



Mostadam Rating System

Residential Buildings O+E Manual

VERSION 2019



Building
Sustainability Assessment

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Introduction

1 Introduction

Mostadam has been developed by *Sustainable Building* as a comprehensive sustainability rating and certification system to address the long-term sustainability of residential buildings in the Kingdom of Saudi Arabia (KSA). Mostadam addresses a wide range of sustainability issues important to KSA and supports the aspirations of Vision 2030.

This manual introduces Mostadam for Residential Buildings O+E and details its components, structure, applicability, methodology and credit requirements.

1.1 Mostadam and Vision 2030

Vision 2030 is KSA's roadmap for future economic and developmental action and expresses the country's long-term goals and objectives. Vision 2030 is built around three themes:

1. A Vibrant Society
2. A Thriving Economy
3. An Ambitious Nation

The criteria for sustainable operation and maintenance that have been developed for Mostadam for Residential Buildings have been informed by the goals and objectives contained in Vision 2030.



1.2 Mostadam and the SgBC

The Saudi Building Code (SBC) is a set of legal, administrative and technical regulations that specify the minimum standards for building design and construction in KSA. The Saudi Green Building Code (SgBC 1001) is part of the SBC and has been developed to ensure that buildings designed and constructed according to the code have a lesser impact on the environment.

Mostadam for Residential Buildings is aligned with the SBC, and in particular the SgBC, and has been developed to go beyond the minimum SBC requirements to ensure an even higher level of sustainability for residential buildings. Furthermore, Mostadam O+E requires a set of specific performance parameters that have been benchmarked with the baseline parameters as defined in the SgBC for performance and further improvement in operation.

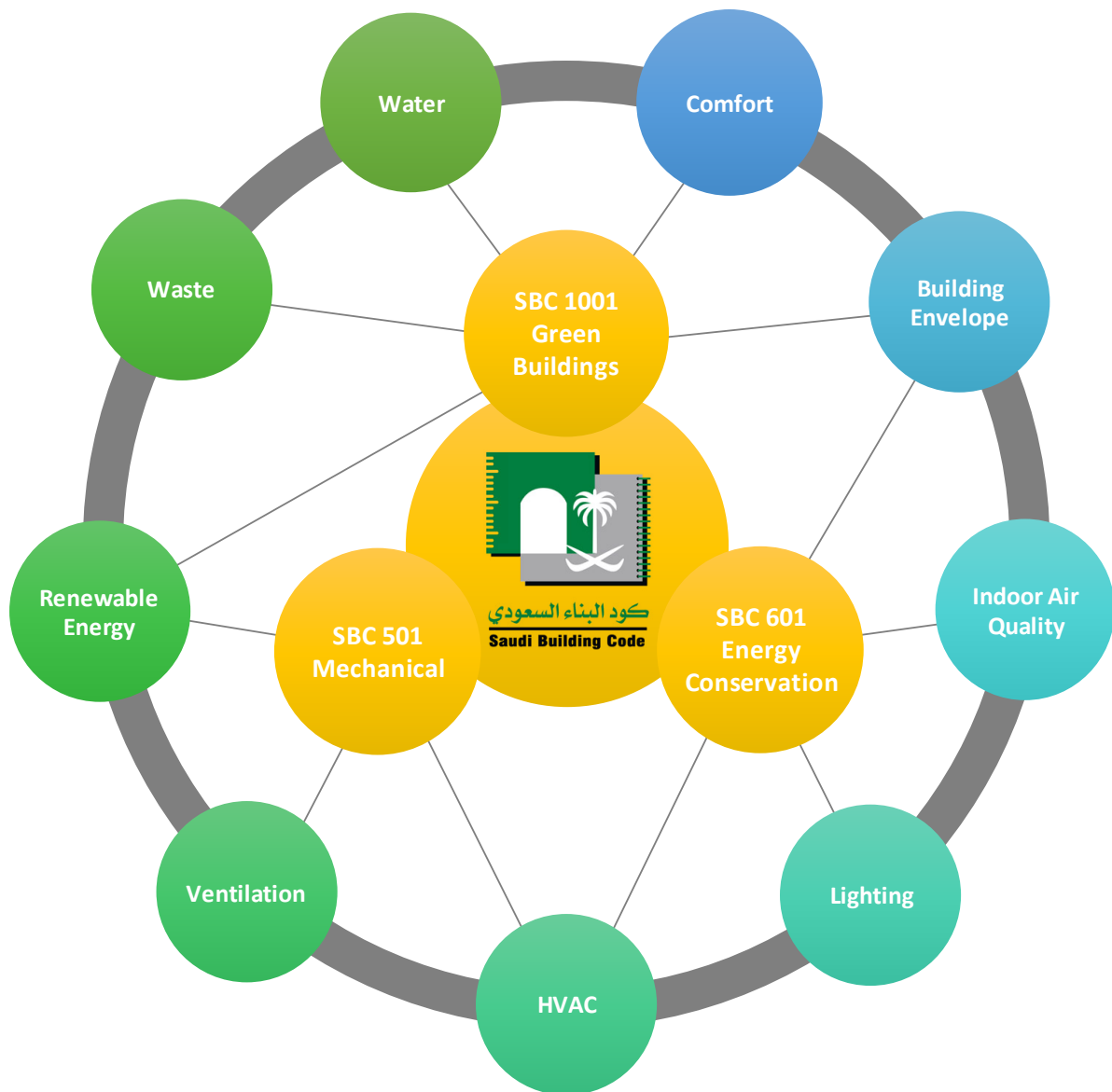


Figure 2 Relationship between SBC and Mostadam for Residential Buildings O+E

About Mostadam for Residential Buildings

2 About Mostadam for Residential Buildings

2.1 Applicability

Mostadam for Residential Buildings is applicable to any size of existing residential development and there is no minimum size for certification. It is applicable to the following types of residential development projects:

- Individual dwellings (e.g. villas) and residential buildings of 3 storeys or less (e.g. town houses, small apartment buildings).
- Multi-residential buildings of 4 storeys or greater.

For multi-residential buildings, the rating system will apply to both the residential units and the common areas. Multi-residential buildings can also include mixed-use developments, provided the residential component is a minimum of 90% of the GFA. For mixed-use developments where the residential component is less than 90% a special application is to be submitted to *Sustainable Building*, who will determine whether the project can be certified under Mostadam for Residential Buildings.

The following types of residential development are not covered by Mostadam for Residential Buildings:

- Temporary developments with a planned existence of less than 2 years
- Hotels
- University halls of residence
- Hotel-type serviced accommodation
- Residential care homes
- Guest worker accommodation
- Imam's residence/mosque

2.2 Structure

Mostadam for Residential Buildings comprises two elements:

Design + Construction (D+C)

D+C is applicable to the design and construction of new buildings.

Operation + Existing (O+E) (*this manual*)

Mostadam for Residential Buildings O+E is applicable to new buildings that have achieved Mostadam D+C certification and existing/older buildings, including those that are undergoing minor renovation, refurbishment and/or extension. If a building is undergoing significant renovation, refurbishment or extension, i.e. the majority of the fixed building services are being replaced and the thermal elements are being renovated, it should follow the D+C component of Mostadam for Residential Buildings.

2.3 Credit categories

Mostadam for Residential Buildings O+E is organized into seven categories of credits (Figure 3).



Figure 3 Mostadam for Residential Buildings O+E categories

2.4 Rating levels

A project's score is the sum of all the credit points achieved. There are five different rating levels: Green, Bronze, Silver, Gold and Diamond. The number of credits points required for each rating level is shown in Table 1.

Table 1 Mostadam rating levels

Number of Points Achieved	Rating Level
≥ 20	 Green
≥ 35	 Bronze
≥ 50	 Silver
≥ 65	 Gold
≥ 80	 Diamond

2.5 Keystone credits

To ensure a basic level of sustainability is achieved across the board, Mostadam for Residential Buildings O+E contains mandatory credits referred to as ‘Keystone’ credits. These credits ensure KSA’s priority goals are addressed by all projects whilst maintaining flexibility in its application. There are 12 Keystone credits (Table 2), the achievement of which results in a score of 20 points and a rating level of Mostadam Green. To achieve a higher rating level, projects must achieve the Keystone credits and additional optional credits in order to obtain the minimum number of points for the targeted level.

