Mode Ventilation: Demonstrate compliance with requirements above for mechanically ventilated buildings and, from 21 Nov to 21 March, with ASHRAE 55-2004.

Credit Submission:

Provide the following documentation:

Mechanical Ventilation: Report describing thermal comfort design conditions and how the project meets the conditions set forth in the referenced standard and meets the Credit Requirements.

Calculations and Methodology:

Not applicable

Related Resources and References:

ISO 7730
ASHRAE Standard 55-2004 -- Thermal Environmental Conditions for Human Occupancy
See Design Guide.

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LB-14a: Materials Emissions: Adhesives and Sealants

Credit Points Available: 1 - 2

Intent:

To improve installer and occupant health, productivity and comfort by reducing indoor air contaminants resulting from the use of adhesives and sealants.

Credit Requirements:

Demonstrate that a proportion of the adhesives and sealants used on the project (indoors) meet or exceed accepted VOC standards (e.g. California Code for Regulation of Consumer Products Regulations, Title 17), as follows:

Office and Retail

1 CREDIT POINT = 95% of all adhesives and sealants

Residential

2 CREDIT POINT = 95% of all adhesives and sealants

Adhesives and sealants must meet the following maximum Total Volatile Organic Compound (TVOC) limits:

Target Contaminant	CAS#	24-Hour Testing Maximum Emission Factor (EF) ($\mu g m^2 \cdot hr$)	14-Day not to exceed Criteria Maximum Emission Factor (EF) ($\mu g m^2 \cdot hr$)
Acetaldehyde	75-07-0	20	16
Benzene	71-43-2	55	55
Caprolactam	105-60-2	120	190
2-Ethylhexanoic Acid	149-57-5	46	46
Formaldehyde	50-00-0	50	30
1-Methyl-2-pyrrolidinone	872-50-4	300	300
Naphthalene	91-20-3	20	8.2
Nonanal	124-19-6	24	24
Octanal	124-13-0	24	13
4-Phenylcyclohexene	4994-16-5	50	17
Styrene	100-42-5	410	410
Toluene	108-88-3	280	280
Vinyl acetate	108-5-4	400	190
TVOC		**500[a]**	N/A

[a]Quality Control Reference

Credit Submission:

Provide the following documentation:

- Brief narrative listing all adhesives and sealants, noting if they conform to the Credit Requirements and including any necessary calculations.
- Extracts from specifications clearly indicating the VOC limits for adhesives and sealants.

- Material Safety Data Sheets (MSDS), Technical Data Sheets or

third party certification of proposed adhesives and sealants showing compliance with VOC limits.

Calculations and Methodology:

Where 100% of the nominated products meet the Credit Requirements, no calculations are needed.

Where less than 100% of the products meet the Credit Requirements, the summary listing all products should indicate the number of products meeting the Credit Requirements as a percentage of the total number of products.

Exempt compounds must not be subtracted in the calculation of VOC content. Values should reflect the final product as mixed. The TVOC content of the ready-to-use product may also be calculated theoretically as the sum total of the VOCs of each of the raw material components comprising the product.

Related Resources and References:

South Coast Air Quality Management District (California, US) – Rule 1168. Compliance Testing: Refer to South Coast Air Quality Management District Rule 1168 for testing methods.
California Code for Regulation of Consumer Products Regulations:2005, Title 17, Chapter 1., S8.5., Article 2. Section 94509. Standards for Consumer Products

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See Design Guide

LB-14b: Materials Emissions: Paints and Coatings

Credit Points Available: 2 - 3

Intent:

To improve installer and occupant health, productivity and comfort by reducing indoor air contaminants resulting from the use of paints and coatings.

Credit Requirements:

Demonstrate that a proportion of the interior surface area covered by paints and coatings in the project meet or are less than the maximum TVOC Content Limits Values for Paints and Varnishes as stated in Annex II, Table A of European Directive 2004/42/CE: 2004 , as follows:

Office and Retail

2 CREDIT POINT = 95% of all surface areas covered by paints and coatings

Residential

3 CREDIT POINT = 95% of all surface areas covered by paints and coatings

Paints and coatings must meet the following maximum TVOC limits:

Product Type/Sub Category		(g/L of ready-to-use product)
Walls and ceilings	– interior semi gloss	16
Walls and ceilings	– interior low sheen	16
Walls and ceilings	– interior flat washable	16
Ceilings	– interior flat	14
Trim	– gloss, semi gloss and satin enamels, varnishes and woodstains	75
Timber and surface binding primers		30
Latex primer	– for galvanized iron and zincalume	60
Interior latex undercoat		65
Interior sealer		65
One and two pack performance coatings for floors		140
Any solvent-based coatings whose purpose is not covered in table		200
Any paint or coating that has no components with any Risk Phrases attached to any component.		No limit

Credit Submission:

Provide the following documentation:

- Brief narrative listing all paintings and coatings, noting if they conform to the Credit Requirements and including any necessary calculations (qualifying surface area covered as a proportion of the total area covered).
- Extracts from specifications clearly indicating the VOC limits paints and coatings.
- Material Safety Data Sheets (MSDS), Technical Data Sheets or third party certification of proposed paints and coatings showing

compliance with VOC limits.

Calculations and Methodology:

Where 100% of the nominated products meet the Credit Requirements, no calculations are needed.

Where less than 100% of the products meet the Credit Requirements, the summary listing all products should note the amount of surface area covered by a given product. Indicate the total surface area covered by the products meeting the Credit Requirements as a percentage of the total surface area covered by all products.

Exempt compounds must not be subtracted in the calculation of VOC content. Values should reflect the final product as mixed. The TVOC content of the ready-to-use product may also be calculated theoretically as the sum total of the VOCs of each of the raw material components comprising the product.

Related Resources and References:

Annex II, Table A of Directive
2004/42/CE of the European Parliament and of The Council of 21 April 2004

See Design Guide

LB-14c: Materials Emissions: Carpets and Floor Finishes

Credit Points Available: 2-3

Intent:

To improve installer and occupant health, productivity and comfort by reducing indoor air contaminants resulting from the installation of carpets and floor finishes.

Credit Requirements:

Demonstrate that a proportion of the surface area covered by carpets and floor finishes meet or exceed the Carpet and Rug Institute GreenLabel Plus or California Section 01350 VOC requirements as follows:

Office and Retail

2 CREDIT POINT = 95% of all surface areas covered by carpets and floor finishes

Residential

3 CREDIT POINT = 95% of all surface areas covered by carpets and floor finishes

The Carpet and Rug Institute GreenLabel Plus VOC requirements are as follows:

Product Type	(g/L of product)
Carpet adhesive – indoor use	50
Carpet underlay/pad adhesive	50
Wood flooring and laminate adhesive	100
Rubber flooring adhesive	60
Sub-floor adhesive	50
Ceramic tile adhesive	65
Cove base adhesive	50
Plasterboard and wall panel adhesive	50
Multipurpose construction adhesive	70
Structural glazing adhesive	100
Architectural sealants	250

Credit Submission:

Demonstrate that 95% of the surface area covered by carpet and internal floor finishes/systems meet or exceed the Carpet and Rug Institute Green Label Indoor Air Quality Test Program

Where less than 25% of the occupied area is designed to have additional finishes/systems, this credit is not applicable.

Calculations and Methodology:

Where 100% of the nominated products meet the Credit Requirements, no calculations are needed.

Where less than 100% of the products meet the Credit Requirements, the summary listing all products should note the amount of surface area covered by a given product. Indicate the total surface area covered by the products meeting the Credit Requirements as a percentage of the total surface area

covered by all products.

Tiled and other floor surface types are considered by this credit
Flooring products Certified under the FloorScore system comply with this credit.

Related Resources and References:

Carpet and Rug Institute -GreenLabel Plus
California Collaborative for High Performance Schools- Section 01350
Floorscore Ecolabel
See Design Guide

LB-14d: Materials Emissions: Ceiling Systems

Credit Points Available: 2

Intent:

To improve installer and occupant health, productivity and comfort by reducing indoor air contaminants resulting from the installation of ceiling systems.

Credit Requirements:

Office

- Demonstrate 95% of all installed ceilings, TVOC Content Limits Values for Paints and Varnishes as stated in Annex II, Table A of European Directive 2004/42/CE: 2004, for relevant paint and adhesive/binder emissions shown in Credits LB-14a and LB-14b.

- This credit does not apply to buildings where less than 25% of the occupied area has installed ceiling systems.

Credit Submission:

Provide the following documentation:

- Brief narrative listing all paintings and coatings, noting if they conform to the Credit Requirements and including any necessary calculations (qualifying surface area covered as a proportion of the total area covered).
- Extracts from specifications clearly indicating the VOC limits paints and coatings.
- Material Safety Data Sheets (MSDS), Technical Data Sheets or third party certification of proposed paints and coatings showing compliance with VOC limits.

Calculations and Methodology:

Where 100% of the nominated products meet the Credit Requirements, no calculations are needed.

Where less than 100% of the products meet the Credit Requirements, the summary listing all products should note the amount of surface area covered by a given product. Indicate the total surface area covered by the products meeting the Credit Requirements as a percentage of the total surface area covered by all products.

Exempt compounds must not be subtracted in the calculation of VOC content. Values should reflect the final product as mixed. The TVOC content of the ready-to-use product may also be calculated theoretically as the sum total of the VOCs of each of the raw material components comprising the product.

Related Resources and References:

Annex II, Table A of Directive 2004/42/CE of the European Parliament and of The Council of 21 April 2004

South Coast Air Quality Management District (California, US) – Rule 1168. Compliance Testing: Refer to South Coast Air Quality Management District Rule 1168 for testing methods

See Design Guide

LB-14e: Materials Emissions: Cleaning Methods

Credit Points Available: 1

Intent:

To improve installer and occupant health, productivity and comfort by reducing indoor air contaminants resulting from the use of cleaning products.

Credit Requirements:

Demonstrate the integration of materials maintenance plan into the materials selection process for finishes and fittings. The maintenance plan must describe how 95% of all finishes and fittings can be cleaned properly and with non-polluting, healthy compounds, as per California Code of Regulations Consumer Products Regulations: 2005 Requirements (CCR), Title 17, Section 94509.

The plan must include maintenance schedules for the high performance cleaning of carpets and soft furnishings with steam or liquid nitrogen cleaning at least once a year using high efficiency filters or a centralised system.

The plan must also include training program and outline training content for maintenance staff.

Credit Submission:

Provide the following documentation:

- Copy of the materials maintenance plan clearly demonstrating compliance with the Credit Requirements.
- Schedule of finishes and fixtures, noting all finishes and fixtures covered by the plan, and any necessary calculations.

Calculations and Methodology:

Where 100% of the nominated finishes and fixtures are covered by the materials maintenance plan, no calculations are needed.

Where less than 100% of the finishes and fixtures are covered by the materials maintenance plan, the schedule(s) of finishes and fixtures must note which are covered by the plan. Indicate the total number of finishes and fixtures covered by the plan as a percentage of the total number of fixtures and finishes.

Related Resources and References:

California Code for Regulation of Consumer Products Regulations:2005, Title 17, Chapter 1, S8.5, Article 2, Section 94509. Standards for Consumer Products
See Design Guide

LB-15a: Indoor Air Quality Management: Pollution Exhaust

Credit Points Available: 1

Intent:

To encourage the provision of building systems that remove or prevent the build up of pollutants from indoor air.

Credit Requirements:

Demonstrate the building includes a dedicated tenant exhaust riser with the following characteristics:

- Provides no less than 0.2 L/s/m² for 100% of the occupied space
- Has a capacity of 0.35 L/s/ m² for 100% of occupied space on any individual floor and
- The exhaust system is not recycled to other enclosures of different use
- The riser and/or individual exhausts discharge externally.

In the case of individual occupied spaces, systems shall comply with ANSI/ASHRAE 62.2:2007, Table 6-4 Individual Exhaust Rates.

Credit Submission:

Provide the following documentation:

- Brief narrative explaining how the project meets the credit criteria.
- Drawings of a typical exhaust system for an entire floor.
- Enthalpy recovery equipment proposed.

Calculations and Methodology:

Not applicable

Related Resources and References:

ANSI/ASHRAE 62.2:2007 Ventilation and Acceptable Indoor Air Quality www.ashrae.org

See Design Guide

LB-15b: Indoor Air Quality Management: CO_2 Management

Credit Points Available: 1

Intent:

To encourage the provision of air quality monitoring and management systems in occupied areas.

Credit Requirements:

Demonstrate the following:

Mechanical Ventilation

- Install permanent carbon dioxide ($_{CO2}$) monitoring and control systems to ensure the adequate provision of outside air at all times. A minimum of one CO_2 sensor at all return points must be provided.

or

- Provide 100% outside air with no recirculated component at all times based around enthalpy recovery equipment.

Mixed-mode Ventilation

Compliance with the requirements above for mechanical ventilation and the provision of a CO_2 alert system enabling occupants to directly adjust ventilation rates when the mechanical ventilation system is not in use.
In all instances comply with WHO Guidelines 2000 Air Quality Guidelines for Europe 2nd Edition, see ANSI/ASHRAE 62.2:2007 Appendix B, Table B-1.

Credit Submission:

Mechanical Ventilation:

- Brief narrative describing how the project meets the credit criteria
- Extracts from specifications indicating requirements for the locations of all CO_2 monitors OR outside air requirements for ventilation systems.

Mixed-mode Ventilation:

- Documentation as above for mechanically ventilated buildings.
- Specifications indicating the requirements for the alert system.

Calculations and Methodology:

Related Resources and References:

ANSI/ASHRAE 62.2:2007 Ventilation and Acceptable Indoor Air Quality www.ashrae.org
WHO Guidelines 2000 Air Quality Guidelines for Europe 2nd Edition.
See Design Guide

LB-15c: Indoor Air Quality Management: Car Park Air Quality Management

Credit Points Available: 1

Intent:

To facilitate the provision of adequate air quality within enclosed car parks.

Credit Requirements

Demonstrate that the ventilation design meets or exceeds requirements for CO and NO2 concentrations in car parks, as follows:

Air Pollutants	Maximum Concentration Micrograms	
	Averaging time	Parts / Million (ppm)
(a) Carbon monoxide (CO)	15 minutes	90
(b) Nitrogen dioxide (NO_2)	15 minutes	0.1

In all instances comply with WHO Guidelines 2000 Air Quality Guidelines for Europe 2nd Edition, see ANSI/ASHRAE 62.2:2007 Appendix B, Table B-1.

Where the project does not contain any enclosed car parks (75% enclosure), this credit is not applicable.

Credit Submission:

Provide the following documentation:

- Drawings or extracts from specifications indicating the location of air quality sensors.
- BMS point schedules.

The system presented in this credit must be consistent with the system included in the energy model (e.g. variable speed drive fans).

Calculations and Methodology:

75% enclosure is defined as a carpark with external walls or other building uses to more than 75% of total external perimeter wall area of the carpark area.

Related Resources and References:

ANSI/ASHRAE 62.2:2007 Ventilation and Acceptable Indoor Air Quality
www.ashrae.org
WHO Guidelines 2000 Air Quality Guidelines for Europe 2nd Edition.
See Design Guide

LB-16: *Legionella* Prevention

Credit Points Available: 1

Intent:

To eliminate the risk of *Legionella* in building cooling systems.

Credit Requirements:

Demonstrate that no water-based systems are used for building cooling thereby eliminating the potential for *Legionella* contamination.

or

A proper protocol for the treatment of Legionella in water-based systems.

Credit Submission:

Provide the following documentation:

- Drawings of the air conditioning system showing there are no water-based cooling systems.

or

- A copy of the protocol for the treatment of Legionella in the specific water-based system chosen.

Calculations and Methodology:

Not applicable

Related Resources and References:

See Design Guide

LB-17: Indoor Noise Pollution

Credit Points Available: 1

Intent:

Improve the noise isolation of normally occupied premises/rooms to reduce impact of unwanted noise.

Credit Requirements:

Offices

Demonstrate that internal ambient noise levels do not exceed 40 dBA for 95% of the occupied area.

Retail

Demonstrate that internal ambient noise levels do not exceed 50 dBA for 95% of the occupied area, excluding restaurant areas, and do not exceed 55 dBA for restaurant areas.

Residential

Demonstrate that internal ambient noise levels do not exceed 30 dBA for bedrooms and do not exceed 50dBa for other occupied areas.

All calculations, measurements and acoustic reports must be made by a qualified acoustics engineer.

Credit Submission:

Provide a noise design report with the following details:

- Short report describing how the project meets the Credit Requirements, all relevant internal and external noise sources, noise control features of the design and any underlying assumptions.
- Results of tests or calculations demonstrating compliance with the requirements (expressed in parameters that are consistent with the test and/or calculation methods).
- Plans, elevations and drawings representing typical floors marked up to clearly indicate noise control features.
- CV of the acoustic engineer.

Calculations and Methodology:

For the purposes of the calculations or measurements, all operable windows should be considered open.

Only noise from building services and external noise sources should be included, not noise from occupants or tenant equipment and appliances.

Measurements and calculations should represent the four noisiest areas of the building, typically near façades on busy streets.

Related Resources and References:

See Design Guide

LS-18: Outdoor Noise Pollution

Credit Points Available: 1

Intent:	To minimise noise pollution associated with the building that may affect neighbour buildings, amenities or wildlife.
Credit Requirements:	Demonstrate that the level of intruding noise at the facade of the nearest noise sensitive premises will be minimised to less than 55 dB(A).
Credit Submission:	Provide a short report describing how the project meets the Credit Requirements including calculations demonstrating that the level of intruding noise at the facade of the nearest noise sensitive premises is less than 55 dB(A).
Calculations and Methodology:	Not applicable
Related Resources and References:	http://www.epa.gov/history/topics/noise/01.htm See Design Guide

LB-19: Construction Indoor Air Quality Management

Credit Points Available: 1

Intent:

To reward construction practices that promote optimum indoor air quality (IAQ) at building delivery.

Credit Requirements:

Demonstrate the development of a Construction IAQ Management Plan. At a minimum the plan must address the following:

- Measures for meeting or exceeding SMACNA IAQ Guidelines for Occupied Buildings Under Construction, 1995 Ch 3
- Protection of all absorptive materials from moisture damage and
- Installation MERV 8 filters in each return air grille during construction and replacement immediately prior to occupancy.

Credit Submission:

Provide a copy of the Construction IAQ Management Plan.

Calculations and Methodology:

Not applicable.

Related Resources and References:

SMACNA IAQ Guidelines for Occupied Buildings Under Construction
See Design Guide

LB-20: Construction Site Management

Credit Points Available: 3

Intent:

To reduce the environmental impacts associated with construction practices.

Credit Requirements:

Demonstrate that the project's Construction Environmental Management Plan (CEMP) is prepared in accordance with Environment Abu Dhabi's CEMP Standard and has been peer reviewed by a suitably qualified professional.

Where the above criteria are met, an additional credit point is awarded where it is demonstrated that the project lead contractor is ISO 14001 certified.

Credit Submission:

Provide the following documentation:

- Copy of the CEMP
- Statement from peer reviewer that the project's CEMP meets the Abu Dhabi CEMP standard
- CV of the peer reviewer

Where the project is seeking the additional point, provide a copy of the ISO 14001 certification of the project's building contractor.

Calculations and Methodology:

Not applicable

Related Resources and References:

Environment Abu Dhabi's Construction Environmental Management Plan Standard
ISO 14001: 2004
See Design Guide

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LB-21: Sustainability Communication

Credit Points Available: 2

Intent:

To promote the efficient ongoing operation of the building by enabling occupants to monitor, improve and maintain peak building performance.

Credit Requirements:

Demonstrate that there is an occupant handbook, including details of ongoing maintenance requirements, prepared by a suitably qualified person from the design team.

1 CREDIT POINT = provision of occupant handbook for each occupant or tenant

This handbook should include details of the maintenance requirements for the buildings performance and a series of actions to be implemented over the life span of the building to ensure that the longer term aspects of building management and maintenance are upheld as new techniques come into effect over the lifespan of the building.

Topics to be addressed in the Occupant Handbook, at a minimum, include:

- The building's energy and water efficiency measures and how occupant behaviour affects the building performance.
- Information on the building's indoor environmental quality (IEQ) and how that is measured, monitored and managed.
- Information on materials used in the building, including environmental and social benefits, as appropriate.
- Waste and recycling policies and information such as location, sorting requirements (if any) and the use of green waste (if applicable).
- Locations of nearby public transport and on-site bicycle facilities.
- Tenant fitout considerations to maximise the building performance potential and minimise environmental impacts.

ADDITIONAL CREDIT: Where the above criteria are met, an additional point is available where it is demonstrated that building occupants receive feedback about their impacts on the building's environmental performance through one of the following measures:

- Digital Feedback Systems/Smart Meters with a user interface (e.g. dashboards) inside each tenancy.
- Integrated building internal communications

Credit Submission:

Provide the copy of the Occupant Guide.

Where the project is seeking the additional point, provide the following

- Brief narrative describing how the project meets the Credit

Requirements.

- Screen grabs of the digital interface screens representative of a user experience.
- Extracts from specifications indicating the functionality and location of all smart meters/dashboards or other building integrated internal communications.

Calculations and Methodology: Not applicable

Related Resources and References: See Design Guide

LB-22: Life Cycle Costing

Credit Points Available: 4

Intent:

To enable effective long-term decisions regarding building design and construction in order to maximise efficiency over the whole life of the development.

5th Pearl Credit

Credit Requirements:

Demonstrate that whole life cycle cost (LCC) report was developed early in the design process by a qualified and experienced professional and was maintained and upgraded throughout the project.

At a minimum, the report should cover the following topics:

- Initial capital expenditures
- Operation and maintenance costs and projections
- Replacement costs
- Residual values
- Finance charges
- Indirect benefits and costs
- Impact of LCC analysis on final design

The report must demonstrate, using evidence from the EIDP that the life cycle cost analysis was used to verify design, technology and process decisions.

Credit Submission:

Provide a copy of the final LCC report with summary history of the progressive decisions that benefitted from LCC.

Calculations and Methodology:

LCC reports are typically prepared by quantity surveyors but may be prepared by any experienced professional with the appropriate experience.

Related Resources and References:

See Design Guide.

LB-23a: Commissioning: Commissioning Requirements

Credit Points Available: 2

Intent:

To ensure that the building performs as designed, thereby protecting occupant health and comfort as well as providing for ongoing building efficiency.

Credit Requirements:

Demonstrate the comprehensive commissioning of the building at construction completion and the implementation of post-commissioning changes to ensure the building performs as intended. The commissioning process must cover, at a minimum, the following systems:

- Heating, ventilation, air conditioning, refrigeration
- On-site energy generation (including co-generation)
- Lighting and lighting controls
- Hot water
- On-site water treatment systems (if applicable) and
- Automated blinds.

Additional areas that can be included in the commissioning scope, but which are not required for this credit, are envelope and glazing systems, stormwater management systems, fire supression systems, and security systems.

Credit Submission:

Provide either extracts from contracts or from specifications clearly indicating commissioning requirements for the project.

Calculations and Methodology:

Not applicable

Related Resources and References:

PW-4b Water Use Reporting
RE-5 Energy Use Reporting

See Design Guide

LB-23b: Commissioning: Ongoing Commissioning

Credit Points Available: 1

Intent:

To ensure that the building performs as designed, thereby protecting occupant health and comfort as well as providing for ongoing building efficiency.

Credit Requirements:

Demonstrate a commitment to the following:

- Quarterly building tuning for the first year of building operation
- Final building tuning one year after construction completion
- Development and handover of an Operation and Maintenance Manual (OM&M) and
- Maintenance of a Building Log Book (BLB) or similar record performance, staff training and maintenance schedules.

Credit Submission:

Provide the following documentation:

- Extracts from contracts or specifications clearly indicating the requirements for ongoing building commissioning as per the Credit Requirements.
- Extracts from contracts or specifications clearly indicating the requirements for a detailed O&MM with via at least a Table of Contents and brief description of each section including details on BMS operation, or other means of monitoring building system performance and utilities consumption and maintenance schedules.
- Written commitment by the building owner to maintain a Building Log book as per the Credit Requirements.

Calculations and Methodology:

Minimum O&MM contents to be in accordance with ANSI/ASHRAE 62.2:2007

Related Resources and References:

PW-4b Water Use Reporting
RE-5 Energy Use Reporting
ANSI/ASHRAE 62.2:2007 Ventilation and Acceptable Indoor Air Quality
ASHRAE Guidelines:

- D-26487 - Commissioning Sustainable Buildings
- D-24619 - CH-89-13-3 -- The HVAC Commissioning Plan
- D-BldgsX56 - Commissioning of Exterior Building Envelopes of Large Buildings for Resultant Moisture Accumulation Using Infrared Thermography and Other Diagnostic Tools
- D-5966 - Commissioning HVAC Controls Systems
- 96564 - CIBSE -- Automatic Controls – Commissioning Code C: 2001
- D-18194 - CH-93-5-4 -- Commissioning to Avoid Indoor Air Quality Problems

- D-24619 - CH-89-13-3 -- The HVAC Commissioning Plan
- D-24621 - CH-89-13-5 -- Designing Healthy Buildings: The Architect’s Role in the Commissioning Process
- D-16838 - CH-03-12-2 (RP-1032) -- A Data Model for Capturing Life-Cycle Data for Re-Use During Building Commissioning
- D-24622 - CH-89-13-6 -- Commissioning: An Owner's Approach for Effective Operations
- D-20842 - Emerging Technologies: Saving Energy with Building Commissioning
- D-86800 - Guideline 0-2005 -- The Commissioning Process
- See Design Guide

LB-23c: Commissioning: Commissioning Agent

Credit Points Available: 1

Intent:

To ensure that the building performs as designed, thereby protecting occupant health and comfort as well as providing for ongoing building efficiency.

Credit Requirements:

Demonstrate that an independent commissioning agent was part of the project design team from schematic design through project completion. The agent must perform the following:

- Issue a design review prior to the issuance of design documentations (DDs) and make recommendations based on this review.
- Review submittals (e.g. shop drawings) from relevant subcontractors during construction.
- Commission all systems as described in Credit LB-23a Commissioning Requirements and prepare a commissioning report for all systems.
- Review and approve final commissioning documents, including but not limited to the operations and maintenance manual(s), building log template and staff training materials.