Table 2 Keystone credits

Credit Category	Keystone Credit
Policies, Management & Maintenance	PMM-01 Annual Audit
	PMM-02 Residential Waste Management
	PMM-03 Sustainable Maintenance and Servicing
	PMM-04 Sustainable Procurement
Energy	E-01 Energy Performance
	E-02 Energy Metering
	E-03 Envelope Assessment
Water	W-01 Water Performance
	W-02 Water Metering
Health and Comfort	HC-01 Outdoor Thermal Comfort
	HC-02 Indoor Thermal Comfort
Education and Innovation	EI-01 Mostadam Guide

2.6 Credit layout

The key features of each credit are highlighted in Figure 4.

TC-02 Home Office

Keystone Credit

Total Number of Points Available

No

1

Aim

To facilitate and promote working from home to encourage flexible working and reduce the pollution associated with commuting.

Requirements

#	Requirement	Points Available	
		Individual dwelling	Multi-residential
1	For dwellings/residential units with up to two bedrooms: A zone in the living room, one of the bedrooms or another suitable area can be used as a home office/study. For dwellings/residential units with three or more bedrooms: A separate room is allocated for use as a home office/study. The home office/study, whether a separate room or a dedicated zone within another room, must have the provisions listed in the Supporting Guidance.	1	1
2	Provide information in the lobby/reception of the building on the benefits of working from home and promoting home offices.	N/A	
	Total	1	1

Evidence

#	Evidence per Requirement
1	- For each dwelling or residential unit type, scaled plans showing: - The location and size of the home office/study, demonstrating compliance with provision #1 in the Supporting Guidance. - The location of provisions #2 and #3 in the Supporting Guidance. - For each dwelling or residential unit type, date-stamped photographs of provisions #2 and #3 in the Supporting Guidance.
2	Date-stamped photographs of the required information displayed in the lobby/reception of the building.

6

Supporting Guidance

Home Office:

The home office/study room or zone must have the following provisions:

1. Adequate space for:
 - A desk, chair and filing cabinet or bookshelf.
 - Movement around the front of the desk.
 - Safe use of the chair and filing cabinet.
2. Two double power sockets.
3. Data and telephone communications e.g. broadband socket, telephone socket.

Information on the Benefits of Home Working:

The information displayed in the lobby/reception must promote flexible working and communicate the benefits of working from home. It should highlight the positive impact that home working has on the environment, the economy and health and wellbeing.

7

Credit Tool

N/A

8

Reference Documents

1. Metric Handbook: Planning and Design Data, 6th edition

Figure 4 Credit key features

Legend

1. Credit reference and title.
2. Whether it is a keystone credit and the available number of points.
3. Credit aim.
4. Credit requirements and associated number of points. If a credit has different requirements for individual dwellings or multi-residential buildings, it will be highlighted in this part of the credit.
5. Evidence per requirement for the operational submission.
6. Supporting guidance providing relevant additional information.
7. Name of Credit tool (if any).
8. Details of relevant reference documents.

Implementing Mostadam for Residential Buildings

3 Implementing Mostadam for Residential Buildings

3.1 Monitoring Period

For an existing building to be eligible for a Mostadam O+E rating, its performance must be monitored over a minimum period of one year at a minimum occupancy of 75%. The following parameters, which link to Keystone credits, are required to be checked and recorded each month during the performance Monitoring Period:

- Energy consumption
- Water consumption
- Waste generation

During the first six months of the Monitoring Period, procedures and policies must be developed for certain keystone credits and optional credits as listed in Table 3. The procedures and policies must then be implemented for a minimum of six months and evidence of their implementation provided as part of the submission. If a building is undergoing renovation, refurbishment and/or extension works, this must be completed before the start of the Monitoring Period. The contents of a typical policy or procedure is shown in Figure 5.

Table 3 Credits requiring a policy or procedure

Category	Credit	Policy/Procedure
Policies, Management and Maintenance	PMM-01 Annual Audit	Annual Audit Procedure
	PMM-02 Residential Waste Management	Waste Diversion Operational Procedure
	PMM-03 Sustainable Maintenance and Servicing	Sustainable Maintenance Procedure
	PMM-04 Sustainable Procurement	Sustainable Procurement Policy
	PMM-06 Hygienic Operations	Sustainable Cleaning Operational Procedure Integrated Pest Management Procedure
Education and Innovation	EI-02 Occupant Engagement	Occupant Engagement Procedure
	EI-03 Sustainability Communication	Sustainability Communication Survey Procedure

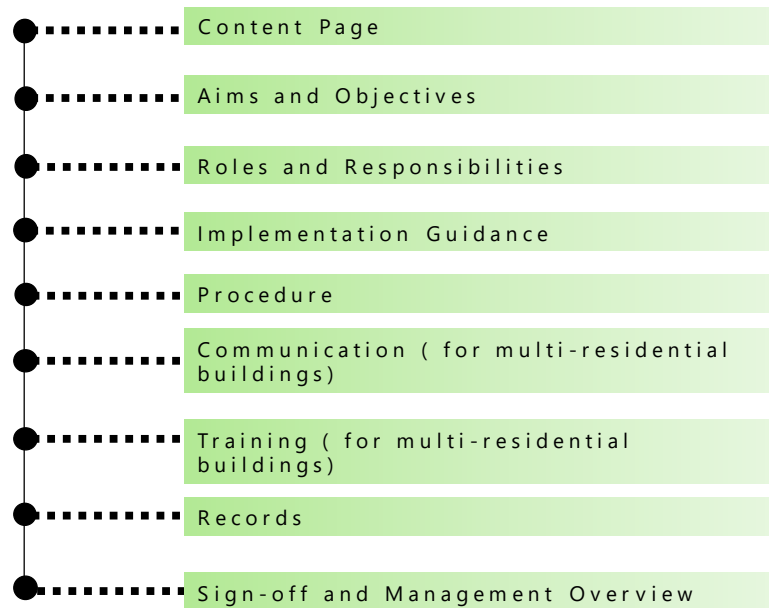


Figure 5 Contents of a typical policy/procedure

3.2 Submission and approval process

Submission

The submission of credit documentation occurs at the following three project stages:

D+C

Submission 1: after completion of detailed design

Submission 2: after construction completion

O+E (this manual)

Submission 3: after the building has been occupied for a minimum of 1 year at a minimum occupancy level of 75% (i.e. a minimum of 75% of the residential units have been sold or let).

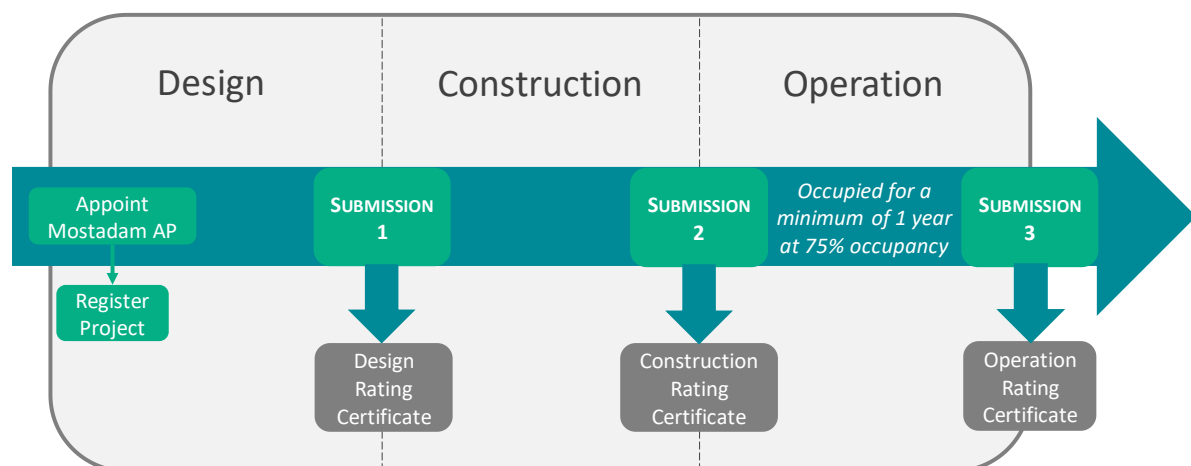


Figure 6 Submission process

Approval

Following the review and approval of each submission, the following certificates are issued:

- D+C
 - Design Rating certificate (following the review of Submission 1)
 - Construction Rating certificate (following the review of Submission 2)
- O+E
 - Operational Rating certificate (following the review of Submission 3)
 - Renewed Operational Rating certificate (to maintain/retain the Operational Rating certificate, a project must be re-assessed a minimum of every 5 years).