The independent agent can be someone from one of the companies involved in the project as long as this person is not directly involved in the project design or construction.

Credit Submission:

Provide the following documentation:

- CV of commissioning agent
- List of all meetings attended by the commissioning agent, including dates
- All reports issued by the commissioning agent on the design and any recommendations for changes during design development and any changes made as a result of the recommendations or analysis.
- Contract extracts to perform commissioning, prepare commissioning report, and review and approve final commissioning documents, as per the Credit Requirements.

Calculations and Methodology:

Not applicable.

Related Resources and References:

Not applicable

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Credit Section **PW**

PRECIOUS WATER

"In an age when man has forgotten his origins and is blind even to his most essential needs for survival, water along with other resources has become the victim of his indifference"

~Rachel Carson

Because of Abu Dhabi's desert climate, water conservation through reduced or cascading use of water is a priority for Estidama. The likelihood of the country becoming even drier — as discussed in the April 2006 UAE Initial National Communication to the United Nations on climate change — is a distinct possibility due to global warming. Coupled with a projected population increases, the importance of accelerating water conservation and reuse efforts is obvious.

In cities with dry climates, 50% or more of water usage can be devoted to landscape irrigation. Use of high water use vegetation that demands more water than native species only exacerbate the situation. Water conservation in Abu Dhabi also has an important energy nexus. Water desalinisation requires significant amounts of fossil fuel or waste energy (by-product of energy generation) to produce (particularly in winter when power consumption is lower), and this in turn contributes to increasing levels of greenhouse gas in the atmosphere and the need to find solutions to the large build up of mineralized salt generated during the process. Therefore, reducing overall water use, and reusing potable water as many times as possible will provide a double benefit to the region.

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PW-r1: Minimum Water Performance

Code Requirement

Intent: To ensure the project is meeting minimum performance requirements for total water use reduction.

Credit Requirements: Demonstrate the project meets the minimum water use requirements by one of the following:

Prescriptive Requirement

General: Use fittings and/or flow management systems that deliver or use no more than flow or delivery rates shown in Appendix 1 Appliances, Equipment and Facilities and Appendix 2 for Fittings.

Irrigation: Eliminate potable water for irrigation purposes and provide Reclaimed Water to surface drip irrigation at a maximum rate of approximately 875 mm/yr, (.875litres/yr).

Swimming pools: All swimming pools utilise a pool blanket whether indoors or outdoors.

Performance Requirement

Indoor: Reduce potable water consumption for indoor use by 30% from current Abu Dhabi consumption levels for indoor use

and

Irrigation:

- Eliminate potable water use for irrigation purposes and
- Use reclaimed water only where available from a licenced source for irrigation purposes and

and

Overall: Reduce consumption for all water types by minimum of 65% compared to current average Abu Dhabi consumption levels.

Credit Submission: Provide the following documentation:

Prescriptive Requirement

- Hydraulic drawings, schedule of fittings, summary of all water using equipment and facilities.
- Data sheets for all specified fixtures and fittings.

Performance Requirement

- Summary Report showing Credit Submission for PW-r3: Water Model and percentage calculations based on required percentages for this credit.
- Hydraulic drawings, schedule of fittings, summary of all

water- using equipment and facilities.

- Data sheets for all specified fixtures and fittings.

Calculations and Methodology:

Prescriptive Requirement

See Appendix 1 and 2 for benchmark data and assumptions to use in the model.

Should the applicant believe different assumptions are appropriate, a report showing results based on assumptions in Appendix 1 and 2 should be submitted as well and an alternative scenario based on the proposed modified assumptions and the rationale for the changes including the Technical Data Sheets and/or actual surveyed or statistical data supporting the rationale of the modification.

Performance Requirement

See Appendix 1 and 2 for benchmark data and assumptions to compare the proposed fittings, equipment and facilities to be used in the project with.

If choosing fittings, equipment and facilities that are higher than the assumptions shown in Appendix 1 and 2, the applicant will need to ensure adequate offsets are created using different initiatives to produce the required minimum efficiencies required.

The report to be provided must show all assumptions and the rationale for any changes including Technical Data Sheets and/or the actual surveyed or statistical data supporting the rationale of the modification.

Related Resources and References:

Appendix 1 and Appendix 2

PW-r3: Water Model

PW-1: Reduced Potable Water Consumption

PW-2: Water Generation

PW-3: Reduced Carbon Intensity of Water

Abu Dhabi Regulations and Supervision Bureau – Wastewater Residuals Reuse Regulation – Draft March 2009, www.rsb.gov.ae

Environment Agency Abu Dhabi- Plumbing Code (Draft – 2009)

Pearls Design System – PW-r1 Water Calculator Spreadsheet

PW-r2: Exterior Water Metering

Code Requirement

Intent:

To prevent water leaks and waste from building water systems and to enable effective management of outdoor water uses.

Credit Requirements:

Demonstrate that all irrigation and exterior water uses are separately metered and, where available, connected to the Building Management System (BMS).

- Exterior uses include, but are not limited to: all external hose bibs, irrigation systems, swimming pools and water features.
- Irrigation main lines and laterals must be colour-coded/Reclaimed Water labelled in accordance with the Abu Dhabi Plumbing Code and connected to Abu Dhabi Reclaimed Water mains where available. Where Reclaimed Water mains are not currently available, the project must provide quick connect valves for future connection to use Reclaimed Water.

The system must also raise an alarm whenever any unexplained or abnormal water consumption is detected, including but not limited to:

- Daily consumption exceeding 20% more than the average daily consumption (seasonally adjusted).
- Increases in cooling tower make-up water when the system is not operating.
- Lack of a 'nil use' 1 minute (or more) period in any 24-hour period.

Credit Submission:

Provide the following documentation:

- Drawings or specifications clearly indicating the locations of meters and quick connect valves.
- Extracts from specifications requiring colour-coded/Reclaimed Water labelled irrigation main lines and laterals in accordance with the Abu Dhabi Plumbing Code (future).
- BMS point schedules.

Calculations and Methodology:

Not applicable

Related Resources and References:

Environment Agency Abu Dhabi- Plumbing Code (Draft – 2009)

PW-r3: Water Model

Code Requirement

Intent: To enable the project team to make informed decisions about the options, implications and benefits of various water supply and conservation strategies.

Credit Requirements: Demonstrate the development and utilization of a water use analysis that accounts for all aspects of the building's predicted water consumption, including potable water, rainwater and reclaimed water, for both indoor and outdoor uses.

The analysis must compare the building's predicted performance to a baseline building and estimate the amount of water compared to the baseline building.

At a minimum, the model must account for the following:

(i) Fixtures and Fittings

Volume of water used by the following fixtures and fittings (where installed):

- Kitchen taps
- Bathroom taps
- Toilets
- Urinals
- Bidets
- Showers
- Prayer wash facilities.

(ii) Appliances

Volume of water used by the following appliances (where installed):

- Dishwashers
- Clothes washing machines

(iii) Pools and Spas

Volume of water lost by all pools, spas and water features (where installed).

(iv) Stormwater/Rainwater Capture

The volume of predicted stormwater/rainwater that will be captured from the roof or the building site, if any.

(v) Reclaimed Water

The volume of water predicted to be captured and treated from plumbing systems from reclaimed water, if any. This includes all municipally provided Reclaimed Water and any treated greywater and blackwater, where permitted. Water from cooling towers, condensate capture and fire system testing is calculated separately (see below). A description of designated uses and levels of treatment must be included.

(vi) Condensate and Bleed-off Capture

The amount of water predicted to be reclaimed and stored or treated for higher reuse from cooling coil condensate and cooling tower bleed-off, where installed.

(vii) Fire System Test Water Collection and Reuse

The volume of water predicted to be captured from fire safety tests or saved from testing mechanisms that do not expel water. A description of the storage facilities (including sizes) and/or testing mechanisms must be included.

(viii) Vehicle and Bin Wash

The volume of water predicted to be used for any dedicated bin or vehicle wash areas, if any.

(ix) Landscaping

The amount of water predicted for irrigation. Where there is no landscaping requiring irrigation, this is excluded from the calculation. Groundwater is a limited resource and should not be used. Any use of groundwater cannot be deducted from a project's potable water use requirements and makes the project ineligible for any points under Credit PW-1.

(x) Cooling Towers

The amount of water used for cooling towers (heat rejection), where installed.

Credit Submission:

Provide a complete report on the site's water use including but not limited to the following:

- Brief narrative describing all onsite water conservation strategies and how the water model was used to make decisions regarding the project design.
- Complete calculations for each item required in the water model, showing total water use and savings for each item. See Calculations and Methodology section below for more details.
- All documentation required for each item in the water model, as noted below.

The final report must be organised by items in the water model, with documentation for each item including technical data sheets of fittings, equipment and facilities, all clearly tabbed.

(i) **Fixtures and Fittings**

- Extracts from specifications detailing all fittings and fixtures
- Data sheets from manufacturers for all installed fittings and fixtures that clearly show water usage rates.

(ii) **Appliances**

- Extracts from specifications for all water consuming appliances provided, including water use ratings for each type and size of appliance if appropriate.
- Data sheets for each appliance that clearly showing standard water usage rates.

(iii) **Pools and Spas**

- Extracts from specifications for all water use parameters for all pools and spas, including volume, filtration system and cover (if present).
- Plans showing location of the pool/spa with details of any cover/enclosure.

(iv) **Stormwater/Rainwater Capture**

- A short narrative describing all rooftop rainwater and site-wide stormwater capture features and calculations demonstrating the predicted quantities for rainwater and stormwater to be captured and reused (see Calculation and Methodology section).
- Relevant plans and specifications extract s in support of the calculations undertaken.

(v) **Reclaimed Water**

- A short narrative describing the uses of reclaimed water on site.
- Where using Reclaimed Water from an offsite facility, provide contract extracts or a Memorandum of Understanding (MOU) describing conditions of access to the Reclaimed Water and parameters around volumes of water to be provided, if any.
- Plans and specification extracts showing details of the capacity of the treatment system, level of treatment provided and connections to points of reuse.

For projects using reclaimed water (except condensate reuse):

- Written approval in principle from Abu Dhabi Regulations and Standards Bureau (RSB).
- Full water quality report based on RSB Wastewater Residuals Reuse Regulations (Draft) – March 2009 (WWRRR Draft: 2009).
- Drawings of fail-safe mechanism to the sewer main.
- Copy of contract for ongoing monitoring and maintenance of the treatment system.

(vi) **Condensate and Bleed-off Capture**

- Specification or schedule extracts listing the parameters of the HVAC and heat rejection systems.
- Drawings of the collection system for capturing and transporting condensate generated from cooling systems and bleed off from cooling towers.

- Calculations of the annual quantities of condensate and bleed-off production, based on the system parameters provided above.
- Narrative describing the mechanisms by which collected condensate and bleed-off will be reused and the relevant water quality control system to deliver water of suitable quality for intended use.

(vii) **Fire System Test Water Collection and Reuse**

- Brief narrative of the storage facilities and/or testing mechanism, including calculations used to determine the size of storage facilities, if appropriate.
- Drawings and specification extracts in support of the calculations provided above.

(viii) **Vehicle and Bin Wash**

- Brief narrative describing the location of vehicle and bin wash facilities, connections to recycled water system (if appropriate) and calculations for the predicted volume of water to be used.
- Drawing(s) showing the connections to the recycled water/Reclaimed Water system, if appropriate.

(ix) **Landscaping**

- Site landscaping plan, including plant types and areas.
- Specification extracts and drawings detailing the irrigation system used with supporting supplier data sheets.
- Calculations showing the amount of water to be used for landscape irrigation purposes.
- Drawing(s) showing the connections to the recycled water /Reclaimed Water system if appropriate

(x) **Cooling Towers**

- Specification extracts and manufacturer data sheets.
- Calculation of annual water usage.
- Details showing number of concentration cycles and water treatment requirements and schedule.

Calculations and Methodology:

To calculate the project's predicted water use savings over a baseline building:

1. Determine the total amount of water used by the baseline building for all uses .[Figure#1]
2. Then determine the total amount of water used by the project for all uses.
3. Subtract the amount of water that is cascaded/ recycled/ reused on site, or Reclaimed Water used and then.
4. Subtract any rainwater or stormwater captured for onsite uses.[Final figure is Figure#2)

The difference between Figures #1 and #2 is the total potable water savings.

Baseline Building:

To calculate the baseline building's predicted water use savings:

1. Use the Abu Dhabi Water benchmarking data to determine the baseline case for a building of the same use and size as the project. The baseline case assumes that no water is recycled or treated on site (including condensate, cooling tower bleed-off water and fire system test water) and that no rainwater or stormwater is captured onsite for reuse.
2. Determine the number of users for the building.
3. For offices, assume one user per every 15 m^2 of occupied area.
4. For retail, assume one user per every 60 m^2 of GFA and 300 visitors per day for every 1000 m^2.
5. For residential, assume one user plus one user for every bedroom in the unit (e.g. assume two users for a 1- bedroom and four users for a 3-bedroom).
6. For all building types, assume equal numbers of men and women in each building.
7. See Appendix 1 to determine the number of fixture uses per user and visitor. Residential buildings must include one dishwasher and one washing machine per unit.
8. Multiply the number of fixture uses by the flow rates in Appendix 2.
9. The baseline building is assumed to not have any pools or spas or vehicle wash areas. Do not include any water for these in the calculation for the baseline building.
10. Have a qualified landscape architect provide calculations on the volume of water predicted to be used by the baseline building for landscape uses over a full year. Calculations must account for soil type, rates of evapotranspiration (2000 mm/yr), species selection (assume non-native), total number of plants, soil improvements and mulching practices and irrigation type (assume a minimum of surface drip irrigation).
11. Add the total amount of water for these uses over a one-year period, expressed as kL/m^2 and as percentages of total use.

Design Case:

- Calculate the project's water use from actual data from the specified fixtures and fittings, pools, spas and other uses as well as predicted amounts of water to be reused and/or captured on site and any Reclaimed Water to be used.
- Use steps 2–4 above to determine the water use from fixtures, fitting and appliances. Data from the actual specified products must be used (and the data sheets from the products must be included in the submission).
- Provide calculations for the amount of water used by any pools

or spas using default loss factors.

- Have a qualified landscape architect provide calculations on the annual volume of water predicted to be used by the project for landscape uses. Calculations must account for soil type, rates of evapotranspiration, species selection, total number of plants, soil improvements and mulching practices and irrigation type (based on the actual irrigation system).
- Add the total amount of water for these uses over a one-year period, expressed as kL/m^2 and as percentages of total use.
- Calculate the total amount of greywater/blackwater/Reclaimed Water/condensate to be captured and treated for reuse on site. Greywater includes all water from bathroom sinks, showers, laundries, cooling tower bleed off, fire system test water. Blackwater is all water from toilets, urinals, dishwashers and kitchen sinks. Drawings of the plumbing systems must be included showing the separate lines for grey and/or blackwater and/or reclaimed water and their separate storage and treatment areas. Clearly indicate where the treated water will be reused onsite and provide a schedule showing the proposed water quality level to be delivered in accordance with the RSB WWRRR Draft 2009.
- Calculate the total amount of rainwater/stormwater to be captured on site, storage location(s) and its onsite uses.
- Subtract the amount of water that will be reused on site from the amount of water the building is predicted to consume. This figure is the project's total potable water use. The final figure must be in kL/m^2.

Determining the project's performance:

- Subtract the project's total potable water use from the baseline case total potable water use to get the project's water savings.
- Divide this number by the baseline case total potable water use to get the project's water savings as a percentage over the baseline case.

Emergency Override:

- Projects treating blackwater and/or greywater and/or using Reclaimed Water and condensate must have an emergency override system to divert flow to the municipal sewer main and be licensed by the RSB.
- All water supply systems that use non-potable water, must have an emergency mains potable water backup with backflow prevention devices.

Related Resources and References:

Required Credit: Minimised Water Use
Appendix 1 and Appendix 2
PW-1: Reduced Potable Water Consumption
PW-2: Water Generation

PW-3: Reduced Carbon Intensity of Water
Abu Dhabi Regulations and Supervision Bureau – Wastewater Residuals Reuse Regulation – Draft March 2009, www.rsb.gov.ae
Environment Agency Abu Dhabi- Plumbing Code (Draft – 2009)

Pearls Design System – PW-r1 Water Calculator Spreadsheet

PW-1: Enhanced Potable Water Reduction

Credit Points Available: 22

Intent:

To reward the reduction of potable water consumption for interior and exterior uses through efficient building design, building systems, landscaping and substitution with reclaimed water.

Credit Requirements:

Demonstrate through the water model created for PW-r3 that the building has achieved the following reduction in water use over baseline:

7 CREDIT POINTS	= 35% reduction
8 CREDIT POINTS	= 40% reduction
9 CREDIT POINTS	= 45% reduction
10 CREDIT POINTS	= 50% reduction
11 CREDIT POINTS	= 55% reduction
12 CREDIT POINTS	= 60% reduction
13 CREDIT POINTS	= 65% reduction
14 CREDIT POINTS	= 70% reduction
15 CREDIT POINTS	= 75% reduction
16 CREDIT POINTS	= 80% reduction
17 CREDIT POINTS	= 85% reduction
18 CREDIT POINTS	= 90% reduction
19 CREDIT POINTS	= 95% reduction
20 CREDIT POINTS	= 100% reduction

Where the landscaped area constitutes 10% of the site or more (at a minimum size of 1000 m^2), two additional points are available where at least 20% of the overall reduction is attributable to the reduction in landscape uses.

Groundwater is a limited resource and should not be used. Any use of groundwater cannot be deducted from a project's potable water use requirements and makes the project ineligible for any points under Credit PW-1.

Credit Submission:

Provide the summary results of the water use analysis from PW-r3, clearly demonstrating through calculations and narrative, the volume of potable water (in percentage) to be saved by this project over the baseline project.

All Credit Submission requirements from PW-p3 must be complete in order to qualify for this credit.

Where the additional points for water savings through landscaping are being claimed, provide the following:

- Calculations demonstrating that the water consumption minimised through efficient landscape and irrigation design accounts for 20% of the total water reduction of the project.
- Site plan marked-up to clearly indicate the size of the landscaped

area and its proportion of the total project site.

Calculations and Methodology:

As per PW-r1 Water Model

Related Resources and References:

Code requirement: Minimised Water Use
Appendix 1 and Appendix 2
PW-r1: Water Model
PW-2: Water Generation
PW-3: Reduced Carbon Intensity of Water
Abu Dhabi Regulations and Supervision Bureau – Wastewater Residuals Reuse Regulation – Draft March 2009, www.rsb.gov.ae
Environment Agency Abu Dhabi- Plumbing Code (Draft – 2009)

Pearls Design System – PW-r1 Water Calculator Spreadsheet

PW-2: Water Generation

Credit Points Available: 10

Intent:

To reward the onsite treatment of non-potable water, including Reclaimed Water and condensate waste and by using innovative condensation technologies creating a net positive production of water onsite.

5th Pearl Credit

Credit Requirements:

Demonstrate the following reduction in water use over a baseline building, based on the water model created for PW-r3, as follows:

2 CREDIT POINTS	= 105%
4 CREDIT POINTS	= 110%
6 CREDIT POINTS	= 115%
8 CREDIT POINTS	= 120%
10 CREDIT POINTS	= 125%

Credit Submission:

Provide the complete water use analysis from PW-r3 clearly demonstrating through calculations the volume of potable water (in percentage) to be saved by this project over the baseline project.

All Credit Submission requirements from PW-p3 must be completed in order to qualify for this credit.

Calculations and Methodology:

As per PW-r1 Water Model
Reclaimed Water is considered for the purposes of this credit to be an input, whereas if treated to a level suitable for purposed other than irrigation, is considered to be generated water (output) .

Related Resources and References:

PW Minimised Water Use: Code Requirement
Appendix 1 and Appendix 2
PW-r1: Water Model
PW-1: Reduced Potable Water Consumption
PW-3: Reduced Carbon Intensity of Water
Abu Dhabi Regulations and Supervision Bureau – Wastewater Residuals Reuse Regulation – Draft March 2009, www.rsb.gov.ae
Environment Agency Abu Dhabi- Plumbing Code (Draft – 2009)

Pearls Design System – PW-r1 Water Calculator Spreadsheet

PW-3: Reduced Carbon Impact of Water

Credit Points Available: 5

Intent:

To reward projects that minimise potable water use and select the most greenhouse-efficient water, wastewater and reclaimed water treatment systems, thereby reducing the energy use and greenhouse gas emissions associated with the production, treatment, storage and transport of water.

Credit Requirements:

Demonstrate greenhouse impact of both potable and total water use of the project has been reduced, as follows:

2 CREDIT POINTS	= 10% reduction
3 CREDIT POINTS	= 20% reduction
4 CREDIT POINTS	= 30% reduction
5 CREDIT POINTS	= 40% reduction

Credit Submission:

Provide the following documentation:

- Complete water use analysis documentation from credit PW-r3: Water Model.
- Calculations of greenhouse impacts for each water source and total greenhouse gas reduction from water use achieved.

Calculations and Methodology:

Attribute each water source with the appropriate greenhouse factor then multiply by the total volume of each consumed flow as follows:

- Potable water – to be determined from Estidama PDS Benchmarking Project
- Reclaimed Water – to be determined from Estidama PDS Benchmarking Project
- Onsite wastewater treatment (including water defined as greywater) – to be provided by project
- Onsite condensate treatment – to be provided by project
- Onsite Reclaimed Water upgrade treatment – to be provided by project.

PILOT Projects Only: If projects have access to any of the data 'to be determined by Estidama PDS' – please inform the PDS Team ASAP.

Related Resources and References:

Code requirement: Minimised Water Use
Appendix 1 and Appendix 2
PW-r1: Water Model
PW-1: Reduced Potable Water Consumption
PW-2: Water Generation

PW-4a: Water Management: Indoor Water Meters

Credit Points Available: 2

Intent:

To enable the ongoing monitoring and management of indoor water use.

Credit Requirements:

Demonstrate that water flow measuring devices are installed to record all major water uses (exceeding 2% annual consumption), including but not limited to:

- Offices/Retail
- Domestic hot water
- Cooling towers
- Irrigation
- Rainwater tank top-up and usage from tank
- Water features
- Reused water systems.
- Residential
- Individual apartments
- Shared pool/spa/sauna and laundry facilities

Where the above point is achieved, demonstrate that all water meters are linked to the BMS to manage and monitor water use and major water leaks within the water distribution systems (including potable water, wastewater – greywater/blackwater, Reclaimed Water and condensate). This included all exterior and landscape meters installed per the Exterior Water Meters code requirement.

The system must also raise an alarm whenever any unexplained or abnormal water consumption is detected, including but not limited to:

- Daily consumption exceeding 20% more than the average daily consumption (seasonally adjusted).
- Increases in cooling tower make-up water when the system is not operating.
- Lack of a 'nil use' one minute (or more) period in any 24-hour period.

Credit Submission:

Provide the following documentation:

- Brief narrative describing how the project meets the Credit Requirements, including a schedule showing the number of meters to be installed and the areas served by each meter and whether it is to be connected to the BMS.
- Drawings or specifications indicating the locations of water flow measuring devices.

Where the additional point is being claimed:

- BMS point schedule showing the water meter connections.
- Description of the alarm system functionality.

Calculations and Methodology:	Annual consumption is to be sourced from the Water Model. All meters are to be connected to the BMS for reporting purposes.
Related Resources and References:	Code Requirement: External Water Meters LB-21: Sustainability Communication

PW-4b: Water Management: Water Use Reporting

Credit Points Available: 1

Intent:
To encourage building managers and designers to monitor, collect and report detailed information on water consumption models and actual usage to a central database.

Credit Requirements:
Demonstrate a written commitment from the building owner to supply the project's predicted and actual water consumption data to a central PDS database.

Credit Submission:
Provide a copy of the written commitment, including specific time frames, to forward the water model created for credit PW-r3 as well as all future water monitoring and building use patterns to a central database on an ongoing annual basis

Where the project is providing a commissioning report as part of credits LB-23a and LB-23b, all summary, quarterly and final commissioning reports on the performance of all water-related building services are considered part of the data that must be submitted to the PDS database. All reported information is confidential and any published data will be free of identifiers.

Calculations and Methodology:
Not applicable

Related Resources and References:
Code requirement: External Water Meters
LB-21: Sustainability Communication
PW-4a: Water Management: Indoor Water Use

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PW-5: Stormwater

Credit Points Available: 4

Intent: To improve stormwater quality draining from the site and reduce peak stormwater flows leaving the project site.

Credit Requirements: Demonstrate that the project design achieves the following performance related to its stormwater run-off:

- No more than 50 mg/l or a reduction of 80% of total suspended solids
- Base load concentration of total phosphorous not to exceed 0.08 mg/l
- Base load concentration of total nitrogen not to exceed 0.9 mg/l
- Minimum 80% reduction in total heavy metals
- No more than 30 mg/l or a reduction of 50% in BOD5
- Minimum 95% removal of litter (gross pollutants, >1mm) from stormwater leaving the site
- Minimum 90% removal of hydrocarbons from stormwater leaving the site.

2 CREDIT POINTS = achieving above stormwater quality

ADDITIONAL CREDIT POINTS: Where the above requirements are met, an additional 2 credit points are available, as follows:

1 CREDIT POINTS = stormwater flows are at or below pre-development flow levels for a 2cm, 24-hour storm.

2 CREDIT POINTS = stormwater flows are 25% below pre-development flow levels for a 2 cm, 24-hour storm.

Calculations must be prepared by a suitably qualified civil engineer.

Credit Submission: Provide the following documentation:

- Summary Report describing the stormwater management/treatment features of the project.
- Calculations that show total suspended solids, total nitrogen, total phosphorous, litter and hydrocarbons in stormwater leaving the site.
- Calculations that show peak and annual stormwater flows from the site pre- and post construction.
- Specifications, drawings and product data sheets (e.g. for filtration devices) in support of the above report and calculations.

Calculations and Methodology: To be provided by the civil engineer.

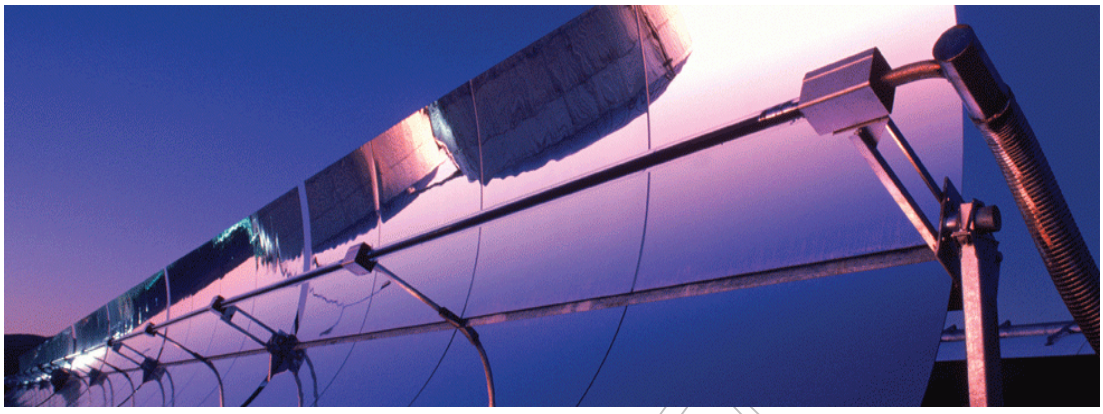
Civil Engineer CV: One-page CV showing qualifications, professional registration and recent similar experience including their specific role in the projects referenced.

Related Resources and References:

Environment Agency Abu Dhabi, www.ead.gov.ae
CSIRO Urban Stormwater Best Practice Environmental Management Guidelines (2006)

Credit Section **RE**

RESOURCEFUL ENERGY



"There are serious issues about **climate change**. We can no longer avoid facing up to this issue on an international level, ... I think the international community for far too long has refused to face up to it."

~ Tony Blair (British Prime Minister)

Although Abu Dhabi has abundant oil reserves, its leaders recognise that fossil fuels are a finite resource that should be conserved to the extent practicable. In order to achieve this vision, the country should embrace renewable energy sources in anticipation of a time when fossil fuel fed energy systems are no longer an option.

Moreover, use of renewable fuels can reduce greenhouse gas emissions (GGE), and United Arab Emirates' (UAE) corresponding carbon footprint. Extensive use of fossil fuels in Abu Dhabi and Dubai and the resulting high level of carbon dioxide emissions were cited as the primary factor for the UAE having the largest ecological footprint per person on the planet.

While some emphasis has been placed on building design and construction techniques to conserve energy, much more needs to be done to reduce the increasing energy demands of Abu Dhabi's growing population.

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RE-r1: Minimum Energy Performance

Code Requirement

Intent: To ensure all buildings meet minimum requirements to reduce energy demand from their operations.

Credit Requirements: Demonstrate that the building meets the energy performance requirements as follows:

Prescriptive Requirement

Minimum building envelope specifications:

Roofs and skylight support structures:

- Minimum assembly heat transfer co-efficient (U value) of 0.2 W/m^2K.

Above-grade walls and opaque assemblies:

- Minimum heat transfer co-efficient (U value) of 0.51 W/m^2K.
- Skylights maximum — 5% of gross floor area. (does not apply to retail buildings).

Below-grade walls:

- Below-grade walls to occupied spaces should provide for a minimum heat transfer co-efficient (U value) of 1.00 W/m^2K.

Windows and skylights:

Glazing — Less than or equal to U value of 1.5 W/m^2K
— Maximum Solar Heat Gain Coefficient (SHGC)of 0.45

Frame — Less than or equal to U value of 3.0 W/m^2K
The average for the façade should be no more than 1.65 W/m^2K.

Façade air tightness — all combined glass and opaque assemblies to have air tightness greater than 9 $m^3/hr/m^2$ façade at 100kPa.

For building shading requirements, see Code Requirement: Cool Building Strategies.

Minimum HVAC, hot water and equipment specifications to be in accordance with ASHRAE90.1:2007 clauses 6, 7, 8 and 10 and all 2008 and subsequent addenda.

Lighting power density to be 30% better than ASHRAE90.1:2007 clause 9 and all 2008 and subsequent addenda.

Performance Requirement

20% improvement over benchmark building performance demonstrated by the energy simulation model as described in credit RE-r2 Energy Model.

Credit Submission:

Provide the following documentation:

Prescriptive Requirement

- Architectural drawings and specification extracts together with a summary report detailing performance properties of all building elements mentioned above.
- Technical data sheets for all prescribed equipment and systems including calculations for façade U-value and lighting power density.
- Report summarising how the ASHRAE requirements have been achieved.
- Extract of the façade specification detailing the air tightness and demonstrating the requirement for façade testing on completion.

Performance Requirement

Summary report detailing results of completed energy model showing how much less final energy consumption is compared to the budget building and including the consequent GHGs based on all fuel sources and primary energy consumption of each fuel used.

The report must summarise the parameters used in the model including façade performance, occupant density, internal loads, operational and occupancy schedules.

Calculations and Methodology:

Prescriptive Requirement

U-values of materials proposed can vary by up to 5%.

Air tightness performance data based on 4 m slab-to-slab heights, if slab heights vary, pro-rata calculations are to be submitted.

Where balconies are inset into building facades and are above occupied space, they should be considered as roofs.

Performance Requirement

Please refer to RE-r2 Energy Model.

Related Resources and References:

www.ashrae.org ASHRAE 90.1: 2007 plus user manual and all addenda and supplements

RE-r2: Energy Metering

Code Requirement

Intent:	To encourage the provision of metering facilities that allow the energy performance of the building to be recorded and monitored to allow future improvement and understanding of the use of energy in buildings.
Credit Requirements:	Demonstrate all individual occupancies and floor plates as well as all major electrical uses over 100 kVa (e.g. HVAC equipment, process loads such as pools and large equipment) are sub-metered and linked to the building management system. No individual meter is to serve more than 200 kVA.
Credit Submission:	Provide the following documentation: • Extracts from specifications or drawings clearly indicating the extent and locations of all metering. • BMS point schedules.
Calculations and Methodology:	Not applicable
Related Resources and References:	See Design Guide

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Re-r3: Cool Building Strategies

Code Requirement

Intent:

To reduce heat build-up in urban areas and lower building cooling requirements.

Credit Requirements:

Demonstrate the project employs building design features that serve to minimise internal building temperatures:

Use materials with a minimum Solar Reflectance Index (SRI) of 29 and emittance of 0.8 for building roof, walls and any other surfaces with heat retention capability not shaded by external shading requirements.

Provide external shading to building façade (opaque and glazed) capable of providing the following shade levels between 21 April and 21 October between the hours of 8.00am and 6.00pm, based on solar sweep throughout the day:

- South – 90%
- East and West – 75%
- North –95%
- Other aspects – 80% for all faces.

Living (green) roofs can contribute to this percentage only if non-potable water is used for irrigation and soil is shaded by mulch and/or landscape planting with projected shade cover of more than 75%.

Credit Submission:

Provide the following documentation:

- Drawings of the façade and shading devices including materials.
- Report including a detailed hour-by-hour summary and model snapshots of each elevation by hour and day.
- Sunpath diagram – model setup to include surrounding solar obstructions including adjoining buildings, structures and approved future developments.

Office and Residential

Balconies generating projected shade can be included in the shading calculations.

Calculations and Methodology:

External Shading Percentage Calculation:

- A façade is considered to be within one of the major aspect categories shown if it falls within 15 degrees of one of the cardinal compass points (i.e. N, S, E or W).
- Calculate the daily average shaded areas for 21 April and 21 July and prepare a summary report based on the following methodology:
    - Calculate the shade percentage by measuring the total shaded area of each elevation at each whole hour between the times specified.
    - Compare shaded and unshaded proportions of walls

and windows to conditioned spaces at each whole hour and convert to a percentage. Add the percentages and divide by nine hour.

- The percentages are to be calculated based on 8.00am to 6.00pm business hours.
- Calculate simple average of the two nominated days shaded areas assessments. This figure must exceed the minimum requirements identified above.

Related Resources and References: See Design Guide

RE-r4: Energy Efficient Appliances

Code Requirement

Intent:

To minimise the energy consumed by common building appliances.

Credit Requirements:

Demonstrate that all developer installed appliances to meet or exceed the top 25% Energy Star or other recognised appliance rating system. Standard appliances to be documented include but are not limited to:

Office

- Dishwashers
- Boiling and chilled water dispensers units.

Retail

- Commercial dishwasher for each food service tenant.

Residential

- Dishwashers
- Clothes Washing machines, clothes dryers or washer/dryers
- Refrigerators and/or freezers.

Credit Submission:

Provide either of the following:

- Manufacturer information regarding appliance energy use or
- Proof of certification by Energy Star program or equivalent.

Calculations and Methodology:

Recognised appliance rating systems include but are not necessarily limited to:

- Energy Star (USA, EU, Australia, New Zealand)
- MEPS (Australia)
- Green Tick Singapore.

Appliances specified above relate only to those items installed within the building contract as follows:

- Residential – to each apartment or tenancy
- Office – to each 1000 m^2 of occupied space
- Retail – to each tenancy identified as a food outlet.

Related Resources and References:

www.energystar.gov
www.energyrating.gov.au
www.clasponline.org

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RE-r5: Ozone Impacts of Refrigerants and Fire Systems

Code Requirement

Intent:

To eliminate the impact of building operations on the ozone layer.

Credit Requirements:

Refrigerants

Demonstrate that all refrigerants to be installed throughout the building life have a low ozone depleting potential (ODP). Where refrigerants have an ODP greater than zero a refrigerant leak detection system must be installed.

Leak detection systems must contain refrigerants in a moderately airtight enclosure and be installed in high-risk parts of the plant. There must also be an automatic refrigerant pump down to a heat exchanger or dedicated storage tanks with isolation valves.

Refrigerants with an ODP of greater than 0.041 are not permitted even with leak detection systems.

Leak detection systems must be designed by qualified mechanical engineers.

This credit requires low ODP equipment to be installed in the building throughout its life. Ensure that sale and/or lease agreements, building management and user guides contain clauses requiring future owners or tenants to comply with ODP requirements.

Fire suppression systems

Demonstrate that all gaseous fire suppression systems to be installed in the building have a zero low ozone depleting potential (ODP).

This credit requires low ODP equipment to be installed in the building throughout its life. Ensure that sale and/or lease agreements, building management and user guides contain clauses requiring future owners or tenants to comply with ODP requirements if fire suppression systems to be installed as part of tenant fitout.

Credit Submission:

Provide the following documentation:

- Brief narrative describing how the project meets the Credit Requirements.
- Data sheets for all refrigerants and gaseous fire suppression systems.
- System specification for leak detection system where installed and consultant report demonstrating compliance with credit requirements.
- Model lease and sale contract clauses to be inserted as special conditions into future agreements.
- Draft content for inclusion for building owner and occupant

manuals.

- CV of the engineer responsible for the design of the leak detection system.

Calculations and Methodology:

Where there is no gaseous fire suppression system, credit points can be awarded if a statement from the fire designer that no fire suppression system is intended or needed to be installed is provided.

Related Resources and References:

See Design Guide

RE-r6: District Cooling System

Code Requirement

Intent:

To encourage the use and operation of efficient district cooling as well communication of the performance of systems over time.

Credit Requirements:

Demonstrate that any District Cooling (DC) system proposed as part of the project within which the site is located achieves a minimum acceptable efficiency of the overall system and regularly declares its system performance in a formal and open way. Show:

- The DC system achieves the required minimum efficiencies overall
- Full insulation of distribution pipes, including underground distribution line(s).
- Operating Contracts that require operating companies to state design coefficients of performance, and to provide annual audited reports confirming attainment of those standards.

Credit Submission:

Provide the following documentation:

- Extracts from specifications requiring all distribution pipes to be insulated with material with a minimum R value of R1.0.
- Extracts from operating agreements specifying the coefficient of performance of the DC system and the requirement for annual performance audits and reporting to PDS and other relevant external agencies.

Calculations and Methodology:

DC systems that complies with the following technical specifications are able to comply with this requirement:

- All distribution pipes from the DC to the project and onsite are insulated with material with a minimum R value of R1.0 or geotechnical report provided showing alternative solution as equal to or better overall system performance.
- Extracts from operating agreements specifying the coefficient of performance (COP) of the DC system and the requirement for annual performance audits and declaration of ongoing system COP on at least an annual basis.
- District cooling (DC) plant: COP of 3.25 (kW/ton = 0.775) for total cooling plant (including cooling towers and primary pumps).
- Thermal distribution system including pumping energy – maximum losses 5%.

COP is defined as net cooling energy exported from the plant over the total electric power used by the plant at the utility electric meters.

Related Resources and References:

www.districtenergy.org

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RE-r7: Energy Model

Code Requirement

Intent: To create a decision-support tool to aid the project team in making informed decisions about the options, implications and benefits of various aspects of the building design and systems as well as energy use and supply options.

Credit Requirements: Demonstrate through either of the following methods, the predicted building performance on an annual basis through dynamic energy simulation of the designed building.

Baseline Comparison Method

Compare the performance of the building to a base case simulation (Budget Building) as per ASHRAE/IESNA Standard 90.1-2007 and Addenda, using the minimum acceptable standards for plant and equipment, building fabric and control performance for the building and its location and additional requirements shown in Calculation and Methodology.

The output of the model will be a percent improvement in both energy usage and kg of $C0_2/m^2$/annum of the Proposed Building over the Budget Building.

Fixed Benchmark Method

Compare performance of the Proposed Building to the following GGE benchmarks per m^2 for each building type:

Building Type	GGEs with Thermal Plant	GGEs with District Cooling
Office	50 kg CO_2e/m^2 [to be confirmed	35 kg CO_2e/m^2 [to be confirmed
Retail	50 kg CO_2e/m^2 [to be confirmed	35 kg CO_2e/m^2 [to be confirmed
Residential	100 kg CO_2e/m^2 [to be confirmed]	70 kg CO_2e/m^2 [to be confirmed]

Carbon coefficients: for electricity, gas, diesel [to be confirmed by PDS]

The performance of the building must be calculated using the schedules per ASHRAE90.1:2007 Schedule G using the above benchmarks instead of the ASHRAE Benchmark in the calculation method in clause G1.2. The output of the model will be a percent improvement in both energy use and in kg of $C0_2e/m^2$/annum over the benchmark target.

Credit Provide a Summary Report detailing the energy simulation per ASHRAE

Submission: Standard 90.1:2007.

Calculations and Methodology :

Climate Zone: Use Climate Zone 1A 'Very Hot- Humid' as per ASHRAE Standard 90.1:2007.

Inclusions in Model

	BUILDING TYPE			
Item	**Office**	**Residential**	**Retail**	
Common lighting	Y	Y	Y	
Tenant lighting	N	Y	N	
HVAC to common space	Y	Y	Y	
AC to tenant space	Y	Y	Y	
Ventilation to tenant space (base-building systems, i.e. toilet exhaust)	Y	Y	Y	
Vertical transportation	Y	Y	Y	
Domestic hot water	Y	Y	Y	
Water treatment and pumping	Y	Y	Y	
Carpark ventilation and lighting	Y	Y	Y	
Tenant equipment	N	N	N	
Renewable energy (base building)	Y	Y	Y	
Irrigation	Y	Y	Y	

General principle: The energy model must include any item that is normally connected to a base-building switchboard, so that the output from the model provides realistic energy targets to help tune operational activities.

Operational Schedules

*Fixed Benchmark Method***:** Adopt the schedules relating to how the building is likely to be operated. If unknown, use default of 60 hours per week occupancy (100%) over a six-day week and 65 hours per week HVAC and lighting operation. If the schedules show less than 40 hours or more than 60 hours then rationale should be detailed.

Baseline Comparison Approach

Office and Retail: Use 60 hours per week occupancy (100%) over a six-day week and 65 hours per week HVAC and lighting operation.
Residential: HVAC 60 hours, over seven days

Benchmark HVAC System Performance Specifications

The budget building HVAC system condenser cooling source shall be air as per ASHRAE 90.1:2007 Figure 11.3.2.

Internal Heat Load (to determine HVAC energy consumption)

- *Office:* Internal load on the air-conditioning system is to be based on lighting loads internal equipment and expected occupant density — nominally 15 m^2 per person)

Task	**Office**	**Retail**	**Residential**
Lighting	12 W/m^2	Tenant: 18 W/m^2 General: 16 W/m^2	8 W/m^2
Equipment	8 w/m^2	-	20 W/m^2
Occupants	15 m^2/person	5 m^2/person	30 m^2/person

Water Treatment System
To be considered in proposed building case, but not in budget building model.

Vertical Transportation and Horizontal Travelators
Budget building is to assume use of a 5 kWh/m^2 base load for vertical transportation and travelators.

Proposed project to be based on this 5 kWh/m^2 benchmark, but adapted to reflect improved motor efficiencies, savings due to destination control and energy regeneration (as applicable), control strategies and other efficiencies to be demonstrated in the summary report.

Renewable Energy:

- Where renewable energy is exported to grid and a net surplus exists, the energy exported is offsetting mains electricity GGEs and this can be included in the model.
- Any export is offsetting power imported at another stage until the project becomes a net exporter.

Carbon Offsets
For offsite generation potential, the system must be capable of meeting Kyoto Protocol (or its successor) compliance under the Clean Development Mechanism (CDM) requirements as defined in Article 12 of the Protocol.

The model can include either site-based energy generation or, where there is a minimum operational carbon reduction of 50% by the building, the purchase of Certified Emissions Reductions (CERs) can be used. The greenhouse benefit of purchasing CERs can be included in the model; however, it must be evenly distributed over a 20-year period.

Simulation software
Software used shall meet either IEA - BesTest standard or ANSI/ASHRAE Standard 140-2001 Standard Method of Test for the Evaluation of Building Energy Analysis Computer Program.

Related Resources and References:	International Energy Agency Building Energy Simulation Test (BESTEST) and Diagnostic Method NREL/TP-472-6132 February 1995 International Energy Agency Building Energy Simulation Test and Diagnostic Method for Heating, Ventilating, and Air-Conditioning Equipment Models (HVAC BESTEST) NREL/TP-550-30152 January 2002 http://apps1.eere.energy.gov www.ashrae.org

RE-1: Energy Use and Carbon Reduction

Credit Points Available: 20

Intent:

To reward the reduction in energy consumption and carbon emissions during building operation.

Credit Requirements:

Demonstrate a percentage reduction in energy consumption based on an improvement over the a baseline benchmark in CO_2e/m^2 /annum, as follows:

Baseline Comparison Method		Fixed Benchmark Method	
4 CREDIT POINTS	= 50% reduction	**4 CREDIT POINTS**	= 35% reduction
6 CREDIT POINTS	= 55% reduction	**5 CREDIT POINTS**	= 40% reduction
8 CREDIT POINTS	= 60% reduction	**6 CREDIT POINTS**	= 45% reduction
10 CREDIT POINTS	= 65% reduction	**7 CREDIT POINTS**	= 50% reduction
11 CREDIT POINTS	= 70% reduction	**8 CREDIT POINTS**	= 55% reduction
12 CREDIT POINTS	= 75% reduction	**9 CREDIT POINTS**	= 60% reduction
13 CREDIT POINTS	= 80% reduction	**10 CREDIT POINTS**	= 65% reduction
14 CREDIT POINTS	= 85% reduction	**11 CREDIT POINTS**	= 70% reduction
15 CREDIT POINTS	= 90% reduction	**12 CREDIT POINTS**	= 75% reduction
16 CREDIT POINTS	= 95% reduction	**13 CREDIT POINTS**	= 80% reduction
17 CREDIT POINTS	= 100% reduction	**14 CREDIT POINTS**	= 85% reduction
		15 CREDIT POINTS	= 90% reduction
		16 CREDIT POINTS	= 95% reduction
		17 CREDIT POINTS	= 100% reduction

ADDITIONAL CREDITS: Where energy savings can be attributed to *passive environmental design*, additional points are available as follows:

1 **CREDIT POINTS** = 10% carbon reduction
2 **CREDIT POINTS** = 20% carbon reduction
3 **CREDIT POINTS** = 30% carbon reduction

Credit Submission:

Provide a summary report of the dynamic energy simulation of the designed building as per credit RE-r2 including additional calculations to show GHG impacts of refrigerants and fire systems included in overall calculation.

Passive Savings Calculations

Where additional credit points are being claimed for passive environmental design, provide the following documentation:

- Short report describing the design features included in the project that meet the Credit Requirements, including calculations showing the portion of the project's energy savings that are attributed to the passive design features.
- Relevant drawings that support the short report in demonstrating how the project meets the Credit Requirements.

Renewable Energy inputs and CDM Offsets

Provide the following documentation:

- Summary analysis of the dynamic energy simulation model of the designed building as per credit RE-r2 showing the renewable energy generation capability of the projects systems (onsite or offsite).
- For site-based systems:
  - Statement from the system design engineer stating that the system as designed with all component specification will be capable of delivering the assumed annual average system performance relied on in the model.
  - CV of the systems design engineer.
- For offsite systems:
  - Copies of system certified emission reductions (CERs) certificate.

Calculations and Methodology:

Calculate the Budget building for calculating the passive contribution as per the energy model created above in RE-r2: Energy Model except:

- Shading can be downgraded to meet the mandatory components of Requirement 3- Cool Building Strategies
- Passive systems can be removed (e.g. thermal storage tanks, light shelves, detune glazing to U=1.5W/m^2K. Add carpet if using hard floor finishes.
- No allowance for natural ventilation in mixed mode buildings;
- Reselecting fans to suit ductwork with 1Pa/lin meter pressure drop (i.e. do not take into account oversizing ducts).
- Deselecting any other passive strategies proposed provided the rationale is described fully in the Summary Report.
- NOTE: all mandatory requirements must still be achieved.

Related Resources and References:

BS 5925: 1991, Code of Practice for Ventilation Principles and Designing for Natural Ventilation

RE-2: Energy Generation

Credit Points Available: 12

Intent:

To reward projects for exceeding energy consumption and carbon emission reduction targets through the production of site-based renewable energy.

5th Pearl Credit

Credit Requirements:

Demonstrate a percentage reduction in energy consumption based on an improvement over the a baseline benchmark in CO_2/m^2 /annum, as follows:

2 CREDIT POINTS	= 105% reduction
4 CREDIT POINTS	= 110% reduction
6 CREDIT POINTS	= 115% reduction
8 CREDIT POINTS	= 120% reduction
10 CREDIT POINTS	= 125% reduction
12 CREDIT POINTS	= 130% reduction

Onsite energy generation systems must be designed by a qualified engineer with a minimum of five years experience.

Credit Submission:

Provide the following documentation:

- Summary report with analysis of the dynamic energy simulation model of the designed building as per credit RE-r2 showing the renewable energy generation capability of the projects systems (site-based or offsite).
- For site-based systems:
  - Statement from the system design engineer stating that the system as designed with all component specifications will be capable of delivering the assumed annual average system performance relied on in the model.
  - CV of the systems design engineer.
- For offsite systems:
  - Copies of system CERs certificate.

Calculations and Methodology:

For offsite generation potential, the system must be capable of meeting Kyoto Protocol (or its successor) compliance under the CDM requirements as defined in Article 12 of the Protocol.

Any emissions generated from combustion must meet European Council Directive 1999/30/EC of 22 April 1999 relating to limit values for sulphur dioxide, nitrogen dioxide and oxides of nitrogen, particulate matter and lead in ambient ai

System Design Engineer CV: One-page CV showing qualifications, professional registration and recent similar experience including their specific role in the projects referenced as experience.

Related Resources and References:	http://cdm.unfccc.int/index.html http://cdm.unfccc.int/Registry

RE-3: District Cooling Connection

Credit Points Available: 4

Intent:

To encourage the appropriate use of district cooling as well as to ensure the efficient connection to and operation of district cooling.

Credit Requirements:

Demonstrate where possible, through use of the Water Balance Model and Life Cycle Costing that connection to a District Cooling (DC) system or implementation of DC Strategy with the following key elements is the appropriate solution for the project. If DC is shown to be an appropriate efficient source of cooling energy for the project, show:

- Connection to a local DC system and use of available cooling.
- Full insulation of distribution pipes, including underground distribution line(s).
- Covenants Codes and Restrictions (CCRs) or Operating Contracts that require operating companies to state design coefficients of performance, and to provide annual audits confirming attainment of those standards.
- The DC system does not use potable makeup water for heat rejection.

Credit Submission:

Provide the following documentation:

- Brief narrative describing how the project meets the Credit Requirements, including details on the amount of cooling to be drawn from the connection to the local DC system.
- Extracts from specifications or drawings clearly indicating connections to a local DC system.
- Extracts from specifications requiring all distribution pipes to be insulated with material with a minimum R value of R1.0.
- Extracts from CCRs or operating agreements specifying the coefficient of performance of the DC system and the requirement for annual performance audits.
- Extracts from specifications or operating agreement indicating the refrigerants used in the District Cooling system and their compliance with credits RE-r1 and RE-7).

Calculations and Methodology:

Project to connect to a DC system through an Energy Transfer Station (ETS). between the DC system and the connected building . ETS to:

- Use heat exchanger/s to transfer energy between DC plant and building.
- Use three variable speed drive (VSD) controlled pumps of 40% peakload capacity each to maintain a constant temperature differential.
- Flow meters and temperature sensors on the flow and return pipe to continually monitor energy consumption. Connect to Building Management System (BMS) and report to central database.
- Control pump speed to minimise circulation, so only enough

cooling is delivered to meet demand.