Recertification

Mostadam O+E offers residential building Owners and Managers the option to regularly verify their facility's operational performance through ongoing verification and promotes the continuing implementation of leading practices in building operations. Built-in prescriptive and performance strategies are intended to provide operational benefits throughout the life of the residential building. By adopting these strategies, the building can maintain and improve its performance over time.

Recertification comprises continuously monitoring and recording data to document the building's performance, including energy, water and waste data, procurement notes and building envelope audit reports from each year. To ensure that projects are performing as intended, as well as to enable a more streamlined process for ongoing verification, *Sustainable Building* shall undertake the initial recertification of existing projects after a period of 5 years from attaining their first O+E certification. This recertification is ongoing, and each Mostadam-certified building must be recertified after a period of 5 years from every assessment. For each recertification, the Mostadam Assessor shall request random samples of their documentation to review and verify continuity of implementation. If a project is unable to furnish all the requested documentation from previous years to *Sustainable Building*, mitigation measures will be undertaken or penalties may be levied, including but not limited to compensation in performance or the recreation of policies.

3.3 Communication protocol

All communication between a project team and *Sustainable Building* (Mostadam Assessor) is to be via the Mostadam Accredited Professional (AP).

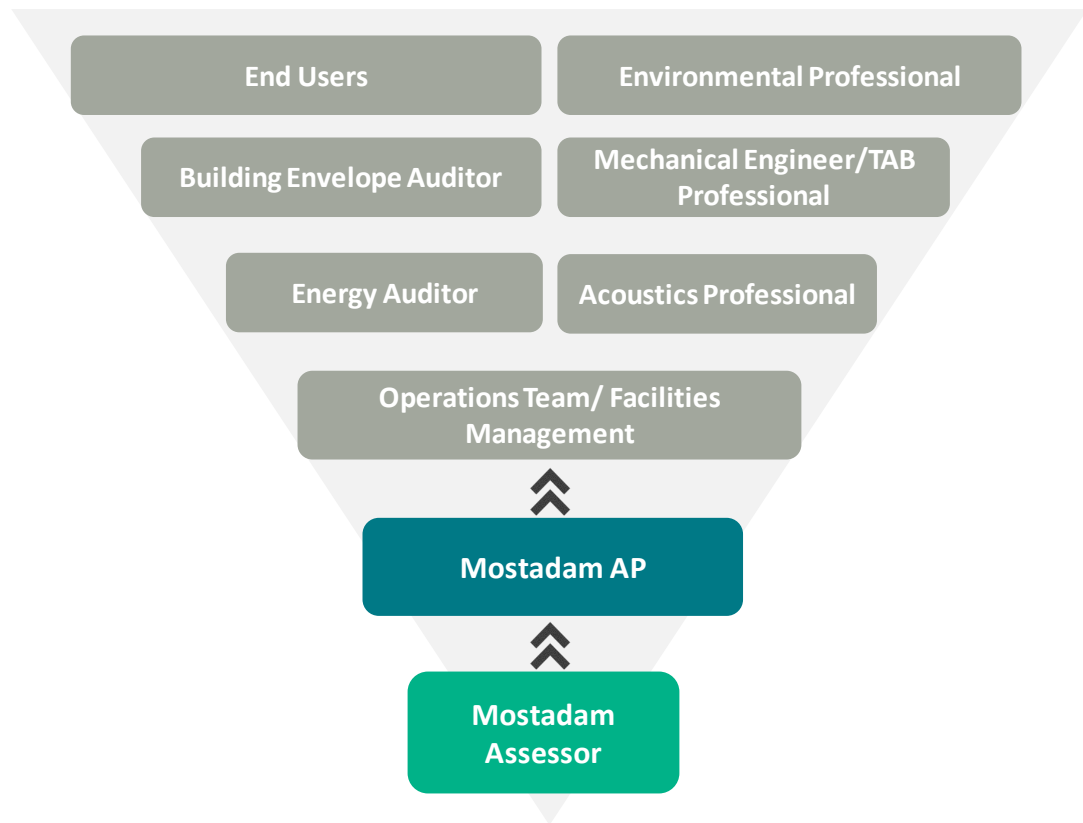


Figure 7 Communication protocol

3.4 Key roles and responsibilities

The roles and responsibilities of the various parties in the Mostadam for Residential Buildings certification process are defined in Table 4.

Table 4 Mostadam roles and responsibilities

Role	Responsibility
<i>Sustainable Building</i>	• Implementing body • Provides training, examinations and licensing for the Mostadam AP and Mostadam Assessor • Reviews and responds to formal credit queries • Issues Mostadam for Residential Buildings certification
Mostadam Assessor	• Appointed by <i>Sustainable Building</i> • Point of contact for the Mostadam AP • Assesses the Mostadam for Residential Buildings project submissions at the design, construction and operation stages • Conducts the official Site Audit Visits during the construction and operation stages of the project
Mostadam Accredited Professional (AP)	• Point of contact for the Mostadam Assessor • Provides expert guidance and support to the project team for the achievement of the targeted Mostadam for Residential Buildings rating • Undertakes quality assurance of all credit documentation/evidence prepared by the project team • Submits the credit documentation to the Mostadam Assessor at the design, construction and operation stages • Coordinates with the Mostadam Assessor to provide any additional information requested
Client/Owner	• Appoints the Mostadam AP at the earliest stage of the project • Pays the Mostadam project fees (registration, certification, site visits, credit queries etc.) • Supports the Mostadam for Residential Buildings assessment process
Building Users	• Understand the objectives of the Mostadam Guide for building sustainability and the role of occupants in ensuring that the building operates as intended and its performance is not compromised • Follow the guidelines for waste management as described in the Mostadam Guide • Contribute to relevant credit documentation
Building Operators/ Contractors	• Implement the credit requirements including establishing and implementing policies and procedures, coordinating with specific professionals to carry out specialty services etc. • Maintain consistent records and documentation of energy, water and waste data, building envelope audit reports and other such performance indicators

Policies, Management and Maintenance

4 Policies, Management and Maintenance

Policies, Management and Maintenance emphasizes the development and implementation of policies and procedures to manage and maintain the sustainable operation of buildings. It encourages sustainable procurement and sustainable maintenance and requires the implementation of an annual audit.

Policies, Management and Maintenance also addresses operational waste management. The average per capita waste generation rate in KSA is 1.5 to 1.8kg per day. With a total population of 29 million, this amounts to approximately 15 million tons of solid waste per year¹. Vision 2030 aims to overcome the challenge of escalated waste production rates through efficient waste management systems by means of two major initiatives: the National Transformation Program (NTP) and the Integrated Waste Management Plan. Mostadam supports this Vision and rewards projects based on building performance and ongoing waste management.



Figure 8 Policies, Management and Maintenance credits

¹ An Argument for Developing Waste-to-Energy Technologies in Saudi Arabia, Chemical Engineering Transactions, vol 45, DOI: 10.3303/CET1545057, Nizami, A.S. et al, (2015)

PMM-01 Annual Audit

Keystone Credit	Total Number of Points Available
Yes	2

Aim

To ensure the performance of sustainable initiatives is assessed annually for continuous improvement.

Requirements

#	Requirement	Points Available	
		Individual dwelling	Multi-residential
1	A procedure is developed for conducting and documenting an internal audit each year that checks and verifies the following as a minimum: • Energy consumption • Water consumption • Waste generation • Systems servicing • Envelope assessment	2	2
	Total	2	2

Evidence

#	Evidence per Requirement
1	• Annual Audit Procedure. • Record Log.

Supporting Guidance

Annual Audit Procedure:

The required contents of the Annual Audit Procedure are detailed in Table PMM-01.1. The procedure must be written within the first 6 months of the Monitoring Period and implemented for the second 6 months and relevant evidence submitted. Thereafter the audit must be undertaken once a year.