Projects that connect to a DC system that complies with the following technical specifications are able to comply with this credit:

- Ozone depletion potential requirements of RE-r1 Ozone Impacts of Refrigerants and Fire Systems and global warming potential thresholds in credit RE-7 Global Warming Impacts of Refrigerants.
- All distribution pipes from the DC to the project and onsite are insulated with material with a minimum R value of R1.0 or geotechnical report provided showing alternative solution as equal to or better overall system performance.
- Extracts from CCRs or operating agreements specifying the coefficient of performance (COP) of the DC system and the requirement for annual performance audits and declaration of ongoing system COP on at least an annual basis.
- District cooling (DC) plant: COP of 3.25 (kW/ton = 0.775) for total cooling plant (including cooling towers and primary pumps).
- Thermal distribution system including pumping energy – maximum losses 5%.

COP is defined as net cooling energy exported from the plant over the total electric power used by the plant at the utility electric meters.

Where district cooling is not available or relevant, this credit is awarded if overall mechanical ventilation and cooling system COP is shown to be in excess of 2.9 with variable output compressor/s or variable volume refrigerant capability.

Single split systems or non-zoned control multi-split systems are not permissible under this credit.

Related Resources and References:

www.districtenergy.org

RE-4: Easily Accessible Stairs

Credits Available: 1

Intent:

To reward projects that provide easily accessible, daylit or well lit stairs as an attractive option for vertical movement through the building or parts thereof in order to reduce electrical energy use and improve occupant wellbeing.

Credit Requirements:

Demonstrate that adjacent to or within a close distance of the main building lifts, there are easily accessible stairs to at least the first five floors of the building. The stairs must have the following characteristics:

- A minimum daylight factor of 2 or be open on at least two sides and well lit with daylight colour corrected light sources.
- No doors required for access on any floor (subject to fire safety restrictions).
- Be clearly visible from the lift area.

Connecting at least five other floors within single tenancy buildings (subject to fire safety restrictions), or allowing access to all levels within retail facilities will also be considered.

Credit Submission:

Provide the following documentation:

- Brief narrative explaining how the project meets the Credit Requirements, and including daylight factor calculations.
- Typical plans including staircase design, indicative elevations section, showing access to daylight and access points.
- Similar information for all stairs included in the building designed to meet this Credit.

Calculations and Methodology:

Daylight factor calculations to be in accordance with Code Requirement: Daylight and Credit LB-10a Improved Daylight Performance.

OR

Manufacturer Colour rendering data sheet for lamps used in staircase and adjoining areas influencing the lighting within the staircase.

Related Resources and References:

See Design Guide

RE-5: Energy Use and Reporting

Credit Points Available: 1

Intent:

To encourage building energy managers and designers to monitor, collect and report detailed energy consumption estimates and actual energy performance to a central database.

Credit Requirements:

Demonstrate a written commitment from the building owner to supply the project's energy simulation data and energy monitoring results to a central database.

Where the project is providing a commissioning report as part of credits LB-23a and LB-23b, all summary, quarterly and final commissioning reports on the performance of all building services are considered part of the data that must be submitted to the PDS database. All reported information is confidential and any published data will be free from identifiers.

Credit Submission:

Provide a copy of the written commitment to PDS to forward an annual summary report in future of all energy monitoring and building use patterns to its central database, including percentage change analysis against the energy simulation results created for Credit RE-r6 as the baseline.

Calculations and Methodology:

Not applicable

Related Resources and References:

See Design Guide

RE-6: Peak Load Reduction

Credits Available: 4

Intent:

To reduce energy demand and consequent increased infrastructure requirements to cater for loads at peak use times through efficient building and services design and site-based renewable energy generation.

Credit Requirements:

Demonstrate that peak electrical demand load on the Abu Dhabi electricity grid has been reduced as follows:

2 CREDIT POINTS = Peak electrical demand is reduced by active means, a minimum of 15%

or

Peak demand is less than 40% greater than the project design annual average load.

4 CREDIT POINTS = Peak electrical demand is reduced by active means, a minimum of 30%

or

Peak demand is less than 20% greater than the project design annual average load

Credit Submission:

Provide the following documentation:

- Summary report describing the peak load reduction strategy/ies, including summary calculations for each peak load reduction feature, the total demand reduction figure (peak without active system, peak with active systems and as appropriate, average peak load) and the percentage reduction/difference achieved.
- Equipment data sheets, project specifications describing equipment specified and showing load reduction/generation capacities used in the calculations provided in the short report.
- Letter from design engineer for any site-based generation potential stating the system is capable of providing the ongoing stated generating capacity into the future, given specified long-term maintenance regimes.
- Copy of the draft system maintenance requirements to be included in the building user guide.

Calculations and Methodology:

Not applicable

Related Resources and References:

See Design Guide

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RE-7: Global Warming Impacts of Refrigerants & Fire System

Credit Points Available: 2

Intent: To reward the selection of refrigerants and fire systems that minimise impacts to the atmosphere.

Credit Requirements: Demonstrate the refrigerants and gaseous fire systems used in the building reduce the potential for global warming from their release into the atmosphere, as follows:

Refrigerants

1 CREDIT POINT: =50% of the refrigerants have a global warming potential (GWP) of 10 or less

or

100% of all refrigerants have a GWP 100 of less than 1300 with a refrigerant leak detection and capture system.

2 CREDIT POINTS: =100% of refrigerants have a GWP of 10 or less

or

no refrigerants are used at all.

Where systems have refrigerant leak detection systems, they must have the following features:

- Located in high-risk parts of the plant.
- Able to detect and recover and contain a minimum of 80% of the refrigerant.
- Located in a relatively airtight enclosure.
- Able to automatically pump down and contain refrigerants, without any human intervention.
- Triggered by a refrigerant leak alarm.

Fire Systems

2 CREDIT POINTS: = 100% of all gaseous fire systems have a GWP 100 of less than 1300

or

no gaseous fire systems are used at all.

Credit Submission: Provide the following documentation:

Refrigerants

- Brief narrative on how the project meets the Credit Requirements, including the refrigerants used in both the primary and secondary systems and a description of the refrigerant containment systems.
- Manufacturer's data sheets with the stated GWP for each refrigerant used in the project's cooling systems.
- Details (drawings, manufacturer technical data sheet for the

refrigerant leak detection and recovery system) and a statement from the design engineer that the system has been designed to recover 80% of refrigerant charge.

Fire Systems

Where gaseous fire systems are used in base building for electrical switchgear rooms, transformer rooms (if enclosed), telecoms rooms, PABX rooms or for integrated fitout tenancy spaces provide:

- Manufacturer's data sheets with the stated GWP for each gas to be used in the project's fire protection system/s.
- Extracts from building specifications or drawings showing specification of gas to each area protected by a gaseous fire protection system matching the Manufacturer data sheets.

.

Calculations and Methodology:

Not applicable

Related Resources and References:

AIRAH Air Conditioning and Refrigeration Industry Refrigerant Selections Guide- 7th Edition 2003

Credit Section **SM**

STEWARDING MATERIALS

"Let him who would enjoy a good future waste none of his present."

Roger Babson (American Business Forecaster and Author, 1875–1967)

In a sustainable building, waste is considered as a resource to be used and reused, not a problem to be disposed of. Buildings should be designed to minimise and manage waste and facilitate resource recovery. Comprehensive building solid waste management programs should incorporate:

- Reduction of the amount of waste produced,
- Reuse of waste materials where possible, and
- Recycling of waste.

In Abu Dhabi, recycling of organic wastes to avoid fugitive methane (a significant greenhouse gas approx. 20 times worse than CO_2) emissions from landfill and CO_2 from incineration takes on particular importance as part of the voluntary initiative by the United Arab Emirates (UAE) to reduce greenhouse gas emissions.

Unnecessary transportation of wastes uses large amounts of fossil fuel so local reprocessing is encouraged wherever possible.

Until now, whole of life cycle impacts of materials have had little attention in relation to climate change or broader toxicity issues. Credits within this section consider life cycle assessment (LCA) of materials as the next step in building performance assessment and challenge the industry to find smart ways to make complex calculations easier and more accessible in the years to come.

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SM-r1: Certified Timber

Code Requirement

Intent:

To ensure that all timber used in the design and construction of the project comes from legal and verifiable sources.

Credit Requirements:

Demonstrate that 100% of timber and composite wood products used on the project is certified as any one of the following types or any combination of the following:

- Post consumer reused or recycled
- PEFC or PEFC compliant member schemes Chain of Custody Certification (CoC)
- FSC Chain of Custody certified including 'Recycled or Neutral' and 'Mixed Sources' certification
- Greenpeace Ecotimber sourced directly from Greenpeace partner suppliers.

Credit Submission:

Provide the following documentation:

- Schedule of typical timber uses for the project as well as the type of timber product, its proposed certification type and intended use for the timber element. Where other materials have been used as substitutes for timber, these should also be shown.
- Extracts from the specifications indicating that all timber uses, including but not limited to structural, temporary shoring and other uses (including concrete formwork, cabinetry, decking, finishes, veneers and joinery) have been certified according to the Credit Requirements.
- Copies of CoC for all timber elements.
- Where timber elements are claimed not to be used on the project, provide a signed letter from the project manager on company letterhead to this effect.

Calculations and Methodology:

This credit is a requirement. No calculation is needed as all timber must be demonstrated to have been either replaced, eliminated or meet the Credit Requirement

Related Resources and References:

www.pefc.org
www.fsc.org
www.greenpeace.org/australia

See Design Guide

SM-r2: Minimum Construction & Demolition Waste Recycling

Code Requirement

Intent:
To ensure that a minimum amount of construction waste on every project is recycled or reused.

Credit Requirements:
Demonstrate the projects meets the construction and demolition waste recycling targets as follows:

Prescriptive Requirement
All clean paper and cardboard, non-film solid plastics with international plastics recycling triangle numbers 1–5, ferrous and non-ferrous metal to be recycled.

Performance Requirement
Minimum 30% of all waste materials by weight and volume (by number of trucks and volumetric capacity of trucks) to be diverted from landfills to recycling operations or centre/s to be reprocessed or recycled.

Credit Submission:
Provide the following documentation:

- Specification excerpts and extracts from contract documents demonstrating the requirement on the main contractor and sub-contractors to meet either the Prescriptive or the Performance the Credit Requirements.
- Provide a schedule of items to be recycled, their source within the project, total estimated weight and volume (by number of trucks and volumetric capacity of trucks) and the details and individual contact for the destination recycling facility.
- Provide a statement from the recycling plant as to the destination and/or locality of recycling plants where resources are being reprocessed/recycled.

Calculations and Methodology:
Prescriptive Requirement
Calculations to show in spreadsheet form relevant recyclables by category and the estimated weight and volume (by number of trucks and volumetric capacity of trucks) of each recyclable to be generated over the project (incineration is not permitted).

Note: All non-concrete or gravel recyclables noted in the credit must be demonstrated to have contractually committed to be recycled or reprocessed.

Performance Requirement
Calculations to show in spreadsheet form all recyclables including concrete, ruble and sand waste by category and the estimated weight and volume of each recyclable to be generated over the project.

Related Resources and References:
www.plasticseurope.org
See Design Guide

SM-r3: Storage for Collection of Waste & Recyclables

Code Requirement

Intent: To ensure that buildings have adequate space and facilities for the separation and storage of waste and recycling.

Credit Requirements: Demonstrate the incorporates the appropriate waste and recycling facilities for ongoing building use, as follows:

Prescriptive Requirement
Localised facilities to be provided for storage and collection of source separated waste streams to maximise resource recovery potential. Ensure adequate vehicular access for appropriately sized vehicles.

Waste groups to be isolated: Residential, commercial, medical.

Waste streams to be separated: Putrescible/non recyclable and paper, glass cans and plastics.

Low rise: Collection and sorting area for separated recyclables and non-recyclables shall be placed at or adjacent to point of rubbish collection. Enclosure design, walking distances and slope requirements must be in accordance with Abu Dhabi Department of Municipal Affairs and Abu Dhabi Municipality requirements as appropriate.

Medium- and high-rise buildings: Each occupied floor must have two clearly labelled rubbish chutes; one for non-recyclable waste and the other for recyclable waste.

Performance Requirement
Waste Management Plan and implementation schedule be provided to show optimised resource recovery and/or onsite treatment strategy to achieve as a minimum the prescribed requirements for resource recovery.

Credit Submission: Provide the following documentation:

Prescriptive Requirement

- Short narrative describing how the project meets the Credit Requirements, including estimated waste quantities for the building, and the adequacy of the size waste storage, sorting and recycling facilities for the type and size of the development.
- Drawing(s) indicating where the storage/disposal facilities are located and vehicle access areas have been designed to ensure adequate space for manoeuvring delivery and waste removal vehicles.
- Waste transfer inventory outlining the intended receiver of waste. This should include information indicating that the

carrier and disposal facilities are licensed/suitable.

Performance Requirement

- Waste Management Plan, including projects waste streams and volumes, methods and locations for waste storage and a description of how the plan optimises waste recovery.
- Implementation schedule for the Waste Management Plan.

Calculations and Methodology: Not applicable

Related Resources and References: See Design Guide

SM-r4: Asbestos Elimination

Code Requirement

Intent:

To eliminate exposure to asbestos by building occupants.

Credit Requirements:

Demonstrate that no asbestos is used within the development and that all asbestos has been removed from refurbished buildings.

Credit Submission:

Provide the following documentation:

New Buildings:

- Co-signed statement from the building architect and building owner that no asbestos is used in the building.
- Extracts from specifications indicating that no asbestos products are to be used in the project.

Refurbished buildings:

- Results of a hazardous materials survey documenting the existence, if any, of asbestos in the building.
- Where asbestos was found, provide evidence of disposal at a hazardous waste facility.

Calculations and Methodology:

Not applicable

Related Resources and References:

See Design Guide

SM-[1-5]: Alternative Compliance Path: Life Cycle Impacts of Materials

Credit Points Available: 17

Intent: To encourage the use of sustainably produced materials through the comprehensive analysis of the lifecycle impacts of major building components and materials.

5th Pearl Credit

Credit Requirements: Demonstrate the significant reduction of environmental and human health impacts through a comprehensive Life Cycle Analysis (LCA) Report on all building components as alternative to demonstrating compliance with each individual credit SM-1 through SM-5 below.

The LCA will evaluate how building components:

- Conserve and enhance Living Systems, Natural Capital and Biodiversity.
- Are fit for purpose, a measure of their performance, durability and longevity relevant to purpose.
- Minimise pollution relative to other similar materials.
- Minimise GHG emissions relative to other similar materials when measured from raw materials extraction to the manufacturing process, transport mode and distance.
- Minimise toxicity levels to humans and living systems relative to other similar materials.
- Encourage the use of local production and content.

The project is awarded points where as a result of the LCA, a sustainable materials procurement process and procedure is implemented in order to minimise overall 'whole of life impacts', as follows:

1 CREDIT POINT	= 20% impact reduction
2 CREDIT POINTS	= 25% impact reduction
3 CREDIT POINTS	= 30% impact reduction
4 CREDIT POINTS	= 35% impact reduction
5 CREDIT POINTS	= 40% impact reduction
6 CREDIT POINTS	= 45% impact reduction
7 CREDIT POINTS	= 50% impact reduction
8 CREDIT POINTS	= 55% impact reduction
9 CREDIT POINTS	= 60% impact reduction
10 CREDIT POINTS	= 65% impact reduction
11 CREDIT POINTS	= 70% impact reduction
12 CREDIT POINTS	= 75% impact reduction
13 CREDIT POINTS	= 80% impact reduction
14 CREDIT POINTS	= 85% impact reduction
15 CREDIT POINTS	= 90% impact reduction
16 CREDIT POINTS	= 95% impact reduction
17 CREDIT POINTS	= 100% impact reduction

Credit Submission:

Provide the following documentation:

- Summary life cycle assessment (LCA) report on the 60 year 'cradle to end-of-service-life/cradle' modelling of the building components, operations (including maintenance, cleaning and replacement) and where relevant, deconstruction and resource recovery including:
    - Where relevant include multiple replacement cycles for components and equipment within the 60-year period.
    - Damages, impacts and savings in all key elements and gross totals.
    - Timeline of LCA findings to minimise building ecological footprint, i.e. when benefits are derived.
    - Report to be in accordance with ISO 14040.
    - Cut-off includes all material (to >99% price) excluding labour noted in the quantity surveys relied upon for all project financial control and remuneration. If it has a price then it also has an ecological cost.
    - Total Ecopoints based on EcoIndicator 99 process.

Building element groups to be reported on include groups of all:

- *Substructure*– footings, slabs, walls, piers, columns, beams and floors including all jointing, formwork, filling, lining bar-chairs, ties, membranes, soil stabilisation and treatments.
- *Superstructure*– with all framing, reinforcement, walls, roofs, floors, windows, doors, linings, cladding and jointing.
- *Joint connection*– screws, bolts, bolts, anchors, nails, staples. glues, tapes, ties, fillers, hinges, handles and locks.
- *Distribution systems*–cable, ductwork, pipe, tube, wire, tie, clamp and tray, outlet, switches, boxes, handles, taps, faucets, flanges, joints and hangers and associated wares.
- *Coverings and coatings*– including all paint, adhesive, carpet, tiling, insulation, foil, paper, sealant and membrane items.
- *Building element*– to be reported on include all groups of all key components and utilities used for manufacturer's recommended.

Life cycle phases to be reported on including:

- Resource acquisition
- Manufacturing
- Transport and delivery
- Maintenance and cleaning
- Deconstruction and/or reuse of short-lived and/or high-churn items including transfer transport
- Reprocessing and/or recycling of short lived and/or high churn items including transfer transport. Discounted Service Life of residual life of structure if estimated to be longer than 60 years.

In addition to providing the Ecopoint, reports should also provide individual performance data for Human Health, Environmental Quality and Resource Depletion impacts.

Calculations and Methodology:

To define 'cradle to end-of-service-life/cradle' modelling of the building components:

Tools that are compliant for this credit include:

- GaBI (Germany)
- LCADesign (Australian)
- Envest2® (UK)
- BEES (US)
- SimaPro (Netherlands).

All impact assessment results have to be assessed according to the Ecoindicator 99 methodology which expresses results as an 'Ecopoint' Score derived from weighted impacts of:

- Human health
- Environmental quality
- Resource depletion.

Gross results are to be shown as EcoIndicator 99 factors noting all results accounting for >20% of any contribution.

Note 1: Any attributions of potential credits for re-use, recycling, reprocessing or downcycling should be made explicit in the report.

Note 2: To obtain this credit the project must still comply with SM-3 Non polluting Materials.

Related Resources and References:

ISO 14040 Series of Standards

See Design Guide

SM-1a: Carbon Intensity of Materials: Recycled Steel

Credit Points Available: 1

Intent:

To encourage the selection of steel for structural purposes that requires less energy in its manufacture than standard steel.

Credit Requirements:

Demonstrate that the project structure meets the following:

Steel-framed Building
50% of all structural steel has a minimum 40% post-consumer recycled content greater or is reused.

Concrete-framed Building
80% of all reinforcing or stressing steel has a minimum 90% post-consumer recycled content.

This credit does not apply to refurbishment projects not adding concrete or steel frame structures or to project where the total cost of steel represents less than 1% of the project's total contract value.

Credit Submission:

Provide the following documentation:

Steel-framed Building

- Brief narrative explaining how the project meets the Credit Requirements, including calculations demonstrating that the steel with recycled content/reused steel constitutes 50% of the structural steel (by weight) used in the project.
- Proof of manufacture for 50% of the structural steel from an arc furnace facility.

Concrete-framed Building

- Brief narrative explaining how the project meets the Credit Requirements, including calculations demonstrating that at least 80% of the reinforcing or stressing steel used in the projects (by weight) qualifies for the credit.
- Proof of manufacture for a minimum 80% of the reinforcing steel showing it is sourced from an arc furnace facility.

Calculations and Methodology:

Calculations should be in the form of a spreadsheet listing all steel uses and their weights and clearly adding the total weight of nominated steel and its percentage of the total weight of all steel used on the project.

Related Resources and References:

Credit SM-12a Design for Appropriate Durability

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SM-1b: Carbon Intensity: Replacement of High Carbon Intensity Materials

Credit Points Available: 1

Intent:

To reward building designs that use materials with lower carbon intensity than the materials commonly used in large buildings for structural purposes.

Credit Requirements:

Demonstrate the replacement of high carbon intensity materials used for structural purposes (e.g. concrete, steel, aluminium) in low-rise, large-span buildings with composite, large-section timber. The value of the replaced material or the timber (whichever is greater) must constitute at least 2% of the total construction cost.

[This credit does not apply to buildings higher than 10 storeys or that do not have large spans (defined as over 6 m).]

Credit Submission:

Provide a short report with the following information:

- Description of how the project has used composite timber in aspects of the building design where concrete, steel and aluminium are traditionally used.
- Calculations demonstrating that the value of the replaced material or the replacement material (whichever is greater) constitutes at least 2% of the total construction cost.

Calculations and Methodology:

Calculations should include the total cost of the building construction, the total cost of the replaced or the replacement materials (either one, not a combination of the two) and this material cost expressed as a percentage of the total cost of construction.

Related Resources and References:

See Design Guide

SM-1c: Carbon Intensity: Cement Replacement

Credit Points Available: 2

Intent

To increase the use of cement replacement in concrete in order to reduce the carbon emissions associated with concrete use in buildings.

Credit Requirements

Demonstrate that through either the use of supplementary cementing materials (i.e. slag, fly ash, silica fume, natural pozzolans and limestone), the increased use of aggregates or admixtures and reduction of cement paste, that the project has reduced the overall amount of Portland cement used in the building.

CREDIT POINTS: = are awarded as per Table 1 below.

Credit Submission

Provide the following documentation:

- Summary sheet listing all concrete uses and their GHG emissions, as per Equation 1 below.
- Calculations demonstrating the GHG emissions of each concrete mix as per Equation 1 below. Where more than one concrete mix is used, also include the calculation demonstrating the weight averaged GHG emissions of all mixes as per Equation 2.
- Extracts from specifications clearly identifying the concrete mix requirements.

OR

- A completed excel spreadsheet calculator showing all individual mix volumes and characteristics and relevant credit points claimed.

Calculations and Methodology

In order to calculate the embodied greenhouse gas (GHG) emissions in a given concrete mix:

1) Determine the necessary grade of concrete (Row A) below
2) Determine the type of element, cast in place, precast or stressed (Rows B, C, or D)
3) Using the concrete mix design provided by your Ready Mix supplier enter the amount of cement, slag, fly ash, natural pozzolans and limestone into Eq. 1.
4) Compare the calculated value from Eq. 1 with the appropriate Embodied GHG Limits in Table 1. Qualification of points is contingent on the calculated value from Eq. 1 being less than or equal to the appropriate value in Table 1. The rightmost column indicates the number of credit points available.

Alternatively, the quantity of embodied GHGs and associated credit points can be determined by using the Concrete GHG Calculator available for download on the Estidama website.

Equation 1

$$Embodied\ GHG = 1/1000 * (Amt\_Cement * 737 + Amt\_Slag * 260 + Amt\_FlyAsh * 60 + A * 170 + Amt\_Limestone * 30)$$

The calculated embodied GHG is then compared to the values provided in the Table below. The rightmost column indicates the number of points available.

Where multiple mixes are used, calculate the weight averaged Embodied GHG emissions (see Eq. 2).

Equation 2

$$Weighted\ Averaged\ Embodied\ GHG = Proportion\ of\ Mix_1 * Embodied\ GHG\ of\ Mix_1 + Proportion\ of\ Mix_2 * Embodied\ GHG\ of\ Mix_2 \ldots etc.$$

SM-1c Table 1 - Embodied GHG of Concrete

Row A	Strength Grade (MPa)	25	30	35	40	45	50	55	60	CREDIT POINTS
	Overall Cementitious (kg)	255	303	343	377	408	435	460	482	
		Embodied GHG $kgCO_{2e}/m^3$								
Row B	Cast in place	162	192	218	240	259	277	292	307	1 CREDIT POINT
Row B	Cast in place	121	144	163	179	194	206	218	229	2 CREDIT POINTS
Row C	Precast	176	209	236	260	281	300	317	332	1 CREDIT POINT
Row C	Precast	149	176	199	220	237	253	268	281	2 CREDIT POINTS
Row D	Stressed	183	217	245	270	292	312	329	345	1 CREDIT POINTS
Row D	Stressed	162	192	218	240	259	277	292	307	2 CREDIT POINTS

Key:

Row A: MPa at specified age (28 days, – there are benefits to specifying certain strengths at late ages e.g. 56 days or other)

Cementitious: kg of Cementitious material per cubic metre of concrete (cementitious material = amount of cement + amount of fly ash + amount of slag + amount of silica fume + amount of limestone + amount of natural pozzolans).

Row B/C/D: Embodied Energy in $kgCO_{2e}/m^3$ of concrete.
Explanation to Equation 1:

- The factors (within the brackets) are emission factors using units of kg CO_{2e} per tonne of material.

- 'Amt of Cement' etc. are entered as kg of material per m^3 of concrete (given in the mix design), and the factor out front (1/1000) is a unit conversion from tonnes CO_{2e} to kg CO_{2e}.
- On the left hand side of the equation, as above, embodied energy is given in $kgCO_2e/m^3$ concrete.

Related Resources and References:

See Design Guide

Pearls Design System – SM-1c Credit Calculator Spreadsheet

SM-1d: Carbon Intensity: Transport of Materials

Credit Points Available: 2

Intent:

To encourage the selection of building materials that require less energy in their transport to the project site than similar materials with the same use.

Credit Requirements:

Demonstrate that the transport distance for materials representing a proportion of the construction cost is not greater than 400 km by road or rail from their origin to the project site (extracted, harvested or recovered, and manufactured), where sea miles are excluded from the calculation.

1 CREDIT POINT = 10% of construction costs
2 CREDIT POINT = 20% of construction costs

Any materials sent by airfreight at any point during their transport do not qualify for this credit.

Credit Submission:

Provide the following documentation:

- Short report listing all nominated materials demonstrating compliance with the Credit Requirements, including their cost, location(s) of extraction/harvest/recovery/manufacture, distance travelled and means of transport. The report should include calculations demonstrating the total amount of the qualifying materials as a percentage of the total construction costs.
- For each nominated material, proof of manufacture detailing country of origin and port of entry, if applicable.
- Extracts from specifications indicating the use of all nominated materials.

Calculations and Methodology:

Where materials or primary constituent elements are quarried, extracted, or harvested the calculation begins at this point and includes the distance travelled to the manufacturing/processing facility, if appropriate.

Where products are primarily comprised of recycled materials, then the calculation begins at the point of manufacture.

Cost calculations should include the total cost of the building construction, the total cost of the nominated materials, and the cost of the nominated material expressed as a percentage of the total cost of construction.

Related Resources and References:

See Design Guide

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SM-2: Virtual Water

Credit Points Available: 1

Intent:

To encourage the selection of materials that require less water in their extraction and manufacture than similar materials with the same use.

Credit Requirements:

Demonstrate the following:

Steel-framed Building
50% of all structural steel has a minimum 40% post-consumer recycled content greater or is reused.

Concrete-framed Building
80% of all reinforcing or stressing steel has a minimum 90% post-consumer recycled content.

This credit does not apply to refurbishment projects not adding concrete or steel frame structures or to projects where the total cost of steel represents less than 1% of the project's total contract value.

Credit Submission:

Provide the following documentation:

Steel-framed Building

- Brief narrative explaining how the project meets the Credit Requirements, including calculations demonstrating that the steel with recycled content/reused steel constitutes 50% of the structural steel (by weight) used in the project.
- Proof of manufacture for 50% of the structural steel from an arc furnace facility.

Concrete-framed Building

- Provide a brief narrative explaining how the project meets the Credit Requirements, including calculations demonstrating that at least 80% of the reinforcing or stressing steel used in the projects (by weight) qualifies for the credit.
- Proof of manufacture that 80% of the reinforcing steel is sourced from an arc furnace facility.

Calculations and Methodology:

Calculations should be in the form of a spreadsheet listing all steel uses and their weights and clearly adding the total weight of nominated steel and its percentage of the total weight of all steel used on the project.

Related Resources and References:

See Design Guide

SM-3: Non-polluting Materials

Credit Points Available: 4

Intent: To reward the selection of materials that do not have long-term negative impacts on human health or pollute natural systems.

Credit Requirements:

1 CREDIT POINT: = Demonstrate that the project has achieved the following initiatives:

- All thermal insulation used in the project was manufactured without the use of ozone depleting substances (i.e. ODP of zero).
- Where timber is specified for external purposes, that no chromated copper arsenate (CCA)-treated timber is used on the project.
- Products that use or produce chlorine during their manufacture, use or disposal have been replaced by products without chlorine in their life cycle. To qualify, the total value of the replaced must represent a minimum of 1% of the total construction cost.

3 FURTHER CREDIT POINTS: = Demonstrate that the project has achieved the following:

Eliminate materials or building products or components containing elements or compounds with R-phrase attribution under EU Risk Phrases (R-Phrases) in accordance with EU Directives 67/548/EEC and 1999/45/EC indicating any of the following risks:

- very toxic
- toxic
- mutagenic
- intergenerational
- long term
- irreversible
- cumulative and
- cancer producing impacts

To be considered for this credit products representing 99% of the building by cost must not contain materials or compounds with over 1% of constituent materials with designated R-phrases in the above categories (See Calculations and Methodology section for list of R-phrases).

Stockholm Convention

This credit is not available to any project using any materials or products that contain in any form or amount, persistent organic pollutant materials included in the Stockholm convention, in particular:

- Polychlorinated Biphenyls (PCBs) – predominantly used in outdated electrical technology such as ballasts and transformers.

- Polybrominated diphenyl ethers – pentabromodiphenyl ether (pentaBDE) and octabromodiphenyl ether (octaBDE) primarily used as flame retardants in ceiling tiles, fabric, foams etc.

Credit Submission:

Provide the following documentation:

Insulation

- Summary sheet listing all uses of insulation in the project and the specific product to be used.
- For all listed products, extracts from specifications requiring their use.
- For all listed products, manufacturer data sheets clearly indicating the materials were manufactured without the use of ozone-depleting materials.

CCA-Treated Timber

- Summary sheet listing all external uses of timber in the project and the specific product to be used.
- For all listed products, extracts from specifications requiring their use.
- For all listed products, manufacturer data sheets clearly indicating the materials were not treated with CCA.

Chlorine Free Materials

- Brief narrative describing which products were replaced, why they were replaced, what they were replaced with, including calculations demonstrating that the cost of the replaced or replacement material meets the Credit Requirements.
- For each replacement material/product, extracts from specifications requiring the use of the material/product.
- Material safety data sheets for each nominated replacement product *and* their constituent materials or a statement from a recognised third party verification organisation or a materials test by a competent body will be accepted.

Low Toxicity Materials

- Brief narrative describing which products were replaced, why they were replaced, what they were replaced with, including calculations demonstrating that 99% of the cost of the base building materials in the project meets the Credit Requirements.
- For each replacement material/product, extracts from specifications requiring the use of the material/product.
- Material safety data sheets for each nominated replacement product *and* their constituent materials or a statement from a recognised third party verification organisation or a materials test by a competent body will be accepted.

Stockholm Convention

A statement from a competent person or Technical Data Sheets from manufacturers or recognised third party verifying that no electrical or

other components contain:

- PCBs
- pentaBDE
- octaBDE.

Calculations and Methodology:

Base Building is defined as all structure, cladding, services (excluding mechanical equipment and transportation systems but including lift cars, pipes, conduits, cable trays, adhesives, sealants and finishes thereto) and finishes, fitments or joinery wherever they are to be provided to common areas, tenancies or individual dwellings other than by the future tenant or subsequent owner.

Calculations should include the total cost of the building construction, the total cost of the replaced or the replacement materials (either one, not a combination of the two) and this material cost expressed as a percentage of the total cost of construction.

Chlorine Free Materials

Products typically that use or produce chlorine and can be included within the value calculation include:

- Polyvinyl chloride (PVC) often referred to as vinyl
  - pipes and electrical conduit
  - water proofing sheets and membranes
  - building cladding
  - door and window frames
  - resilient flooring
  - external blinds and awnings
  - carpet backing
  - wall coverings
  - internal window treatments (curtains, blinds etc)
  - furniture upholstery
  - wire and cable sheathing
- Chlorinated polyethylene (CPE)
  - Geomembranes
  - wire and cable jacketing
- Chlorinated polyvinyl chloride (CPVC)
  - water pipes
- Chlorosulfonated polyethylene (CSPE)
  - roof membranes
  - electrical connectors
  - sheet membrane for pond liners
- Polychloroprene (CR or chloroprene rubber, also brand name Neoprene)
  - Geomembranes
  - weather stripping
  - expansion joint filler
  - water seals
  - other gaskets and adhesives

Risk Phrases

List of R-phrases for assessment:

R26: Very toxic by inhalation
R27: Very toxic in contact with skin
R28: Very toxic if swallowed
R32: Contact with acids liberates very toxic gas

R33: Danger of cumulative effects
R39: Danger of very serious irreversible effects
R45: May cause cancer
R46: May cause heritable genetic damage
R48: Danger of serious damage to health by prolonged exposure
R49: May cause cancer by inhalation
R60: May impair fertility
R61: May cause harm to the unborn child
R63: Possible risk of harm to the unborn child
R64: May cause harm to breast-fed babies
R68: Possible risk of irreversible effects

Ecosystem Quality
R50: Very toxic to aquatic organisms
R59: Dangerous for the ozone layer
R53: May cause long-term adverse effects in the aquatic environment
R58: May cause long-term adverse effects in the environment

Related Resources and References: See Design Guide

SM-4a: Ecological Impact of Materials: FSC-certified Timber

Credit Points Available: 2

Intent:

To reward sustainable timber harvesting practices that support biodiversity and minimise ecological impacts.

Credit Requirements:

Demonstrate the a proportion of the wood, composite wood or compressed paper products used on the project during design and construction are Forest Stewardship Council (FSC) Chain of Custody certified or are reused, as follows:

1 CREDIT POINT = 50% of timber
2 CREDIT POINT = 95% of timber

Credit Submission:

Provide the following documentation:

- Summary listing all timber uses on the project, including quantities, and noting which of the nominated uses meet the Credit Requirements.
- Calculations demonstrating that the quantities of the nominated timber meet the Credit Requirements.
- Extracts from all relevant specifications requiring the use of FSC-certified timber certified including 'Recycled or Neutral' and 'Mixed Sources' certification or reused timber.

Calculations and Methodology:

Calculations should include the total cost of timber used on the project, the total cost of the nominated timber and the cost of the nominated timber expressed as a percentage of the total cost of timber.

Extracts from the specifications indicating that all timber uses, including but not limited to structural, temporary shoring and other uses (including concrete formwork, cabinetry, decking, finishes, veneers and joinery) have been certified according to the Credit Requirements.

Related Resources and References:

Forest Stewardship Council
www.fsc.org

See Design Guide

SM-4b: Ecological Impact of Materials: Recycled Aggregate

Credit Points Available: 2

Intent:

To reduce the demand for aggregate extraction and thereby reduce the ecological impacts associated with building development.

Credit Requirements:

Demonstrate that 15% of all aggregate used on site (by volume), in structural and non-structural uses is recycled.

An additional point is available where only recycled aggregate and/or aggregate from industrial waste by-product is used as base, sub-base or backfill.

Credit Submission:

Provide the following documentation:

- Brief narrative describing the uses of the nominated aggregate and including calculations demonstrating that the amount of nominated aggregate meets the Credit Requirements.
- Extracts from specifications requiring the use of the nominated aggregate in the percentages described in the report.
- Signed statement from the structural engineer that the use of the nominated aggregate in the percentages described in the narrative meet the project's structural requirements.

Calculations and Methodology:

Calculations should include the total volume of aggregate used in the project (including site uses), the total cost of the recycled aggregate, and the volume of the recycled aggregate expressed as a percentage of the total volume of aggregate used.

Related Resources and References:

See Design Guide

SM-5a: Resource Conservation: Reused Materials

Credit Points Available: 1

Intent:

To reward the selection of previously used or savaged materials in order to reduce the consumption of resources associated with building development.

Credit Requirements:

Demonstrate reused or salvaged materials constitute 2% of the total construction cost of the project.

The following materials are *not* eligible for this credit:

- Materials addressed in other credits (i.e. timber, aggregate and steel).
- The building structural skeleton, which is addressed in the Building Reuse Credit.
- Cooling equipment (but includes ventilation ducts and grilles).

Credit Submission:

Provide the following documentation:

- Summary sheet listing all nominated materials meeting the Credit Requirements, their cost, and source or location of previous use.
- Calculations demonstrating that the total cost of the nominated materials meet the Credit Requirements.
- Extracts from specifications requiring the use of the nominated materials.

Calculations and Methodology:

Cost calculations should include the total cost of the building construction, the total cost of the nominated materials, and the cost of the nominated material expressed as a percentage of the total cost of construction.

Related Resources and References:

See Design Guide

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SM-5b: Resource Conservation: Recycled and Recyclable Materials

Credit Points Available: 2

Intent

To increase the demand for materials that extend the life cycle of their constituent elements and reduce the amount of waste going to disposal.

Credit Requirements

Demonstrate that materials with any combination of the following characteristics:

- minimum 30% post-consumer recycled content *and* which are subsequently readily recyclable
- minimum of 80% post-industrial content *and* which are readily recyclable
- 50% agricultural waste by-product

constitute a designated proportion of the total construction cost, as follows:

1 CREDIT POINT = 1% of the total construction cost
2 CREDIT POINTS = 2% of the total construction cost.

This figure must exclude materials addressed in other credits (e.g. timber, cement, aggregate and steel)

In order to qualify for this credit, materials must have an independent third-party verification that they do not contain any more than 1% of materials characterised by the R-Phrases in accordance with EU Directives 67/548/EEC and 1999/45/EC (listed in the Calculations and Methodology section below).

Credit Submission

Provide the following documentation:

- Summary sheet listing all of the nominated materials, how they meet the Credit Requirements and their cost.
- Calculations demonstrating that the total cost of the nominated materials meet the Credit Requirements.
- Extracts from specifications requiring the use of the nominated materials.
- For all nominated materials, either a manufacturer data sheet with the verified post-consumer recycled/waste product content OR an independent third-party verification of the post-consumer recycled/waste product content.
- For all nominated materials, third-party verification or materials test by a competent body verifying they do not contain more than 1% of materials characterised by the R-Phrases in the Calculations and Methodology section below.

Calculations and Methodology

Cost calculations should include the total cost of the building construction, the total cost of the nominated materials, and the cost of the nominated material expressed as a percentage of the total cost of

construction.

Recyclable materials are defined as having one or more of the following:

- manufacturer stewardship or take-back program
- identified recycling stream
- connection between the recycling stream and the take back program able to be recycled

and

is able to be recycled without a significant reduction in material integrity.

Materials or compounds with over 1% of constituent materials with the following designated R-phrases are excluded from this credit:

Human Health
R26: Very toxic by inhalation
R27: Very toxic in contact with skin
R28: Very toxic if swallowed
R32: Contact with acids liberates very toxic gas
R33: Danger of cumulative effects
R39: Danger of very serious irreversible effects
R45: May cause cancer
R46: May cause heritable genetic damage
R48: Danger of serious damage to health by prolonged exposure
R49: May cause cancer by inhalation
R60: May impair fertility
R61: May cause harm to the unborn child
R63: Possible risk of harm to the unborn child
R64: May cause harm to breast-fed babies
R68: Possible risk of irreversible effects

Ecosystem Quality
R50: Very toxic to aquatic organisms
R59: Dangerous for the ozone layer
R53: May cause long-term adverse effects in the aquatic environment
R58: May cause long-term adverse effects in the environment

Related Resources and References

EU Directives 67/548/EEC and 1999/45/EC,
EU REACH System
www.ec.europa.eu/environment/chemicals/reach/reach_intro.htm and
United Nations Globally Harmonised System (GHS)
www.echa.europa.eu/classification_en.asp
California Green Chemistry Initiative – Ca Department of Toxic Substances Control (DTSC) Clearinghouse.

See Design Guide

SM-5c: Resource Conservation: Modular Materials

Credit Points Available: 1

Intent:

To enable the targeted replacement of materials through the use of modular design.

Credit Requirements:

Demonstrate that 95% of the occupied area uses modular carpets. To qualify, carpets must have a minimum of 30% post-consumer recycled content or be readily recyclable (manufacturer must provide a take back system).

Offices

This credit does not apply to projects where less than 5% of occupied area is carpeted or which are delivered as shell and core.

Credit Submission:

Provide the following documentation:

- Brief narrative describing all of the nominated carpets, their locations in the building, total area covered, noting their post-consumer recycled content or that they are recyclable, and including calculations demonstrating that they meet the Credit Requirements.
- For all nominated products with recycled content, either a manufacturer data sheet with the verified post-consumer recycled content OR an independent third-party verification of the post-consumer recycled content.
- For all nominated products that are recyclable, a statement from the manufacturer describing the take-back program available to the Abu Dhabi.

For project where less than 5% of occupied area is carpeted or which are delivered as shell and core, provide a brief narrative describing why this credit is not applicable, including any relevant calculations if needed.

Calculations and Methodology:

Calculations should include the total carpeted area in the building, the total area covered with modular carpet, and the total area covered by modular carpet expressed as a percentage of the total carpeted area.

Related Resources and References:

See Design Guide

SM-5d: Resource Conservation: Rapidly Renewable Materials

Credit Points Available: 1

Intent:

To increase the use of fast growing materials instead of slow growing materials or finite resources.

Credit Requirements:

Demonstrate that rapidly renewable materials are a significant constituent of the walls, ceilings, joinery, or finishes (floors are excluded), as follows:

95% of one item (by area)
or
50% of two items (by area)
or
25% of four items (by area)

Credit Submission:

Provide the following documentation:

- Summary sheet listing all of the nominated materials meeting the Credit Requirements and their use in the project (i.e. wall, ceiling, joinery, finishes).
- Calculations demonstrating that the total area of nominated materials meets the Credit Requirements.
- Extracts from specifications requiring the use of the nominated materials.
- For all nominated materials, a statement from the manufacturer verifying the percentage of rapidly renewable content OR an independent third-party verification of the percentage of rapidly renewable content.

Calculations and Methodology:

Calculations should include the total area of the nominated item(s), the total area of the item(s) made from a rapidly renewable material, and the total area of the item(s) made from a rapidly renewable material expressed as a percentage of the total area of the item.

Example: The total area of ceiling tiles is 5000 m^2 and the total area made from rapidly renewable materials is 3500 m^2, or 70%. The total area of joinery is 1000 m^2 and the total area made from rapidly renewable materials is 600 m^2, or 60%. The project is eligible for the credit point.

Related Resources and References:

See Design Guide

SM-6a: Socially Sustainable Materials: Community Benefits in Emerging Economies

Credit Points Available: 1

Intent:

To reward the selection of materials that have direct, localised economic and social benefits in the communities in which they are extracted or produced.

Credit Requirements:

Demonstrate that materials with substantiated, localised community benefits in an emerging economy comprise at least 0.1% of the total construction cost. At least 50% of the nominated materials must come from a GCC country.

Fair Trade certified products and materials qualify for this credit. An emerging economy is defined as a G77 country.

Credit Submission:

Provide a short report with the following:

- Brief narrative describing how the nominated materials meet the Credit Requirements, including the origin of the materials.
- The quantified benefit to the community harvesting/recovering/producing the materials.
- Calculations demonstrating that the materials constitute at least 0.1% of the project and that 50% of the materials are from a GCC country.

Calculations and Methodology:

Cost calculations should include the total cost of the building construction, the total cost of the nominated materials, and the cost of the nominated material expressed as a percentage of the total cost of construction.

Community based NGOs engaged in supporting indigenous or local communities locally and internationally may apply for recognition under this credit.

Related Resources and References:

See Design Guide

SM-6b: Socially Sustainable Materials: Labour Practices

Credit Points Available: 1

Intent:

To encourage the selection of building materials from companies with responsible labour practices.

Credit Requirements:

Demonstrate that project has achieved one of the following initiatives:

- All quarried materials are extracted by companies that have both public commitments to not using child labour (defined as children ages 15 and under) and which submit to regular inspections and audits verifying this commitment.

or

- Building materials constituting 10% of the total construction cost are manufactured by companies that have collective bargaining agreements with 90% of their workforce.

Credit Submission:

Child Labour

Provide a brief narrative describing how all quarried materials (e.g. marble, sandstone) come from sources that have been verified as free of child labour. PDS assessors reserve the right to request and review inspection reports and audits.

Collective Bargaining

Provide the following documentation:

- Brief narrative describing how the project meets the Credit Requirements, including a list of all nominated products and their manufacturers, and calculations clearly demonstrating the nominated materials constitute 10% of the total construction cost.
- For all nominated products, either extracts from the manufacturers' collective bargaining agreements, clearly indicating the number of employees covered by the agreement as a percentage of total employees OR a co-signed statement from the manufacturer and the collective bargaining organisation indicating the number of employees covered by the agreement as a percentage of total employees.

Calculations and Methodology:

Cost calculations should include the total cost of the building construction, the total cost of the nominated materials, and the cost of the nominated material expressed as a percentage of the total cost of construction.

Related Resources and References:

UN International Labor Office
www.ilo.org/global/lang--en/index.htm
See Design Guide

SM-6b: Socially Sustainable Materials: Sustainable Timber

Credit Points Available: 2

Intent:

To reward the selection of timber certified by schemes that ensure the protection and support of indigenous communities at the point of origin.

Credit Requirements:

Demonstrate the a proportion of the wood, composite wood or compressed paper products used on the project (during design and construction) are certified by a sustainable timber certification scheme that recognises the rights of and benefits directly, indigenous peoples and traditional land owners in the country of origin, as follows:

1 CREDIT POINT = 50% of timber
2 CREDIT POINTS = 95% of timber

Credit Submission:

Provide the following documentation:

- Summary listing all timber uses on the project, including quantities, and noting which of the nominated uses meet the Credit Requirements.
- Calculations demonstrating that the quantities of the nominated timber meet the Credit Requirements.
- Extracts from all relevant specifications requiring the use of FSC-certified timber or other approved source.

Calculations and Methodology:

Calculations should include the total cost of timber used on the project, the total cost of the nominated timber and the cost of the nominated timber expressed as a percentage of the total cost of timber.

Community based NGOs engaged in supporting indigenous or local communities locally and internationally may apply for recognition under this credit.

Related Resources and References:

Forest Stewardship Council
www.fsc.org

See Design Guide

SM-7: Dematerialisation

Credit Points Available: 1

Intent:
To reduce the overall amount of material used in the development of buildings.

Credit Requirements:
Offices
Demonstrate that fewer materials were used in the final building design than in a typical building of the same type by achieving two of the following initiatives in occupied spaces:

- At least 90% of the interior floor area design does not include finishes (apart from sealant).
- At least 90% of the ceiling area does not have any ceiling systems (exposed ceilings only).
- At least 90% of the urinals do not have supply plumbing (are waterless).
- Use of dual function surfaces or materials such as Building Integrated Photovoltaics (BIPV) and vegetated roofs or walls to more than 20% of roof or any individual proposed building elevation.

Retail & Residential

- Any one of the above initiatives are required for this credit.

Credit Submission:
Provide the following documentation:

- Summary report describing how the project meets the Credit Requirements with schedules as relevant for:
  - overall floor areas
  - overall ceiling areas
  - potential pipe runs to urinals using conventional solutions.
- Extracts from specifications confirming the proposed initiatives are as per the report.
- Where there are dual function surfaces or materials — drawings, schedules and specifications confirming that more than 20% of roof or any individual proposed building elevation is as per the narrative.

Calculations and Methodology:

Floor and ceiling finishes, urinal pipe runs
Compare the actual overall areas or runs to the proposed reduced floor and/or ceiling areas and/or length of urinal pipe and expressed as a percentage.

Dual function surfaces or materials
Provide schedule that shows the overall building element area. For example, a single elevation if dual use surface is on one elevation increasing area for each elevation dual surface touches, overall roof area if it affects or roof and compare to area of dual function surface, expressed as a percentage.

Related Resources and References:	See Design Guide

SM-8: Building Reuse

Credit Points Available: 1

Intent:

To encourage the reuse and improvement of existing building stock.

Credit Requirements:

Demonstrate that 60% of the existing building structural skeleton, by surface area, is reused.

This credit does not apply to buildings where the surface area of the reused building skeleton constitutes less than 25% of the surface area of the structural skeleton of the new building.

Credit Submission:

Provide the following documentation:

- Brief narrative describing how the project meets the Credit Requirements, including calculations demonstrating the amount of surface area of the existing building being reused and that the project meets the 25% GFA threshold.
- Plan drawings or demolition drawings of the existing building demonstrating the amount of surface area to be reused.
- Signed statement from the project architect or building owner confirming the GFA of the portion of the existing building as a percentage of the GFA of the new building.

Calculations and Methodology:

One calculation should indicate the total surface area of the existing building skeleton, the surface area of the portion of the building skeleton that will be used in the new building, and this reused area expressed as a percentage of the total existing building skeleton.

The second calculation should indicate the total surface area of the new building skeleton, the surface area of the existing building skeleton that will be used in the new building, and this reused area expressed as a percentage of the total new building skeleton.

Related Resources and References:

See Design Guide

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SM-9: Spatial Efficiency

Credit Points Available: 2

Intent:
To promote the reduction in size of building footprints while offering the same level of amenity.

Credit Requirements:

Office
1 credit Demonstrate that the ratio of occupied area over GFA is 85%.

Retail
Demonstrate that the ratio of occupied area over GFA is 85%.

Residential
Demonstrate that 80% of total units meet or are below the size thresholds as listed here:

- Studio – 35m^2
- 1 bedroom unit – 50m^2
- 2 bedroom unit – 110m^2
- 3 bedroom unit – 140m^2
- 4 bedroom unit – 170m^2
- 5 bedroom unit – 200m^2.

Credit Submission:

Office
Provide the following documentation:

- Brief narrative describing how the project meets the Credit Requirements, including calculations.
- Floor plan of both the ground/entrance floor and a typical above-ground floor, marked up to indicate the areas of occupied area and non-occupied area and clearly noting the size of their areas in square metres.

Retail
Provide the following documentation:

- Brief narrative describing how the project meets the Credit Requirements, including calculations.
- Floor plans of all floors, marked up to indicate the occupied area and common mall area and noting the size of these areas in square metres.

Residential
Provide the following documentation:

- Brief narrative describing how the project meets the Credit Requirements, including calculations.
- Floor plan of the ground/entrance floor and all typical above-ground floors, marked up to indicate the unit sizes in square metres and number of bedrooms.

Calculations and Methodology:

Office and Retail

Calculations should include the total GFA of the building, the total area of occupied area, and the total occupied area expressed as a percentage of the GFA.

Residential

Calculations should indicate the total number of units in the building, the total number of qualifying units, and the number of qualifying units as a percentage of the total number of units.

Related Resources and References:

See Design Guide

SM-10: Design for Disassembly

Credit Points Available: 1

Intent:

To facilitate the future deconstruction and reuse of buildings and their constituent structural and façade materials.

Credit Requirements:

Demonstrate the following:

- 50% of the surface area of any one of the building structural skeleton or foundation

or

- 75% of facade

or

- 90% total roof systems are designed for disassembly

and

- Building Disassembly Plan with the following elements – materials intended for recovery, materials connection requirements, system for marking and identifying recoverable elements prior to installation, best management practices for disassembly and the disassembly sequence.

Credit Submission:

Provide the following:

- Short report, including calculations, demonstrating that the project meets the Credit Requirements.
- Building Disassembly Plan conforming to Project Requirements.

Calculations and Methodology:

Calculations should indicate the total surface area of the building skeleton, foundation, façade and roofing systems, and the amount of this surface area that can be disassembled both in square metres and as a percentage of the total surface area.

Related Resources and References:

See Design Guide

SM-11a: Building Durability: Design for Appropriate Durability

Credit Points Available: 1

Intent:

To encourage a long asset life by minimising building impacts from condensation, water ingress, improper drainage and protecting vulnerable areas of the building envelope and surroundings.

Credit Requirements:

Demonstrate that a Building Durability Plan has been implemented to optimise the integrity of the building's internal and external envelope and can achieve the projected life with low maintenance.