Table PMM-01.1 Annual Audit Procedure contents

Annual Audit Procedure		
#	Section Title	Content Requirements and Guidance
1	Aims & Objectives	Aims and objectives of the procedure.
2	Roles & Responsibilities	Designated individuals (with contact details) responsible for procedure creation, undertaking the audit, documenting the audit and annual overview.

		For multi-residential buildings, the audit should be conducted by the Facility Manager or other competent professional.
3	Procedure	Provide an introduction to the site including location, description of spaces and occupant types/numbers. Document the following parameters: • Monthly energy consumption and onsite renewable generation (E-01 Energy Performance and E-04 Renewable Energy). • Monthly indoor and outdoor water consumption (W-01 Water Performance). • Monthly waste generation (PMM-02 Residential Waste Management). • Systems servicing - a summary based on a short description of the systems (PMM-03 Sustainable Maintenance and Servicing). • Envelope assessment - a summary based on a short description and images from the annual walkaround (E-03 Envelope Assessment).
4	Communication (multi-residential buildings)	The general principles, good practice and audit results should be communicated to all residential units at least annually. All communication should be by a public notice at the main building entrance and by emails or physical letters to all residential units.
5	Records	Provide a log template within the appendix of the procedure for recording the Annual Audit activities. Records must be kept in a well-structured electronic log. The Record Log will include documentation regarding the following audit items: • Monthly energy consumption (copies of bills are required). • Monthly water consumption (copies of bills are required). • Monthly waste generation. • Systems servicing. • Envelope assessment. For multi-residential buildings, records must also be kept of: • Communications • Annual management overview
6	Sign-off & Management Overview	A one-page summary should list past and present results. The procedures must be re-evaluated annually and required actions stated based on the recorded data. For multi-residential buildings, sign-off and management overview should be undertaken by the Facility Manager or Owner.

Credit Tool

Annual Audit Tool

Reference Documents

N/A

PMM-02 Residential Waste Management

Keystone Credit	Total Number of Points Available
Yes	4

Aim

To reduce the generation of residential waste and encourage users to divert waste from landfill.

Requirements

#	Requirement	Points Available	
		Individual dwelling	Multi-residential
Keystone Requirement - achieve requirements #1, #2 and #3 (1 credit point).			
1	A Residential Waste Operational Procedure is developed and implemented which diverts at least 30% of operational waste (by weight or volume) from landfill via recycling or reuse.	1	
2	Clearly labelled segregated waste bins are provided within each individual dwelling or residential unit for a minimum of the following two waste streams: - Recyclable waste (e.g. paper, cardboard, glass, plastic, metals). - General waste.		
3	Clearly labelled segregated waste bins are provided within common areas such as lobbies, gyms, pools and community centers for a minimum of the following two waste streams: - Recyclable (e.g. paper, cardboard, glass, plastic, metals). - General waste. A communal storage area is provided for the following waste streams to be stored separately per category: - Large bulky items. - Electronic items. - Batteries. Hazardous material (if present) is separately stored in a conditioned spaced with direct exhaust and separate ventilation.	N/A	1
4	Advanced Diversion A minimum of 50% of operational waste (by weight or volume) is diverted from landfill via recycling or reuse.	2	2
5	Organic Composting Organic waste management procedures are developed and implemented which divert organic waste from landfill. For all residential units, common areas and landscape areas, a clearly labelled organic waste bin is provided. The organic waste is	1	1

	composted and reused on-site or sent for composting and reuse off-site.		
	Total	4	4

Evidence

#	Evidence per Requirement
1, 2, 3, 4 & 5	- Waste Diversion Operational Procedure. - Record Log. - Mostadam Guide (EI-01 Mostadam Guide).

Supporting Guidance

Waste Diversion Operational Procedure:

The required contents of the Waste Diversion Operational Procedure are detailed in Table PMM-02.1. The procedure must be written within the first 6 months of the Monitoring Period and implemented for the second 6 months and relevant evidence submitted. Thereafter the procedure must be continuously enforced and waste records updated monthly.

Table PMM-02.1 Waste Diversion Operational Procedure contents

Waste Diversion Operational Procedure		
#	Section Title	Content Requirements and Guidance
1	Aims & Objectives	Aims and objectives of the procedure.
2	Roles & Responsibilities	Designated individuals (with contact details) responsible for procedure creation, procurement, onsite waste management, onsite composting (if applicable), monitoring and annual overview. For multi-residential buildings, if waste handling is carried out by contractors, ensure that they agree to, and are bound by, the procedure.
3	Implementation Guidance	If the building has tenants, waste bin installation and monitoring should be carried out at a time which causes least disruption to residents e.g. during tenancy change.
4	Waste Generation	Provide an introduction to the site including location, description of spaces, occupant types/numbers and typical waste generation. Typical residential waste types are shown in Figure PMM-02.1. Investigate the need and suitability of on-site composting. The procedure must clearly describe all the applicable and regulatory health and safety requirements and procedures for cleaning and odor minimization.
5	Local Waste Facilities	Investigate the availability of licensed waste operators and the waste streams which can be diverted. If the building has tenants, provide a map of any local authority waste recycling centers for waste streams not collected within the building. Investigate the availability of licensed waste operators to transfer organic waste to off-site composting facilities.

5	Collection & Storage	Provide clear labelling (in Arabic and other appropriate languages) and images as well as consistent container color to indicate suitable waste content for each container. Update labels as recycling waste streams become available. Examples of label images and colors are provided in Figure PMM-02.2. Do not request segregation at source if the waste will be comingled prior to collection as this reduces occupant engagement.
		The recycling and composting bins within each individual dwelling/residential unit should be sized based on occupancy.
		The sizes of the central storage bins should be adequate for the amount of waste generated (as recorded in the Waste Tool) and the collection rates (as per the licensed waste operator's collection frequency), with bins generally between 120L and 500L.
		Materials can be designated reused if they are removed from the site for a secondary use. Reuse within the same site cannot be considered as diverted waste but should be encouraged as it reduces overall waste volumes. A reasonable case must be made that the material is waste with immediate potential for landfill (e.g. furniture left in bulk storage for free collection) and not the resale of material assets (e.g. resale of good condition furniture).
		For multi-residential buildings, regularly check that the communal storage room is secure to avoid inappropriate access and that it is suitably ventilated (mechanical or natural) to avoid excessive odor. If organic material is stored separately then the storage area must have mechanical cooling and a water tap and drainage system for cleaning the area.
		Engage licensed waste operators to remove general, recycling and organic waste. Fulfill any local authority specific requirements for access to waste areas.
		Small quantities of hazardous waste may be generated from renovations or maintenance due to the use of bitumen, toxic paints, toxic sealants or toxic adhesives etc. The use of these products should be avoided and low-toxic alternatives prioritized. In instances where this is not possible, the contractor or Facility Manager must be required to immediately remove hazardous waste from the site to an appropriate disposal facility. Ongoing generation will require bunded storage with isolated ventilation. Any temporary storage on-site should be within a metal box sealed with a metal clasp and provided with separate handles to avoid double handling.
6	Onsite Composting	If organic material is stored or composted inside, such as in-vessel composting, then mechanical cooling must be provided along with a water connection for cleaning and a connection to the foul drainage system.
		For individual dwellings, onsite composting may be via commercially available or home-made composting containers which are well drained, sealed or well covered to avoid pests. Careful planning to ensure a suitable balance of wet and dry organic waste with layering of soil is required.
		For multi-residential buildings, a central composting structure can be