The Building Durability Plan should include the following:

- Estimated life span of key building features, including concrete walls foundations or structural elements, flooring, ceilings, roofs, cladding, windows and glazing/curtainwall.
- Where components or assemblies have a shorter service life than the life of the building, a plan for how these slower cycling materials can be specified to reduce life-cycle impacts (e.g. carbon and toxicity) and be maintained or replaced without damage to the longer cycling elements/materials.
- Description of design measures to improve durability and long term service life such as
    - Bollards in loading areas
    - Condensate capture
    - Drains/shower waterproofing and drainage gradients
    - Façade waterproofing and leakage
    - Insulation of ducts and durability of ceilings (particularly waterproofing)
    - Ease of maintenance
    - Access to façade and systems.

Credit Submission:

Provide the following documentation:

- Outline Building Durability Plan conforming to the Credit Requirements.
- Drawings and extracts from specifications and consultant briefs or scope demonstrating engagement to provide the supporting measures described in the Building Durability Plan.

Calculations and Methodology:

Building Durability Management Plan to coordinate and integrate wherever possible the intent and outcomes shown in SM-1 Carbon Intensity of Materials.

Related Resources and References:

Credit SM-1c: Replacement of High-Carbon Intensity Materials

See Design Guide

SM-11b: Building Durability: Durability Management During Construction

Credit Points Available: 1

Intent:

To encourage a long asset life by minimising building impacts from condensation, water ingress, improper drainage and protecting vulnerable areas of the building envelope and surroundings.

Credit Requirements:

Demonstrate the development of a Building Durability Plan for Construction that covers construction measures to improve durability, including but not limited to:

- Envelope commissioning and testing (commercial and multi-residential over 10 storeys).
- Window and door weatherproofing (commercial and multi-residential over 10 storeys).
- Inspection schedule and responsibilities for correct installation of wall waterproofing, façade and window flashings, shower waterproofing, falls to drains and stormwater grates/pits.

Credit Submission:

Provide the following documentation

- Building Durability Plan for Construction conforming to the Credit Requirements.
- Extracts from specifications indicating requirements for envelope commissioning and weatherproofing, including inspection requirements and schedules.

Calculations and Methodology:

Building Durability Management Plan to coordinate and integrate wherever possible the intent and outcomes shown in SM-1 Carbon Intensity of Materials.

Related Resources and References:

Credit SM-1c: Replacement of High-Carbon Intensity Materials

See Design Guide

SM-12: Design for Flexibility

Credit Points Available: 1

Intent:
To enable building interiors to be easily renovated and transformed for similar program uses.

Credit Requirements:

Office
Demonstrate the following:

- 95% of pipes, wiring and conduits are not installed in concrete or otherwise permanently embedded in building materials and finishes

and either

- 95% of interior, non-structural walls are demountable or movable

or

- 95% if the occupied area is ventilated through underfloor plenums.

Residential
Demonstrate the following:

- 95% of pipes, wiring and conduits are not installed in concrete or otherwise permanently embedded in building materials and finishes

and

- 90% of the units were delivered without interior walls (except for bathroom walls) or with walls that are easily relocated

and

- where units are for sale, 90% of units are delivered with finishes selected by the occupants.

Credit Submission:
Provide the following documentation:

Office

- Brief narrative describing how the project meets the Credit Requirements, including any relevant calculations.
- Extracts from specifications for plumbing and electrical services indicating compliance with the Credit Requirements.
- Typical floor plan indicating the location of any interior walls and locations of connections for movable/demountable walls.
- Typical elevation illustrating ventilation through underfloor plenums.

Residential

- Brief narrative describing how the project meets the Credit Requirements, including any relevant calculations.
- Extracts from specifications for plumbing and electrical services indicating compliance with the Credit Requirements.
- Typical floor plan indicating the location of any interior walls and, if applicable, locations of connections for

movable/demountable walls.

- Where units are for sale provide a signed statement from building owner that 90% of units are delivered with finishes selected by the occupants.

Calculations and Methodology:

Pipes, Wiring and Conduit

Where 100% of pipes, wiring and conduits are not installed in concrete, then no calculations for this part of the requirement have to be submitted.

Where less than 100% of the pipes, wiring and conduits meet the requirements, then calculations should indicate the total quantity of pipes, wires and conduits (in length) in the project and the quantity of pipes, wires and conduits that meet the requirements, both in length and as a percentage of the total amount of pipes, wires and conduits.

Walls

Where 100% of interior, non-structural walls are demountable or movable, then no calculations for this part of requirement have to be submitted.

Where less than 100% of the interior, non-structural walls meet the requirements, then calculations should indicate the total amount of interior, non-structural walls (by area) in the project and the amount of interior, non-structural walls that meet the requirements, both in area and as a percentage of the total amount of interior, non-structural walls.

Underfloor Plenums

Where 100% of the occupied area is ventilated through underfloor plenums, then no calculations for this part of requirement have to be submitted.

Where less than 100% of the occupied area is ventilated through underfloor plenums, then calculations should indicate the total occupied area in the project and the amount of occupied area that is ventilated through underfloor plenums, both in square metres and as a percentage of the total amount of occupied area.

Residential Units

Where 100% of the units meet the credit requirements, then no calculations for this part of requirement have to be submitted.

Where less than 100% of the units meet the requirements, then calculations should indicate the total number of units in the project and the number that meet the requirements, both as a flat figure and as a percentage of the total number of units.

Related Resources and References: See Design Guide

SM-13: Design for Adaptability

Credit Points Available: 1

Intent:

To lengthen the useful life of buildings through designs that are easily appropriated for other types of uses.

Credit Requirements:

Demonstrate that the building has the following characteristics:

- 90% of the building has regular rhythm to exposed facades
- floor-to-floor heights of at least 3.6 metres
- minimal number of load-bearing walls

and

- 90% of the operable windows are evenly distributed around exposed elevations.
- Façade/windows/curtain wall is able to be removed or adapted without damage to the integrity of building structure or skin.

Credit Submission:

Provide the following documentation:

- Brief narrative describing how the project meets the Credit Requirements, including any calculations.
- Elevations of all sides of the building clearly indicating which are exposed and the regular rhythm façades and floor-to-floor heights and distribution of operable windows.
- Typical floor plan clearly indicating the load-bearing walls and extent of windows and adjoining buildings if any.

Calculations and Methodology:

Calculations should include the total surface area of the building façade in square metres and total surface area of the façade that can be characterised as having a regular rhythm façade (typically the pattern of windows but also in massing), as well as non-exposed façades (where relevant) both in square metres and as a percentage of the entire façade area.

Related Resources and References:

See Design Guide

SM-14: Recycling and Resource Recovery: Construction Waste Recycling

Credit Points Available: 2

Intent:

To increase resource recovery from waste streams generated from building construction.

Credit Requirements:

Demonstrate the following:

- The creation of a Construction and Demolition Waste Management Plan (C&DWMP) prior to the start of construction for inclusion in all construction contracts and subcontracts. The plan must identify the materials to be diverted and indicate whether the materials will be stored on-site (if so, how) or co-mingled. If materials are planned for salvage, the plan must indicate their planned use (e.g. organisation taking possession or location of next use).

and

- Recycling or salvaging of the following percentage of construction and demolition debris.

1 CREDIT POINT = 60% of waste recycled
2 CREDIT POINTS = 80% of waste recycled

This figure excludes all hazardous waste that must be taken to separate hazardous waste facilities.

Credit Submission:

Provide the following documentation:

- Construction and Demolition Waste Management Plan conforming to the Credit Requirements.
- Extract from contract with main building contractor with stipulated requirements for recycling/salvaging construction and demolition waste materials.
- Contractors identified capable of executing requirements of the C&DWMP.
- Provide a schedule of items to be recycled, their source within the project, total estimated weight and volume (by number of trucks and volumetric capacity of trucks) and the details and individual contact for the destination recycling facility.

Calculations and Methodology:

Not applicable

Related Resources and References:

See Design Guide

SM-14: Recycling and Resource Recovery: Green Waste

Credit Points Available: 1

Intent:

To encourage the recovery and reuse of vegetated waste from building operations.

Credit Requirements:

Demonstrate the provision of an onsite location for all project occupants dedicated to the collection and/or composting of green waste generated onsite.

Area must be suitably sized for the projected amount of waste to be collected and located within 50 m of other waste and recycling storage areas with ready access to adequate collection vehicle manoeuvring area or onsite trittering and composting facility.

Credit Submission:

Provide the following:

- Brief narrative describing how the project meets the Credit Requirements, including details on the size of the storage area and the project amount of waste to be generated.
- Drawings clearly indicating the location and size of green waste collection area.

Calculations and Methodology:

Not applicable

Related Resources and References:

See Design Guide

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Credit Section **IP**

INNOVATING PRACTICE

"Just as energy is the basis of life itself, and ideas the source of innovation, so is innovation the vital spark of all human change, improvement and progress."

Theodore Levitt (American Economist and Professor, 1925–2006)

Through the use of the Estidama Integrative Design Process and the Design Guide, many projects will find they can achieve a higher level of practice than established as a benchmark through the various credits.

The ***Innovating Practice*** section is provided as 'extra credit' for those projects that demonstrate an ability to transform the practices of community design, construction and ongoing operations or education.

The process for rewarding these projects is based on a peer review approach that will help substantiate the project's claims for Innovating Practice. The process is modeled after other established programs that have sought to achieve the same goals of market transformation and rewarding project's that go beyond performance standards evidenced in these documents. An additional fee is charged for each innovation credit application received.

Eligibility Criteria for Innovation Credits

The following criteria will be used to evaluate the eligibility of claims for proposed Innovation credit status:

Does the project's design, construction or operational demonstrate a significant advancement in any of the following areas:

- Increase in bio-diversity or capacity of a site to sustain living systems
- Superior energy or water efficiency
- Unique application of renewable energy production
- Reduction in costs of construction or operations through 'synergy'
- Thorough documentation and analysis of sufficient detail to provide credible communication tools for the benefits of sustainable design in this project type
- Changes to user behavior resulting in higher resource efficiency
- Unique Technical or innovation in products, technology or practices

IP-1a Innovating Practice: Building and Site Design

Credit Points Available: 1

Intent

To reward building and site design that transcends traditional design practice to create more sustainable built environments and living systems.

Credit Requirements

Demonstrate that the design of the building or site has surpassed traditional building or site design in either process or outcome, as follows:

- Generated an innovation in modern design practice and/or process, resulting in a positive social and/or environmental outcome.

or

- Produced an exceptional sustainability outcome, either through surpassing thresholds in the Pearls rating method or by achieving significant positive outcomes outside of the scope of the Pearls rating method.

In order to qualify for the credit, the nominated achievement must be replicable by others in order to create a lasting transformation in the practice of building and site design.

Credit Submission

Where the design is innovative

Provide a short report as to how the project meets the Credit Requirements, including the following:

- Complete description of the innovation and a comparison, with examples, to standard design practice and/or standard building and site design.
- Meeting notes or other documentation of the evolution of the innovation in design.
- Documentation to support the design achievement such as, but not limited to, plans, drawings, specifications and photographs.
- Description of the positive social or environmental outcome with appropriate metrics establishing the outcome.
- Instructions or guidelines as to how other designers can achieve similar results.

Where the outcome is exceptional

Short report as to how the project meets the Credit Requirements, including as appropriate:

- Complete description of the relevant Pearls credit(s) surpassed.
- Complete description of any initiatives or outcomes achieved outside of the Pearls rating system and how they relate to scope and aims of Estidama.
- Calculations clearly demonstrating the social or environmental outcome achieved.
- Documentation to support the design achievement such as, but

not limited to, plans, drawings, specifications and photographs.

- Instructions or guidelines as to how other designers can achieve similar results.

Calculations and Methodology

Calculations may be required to support the documentation for innovation in design.

Related Resources and References

Not applicable.

IP-1b Innovating Practice: Building and Site Construction

Credit Points Available: 1

Intent

To reward building and site design that transcends traditional construction practice to create more sustainable built environments and living systems.

Credit Requirements

Demonstrate the construction of the building or site has surpassed traditional building or site design either in process or outcome, as follows:

- Generated an innovation in modern construction process and practice, resulting in a positive social and/or environmental outcome.

or

- Produced an exceptional sustainability outcome, either through achieving a range of high thresholds established in the Pearls rating system, surpassing the thresholds in the Pearls rating system, or achieving significant positive outcomes outside of the scope of the Pearls rating system.

In order to qualify for the credit, the nominated achievement must be replicable by others in order to create a lasting transformation in the practice of building and site construction.

Credit Submission

<u>Where the construction is innovative</u>

Provide a short report as to how the project meets the Credit Requirements, including the following:

- Complete description of the innovation and a comparison, with examples, to standard construction practice and/or means and methods.
- Meeting notes or other documentation of the evolution of the innovation in construction.
- Documentation to support the construction achievement such as, but not limited to, plans, drawings, specifications and photographs.
- Description of the positive social or environmental outcome with appropriate metrics establishing the outcome.
- Instructions or guidelines as to how other construction contractors can achieve similar results.

<u>Where the outcome is exceptional</u>

Provide a short report as to how the project meets the Credit Requirements, including as appropriate:

- Complete description of the relevant Pearls credit(s) surpassed.
- Complete description of any initiatives or outcomes achieved outside of the Pearls rating system and how they relate to scope and aims of Estidama.
- Calculations clearly demonstrating the social or environmental

outcome achieved.

- Documentation to support the construction achievement such as, but not limited to, plans, drawings, specifications and photographs.
- Instructions or guidelines as to how other construction contractors can achieve similar results.

Calculations and Methodology

Calculations may be required to support the documentation for innovation in construction.

Related Resources and References

Not applicable.

Innovating Practice: Building and Site Operations

Credit Points Available: 1

Intent

To reward building and site operations that transcend traditional operations practice to create more sustainable built environments and living systems.

Credit Requirements

Demonstrate that the operation of the building or site has surpassed traditional building or site operations in either process or outcome, as follows:

- Generated an innovation in building operations, resulting in a positive social and/or environmental outcome.

or

- Produced an exceptional sustainability outcome, either through surpassing the thresholds in the Pearls rating method or by achieving significant positive outcomes outside of the scope of the Pearls rating method.

In order to qualify for the credit, the nominated achievement must be replicable by others in order to create a lasting transformation in the practice of building and site operations.

Credit Submission

Where the operational practice is innovative

Provide a short report as to how the project meets the Credit Requirements, including the following:

- Complete description of the innovation and a comparison, with examples, to standard building and/or site operations.
- Meeting notes or other documentation of the evolution of the innovation in operations.
- Description of the positive social or environmental outcome with appropriate metrics establishing the outcome.
- Instructions or guidelines as to how other building or site managers can achieve similar results.

Where the outcome is exceptional

Provide a short report as to how the project meets the Credit Requirements, including as appropriate:

- Complete description of the relevant Pearls credit(s) surpassed.
- Complete description of any initiatives or outcomes achieved outside of the Pearls rating system and how they relate to scope and aims of Estidama.
- Calculations clearly demonstrating the social or environmental outcome achieved.
- Documentation to support the operations achievement such as, but ot limited to, plans, drawings, specifications and photographs.
- Instructions or guidelines as to how other building or site managers can achieve similar results.

Calculations and Methodology	Calculations may be required to support the documentation for innovation in operations.
Related Resources and References	Not applicable.

GLOSSARY

Above-grade wall:	A wall that is not a below-grade wall. [12]
Above-grade wall:	See 'wall'. [12]
Acre-foot	A volume of water that would cover one acre to a depth of one foot (326,500 gallons).
Aerobic decomposition	The decomposition of organic matter in the presence of oxygen
Albedo	Albedo, or solar reflectance, is a measure of a material's ability to reflect sunlight (including the visible, infrared and ultraviolet wavelengths) on a scale of 0 to 1. An albedo value of 0.0 indicates that the surface absorbs all solar radiation, and a 1.0 albedo value represents total reflectivity. The Energy Star Reflective Roof Products criteria specify an albedo of 0.65 or higher for low-slope roof applications and 0.25 for sloped roofs.[21]
Alley	A public or private way at the rear or side of property, permanently reserved as a means of secondary vehicular access to abutting property. Frontage on said alley shall not be construed as satisfying the requirements of this ordinance related to frontage on a dedicated street.
Alternative Fuel Vehicles	A vehicle that runs on a fuel other than conventional petroleum fuels (petrol or diesel); any method of powering an engine that does not involve solely petroleum (e.g. electric car, petrol-electric hybrid, solar powered).
American National Standards Institute (ANSI):	ANSI is a non-profit organisation that administers and coordinates the U.S. voluntary standardisation and conformity assessment system. It is composed of approximately 1000 companies, non-profit organisations, government agencies and other members. [3]
American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE):	ASHRAE is an international organisation that establishes standards for the uniform testing and rating of heating, ventilation, air conditioning, and refrigeration equipment. It also conducts related research, disseminates publications, and provides continuing education to its members. [3]
Anaerobic decomposition	The decomposition of organic matter in the absence of oxygen (i.e. rotting).
Automatic:	Self-acting, operating by its own mechanism when actuated by some non-manual influence, such as a change in current strength, pressure, temperature or mechanical configuration (see 'manual'). [12]
Ballast, electronic:	A ballast constructed using electronic circuitry. [12]
Ballast, high frequency	A high frequency electronic or magnetic ballast
Ballast, hybrid	A ballast constructed using a combination of magnetic core and insulated wire winding and electronic circuitry. [12]
Ballast, magnetic:	A ballast constructed with magnetic core and winding of insulated wire. [12]
Ballast:	Ballast is a device used in conjunction with an electric-discharge lamp to cause the lamp to start and operate under the proper circuit conditions of voltage, current, wave form, electrode heat etc. [12]
Baseline building performance:	The annual energy cost for a building design intended for use as a baseline for rating above-standard design. [12]
BAU – Business as usual	The practice of conducting business according to the status quo, with no attempt to assess additional or new needs, identify possibilities for improvement, or implement change.
Below-grade wall:	That portion of a wall in the building envelope that is entirely below the finish grade and in contact with the ground. [12]
Below-grade wall:	See 'wall'. [12]

Biodiversity:	Term used by biologists to describe the entire diversity of life - encompassing all of the species, genes, and ecosystems on earth (or within a given area). In practice, biodiversity is sometimes measured by counting the number of species found in an area - known as the area's species richness. A more precise measure would also consider the number of different ecosystems present as well as the genetic diversity found within individual species. Additionally, community structure – the proportions and arrangements of species on the landscape, and ecological and evolutionary processes - are generally considered important aspects of biodiversity. [2]
Biofuel:	Fuel derived from biological (and therefore renewable) matter.
Biomass:	The total mass of organic material within a given area.
Bio-retention rain gardens	Yard depression planted with perennial vegetation. Includes layer of organic and sand-amended topsoil above a gravel drainage layer.
Bio-retention swales:	Depressed parking lot or roadside islands planted with perennial vegetation. Includes layer of organic and sand-amended topsoil above a gravel drainage layer.
Blackwater:	Wastewater from toilets, urinals, kitchen sinks and dishwashers.
Block:	A parcel of land bounded by public streets, transportation rights of way, or land unsubdivided into urban plots or any combination thereby.
BMS:	A computer based digital building management or operation system with monitoring, reporting and capability to allow modification to the performance of building systems, control and functions to record and improve building system function and efficiency.
BOA:	Biodiversity Offset Arrangements. A legally binding agreement between a project and an Estidama recognised third party NGO to plan, finance, deliver and maintain biodiversity restoration off-site in developing countries and other GCC nations. Any BOA to be included in any Credit proposal, must be approved in by UPC in a multi-stage approval process.
Brownfield:	Property of which the expansion, redevelopment, or reuse may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant. [3]
Building Code:	The International Building Code as will be adopted by the Emirate of Abu Dhabi.
Building envelope, exterior:	The elements of a building that separate conditioned spaces from the exterior. [12]
Building envelope, semi-exterior:	The elements of a building that separate conditioned space from unconditioned space or that enclose semi-cooledspaces through which thermal energy may be transferred to or from the exterior, or to or from unconditioned spaces, or to or from conditioned spaces. [12]
Building envelope:	The exterior plus the semi-exterior portions of a building. For the purposes of determining building envelope requirements. [12]
Building material:	Any element of the building envelope through which heat flows and that is included in the component U-factor calculations other than air films and insulation. [12]
Building:	A structure wholly or partially enclosed within exterior walls, or within exterior and party walls, and a roof, affording shelter to persons, animals or property. [12]
Build-to line:	An alignment established a certain distance from the right-of-way line to a line along which a designated façade of a building must be built on.
Caliper:	The standard measure for the diameter of a tree measured 150mm above the ground (for trees larger than 12mm and smaller than 100mm in diameter). [4]
Canopy:	Canopy refers to the tree cover in an urban setting. Canopy size is an important determinant of a city's heat island reduction potential. The 'urban fabric' can be characterised both above and below the canopy for a better understanding of the area's surface cover. [3]
Carbon dioxide:	Colourless, odourless atmospheric gas.

Carbon emissions:	The release of greenhouse gases and/or their precursors into the atmosphere over a specified area and period of time. [22]
Carbon footprint:	Our environmental impact measured in terms of greenhouse gases emitted.
Carbon sink:	A reservoir that stores more carbon than it releases (i.e. ocean, forest).
Carpooling:	Shared use of a car by the driver and one or more passengers, usually for commuting.
Car-sharing programs:	A model of car rental where people rent cars for short periods of time, often by the hour. They are attractive to customers who make only occasional use of a vehicle, as well as others who would like occasional access to a vehicle of a different type than they use day-to-day. The organisation renting the cars may be a commercial business or the users may be organised as a democratically-controlled company, public agency, cooperative or ad hoc grouping.
CCR:	Convenants Codes and Restrictions
CER:	Certified emissions reductions
C-factor (thermal conductance):	Time rate of steady-state heat flow through unit area of a material or construction, induced by a unit temperature difference between the body surfaces. Units of C are W / m2·K. Note that the C-factor does not include soil or air films. [12]
Chemical Mass	See Mass: Chemical
CIE	Commission Internationale de l'Eclairage
Climate change:	A change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods. [5]
Coefficient of performance (COP) - cooling:	The ratio of the rate of heat removal to the rate of energy input, in consistent units, for a complete refrigeration system or some specific portion of that system under designated operating conditions. [12]
Cogeneration:	Simultaneous production of electricity and heat using a single fuel source.
Complete streets:	Streets that carry a bundle of transportation networks including bike, pedestrian and neighbourhood street vehicles which should connect to each other and to adjacent neighbourhoods.
Compost:	Composting emulates the natural process of creating soil through the interaction of many elements (rock particles, minerals, water, air, microbes and macro-organisms, and others). This English word originates from the Latin 'compositus' which means the making of a single substance using many pieces. [6]
Computational Fluid Dynamics (CFD):	One of the branches of fluid mechanics that uses numerical methods and algorithms to solve and analyse problems that involve fluid flows.
Conditioned floor area:	See 'floor area'. [12]
Conductance:	See 'thermal conductance'. [12]
Construction documents:	Drawings and specifications used to construct a building, building systems or portions thereof. [12]
Construction:	The fabrication and erection of a new building or any addition to or alteration of an existing building. [12]
Context-sensitive Solutions (CSS):	A multidisciplinary design approach to streets that balances different needs – the road user, the pedestrian, and the environment.
Cool roof:	A roof with a high solar reflectance (albedo) as well as a high thermal emittance to help reflect sunlight and heat away from a building and reduce roof temperatures up to 50-60°F (28-33°C) over conventional materials during peak summer weather. [7]
Cool roofs:	Roofing material that has high solar reflectance. This characteristic can reduce heat transfer to the indoors and enhance roof durability. Cool roofs may also be highly emissive, releasing a large percentage of the solar energy they absorb. [3]
Cooled space:	An enclosed space within a building that is cooled by a cooling system whose sensible output capacity exceeds 15 W/m2 of floor area. [12]

COP:	The net cooling energy exported from the plant over the total electric power used by the plant at the utility electric meters.
Coverage:	That portion of a lot or building site that is occupied by any building or structure, regardless of whether said building or structure is intended human occupancy.
Critical Natural Resources:	Elements, materials or habitat that are essential for the life of humans and other species of flora and fauna.
Cul-de-sacs:	A dead-end street with only one inlet/outlet. While historically built for other reasons, its modern use is to calm vehicle traffic.
Daylight factor:	Ratio of the illuminance at a point on a given plane due to the light received directly or indirectly from a sky of assumed or known luminance distribution, to the illuminance on a horizontal plane due to an unobstructed hemisphere of this sky. The contribution of direct sunlight to both illuminances is excluded. (Glazing, dirt effects etc. are included, when calculating the lighting of interiors. The contribution of direct sunlight must be considered separately). Unless stated otherwise the sky luminance distribution is assumed to be that of the CIE standard overcast sky.[23]
DC:	District cooling
Dew point temperature (DPT):	Is the expected dew point in degrees Fahrenheit valid for the indicated hour. Dew point temperature is a measure of atmospheric moisture. It is the temperature to which air must be cooled in order to reach saturation (assuming air pressure and moisture content are constant).
Distribution system:	Systems, components and mechanisms conveying (such as ducts, pipes, and wires) to bring substances or energy from a source to the point of use. The distribution system includes such auxiliary equipment as fans, pumps and transformers and their respective control systems.
DOE:	U.S. Department of Energy
Door area:	Total area of the door measured using the rough opening and including the door slab under the frame (see 'Window area'). [12]
Dry-bulb temperature (DBT)	The temperature of an air sample, as determined by an ordinary thermometer, the thermometer's bulb being dry. It is typically the x-axis, the horizontal axis, of the graph. The SI units for temperature are Celsius; other units are Fahrenheit.
Dwelling unit:	A single unit providing complete independent living facilities for one or more persons, including permanent provisions for living, sleeping, eating, cooking and sanitation. [12]
EAD:	Environment Agency Abu Dhabi
Easement:	A portion of land created by grant or agreement for specific purpose; an easement is the right, privilege or interest which one party has in the land of another. Examples include public access and utility easements.
Ecological services:	Those ecosystem functions that provide economic utility to humans (e.g. flood control, water purification, stormwater cleansing and retention, nutrient cycling). It is estimated that the value of ecosystem services worldwide is the equivalent of $33 trillion annually – twice the global GDP. [8]
Ecosystem services:	Benefits that the human species derives from resources and processes supplied by natural ecosystems. These include products like clean drinking water and processes such as the decomposition of wastes. Services can be subdivided into five categories: provisioning (e.g. production of food and water), regulating (e.g. control of climate and disease), supporting (e.g. nutrient cycles and crop pollination) cultural (e.g spiritual and recreational benefits) and preserving (e.g. guarding against uncertainty through the maintenance of diversity).
EER:	Energy efficiency ratio
EF:	Energy factor
Efficiency:	Performance at specified rating conditions. [12]
Emissivity:	The ratio of the radiation emitted by a surface to the radiation emitted by a black body at the same temperature. [9]