		created or purchased and should take into account the distance from the building and adequate ventilation to avoid odor issues, physical barriers and monitoring of pest populations (refer to PMM-06 Hygienic Operations) to avoid pest problems, and sufficient shading to avoid overheating. Commercially available communal indoor sealed in-vessel composting machines may be suitable depending on scale, budget and on-site composting needs.
		Regularly check that the composting area is secure to avoid inappropriate access and that it is suitably ventilated to avoid excessive odor.
		Harder vegetation such as stalks or branches may need to be cut or shredded. Biodegradable bags are a useful way to collect food waste.
7	Offsite Composting	Size central storage bins as per generation and collection rates with bins between 120L and 500L.
8	Waste Tool	The Waste Tool will calculate the % diversion achieved. Diversion from landfill refers to all waste which is reused, sent for recycling or sent for controlled treatment (if deemed hazardous waste).
		The amount of waste can be measured by weight or volume and is to be entered in the Waste Tool for each waste stream.
		Any onsite or offsite composted waste will support the diversion % irrespective of achieving the Organic Composting points provided it follows the storage and documentation requirements.
		Hazardous waste can be excluded from this calculation provided that evidence confirms the hazardous nature of the waste and the appropriate disposal.
		Ideally waste transfers should be documented on a per trip basis based on documents from licensed waste removal companies or local authorities which include a certified end point reference. If this is not possible, justify missing elements with documents/references and provide an alternative.
		Alternatives should aim to be inclusive, verifiable, reasonable and consistent: • Inclusive – e.g. demonstrate with a site plan and photographs all site access points and waste containers to show that all waste collection is captured. Keep a regular tally of the number of containers, their size and fullness. • Verifiable – e.g. take date-stamped photographs. Further strengthen this with sign-off from waste collectors or regular management inspection. Only include data in the Waste Tool that is verifiable, even if that is the worst-case volume/landfill designation until records can justify improvements. • Reasonable – e.g. if waste container size is not known, make a reasonable estimate based on dimensions. Take date-stamped photographs of all containers, or if too onerous take a sample sufficient to justify container number/volume across the majority of the input range.

		• Consistent – e.g. avoid data gaps which require estimates. Aim to use the same fundamental process across the period. • For onsite organic waste composting, create suitable written records of volumes supported with date stamped images. • For materials removed from the site for reuse, generate suitable documents such as a signed letter of receipt and/or date-stamped photographs.
9	Communication (multi-residential buildings)	Provide information on the communal storage area's location and access times and guidance on what is and is not acceptable within each waste stream. This information should be included in the Mostadam Guide (EI-01 Mostadam Guide). The general principles, good practice and any site-specific considerations of the procedure should be communicated to all residential units at least annually. Total waste volumes, % diversion and end-destination of recyclables should be communicated at least 4 times a year to promote occupant engagement. Communication should be by a public notice at the building entrances, waste chutes and waste rooms and by emails or physical letters to all residential units.
10	Training (multi-residential buildings)	Provide training at least once a year to the individuals responsible for waste management and monitoring. Include training content and attendance registry template within the appendix of the procedure.
11	Records	Provide a log template within the appendix of the procedure. Records must be kept in a well-structured electronic log. Purchase receipts for waste bins and onsite composters (if purchased during operation). Marked-up floor plan(s) showing the types and locations of all bin and composting facilities. Date-stamped photographs showing installation of bins for each residential unit type, all bins in common areas, all communal bins in storage areas and all on-site composting facilities. Waste transfer receipts from the waste removal company. For multi-residential buildings, records must also be kept of: • Communications • Training • Annual management overview
12	Sign-off & Management Overview	A one-page summary should list past and present results and efforts to improve on them for easy review. The procedures must be re-evaluated annually and updated as necessary. The Facility Manager or Owner must review and sign-off the procedure on an annual basis.

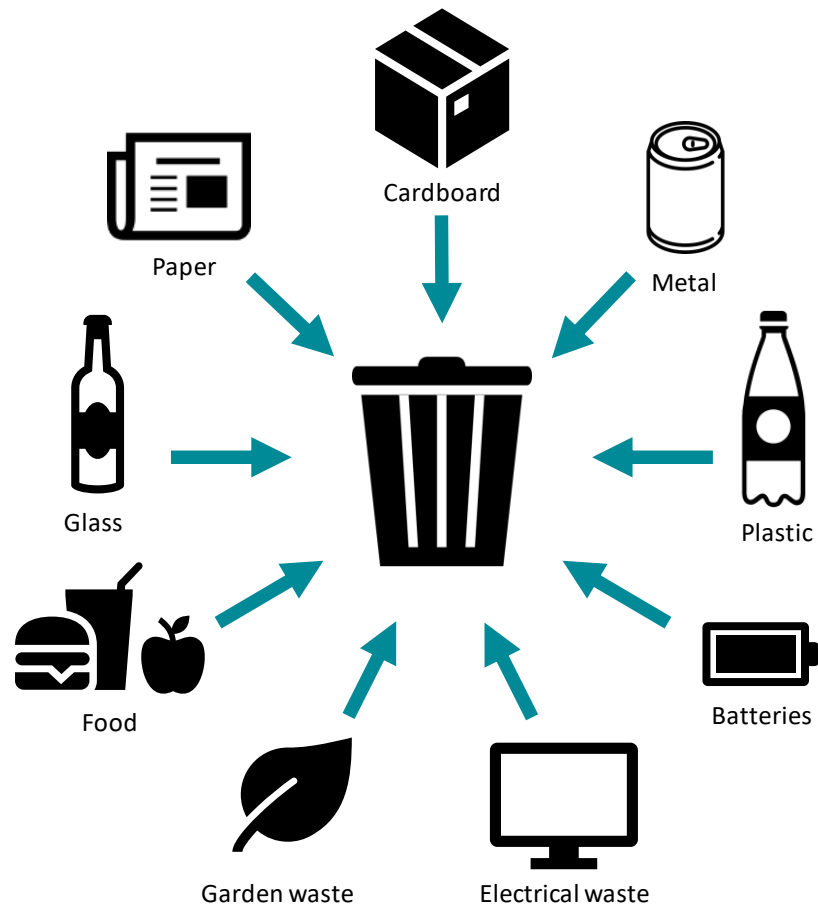


Figure PMM-02.1 Residential waste types

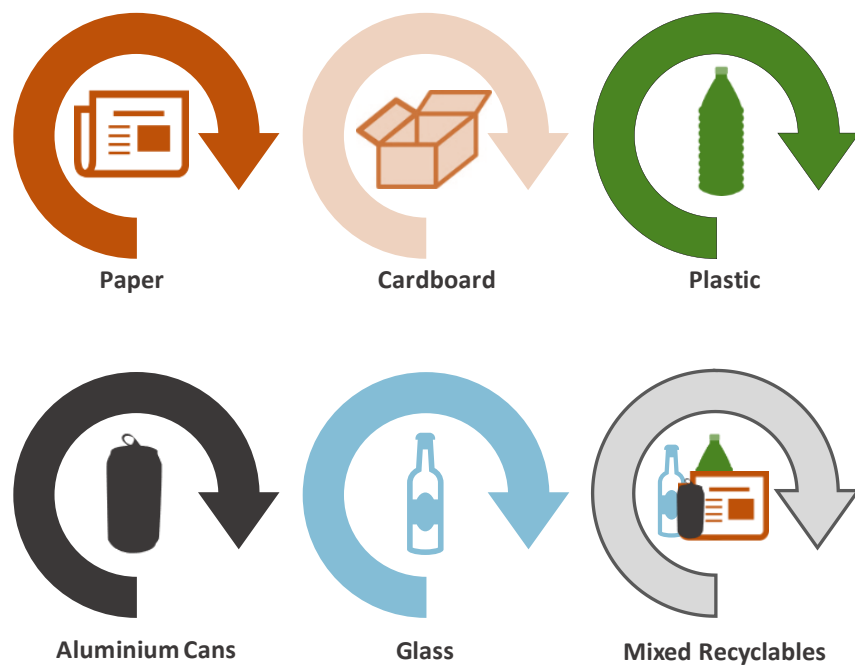


Figure PMM-02.2 Examples of container label images and colors

Credit Tool

Waste Tool

Reference Documents

1. Presidency of Meteorology and Environment, General Environmental Regulations and Rules for Implementation
2. Ministry of Municipal and Rural Affairs (for landfill regulations and solid waste guidelines)

PMM-03 Sustainable Maintenance and Servicing

Keystone Credit	Total Number of Points Available
Yes	4

Aim

To prolong the use, value and efficiency of onsite assets and to avoid environmental impact of early redundancy, unnecessary replacement or avoidable utility use.