Emittance:	The emittance of a material refers to its ability to release absorbed heat. Scientists use a number between 0 and 1, or 0% and 100%, to express emittance. With the exception of metals, most construction materials have emittances above 0.85 (85%). The ratio of the radiant heat flux emitted by a specimen to that emitted by a blackbody at the same temperature and under the same conditions. [12]+[3]
Enclosed space:	A volume substantially surrounded by solid surfaces such as walls, floors, roofs, and openable devices such as doors and operable windows. [12]
Energy balance:	An energy balance is a detailed accounting of all energy flowing into and out of a volume or surface. Examples of energy flows include convection, evaporation, heat stored or conducted, and heat generated in a volume (such as anthropogenic heat in a city). Energy balances of urban and rural areas can illustrate the cooling effects of trees and vegetation on evaporation and heat storage rates. [3]
Energy efficiency ratio (EER):	The ratio of net cooling capacity in kWh to total rate of electric input in watts under designated operating conditions (see 'coefficient of performance [COP]-cooling'). [12]
Energy factor (EF):	A measure of water heater overall efficiency. [12]
Energy:	The capacity for doing work. It takes a number of forms that may be transformed from one into another such as thermal (heat), mechanical (work), electrical and chemical. Customary measurement units are British thermal units (kWh·MJ). [12]
Environmental design:	Is the process of addressing surrounding environmental parameters when devising plans, programs, policies, buildings, or products. Environmental design in the old-fashioned sense develops physical environments, both interior and exterior, to meet one or more aesthetic or day-to-day functional needs, or to create a specific sort of experience - the focus being the human-designed environment.
Equinox:	Either of two times of the year when the sun crosses the plane of the earth's equator and day and night are of equal length.
Estidama:	The established designation for sustainability of projects within Abu Dhabi and the region.
ETS:	Energy transfer system
Evapotranspiration:	The transport of water into the atmosphere from surfaces, including soil and vegetation.
Exterior building envelope:	See 'Building envelope'. [12]
Façade area:	Area of the facade, including overhanging soffits, cornices, and protruding columns, measured in elevation in a vertical plane parallel to the plane of the face of the building. Non-horizontal roof surfaces shall be included in the calculation of vertical facade area by measuring the area in a plane parallel to the surface. [12]
Façade:	The exterior wall of a building exposed to public view or that wall viewed by persons not within the building. The portion of any exterior elevation of a building extending vertically from the grade to the top of a parapet wall or eave, and horizontally across the entire width of the building elevation.
Floor Area Ratio (also known as Floor Space or Plot Ratio):	The ratio of the gross floor area of all buildings to the total area of the plot upon which such buildings are located, where plot area is expressed in decimal form, e.g. 5.0 to 10.0. While the ICC does not include a definition for Floor Area Ratio (FAR), the concept is fairly straightforward and various definitions are consistent. Some definitions include explanations of how to calculate FAR, however, we have included this in Rules of Measurement.
Floor area, gross:	The sum of the floor areas of the spaces within the building, including basements, mezzanine and intermediate-floored tiers, and penthouses with a headroom height of 2.3 m or greater. It is measured from the exterior faces of exterior walls or from the centreline of walls separating buildings, but excluding covered walkways, open roofed-over areas, porches and similar spaces, pipe trenches, exterior terraces or steps, chimneys, roof overhangs, and similar features. [12]
Fluorescent lamp:	A low-pressure electric discharge lamp in which a phosphor coating transforms some of the ultraviolet energy generated by the discharge into light. [12]

Formaldehyde:	Formaldehyde is a simple, highly reactive hydrocarbon that is used as a fixative in the pathology laboratory, as a fumigant, and in the manufacture of foam insulation, cosmetics, drugs, clothing and furniture. It is also a major toxic component of photochemical smog. Formaldehyde is a strong allergen.[24]
Fossil fuel:	Fuel derived from a hydrocarbon deposit such as petroleum, coal or natural gas derived from living matter of a previous geologic time. [12]
Frontage, Street (Frontage, Plot):	All property fronting on one side of a street or between intersecting or intercepting streets, or the end of a dead-end street.
Fuel:	A material that may be used to produce heat or generate power by combustion. [12]
Fully-shielded luminaire:	A luminaire emitting no light above the horizontal plane. [10]
G77 countries:	The Group of 77 (G-77) was established on 15 June 1964 by seventy-seven developing countries signatories of the "Joint Declaration of the Seventy-Seven Countries" issued at the end of the first session of the United Nations Conference on Trade and Development (UNCTAD) in Geneva.. Although the members of the G-77 have increased to 130 countries, the original name was retained because of its historic significance. [25]
Geographic Information Systems (GIS):	Any information system that integrates, stores, edits, analyses, shares and displays geographic information. Generically, GIS applications are tools that allow users to create interactive queries (user-created searches), analyse spatial information, edit data, maps and present the results of all these operations.
Geothermal energy:	The heating and/ or cooling potential of earth.
GFA:	See Gross Floor Area
GGE:	Greenhouse Gas Emissions
Glare:	Glare is the result of excessive contrast between dark areas in the field of view. This can happen when viewing an unshielded or badly shielded light. There are three types of glare: blinding glare, which leaves temporary or permanent vision deficiencies, disability glare, which reduces sight capabilities, and nuisance glare, which does not cause a dangerous situation but can be irritating.
Green infrastructure:	The natural life support system – a strategically planned and managed network of wilderness, parks, greenways, conservation easements, and working lands with conservation value that supports native species, maintains natural ecological processes, sustains air and water resources, and contributes to the health and quality of life for communities and people. [11]
Green roof:	Rooftops planted with vegetation. Intensive green roofs have thick layers of soil (150-200 or more) that can support a broad variety of plant or even tree species. Extensive roofs are simpler green roofs with a soil layer of 150mm or less to support turf, grass, or other ground cover. [3]
Greenfield:	Previously undeveloped land in a city or rural area, currently used for agriculture, landscape design or left to nature.
Greenhouse gases:	Gases which absorb infrared radiation (heat) and contribute to the greenhouse effect (water vapour, carbon dioxide, methane etc.).
Greenway:	Natural land corridor.
Greywater:	Wastewater from uses (such as showering, laundry or sinks) and fire system test and cooling tower drain-down water.
Gross Floor Area (Gross External Area):	The sum of all enclosed floor area in a building or structure, measured from the exterior faces of the exterior walls or from the centreline of walls separating two buildings, including but not limited to: interior structural elements, circulation corridors, stairs, service rooms, shafts, all mechanical-electrical-plumbing rooms, storage and equipment spaces, above-grade parking, and the portion of balconies that are enclosed on 3 sides (the entire floor area of corner balconies with only 2 enclosing walls is excluded). Essentially, GFA is a physical volume, not related to use or space types. Stairs, ramps, shafts and other floor penetrations are counted once at each respective floor level they penetrate. Attic space with headroom of 2.5 metres or more is included.
Groundwater:	Water that occurs below the surface of the earth, where it occupies spaces in soils or geological strata.

Gulf Cooperation Council (GCC):	Officially Cooperation Council for the Arab States of the Gulf, organisation (est. 1981) promoting stability and economic cooperation among Arab Gulf nations.
GWP	Global warming potential
HCP (Habitat Conservation Plan):	A plan developed by Private landowners that allow otherwise prohibited impacts to endangered, threatened and other species covered in the permitting documents based on offsetting conservation, restoration and regeneration actions.
Heat:	Thermal energy of a radioactive, conductive, or convective nature.
Height:	The vertical distance from (a) the adjacent public sidewalk or street curb elevation if the building is not more than two metres from the right-of-way or (b) from averaged finished grade, as calculated for the corner point elevations of the exterior walls of the building in all other cases, to the highest point of the height of the building roof. This measurement does not include the roof finishing layer or the roof of the staircase, mechanical equipment, elevator penthouse or services located on the roof. The height of a stepped or terraced building is the maximum height of any segment of the building.
High-frequency electronic ballast:	Ballasts that operate at a frequency greater than 20 kHz. [12]
High-intensity discharge (HID) lamp:	An electric discharge lamp in which light is produced when an electric arc is discharged through a vaporised metal such as mercury or sodium. Some HID lamps may also have a phosphor coating that contributes to the light produced or enhances the light colour. [12]
HVAC system:	The equipment, distribution systems, and terminals that provide, either collectively or individually, the processes of heating, ventilating, or air conditioning to a building or portion of a building. [12]
HVAC:	Heating, ventilating, and air conditioning.
Hybrid vehicles:	A hybrid vehicle is a vehicle that uses an on-board rechargable energy storage system (RESS) and a fuel based power source for vehicle propulsion.
Hydrozone:	A portion of the landscaped area having plants with similar water needs that are served by a valve or set of valves with the same schedule. A hydrozone may be irrigated or nonirrigated. For example, a naturalised area planted with native vegetation that will not need supplemental irrigation once established is a nonirrigated hydrozone.
IESNA:	Illuminating Engineering Society of North America
Impervious pavement:	A ground layer that is not penetrable by water.
Incandescent lamp:	A lamp in which light is produced by a filament heated to incandescence by an electric current. [12]
Indirectly conditioned space:	An enclosed space within a building that is not a heated space or a cooled space, which is heated or cooled indirectly by being connected to adjacent space(s) provided. [12]
Infiltration -air:	The uncontrolled inward air leakage through cracks and crevices in any building element and around windows and doors of a building caused by pressure differences across these elements due to factors such as wind, inside and outside temperature differences (stack effect) and imbalance between supply and exhaust air systems. [12]
Infiltration Rate	The rate of water entry into the soil expressed as a depth of water per unit of time (e.g. inches/hour or mm/hour).
Infiltration -water:	The downward movement of water through soil.
Infrared radiation:	Infrared radiation is the heat energy emitted from a material. The term infrared refers to energy in the region of the electromagnetic radiation spectrum at wavelengths longer than those of visible light, but shorter than those of radio waves. [3]
Installed interior lighting power:	The power in watts of all permanently installed general, task and furniture lighting systems and luminaires. [12]
Integrated part-load value (IPLV):	A single-number figure of merit based on part-load EER, COP, or kW/tonne expressing part-load efficiency for air-conditioning and heat pump equipment on the basis of weighted operation at various load capacities for the equipment. [12]
IPLV:	Integrated part-load value.
IPM	Integrated Pest Management Plan

Isolation devices:	Devices that isolate HVAC zones so that they can be operated independently of one another. Isolation devices include, but are not limited to, separate systems, isolation dampers, and controls providing shutoff at terminal boxes. [12]
Jobs/housing balance:	The number of jobs to job seekers within a community.Providing mixed land uses that support a balance of jobs and housing in close proximity is a hallmark of the smart growth movement. Research suggests that jobs/housing balance can reduce a region's vehicle miles travelled (VMT) by upwards 15% (Ewing, 1996).
Joule (J):	Metric unit of energy equal to the work done by a force of one newton acting through a distance of one metre. [3]
K:	Kelvin
kg:	Kilogram
Kilovolt-ampere (kVA):	The product of the line current (amperes) times the nominal system voltage (kilovolts) times 1.732 for three-phase currents. For single-phase applications, kVA is the product of the line current (amperes) times the nominal system voltage (kilovolts). [12]
Kilowatt (kW):	A unit of electrical power equal to 1000 watts.
Kilowatt hour (kWh):	A unit of energy equal to that expended by one kilowatt of electricity in one hour.
kVA:	Kilovolt-ampere
kW:	Kilowatt
kWh:	Kilowatt-hour
Lamp:	A generic term for a man-made light source often called bulb or tube. [12]
Landscape - Hydrozone:	A portion of the landscaped area having plants with similar water needs that are served by a valve or set of valves with the same schedule. A hydrozone may be irrigated or non-irrigated. For example, a naturalised area planted with native vegetation that will not need supplemental irrigation once established is a non-irrigated hydrozone.
Landscaping - Infiltration Rate:	The rate of water entry into the soil expressed as a depth of water per unit of time (e.g., inches per hour).
Landscaping - Runoff:	Water that is not absorbed by the soil or landscape to which it is applied and flows from the area. For example, runoff may result from water that is applied at too great a rate (application rate exceeds infiltration rate) or where there is a severe slope.
Landscaping - Turf:	A single-bladed grass or sod.
Landscaping:	The planting, configuration and maintenance of trees, ground cover, shrubbery and other plant material, decorative natural and structural features (walls, fences, hedges, trellises, fountains, sculptures), earth patterning and bedding materials, and other similar site improvements that serve an aesthetic or functional purpose.
LCA:	Life Cycle Analysis
Level of Service (LOS):	Defined as a qualitative measure describing operational conditions within a traffic stream, and their perceptions by motorists and/or passengers (speed, travel time, traffic interruptions, comfort and convenience etc). There are six levels: A (free flow), B (stable flow), C (flow starts to deteriorate), D (speed, convenience, comfort, deteriorated), E (almost at capacity level), F (breakdown flow).
Light Fixture - Cutoff:	The luminous intensity (in candelas) at or above an angle of 90° above nadir does not numerically exceed 2.5% of the luminous flux (in lumens) of the lamp or lamps in the luminary, and the luminous intensity (in candelas) at or above a vertical angle of 80° above nadir does not numerically exceed 10% of the luminous flux (in lumens) of the lamp or lamps in the luminary.
Light Fixture - Full Cutoff:	The luminous intensity (in candelas) at or above an angle of 90° above nadir is zero, and the luminous intensity (in candelas) at or above a vertical angle of 80° above nadir does not numerically exceed 10% of the luminous flux (in lumens) of the lamp or lamps in the luminaire.
Light Fixture - Non-cutoff:	There is no candela limitation in the zone above maximum candela.
Light Fixture - Semi-cutoff:	The luminous intensity (in candelas) at or above an angle of 90° above nadir does not numerically exceed 5 percent of the luminous flux (in lumens) of the lamp or lamps in the luminary, and the luminous intensity (in candelas) at or above a vertical angle of 80° above nadir does not numerically exceed 20% of the luminous flux (in lumens) of the lamp or lamps in the luminary.

Light Fixture - Shielded Fixture	Outdoor light fixtures shielded or constructed so that light rays emitted by the lamp are projected below the horizontal plane passing through the lowest point on the fixture from which light is emitted.
Light Fixture Cutoff	Light fixtures are classified as full cutoff, cutoff, semi-cutoff, or non-cutoff according to the most recent adopted criteria of the Illuminating Engineering Society of North America (IESNA).
Light pollution:	Any adverse effect of artificial light, including sky glow, glare, light trespass, light clutter, decreased visibility at night and energy waste. [13]
Lighting system:	A group of luminaires circuited or controlled to perform a specific function. [12]
Lighting, decorative:	Lighting that is purely ornamental and installed for aesthetic effect. Decorative lighting shall not include general lighting. [12]
Lighting, general:	Lighting that provides a substantially uniform level of illumination throughout an area. General lighting shall not include decorative lighting or lighting that provides a dissimilar level of illumination to serve a specialised application or feature within such area. [12]
lin:	Linear
Living systems patterns:	The entire underlying patterns of nature that define and support interrelated life within ecosystems.
Low-slope roof:	A roof surface with a maximum slope of 50mm 'rise' for 300mm 'run' as defined in American Society for Testing and Materials Standard E 1918-97. [3]
Luminaire (light fixture):	A complete lighting unit consisting of a lamp or lamps together with the housing designed to distribute the light, position and protect the lamps, and connect the lamps to the power supply. [12]
m:	Metre
m2·K/W:	Square metre per kelvin per watt.
Manager:	The General Manager of the Urban Planning Council or his designee.
Manual (non-automatic):	Requiring personal intervention for control. Non-automatic does not necessarily imply a manual controller, only that personal intervention is necessary (see 'Automatic'). [12]
Manufacturer:	The company engaged in the original production and assembly of products or equipment or a company that purchases such products and equipment manufactured in accordance with company specifications. [12]
Mass: Chemical	Materials that store or release energy as a result of changes in their chemical bonds.
Mass: Phase Change	Elements or compounds that store or release energy as a result of the latent heat of condensation during a change from liquid to solid state or vice versa e.g. water. Usually eutectic salt compounds.
Mass: Thermal	Materials with a high volumetric heat storage capacity such as water, stone concrete, masonry, brick etc. Used to store evening cool till the following day (or more) and enable passive cooling during appropriate times of the year.
Mean temperature:	One-half the sum of the minimum daily temperature and maximum daily temperature. [12]
Mechanical cooling:	Reducing the temperature of a gas or liquid by using vapour compression, absorption, desiccant dehumidification combined with evaporative cooling, or another energy-driven thermodynamic cycle. Indirect or direct evaporative cooling alone is not considered mechanical cooling. [12]
Median radiant temperature (MRT):	This index is the average temperature at a node (pedestrian level height) as a result of heat exchange from all the surrounding surfaces in the sidewalk (or civic place), including the sky and sun above. Variations in the microclimatic parameters of air temperature, humidity, air movement or wind, and mean radiant heat, all affect the MRT.
Microclimate:	The localised climate conditions within an urban area or neighbourhood.

Mixed use:	A specific zoning district or planning area that allows for a variety of uses within one district. Contemporary city planning acknowledges that certain single-use districts must exist and that the presence and use of the automobile is an inevitable reality of future cities. However, the central goal of mixed-use development is to increase, as much as possible, urban landscapes that are less car-oriented, more pedestrian-oriented and more resource efficient.
Mixed-Use Development:	Development that includes more than one major class of uses — such as residential, commercial, industrial, or public and semi-public uses — within the same building, project, or site. The most common examples are a project with both commercial and residential uses, or commercial and industrial uses.
MOU	Memorandum of Understanding
MRT:	See Mean Radiant Temperature
Naturalised detention:	Detention basin naturalised with shallow side slopes and native wetland and prairie vegetation.
Neighbourhood completeness concept:	This concept is based on the aggregate sum of areas determined by pedestrian sheds or 'walking catchment areas' (400m or 5 minute walking distance) as a basis to determine how 'complete' is a neighbourhood and therefore how walkable it is.
NERC:	National Window Rating Council
NGO	Non Governmental Organisation
Nitrogen oxides (NOx):	Collective term for nitrogen compounds such as NO and NO2. Nitrogen oxides are an environmental and public health concern because human activity has increased their concentration in the atmosphere. NO and NO2 are interconvertible and are precursor molecules for the production of ground-level ozone. [3]
NMS	See Nutrient Management Strategy
Nonpoint pollution source:	Sources of pollution that cannot be traced to any single site of discharge, typically by runoff, subsurface flow, or deposition from the atmosphere
Nonrenewable energy:	Energy derived from a fossil fuel source. [12]
Nutrient Management Strategy	(NMS) that outlines techniques for salt flushing from soils (where relevant) and fertilisation scheme(s) over the course of development and occupation of the proposed project.
Obtrusive light:	Spill light that causes glare, annoyance, discomfort, or loss of visual ability. See Light pollution.
Occupied area:	All area leased to tenants including all office areas and kitchens inside of tenanted areas. Specifically exclude hallways, corridors, ensuites and service areas.
Open grid paving	Paving elevated above a structural deck or base on thermally insulating spacers without adhesion or mortar. Often used as a roof membrane protection or shading device structures below and to minimise urban heat island effect.
Open Space - Common Open Space:	Areas for outdoor living and recreation that are accessible to all dwelling units they are designed to serve. Land not individually owned or dedicated for public use that is designed and intended for the use of residents and guests of more than one dwelling unit.
Open Space - Private Open Space:	Open areas for outdoor living and recreation that are adjacent and directly accessible to a single dwelling unit, reserved for the exclusive use of residents of the dwelling unit and their guests.
Openness factor (OF):	This factor measures the proportion of holes in a woven fabric. This parameter, together with other technical properties of the fabric, should be considered when determining the degree of visibility (and heat and glare control) that the fabric offers. The openness factor can vary slightly from colour to colour in the same fabric, and is often expressed as an Average OF. A low OF indicates that the fabric has a very close weave.
Orientation:	The direction an envelope element faces (i.e. the direction of a vector perpendicular to and pointing away from the surface outside of the element). [12]

Outdoor (outside) air: Air that is outside the building envelope or is taken from outside the building that has not been previously circulated through the building. [12]

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Peak demand: The maximum electricity used to meet the cooling load of a building or buildings in a given area, measured in kilowatts.

Peak load: The maximum hourly amount of heat that must be removed from a building to maintain required indoor comfort conditions.

Pearls Rating System: Abu Dhabi's preferred rating system for qualifying site plans, community designs and buildings to measure their attainment of Estidama.

Pedshed: Pedestrian shed, or all area of land use that can be walked by pedestrians in a designated time frame to a designated point (i.e. 3 or 5 minute walk).

Permaculture: The conscious design and maintenance of productive human settlements and ecosystems which have the diversity, stability, and resilience of natural ecosystems. The philosophy behind permaculture is one of working with, rather than against, nature; of protracted and thoughtful observation rather than protracted and thoughtless action; of looking at systems in all their functions, rather than asking only one yield of them; and of allowing systems to demonstrate their own evolutions.

Pervious or permeable paving: Paving designed to allow water to pass through surface using porous asphalt or concrete or using interlocking concrete permeable pavers or open grid paver. Water can be stored in open-graded stone beneath the surface to meet local detention requirements.

Pervious paving: Paving material that is at least 50% open and allows moisture to pass through the material and soak into the earth below.

Phase Change Mass See Mass: Phase Change

Photovoltaics: Photovoltaic cells are designed and engineered to convert solar radiation into usable energy. They are considered a 'renewable' form of energy and can be installed on rooftops in conjunction with cool roof materials. [3]

Plan 2030: The Urban Structure Framework Plan is designed to help Abu Dhabi filter and respond to current and future development needs, establish a planning culture and introduce strong guiding principles for new development.

Plenum: A compartment or chamber to which one or more ducts are connected, that forms a part of the air distribution system, and that is not used for occupancy or storage. A plenum often is formed in part or in total by portions of the building. [12]

Point source of pollution: Sources that discharge pollutants at specific points through pipes, ditches, or sewers into bodies of surface water.

Pool: Any structure, basin, or tank containing an artificial body of water for swimming, diving or recreational bathing. The term includes, but is not limited to, swimming pool, whirlpool, spa and hot tub. [12]

Porous block pavement systems: Prefabricated lattice structures made of concrete or plastic that are designed to support light traffic from cars and pedestrians, while allowing water to drain through. The blocks are filled with aggregate, or with soil planted with vegetation. [3]

Potable water: Drinkable water for human use, supplied from wells or municipal water systems.

Process energy: Energy consumed in support of a manufacturing, industrial, or commercial process other than conditioning spaces and maintaining comfort and amenities for the occupants of a building. [12]

Profile angle: The angle used to size overhangs or spacing between buildings for shade; specifically, the vertical shadow angle of an overhang made by the angle between a horizontal from the bottom of a window and a line between the bottom of the window and the end of the overhang. It is the geometric translation of the solar altitude of the sun at a particular time into the plane normal to the window. [16]

Projected shade: The shade projected onto a horizontal or vertical surface by another element including buildings or part thereof, shade device or structure.

Proposed building performance: The annual energy cost calculated for a proposed design. [12]

Psychrometric chart: A visual aid to help estimate outdoor thermal comfort in very specific microclimate environments for a city and even at the project scale. The chart helps designers and planners to determine the specific environmental variables (humidity, dry bulb temperature etc.) that affect very specific microclimates. By knowing the specific microclimate of a project, designers can later manipulate the built environment to enhance certain conditions onsite.

Pump system power: The sum of the nominal power demand (nameplate kW) of motors of all pumps that are required to operate at design conditions to supply fluid from the heating or cooling source to all heat transfer devices (e.g. coils, heat exchanger) and return it to the source. [12]

Purchased energy rates: Costs for units of energy or power purchased at the building site. These costs may include energy costs as well as costs for power demand as determined by the adopting authority. [12]

R: R-value (thermal resistance)

Radiation: Radiation is energy emitted in the form of electromagnetic waves. Radiation has differing characteristics depending upon the wavelength. Because the radiation from the sun is relatively energetic, solar radiation has a short wavelength (ultraviolet, visible and near infrared). Energy radiated away from the earth's surface and the atmosphere has a longer wavelength (e.g. infrared radiation) because the earth is cooler than the sun. [3]

Readily accessible: Capable of being reached quickly for operation, renewal, or inspection without requiring those to whom ready access is requisite to climb over or remove obstacles or to resort to portable ladders, chairs etc. In public facilities, accessibility may be limited to certified personnel through locking covers or by placing equipment in locked rooms. [12]

Recirculating system: A domestic or service hot-water distribution system that includes a closed circulation circuit designed to maintain usage temperatures in hot-water pipes near terminal devices (e.g. lavatory faucets, shower heads) in order to reduce the time required to obtain hot water when the terminal device valve is opened. The motive force for circulation is either natural (due to water density variations with temperature) or mechanical (recirculation pump). [12]

Reclaimed water: The liquid discharged from a greywater or wastewater treatment system, treated to reduce the concentration of any substance or organism that may be detrimental to public health or the environment and made suitable for reuse.