Requirements

#	Requirement	Points Available	
		Individual dwelling	Multi-residential
Keystone Requirement - achieve requirement #1 (1 credit point).			
1	Inspections and Maintenance Individual Dwelling: Regular maintenance and fault inspections are undertaken for systems and building elements. Multi-Residential Building: A Sustainable Maintenance Procedure is developed and implemented for building elements and systems in line with best practice and incorporating periodic proactive inspections.	1	1
2	Annual Systems Servicing Individual Dwelling: A Competent Professional is engaged to undertake annual systems servicing. Multi-Residential Building: A Competent Professional is engaged to undertake annual systems servicing and the requirements are included within the Sustainable Maintenance Procedure.	3	3
	Total	4	4

Evidence

#	Evidence per Requirement
1	Individual Dwelling: - Complete asset register for MEP equipment and systems. - Schedule of maintenance items. - Date-stamped photographs from quarterly maintenance and inspection. - Signed commitment letter.

	Multi-Residential Building: • Complete asset register for MEP equipment and systems. • Sustainable Maintenance Procedure. • Record Log.
2	Individual Dwelling: • Servicing contract and CV of appointed Competent Professional. • Systems servicing report written by the Competent Professional including date-stamped photographs from the annual system service. Multi-Residential Building: • Servicing contract and CV of appointed Competent Professional. • Annual systems servicing schedule (to be included in the Sustainable Maintenance Procedure). • Systems servicing report written by the Competent Professional including date-stamped photographs from the annual system service. • Record Log.

Supporting Guidance

Regular Maintenance and Fault Inspections (Individual Dwelling):

- An inspection for faults or damage, and the associated maintenance required, must be undertaken every quarter by the Owner or a Competent Professional with at least two years of relevant experience. This will include a visual inspection of the items listed in Figure PMM-03.1.
- In addition to rectifying any faults or damage, maintenance may include cleaning dust from air ventilation grills, lighting fixtures and solar collectors, clearing drains etc.
- To monitor and support continuous improvement, a schedule should be kept of actual maintenance issues and repair/replacement. Causes should be investigated to avoid recurring issues.
- Repair/replacement should avoid recurring faults due to poor quality materials and should minimize environmental impact with sustainable procurement (refer to **PMM-04 Sustainable Procurement**).
- A letter of commitment must be provided, signed by the building Owner, confirming that the required inspections and maintenance will be undertaken 4 times a year.

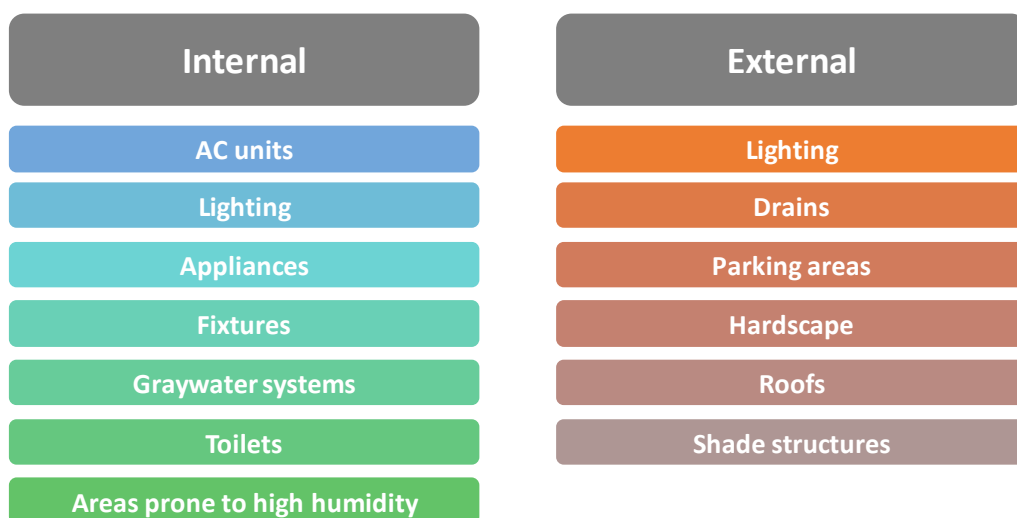


Figure PMM-03.1 Internal and external items requiring a visual inspection

Sustainable Maintenance Procedure (Multi-Residential Building):

The required contents of the Sustainable Maintenance Procedure are detailed in Table PMM-03.1. The procedure must be written within the first 6 months of the Monitoring Period and implemented for the second 6 months and relevant evidence submitted. Thereafter the procedure must be continuously enforced.

Table PMM-03.1 Sustainable Maintenance Procedure contents

Sustainable Maintenance Procedure		
#	Section Title	Content Requirements and Guidance
1	Aims & Objectives	Aims and objectives of the procedure.
2	Roles & Responsibilities	Designated individuals (with contact details) responsible for procedure creation, procurement, inspections, maintenance, servicing communication, training and annual overview. If undertaking Annual Systems Servicing, ensure that the Competent Professional agrees to, and is bound by, this Procedure.
3	Implementation Guidance	Sustainable Maintenance refers to regular assessment, parts replacements and ad-hoc repair or replacement of physical elements and systems. Annual systems servicing refers to annual specialist review and servicing of systems.
4	Asset Registry	Create a detailed asset registry of systems, parts and materials which will likely require ongoing maintenance, repair or replacement. Provide an asset name and description, manufacturer, serial number, general location, date of purchase, date of installation and warranty expiry date. Likely building systems needing maintenance include: • HVAC • Water pumps

		• Electrical systems • Onsite power generation (including renewable or backup generation) • BMS • Vertical transportation
		Collate original as-built drawings, building services manuals and product information for the applicable systems. This may require contacting the construction team via the Owner. Keep documentation updated as retrofits or system updates change onsite conditions.
5	Systems Maintenance	Determine the maintenance scheduling for systems based on the manufacturers' product documentation. Create a table of systems across a 12-month cycle and schedule each item's maintenance requirements in terms of action, equipment and consumables required. Add a new line for each frequency e.g. chiller monthly and chiller quarterly services will be on different lines. Examples are provided in Table PMM-03.2.
		In relation to the procurement of maintenance contracts refer to A Guide to Best Practice for Procurement BG66/2016 or Business-Focused Maintenance BG53/2016.
6	Physical Asset Maintenance	Create a table of items across a 12-month cycle and schedule proactive inspections, maintenance requirements (equipment and consumables) and likely fault origin for physical assets. Examples are provided in Table PMM-03.3.
		A Guide to Best Practice for Procurement BG66/2016 may be used to further identify suitable scheduling requirements.
7	Maintenance Response	Maintenance actions should be carried out based on the following Sustainable Maintenance Principles: • Avoid unnecessary maintenance by considering if the action is absolutely necessary e.g. if a wider component is scheduled to be replaced soon. • Avoid recurring maintenance by investigating the cause of the fault. This may include construction faults, material failures, quality of materials or inappropriate occupant use. • Seek value for money by considering the capital cost, operational cost and life span of a maintenance action e.g. replacement with a more expensive light fixture with a longer lifetime may reduce future costs. • Minimize environmental impact - refer to Product Environmental Performance and Environmental Product Declarations guidance within PMM-04 Sustainable Procurement.
8	Communication	To avoid unnecessary exposure or inconvenience to building occupants, or disruption to the procedure, provide 72 hours warning to all building occupants of services which will significantly disrupt building system functionality.

		An immediate notice can be given in emergency cases. An emergency is when health and safety or property is deemed to be at risk.
		All communication should state the time and location of the services, a large clear summary word (such as “No Access” or “Limited Function”) and the FM contact.
		The general principles, good practice and any site-specific considerations of the procedure should be communicated to all residential units at least annually.
		All communication should be by a public notice at the building entrances and emails or physical letters to all residential units.
9	Training	Provide training at least once a year to the Facility Management individuals responsible for procurement and monitoring.
		Include training content and attendance registry template within an appendix.
10	Records	Provide a log template within the appendix of the procedure. Records must be kept in a well-structured electronic log.
		The Record Log will include documentation regarding: • Asset registry. • Maintenance schedule. • Maintenance log - a detailed maintenance log of work undertaken, time spent, qualification of individuals, cost of consumable use and cost of any replacements. • Monthly maintenance summary - the aim is to identify reoccurring faults or issues which are consuming large amounts of maintenance time and procurement budget.
		For multi-residential buildings, records must also be kept of: • Communications • Training • Annual management overview
11	Sign-off & Management Overview	A one-page summary should list past and present results and efforts to improve on them for easy review. This should utilize information from the Monthly Maintenance Summary (see Record Log).
		The procedure must be re-evaluated annually and updated as necessary to include new products, techniques, recurring issues and any occupant feedback.
		The Facility Manager or Owner must review and sign off the procedure on an annual basis.

Table PMM-03.2 Examples of regular systems maintenance

Item	Monthly	Quarterly
Water systems (including any graywater systems)	Water testing	Chemical dosing (if needed)
Air conditioning	Minor monthly equipment service	Filter cleaning
Renewable energy generation	Cleaning	Angle adjustment (if needed)

Table PMM-03.3 Examples of physical asset maintenance requirements

Item	Issue	Response
Lighting	Broken lighting fixtures	Replace and investigate any cause from physical damage or electrical outages and consider alternative products (refer to PMM-04 Sustainable Procurement)
Appliances/fixtures	Broken appliances/fixtures that are provided by the Owner/Facility Manager	Repair devices and investigate component failure and likely cause. Consider alternative products (refer to PMM-04 Sustainable Procurement and E-05 Energy Efficient Appliances)
Waste rooms	Damaged waste doors or walls	Investigate container types for sharp edges and inappropriate occupant use
Waste collection areas	Standing vehicles leaving oil or garbage debris	Determine frequency by pressure washer
Parking areas	Excessive tire marks	Remove and investigate modifying the location of speed bumps and alternative paints
Toilets	Blocked toilets	Unblock and investigate wider pipe system, flush volume and inappropriate occupant use
Drains	Blocked drains	Unblock and investigate cause of blockage from sand, litter, oils, vegetation etc.
Outside hardscape	Scratched, loose or broken tiles	Investigate grouting quality and any inappropriate occupant use or vehicle traffic
Roofs and shade structures	Damaged roof or shade structure	Repair or replace as appropriate
Floors	Scratched or broken tiles	Investigate grouting quality and any inappropriate occupant use
Walls	Wall marks, scratches or	Investigate grouting/paint quality and

	broken tiles	inappropriate occupant use
Service lifts	Marks or scratches	Replacement of service lifts' protective board or regular washing of removable fabric coverings

Competent Professional for Annual Systems Servicing:

- Engage a Competent Professional (with at least five years of experience) to undertake annual servicing of systems. For multi-residential buildings, the Competent Professional must be independent i.e. not part of the Facility Management team.
- The Competent Professional should be appointed within the first 6 months of the first Monitoring Period and undertake the systems servicing within the second 6 months. Systems servicing should be undertaken on an annual basis thereafter.

Annual Systems Servicing (Individual Dwelling):

- Typical items for servicing include:
 - Air conditioning filters
 - Ducting
 - General mold inspection
 - Hot/cold water tanks
 - Hot water heating unit
 - Smoke detectors
 - Fire safety equipment
- The systems servicing report, written by the Competent Professional, should outline the systems checked, key results, concerns and suggestions. The report should also include date-stamped photographs documenting the key aspects of the annual systems service.

Annual Systems Servicing (Multi-Residential Building):

An annual systems servicing schedule is to be included in the Sustainable Maintenance Procedure and must address the following:

- Assign inspection and servicing requirements from manufacturers' product documentation. Create an annual and bi-annual (every 2 years) list for systems servicing. Examples are provided in Table PMM-03.4.
- In the absence of clear servicing recommendations from the manufacturer, refer to the Reference Documents section of this credit for sources of further information.

Table PMM-03.4 Example of annual and bi-annual list for systems servicing

Item	Annual	Bi-Annual
Water systems	Tank insulation Tank cleaning	Pumps
Air conditioning	Refrigerant gas levels Filters replacement Motors	-
Fire protection	Extinguishers	-

	Sprinkler suppression	
Electrical MV transformer	Oil sampling and analysis	Major equipment service
Standby generator	Alternator and auxiliaries service	-
Renewable energy generation	Load test	-
Other items		

A Systems Servicing report written by the Competent Professional must be included in the Record Log of the Sustainable Maintenance Procedure and outline the systems checked, key results, concerns and suggestions. The report should also include date-stamped photographs documenting the key aspects of the annual systems service.

Credit Tool

N/A

Reference Documents

1. BG66/2016 Maintenance Contracts: A Guide to Best Practice for Procurement
2. BG53/2016 Maintenance Contracts: Business-Focused Maintenance
3. CIBSE TM44 Inspection of Air Conditioning Systems, 2012
4. HSE INDG236 Maintaining Portable Electrical Equipment in Low-Risk Environments, Rev 2
5. CIBSE Guide D Transportation Systems in Buildings, 2015

PMM-04 Sustainable Procurement

Keystone Credit	Total Number of Points Available
Yes	4

Aim

To minimize environmental impacts through sustainable procurement.

Requirements

#	Requirement	Points Available	
		Individual dwelling	Multi-residential
Keystone Requirement - achieve requirement #1 (1 credit point).			
1	A Sustainable Procurement Policy (SPP) is developed and implemented that encourages the purchase of sustainable materials and products for the operation and maintenance of the building.	1	1
2	Of the materials and products purchased during the operation of the building, 80% (by cost) comply with the SPP.	2	2
3	Of the materials and products purchased during the operation of the building, 30% (by cost) are regional.	1	1
	Total	4	4

Evidence

#	Evidence per Requirement
1, 2 & 3	- Sustainable Procurement Policy. - Record Log of materials and products purchased, including product information and purchase orders/receipts.

Supporting Guidance

Sustainable Procurement Policy:

The required contents of the Sustainable Procurement Policy are detailed in Table PMM-04.1. The Sustainable Procurement Policy must be developed within the first 6 months of the Monitoring Period and implemented for the second 6 months and relevant evidence submitted. Thereafter the policy must be continuously enforced.

Table PMM-04.1 Sustainable Procurement Policy

Sustainable Procurement Policy		
#	Section Title	Content Requirements and Guidance
1	Aims & Objectives	Aims and objectives of the policy.
2	Roles & Responsibilities	Designated individuals (with contact details) responsible for policy creation, procurement, training, communication and annual overview.
3	Sustainable Products & Materials	Description of the products and materials that are covered by the Policy, to include the following as a minimum: • Finishes • Fixtures • Fittings • Furnishings • Equipment • Appliances • Consumables (cleaning, pest management, refrigerants, fire suppression gases) • Maintenance (composite wood, suspended ceilings, insulation)
		The SPP should give preference to products and materials which have the following attributes: • Durable and not for single-use only • Non-toxic or minimally toxic • Biodegradable • Manufactured/assembled in KSA • Environmental Product Declaration (EPD) • Energy efficient • Minimally packaged and no plastic or foam cases • Recycled and reusable packaging • Made from locally sourced materials • Recyclable If requirement #2 is targeted, at least 80% (by cost) of the materials and products purchased during the operation of the building must have at least one of the above attributes.
		The Sustainable Procurement Policy should give preference to suppliers/manufacturers which have the following: • Environmental awards and certificates e.g. FSC, Organic and Fair Trade • Internal management systems which showcase consideration towards the environment e.g. ISO 14001 certification, Carbon Trust and EMAS (Eco-Management and Audit Scheme)
		Procurement choices should be made by ranking options based on the sustainability principles in Figure PMM-04.1.
		If any of the credits in Table PMM-04.2 are being targeted, this policy must

		be used to record compliance with the procurement requirements of the individual credits.
4	Communication (multi-residential buildings)	The general principles, good practice and site concerns of the policy should be communicated to all residential units at least once a year. All communication should be by a public notice at the building entrances and emails or physical letters to all residential units.
5	Training (multi-residential buildings)	Provide training at least once a year to the individuals responsible for procurement. Include training content and attendance registry template within the policy appendix.
6	Records	Provide a log template within the appendix of the policy. Records must be kept in a well-structured electronic log and include all applicable materials and products purchased, summarized in a table containing the following information in order to monitor and support continuous improvement: • Date of purchase • Material or product type • Use/application • Manufacturer • Model • Supplier • Cost, supported by purchase order/receipt • Sustainability attributes, including the following documentation as appropriate: ○ MSDS ○ Supplier statements on environmental or community benefit ○ Certificates ○ Company reports For multi-residential buildings, records must also be kept of: • Communications • Training • Annual management overview
7	Sign-off & Management Overview	A one-page summary should list past and present results and efforts to improve on them for easy review. The policy must be re-evaluated annually and updated as necessary to include new products, techniques and any occupant feedback. The Facility Manager or Owner must review and sign-off the policy on an annual basis (for multi-residential buildings).