Reflectance: The ratio of the light reflected by a surface to the light incident upon it. [12]

Reflector lamp: A class of incandescent lamps that have an internal reflector to direct the light. Reflector lamps are typically characterised by reflective characteristics such as R: reflector, ER: ellipsoidal reflector, PAR: parabolic aluminised reflector, MR: mirrorised reflector and others. [12]

Regeneration: Regeneration differs from Restoration through engaging in processes that will enable the development of larger, more diverse, and complex ecological systems (on, as well as beyond, the site) to provide increasingly higher orders of expression of ecological services. This requires that humans learn to become an integral part of nature (to participate with nature in partnership) in order that both systems recieve mutual benefit and become a unified whole system.

Relative humidity (RH): The ratio of the mole fraction of water vapour to the mole fraction of saturated moist air at the same temperature and pressure. RH is dimensionless and is usually expressed as a percentage. Lines of constant RH reflect the physics of air and water - they are determined via experimental measurement. (Note: the notion that air 'holds' moisture, or that moisture dissolves in dry air and saturates the solution at some proportion, is an erroneous (albeit widespread). Source: Wikipedia

Renewable energy credit: Tradable environmental commodities which represent proof that one megawatt-hour of electricity was generated from an eligible renewable energy source.

Renewable energy: Thermal, chemical, phase-change or electrical energy derived from direct conversion of incident solar radiation at the building site and used to offset consumption of purchased fuel or electrical energy supplies. For the purposes of applying this tool, renewable energy shall not include passive strategies. [12]

Residential:	Spaces in buildings used primarily for living and sleeping. Residential spaces include, but are not limited to, dwelling units, dormitories and lodging houses. [12]
Restoration:	Modification of an ecological subsystem (a portion of a wetland, waddi, desert wildlife habitat, dune system, estuary, mangrove remnant, grove of trees, or patch of native vegetation) in such a way as to reestablish an ecosystem's structure, and basic function. This can never bring a system back to its 'original' condition, but should provide the structural relationships to allow it achieve self-organising (evolutionary) capability offering recently perceived ecosystem services.
Roof:	The upper portion of the building envelope, including opaque areas and window, that is horizontal or tilted at an angle of less than 60° from horizontal. [12]
Runoff:	Water that is not absorbed by the soil or landscape to which it is applied and therefore flows from the area. For example, runoff may result from water that is applied at too great a rate (application rate exceeds infiltration rate) or where there is a severe slope.
R-value:	R-value or 'thermal resistance value' is a measure of the resistance of a material to heat flow. The term is typically used to describe the resistance properties of insulation. The higher the R-value, the greater the insulation's resistance to heat flow. R-value is the inverse of U-value. [3]
SC:	Shading coefficient
SEER:	Seasonal energy efficiency ratio
Sequestration:	Absorption, containment
Service equipment:	The necessary equipment, usually consisting of a circuit breaker or switch and fuses and accessories, located near the point of entrance of supply conductors to a building or other structure (or an otherwise defined area) and intended to constitute the main control and means of cutoff of the supply. Service equipment may consist of circuit breakers or fused switches provided to disconnect all underground conductors in a building or other structure from the service-entrance conductors. [12]
Service water heating:	Heating water for domestic or commercial purposes other than space heating and process requirements. [12]
SET:	An index that couples the variables of human thermal sensation, discomfort and physiological effect of environmental conditions, and subjective self-affecting variables like clothing and activity types. SET uses an average of ambient air temperature and MRT weighted by air velocity and activity level to produce a dynamic and comprehensive index. [17]
Setpoint:	Point at which the desired temperature (°C) of the heated or cooled space is set. [12]
Shadeways:	Pedestrian thoroughfares provided with predominantly continuous projected shade via any means whether in the public realm or on privately owned sites.
SHGC:	Solar heat gain coefficient
SI:	Systeme International d'Unites
Sidewalk:	A paved, surfaced, or levelled area, paralleling and usually separated from the street, used as a pedestrian walkway.
Simulation program:	A computer program that is capable of simulating the energy performance of building systems tested to BESTEST or equal. [12]
Site plan:	A plan showing the relation of the proposed development to the boundary of the plot.
Site:	One or more plots, parcels, leaseholds, or other physical locations that are in a single ownership or under unified control.
Skylight:	A window surface having a slope of less than 60 degrees from the horizontal plane. Other window, even if mounted on the roof of a building, is considered vertical window. [12]

Smart Growth:	Smart Growth supports the integration of mixed landuses into communities as a critical component of achieving better places to live. By putting uses in close proximity to one another, alternatives to driving, such as walking or biking, become more viable. Mixed landuses also creates a more diverse and sizable population and commercial base for supporting viable public transportation. It can enhance the vitality and perceived security of an area by increasing the number and improving the attitude of people using the streets. It helps streets, public spaces and pedestrian-oriented retail again become places where people meet, attracting pedestrians back onto the street and helping to revitalise community life.
Solar gain:	Also known as solar heat gain or passive solar gain, solar gain is the increase in temperature in a space, object or structure that results from solar radiation. The amount of solar gain increases with the strength of the sun, and with the ability of any intervening material to transmit or resist the radiation.
Solar Heat Gain Coefficient (SHGC):	The ratio of the solar heat gain entering the space through the window area to the incident solar radiation. Solar heat gain includes directly transmitted solar heat and absorbed solar radiation, which is then reradiated, conducted, or convected into the space (see 'Window area'). [12]
Solar irradiance:	The amount of solar energy that arrives at a specific area at a specific time.
Solar radiation:	Solar radiation is heat energy from the sun, including the infrared, visible and ultraviolet wavelengths. For heat island mitigation purposes, solar radiation is measured by the American Society for Testing and Materials Standard E 1918, which provides for in-field use of a pyrometer to measure incoming and outgoing radiation. [3]
Solar Reflectance Index (SRI):	SRI is the measure of a material's ability to reject solar heat, as shown by a small temperature rise. It is defined so that a standard black material (reflectance 0.05, emittance 0.90) is zero and a standard white material (reflectance 0.80, emittance 0.90) is 100. (Note: observe that the emittance, the ability to release heat, is the same 0.90, and most construction materials have emittances above 0.85). For example, a standard black surface has a temperature rise of 90 degrees F (50 degrees C) in full sun, and a standard white surface has a temperature rise of 14.6 degrees F (8.1 degrees C). Materials with the highest SRI values are the coolest choices for paving. [19]
Solar reflectance:	Solar reflectance is a measure of the ability of a surface material to reflect sunlight — including the visible, infrared and ultraviolet wavelengths — on a scale of 0 to 1. Solar reflectance is also called 'albedo'. [3]
SOP	Standard Operating Procedure
Space:	An enclosed space within a building.
Standard Efficient Temperature (SET):	An index that couples the variables of human thermal sensation, discomfort and physiological effect of environmental conditions, and subjective self-affecting variables like clothing and activity types. SET uses an average of ambient air temperature and MRT weighted by air velocity and activity level to produce a dynamic and comprehensive index.
Steel-framed wall:	A wall with a cavity (insulated or otherwise) with exterior surfaces separated by steel framing members (i.e. typical steel studwalls and curtain wall systems). [12]
Storey:	A space in a building between the surface of any floor and the surface of the floor next above, or if there be no floor above, then the space between such floor and the ceiling or roof above.
Stormwater:	Water volumes that are created during precipitation events and are seen as excess water. These waters are often directed into stormwater drains or directly to receiving waters because this water is seen as a waste product. In desert climates, it should be called rainwater, respected and used as a resource.
Street Centre Line:	The centreline of a street or right of way as established by official surveys.
Street Tree:	Any tree planted by the Municipality on a City easement, parkway and or dedicated land. Trees or landscaping planted in the public right-of-way by adjacent property owners are not considered street trees.
Street:	A public or private right-of-way, other than a major or secondary highway or alley, whose function is to carry vehicular traffic or provide vehicular access to abutting property.

Summer Solstice:	The time at which the sun is at its northernmost point in the sky (southernmost point in the southern hemisphere), appearing at noon at its highest altitude above the horizon. It occurs about 21 June (22 December in the southern hemisphere)
Surface water:	Water that does not soak into the ground or return to the atmosphere via evaporation or transpiration
System:	A combination of equipment and auxiliary devices (e.g. controls, accessories, interconnecting means, and terminal elements) by which energy is transformed so it performs a specific function such as HVAC, service water heating or lighting. [12]
Task lighting:	Lighting directed to a specific surface or area that provides illumination for visual tasks. [12]
TDM (Transportation Demand Management):	Strategies to change travel behaviour.
Thermal Mass	See Mass: Thermal
Thermal resistance (R-value):	The reciprocal of the time rate of heat flow through a unit area induced by a unit temperature difference between two defined surfaces of material or construction under steady-state conditions. Units of R are m2·K/W. [12]
Thermal transmittance:	See 'U-factor'. [12]
Thermostat:	An automatic control device used to maintain temperature at a fixed or adjustable setpoint. [12]
Thermostatic control:	An automatic control device or system used to maintain temperature at a fixed or adjustable setpoint. [12]
Tinted:	(As applied to window) bronze, green, blue, or grey colouring that is integral with the glazing material. Tinting does not include surface-applied films such as reflective coatings, applied either in the field or during the manufacturing process. [12]
TOD	See Transit Oriented Development
Transit Oriented Development (TOD)	It is a walking shed around a transit station that should be mixed use and very walkable. The idea is that people are more likely to use transit if they can walk to the station than if they have to drive, park and then get on the transit system. [26]
Transit shed	A building located on or near a pier (piershed) or wharf (wharf shed) used for short-term storage of cargo in transit.
Transit-ready	Organising landuse and providing logical framework of corridors and right-of-ways to accommodate the construction of transit in the future that will support evolved landuse patterns and regional transit networks.
Transmittance:	Transmittance is the fraction of radiant energy that, having entered a layer of absorbing material, reaches its further boundary. For example, when sunlight reaches a tree's canopy, some amount of light is absorbed by the leaves and used for photosynthesis, some amount is reflected back into the atmosphere, and some amount is transmitted to the grass or ground below. The latter quantity determines the tree's transmittance, which is typically 10% to 30% in the summertime. [3]
Trittering	The fine chipping/shredding and chopping into short lengths of hard stemmed plant matter by mechanical means
Turf:	A single-bladed grass or sod.
TVOC:	Total Volatile Organic Compound content (see 'VOC').
U-factor (thermal transmittance):	Heat transmission in unit time through unit area of a material or construction and the boundary air films, induced by unit temperature difference between the environments on each side. Units of U are W/m2·K. U-value is the inverse of R-value. [12]
Unconditioned space:	An enclosed space within a building that is not a conditioned space or a semi-heated space. Crawlspaces, attics and parking garages with natural or mechanical ventilation are not considered enclosed spaces. [12]
Unconditioned space:	See 'Space'. [12]
UPC	Abu Dhabi Urban Planning Council
Urban canopy layer:	The layer of air in the urban canopy beneath the mean height of the buildings and trees. [20]

Urban heat island (UHI):	The term 'heat island' typically describes built-up areas that are hotter than nearby rural areas. In the context of desert environments without natural vegetation, it means that cities are hotter than they need to be compared with if they were shaded and non-heat absorbing. The annual mean air temperature of a city with one million people or more can be 1.8–5.4°F (1–3°C) warmer than it might be otherwise. In the evening, the difference can be as high as 22°F (12°C). Heat islands can affect communities by increasing summertime peak energy demand, air-conditioning costs, air pollution and greenhouse gas emissions, heat-related illness and mortality, and water quality. UHI in hot desert environments results primarily from unshaded heat absorbing buildings, roads and other infrastructure.[19]
Urbanisation:	To densify and populate.
Valuable Natural Systems:	Communities or assemblies of plants and animals and the landforms and waterways that support them that provide important ecosystem services or unique habitats or species.
Variable-air-volume (VAV) system:	HVAC system that controls the dry-bulb temperature within a space by varying the volumetric flow of heated or cooled supply air to the space. [12]
VAV:	Variable-air-volume
Vehicle kilometres travelled (VKTs):	The number of vehicle kilometres travelled within a specified geographic area during a given period of time. For example, one vehicle travelling one kilometre constitutes one vehicle kilometre, regardless of its size or the number of passengers.
Vent damper:	A device intended for installation in the venting system of an individual, automatically operated, fossil-fuel-fired appliance in the outlet or downstream of the appliance draft control device, which is designed to automatically open the venting system when the appliance is in operation and to automatically close off the venting system when the appliance is in a standby or shutdown condition. [12]
Ventilation:	The process of supplying or removing air by natural or mechanical means to or from any space. Such air is not required to have been conditioned. [12]
Visible light transmittance (VLT):	This factor measures the percentage of visible light coming through the fabric that can be seen by the naked eye. It is related to the amount of light (brightness) a person receives through a glazing system. A low figure shows a very efficient fabric.
VLT:	Visible light transmittance
Volatile Organic Compounds (VOCs):	The several hundred organic chemicals which have a boiling point range falling below 250°C. These consist primarily of petrochemical solvent-type compounds (e.g. aliphatic and aromatic hydrocarbons such as benzene, xylene, toluene, alkenes, halogenated hydrocarbons, ketones, aldehydes and esters). Many of these have significant health implications in short and long term.
VSD:	Variable speed drive
W/m·K:	Watts per metre per kelvin
W/m2:	Watts per square metre
W/m2·°C:	Watts per square metre per degree Celsius
W/m2·K:	Watts per square metre per kelvin
W:	Watt
Walkability:	Walkability is the cornerstone and key to an urban area's efficient ground transportation. Every trip begins and ends with walking. Walking remains the cheapest form of transport for all people, and the construction of a walkable community provides the most affordable transportation system any community can plan, design, construct and maintain.[27]
Walkways:	Improved concrete or asphalt surface or continuous blocks of pavers for pedestrian travel.
Wall area, gross:	The area of the wall measured on the exterior face from the top of the floor to the bottom of the roof. [12]
Wall:	That portion of the building envelope, including opaque area and window, that is vertical or tilted at an angle of 60 degrees from horizontal or greater. This includes above- and below-grade walls, between floor spandrels, peripheral edges of floors, and foundation walls. [12]
Wastewater:	Water that has been adversely affected in quality by human activity. Wastewater is a source of potentially valuable resources including biosolids, nutrients and water. Before wastewater can be reused in must be treated in licensed treatment plants.

Water balance model:	An analytical tool used to understand how much potable water is used in a community and how it can be balanced by using all other potential sources of water, including greywater, reclaimed water, recycled water and stormwater harvesting.
Water cycle:	Evaporation and condensation that controls the distribution of the earth's water as it evaporates from bodies of water, condenses, precipitates and returns to those same bodies of water.
Water heater:	Vessel in which water is heated and is withdrawn for use external to the system. [12]
Watershed:	Areas of land that drain into bodies of surface water.
Watt:	A watt is the absolute unit of power equal to the work done at the rate of one joule per second. [3]
Wet-bulb temperature (WBT):	The temperature of an air sample after it has passed through a constant-pressure, ideal, adiabatic saturation process, that is, after the air has passed over a large surface of liquid water in an insulated channel. In practice, this is the reading of a thermometer with a sensing bulb covered in a wet sock evaporating into a rapid stream of the sample air. The WBT is the same as the DBT when the air sample is saturated with water. The slope of the line of constant WBT reflects the heat of vaporisation of the water required to saturate the air of a given relative humidity. Source: Wikipedia
Wh/m2·K:	Watt-hours per square metre per Kelvin
Window area:	Total area of the window measured using the rough opening and including the glazing, sash and frame. For doors where the glazed vision area is less than 50% of the door area, the window area is the glazed vision area. For all other doors, the window area is the door area (see 'Door area'). [12]
Window:	All areas (including the frames) in the building envelope that let in light, including windows, panels, clerestories, skylights, doors that are more than one-half glass and glass block walls (see 'Building envelope','Door area'). [12]
WOL	Whole of Life
Xeriscape:	Water conserving landscaping.
Yard - Front Yard:	A yard extending across the front of a plot for the full width of the plot between the side plot lines. The depth of a front yard shall be a distance specified by the DMAP for the precinct or district in which it is located and measured inward from the front plot line.
Yard - Interior Side Yard:	A yard extending along an interior side of a plot from the front plot line to the rear plot line, and to a depth specified by the DMAP for the precinct or district in which it is located and measured inward from the interior side plot line.
Yard - Rear Yard:	A yard extending across the rear of a plot for its full width between side plot lines, and to a depth specified by the DMAP for the district in which it is located. If a plot has no rear plot line, a line three metres in length within the plot, parallel to and at the maximum possible distance from the front plot line, will be deemed the rear plot line for the purpose of establishing the minimum rear yard.
Yard - Street Side Yard	A yard extending along the street side of a corner plot from the front plot line to the rear plot line, and to a depth specified by the DMAP for the precinct or district in which it is located and measured inward from the street side plot line.
Yard:	An open space on a plot that is unoccupied and unobstructed from the ground upward, except as otherwise permitted by the UPC DMAP Development Review Process.

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APPENDIX 1:

EPDS-NB Water Model Code Requirement: Base Case Reference Table

Item	Baseline	Comments
Fixtures and Fittings	See separate fittings and fixture table in Appendix 2.	
Appliances, Equipment and Facilities		
Dishwashers	Efficiency = 0.9 litres per place setting per wash Usage: Office = 0.25 place settings/person/day Residential = 2.5 place settings/person/day Retail = 0.25 place settings/person/day.	Efficiency derived on a baseline efficiency of 4 star Australian WELS rating derived see www.waterrating.gov.au
Washing machines	Efficiency = 8.5 l/kg washing Usage (Residential) = 2kg/person/day	Efficiency derived on a baseline efficiency of 4 star derived
Pools and Spas	Annual water losses: External, no pool cover = 1.5 times pool volume Internal, no pool cover = 0.5 times pool volume External/Internal, pool cover = 0.2 times pool volume.	External water loss derived from pool cover manufacturer data, supported by publications from govt water authorities and spa/pool association. Internal water loss derived from research papers calculating pool water loss.
Stormwater/rainwater	1. Calculate areas of collection (roof and hardstand). 2. Apply run-off coefficient: • Pitched tile roof (0.9) • Steel roof (0.8) • Flat smooth roof (0.5) • Flat gravel/turf roof (0.4) • Hardstand (0.5) 3. Determine size of storage tank 4. Determine monthly usage of collected water (refer to fixtures calculations see Appendix 2). 5. Determine monthly rainfall collection, subtract monthly usage and determine any overflow or carry over	

	6. Calculate total annual capture and reuse	
Wastewater Use and Recycling		
Condensate generated	Condensate water generated= 10 litres/m^2/year	Based on Abu Dhabi climate and approximate calculations from first principles monthly average temperature and humidity and cooling outside and recirculating air to 12^{o}C and 95%RH and 60hours per week operation. To be confirmed.
Cooling Tower Bleed off water	70 litres/m^2/year	Based on 6 cycle of concentration cooling tower rejecting 100W/m2 of thermal energy running 2500hrs per year. To be confirmed.
Fire System test water	1. Calculation of volume generated to be undertaken based on mandatory testing requirements 2. Size of storage tank to be determined (can be combined with rainwater tank yet total capacity and demand needs to be taken into account)	To determine the testing requirements for Abu Dhabi.

Vehicle and Bin wash	Base case is a hand held trigger hose used to clean: • each bin in the facility once per week @ 125 litres per wash and • each base building owned vehicle once per fortnight @ 150 litres per wash (based on number of base building car parks provided)	125 litres required to clean one wheelie bin with a standard hose. 60 litres used to clean with a high pressure hose
Landscaping	Base case is surface drip irrigation of exotic species @ 875 mm/year	Annual evaporation in AD 2200mm/yr • Poor practice is flood irrigation and uses approx 2500mm/yr • Best practice is sub-surface drip and uses 350mm/yr • General sub-surface drip uses 50% less than surface drip • Surface drip uses 35% of flood irrigation
Cooling Tower Evaporation	1000 l/m2/year	To be confirmed.

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APPENDIX 2:

EPDS-NB Water Model Code Requirement: Water Use Benchmark for Fixtures

OFFICES						
Fitting	**Uses per day**		**Duration per use (mins)**	**Benchmark Flow Rate (l/min or l/flush)**	**Benchmark Water (Usage/ Use)**	**Benchmark Water (Usage/ person/ day)**
	Male (50%)	**Female (50%)**				
Kitchen taps	2.3	2.3	0.167	6	1.0	2.3
Bathroom washbasin taps	2.3	2.3	0.167	6	1.0	2.3
WCs	0.3	2.3	1 flush	4.5	4.5	5.9
Urinals	2	0	1 flush	2	2.0	2.0
Bidets	0.3	2.3	0.167	4	0.7	0.9
Showers	0.1	0.1	5	7.5	37.5	3.8
Prayer Room wash facilities	1.5	1.5	2	7.5	15.0	22.5
TOTAL						**39.6**

RESIDENTIAL						
Fitting	**Uses per day**		**Duration per use (mins)**	**Benchmark Flow Rate (l/min or l/flush)**	**Benchmark Water (Usage/ Use)**	**Benchmark Water (Usage/ person/ day)**
	Male (50%)	**Female (50%)**				
Kitchen taps	2.3	2.3	0.167	6	1.0	2.3
Bathroom washbasin taps	5.2	5.2	0.167	6	1.0	5.2
WCs	5.2	5.2	1 flush	4.5	4.5	23.4
Urinals	0	0	0	0	0	0
Bidets	0.5	2.3	0.167	4	0.7	0.9
Showers	1	1	5	7.5	37.5	37.5
Prayer Room wash facilities	1	1	2	7.5	15.0	15.0
TOTAL						**84.3**

Appendix 2: (Cont'd)
EPDS-NB Water Use Benchmark for Fixtures

RETAIL (Staff)						
Fitting	**Uses per day**		**Duration per use (mins)**	**Benchmark Flow Rate (l/min or l/flush)**	**Benchmark Water (Usage/ Use)**	**Benchmark Water (Usage/ person/ day)**
	Male (50%)	**Female (50%)**				
Kitchen taps	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Bathroom washbasin taps	2.3	2.3	0.167	7.5	1.3	2.9
WCs	0.3	2.3	1 flush	4.5	4.5	5.9
Urinals	2	0	1 flush	2	2.0	2.0
Bidets	0.3	2.3	0.167	5	0.8	1.1
Showers	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Prayer Room wash facilities	1.5	1.5	2	7.5	15.0	22.5
TOTAL						**34.3**
RETAIL (Visitors)						
Fitting	**Uses per day**		**Duration per use (mins)**	**Benchmark Flow Rate (l/min or l/flush)**	**Benchmark Water (Usage/ Use)**	**Benchmark Water (Usage/ person/ day)**
	Male (50%)	**Female (50%)**				
Kitchen taps	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Bathroom washbasin taps	1	1	0.167	7.5	1.3	1.3
WCs	0.3	1	1 flush	4.5	4.5	2.9
Urinals	0.7	0	1 flush	2	2.0	0.7
Bidets	0.15	1	0.167	5	0.8	0.5
Showers	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Prayer Room wash facilities	0.5	0.5	2	7.5	15.0	7.5
TOTAL						**12.9**

NOTE- Prayer ablutions presumed to involve washing hands and wrists three times, mouth and nose three times, face three times, arms three times, head and neck once and feet three times.

NOTE- Office occupancy assumes a 50/50 split between male and female users. If percentages differ, benchmark water usage per person per day must be re-calculated accordingly and included in submittals.

APPENDIX 3:

LS-2 Ecosystem Services Restoration:

Possible Ecosystem Services and Functions for the development of KPIs[11]

Table 1 Ecosystem services and functions used in this study

Number	Ecosystem service*	Ecosystem functions	Examples
1	Gas regulation	Regulation of atmospheric chemical composition.	CO_2/O_2 balance, O_3 for UVB protection, and SO_x levels.
2	Climate regulation	Regulation of global temperature, precipitation, and other biologically mediated climatic processes at global or local levels.	Greenhouse gas regulation, DMS production affecting cloud formation.
3	Disturbance regulation	Capacitance, damping and integrity of ecosystem response to environmental fluctuations.	Storm protection, flood control, drought recovery and other aspects of habitat response to environmental variability mainly controlled by vegetation structure.
4	Water regulation	Regulation of hydrological flows.	Provisioning of water for agricultural (such as irrigation) or industrial (such as milling) processes or transportation.
5	Water supply	Storage and retention of water.	Provisioning of water by watersheds, reservoirs and aquifers.
6	Erosion control and sediment retention	Retention of soil within an ecosystem.	Prevention of loss of soil by wind, runoff, or other removal processes, storage of silt in lakes and wetlands.
7	Soil formation	Soil formation processes.	Weathering of rock and the accumulation of organic material.
8	Nutrient cycling	Storage, internal cycling, processing and acquisition of nutrients.	Nitrogen fixation, N, P and other elemental or nutrient cycles.
9	Waste treatment	Recovery of mobile nutrients and removal or breakdown of excess or xenic nutrients and compounds.	Waste treatment, pollution control, detoxification.
10	Pollination	Movement of floral gametes.	Provisioning of pollinators for the reproduction of plant populations.
11	Biological control	Trophic-dynamic regulations of populations.	Keystone predator control of prey species, reduction of herbivory by top predators.
12	Refugia	Habitat for resident and transient populations.	Nurseries, habitat for migratory species, regional habitats for locally harvested species, or overwintering grounds.
13	Food production	That portion of gross primary production extractable as food.	Production of fish, game, crops, nuts, fruits by hunting, gathering, subsistence farming or fishing.
14	Raw materials	That portion of gross primary production extractable as raw materials.	The production of lumber, fuel or fodder.
15	Genetic resources	Sources of unique biological materials and products.	Medicine, products for materials science, genes for resistance to plant pathogens and crop pests, ornamental species (pets and horticultural varieties of plants).
16	Recreation	Providing opportunities for recreational activities.	Eco-tourism, sport fishing, and other outdoor recreational activities.
17	Cultural	Providing opportunities for non-commercial uses.	Aesthetic, artistic, educational, spiritual, and/or scientific values of ecosystems.

*We include ecosystem 'goods' along with ecosystem services.

[11] Costanza, R, et al, *The value of the World's Ecosystem Services and Natural Capital* in Nature Vol 387, 15 May 1997