Environmental Product Declarations:

Manufacturers typically undertake a life cycle assessment of their products to provide proof of their reduced environmental impact relative to other products in the market. This proof comes in the form of an Environmental Product Declaration (EPD) which lists the potential impact of a product by its contribution to the following environmental hazards:

- Global warming (greenhouse gases)
- Eutrophication of fresh water
- Depletion of non-renewable energy resources
- Acidification of land/sea
- Stratospheric ozone depletion
- Formation of tropospheric ozone

It is important to note that a product that provides an EPD is not a guarantee that it is environmentally friendly. However, the transparency an EPD provides is intended to influence the comparison and selection of goods. All EPDs must follow either the ISO 14025 and/or EN 15804 standards for their calculation and reporting format.

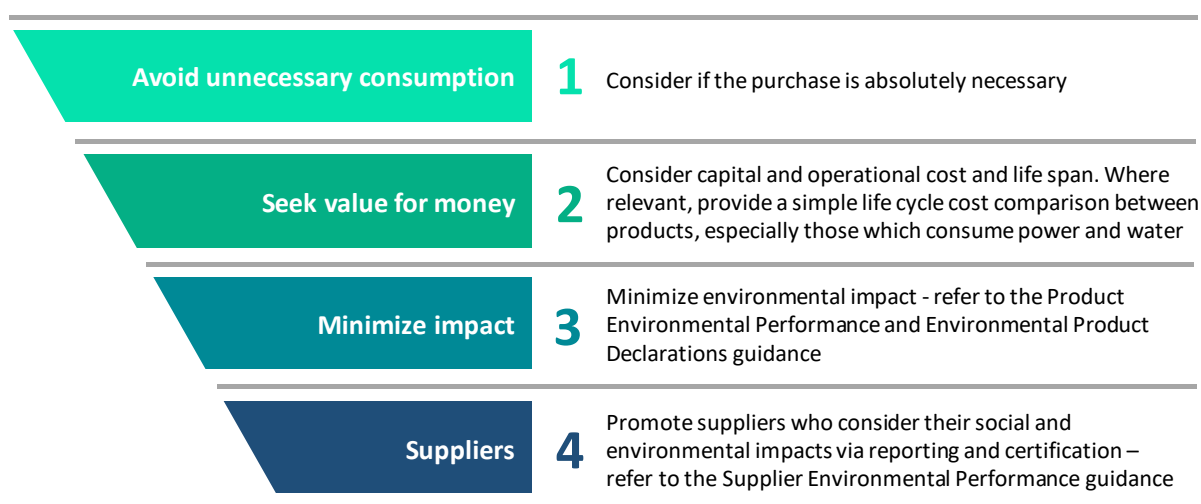


Figure PMM-04.1 Procurement hierarchy

Table PMM-04.2 Linked credits

Procurement Category	Priority Requirements	Related Credit
Cleaning	Low toxicity cleaning agents, preferably bio-based and in concentrated form	PMM-06 Hygienic Operations
Pest management	Low toxicity chemical control	PMM-06 Hygienic Operations
Equipment/appliances	Energy efficiency	E-05 Energy Efficient Appliances
Refrigeration and fire	Gases with zero CFCs and ODP	E-06 Ozone Impact

suppression		
Indoor and outdoor water fixtures and fittings	Water efficiency	W-03 Water Efficient Products and Systems
Adhesives, sealants, paints and coatings	Low VOC materials	HC-07 VOCs and Low Emitting Materials
Composite Wood and suspended ceilings	Low formaldehyde materials	HC-07 VOCs and Low Emitting Materials
Insulation materials	Zero CFCs, HCFCs and ODP GWP ≤ 5 ≤ 13.5 ppb added formaldehyde	HC-08 Non-Polluting Insulation Materials
Lighting fixtures	Fixtures which do not cause glare or light pollution	SS-03 Light Pollution

Regional Materials:

If credit requirement #3 is targeted, 30% of all relevant materials and products (by cost) must be sourced within KSA and this requirement is to be included in the Sustainable Procurement Policy. The Record Log table, which documents all applicable materials and products purchased, must indicate whether each purchase is regional or non-regional. An annual summary must then be prepared comparing the regional and non-regional purchases for the year, demonstrating that the minimum requirement of 30% has been achieved. The following guidance should be adhered to when calculating the percentage of materials/products sourced within KSA:

- For a material/product to be considered as sourced within KSA, it must meet at least one of the following conditions:
 - Extracted in KSA
 - Manufactured in KSA
 - Final point of assembly in KSA
- The material or product cost is as per the purchase order/receipt and does not include labor costs for transport, installation or application.
- For composite materials, the material with the largest percentage of content shall be used in the calculation.
- Materials that are primarily made from recycled content can also be included in the calculations.
- It is important to ensure that the source of extraction, manufacturing or assembly is validated against Mostadam requirements before procurement. Suppliers must provide their Trade Licenses and the Country of Origin Certificates for their materials and these must be confirmed as acceptable.

Credit Tool

N/A

Reference Documents

1. ISO 14025:2006 Environmental labels and declarations - Type III Environmental Declarations, Principles and Procedures
2. US Environmental Protection Agency (EPA), Sustainable Purchasing Program

PMM-05 Building Performance Monitoring

Keystone Credit	Total Number of Points Available
No	2

Aim

To utilize smart meters for real-time monitoring of energy and water consumption, thereby raising awareness and enabling residents to use the data to reduce their consumption.

Requirements

#	Requirement	Points Available	
		Individual dwelling	Multi-residential
1	Smart meters and digital feedback systems are present which configure and display energy and water usage data on a user-friendly interface such as a display screen (dashboard) and which provide data monitoring, logging, trending and alerts.	2	2
	Total	2	2

Evidence

#	Evidence per Requirement
1	- Plans showing the location of the smart meters, the connected systems and the display screens (dashboards). - Manufacturers' data sheets for the smart meters and dashboards which highlight the energy and water monitoring capabilities. - Date-stamped photographs of the smart meters and dashboards. - Confirmation that installation, testing, commissioning and training has been performed. - Mostadam Guide (refer to credit EI-01 Mostadam Guide) with a section on Smart Metering providing user support for meters and dashboards.

Supporting Guidance

The presentation of the building's live performance to the operator and occupants can influence consumption. The operators and occupants can understand the systems and areas which are consuming more energy than expected and when smart meters are used, energy information can be available in real-time.

Display Screen (Dashboard) and Web-Based Application:

- The display screens should be present in the following locations:
 - Individual dwelling – one display screen in a room that is regularly used by all residents e.g. the main living room.

- Multi-residential building – one display screen in the lobby area (for overall building usage) and one display screen in each residential unit in a room that is regularly used by all residents e.g. the main living room.
- The display screen must interface with a web-based application and allow secure access by the local utility provider, *Sustainable Building*, and the end users.
- Monitoring capabilities must include daily, weekly, monthly and annual summaries of consumption for comparison. It is also recommended that the consumption for a week, on an hourly basis, is stored and made available.
- The web-based application must:
 - Be accessible from residents' smart phones and tablets in addition to the display screen.
 - Maintain records for a rolling 18-month period.
 - Provide visual, and optional audible, alerts indicating peak demand periods and high consumption rates.
 - Provide the ability to view trend logs of consumption at a minimum of 1-hour increments.
- If the project is also targeting credit **E-04 Renewable Energy**, energy generation data (real-time and cumulative) must also be monitored and reported on the dashboard.

Mostadam Guide Content:

The following are to be included in the Mostadam Guide (refer to credit **EI-01 Mostadam Guide**):

- Smart meter and display screen locations inside the building.
- User interface guide for the display screens and access guide for the web-based application.

Credit Tool

N/A

Reference Documents

1. CIBSE TM39 Building Energy Metering

PMM-06 Hygienic Operations

Keystone Credit	Total Number of Points Available
No	4

Aim

To promote good indoor environmental quality for all building occupants whilst minimizing pest problems via active management and environmental impacts.

Requirements

#	Requirement	Points Available	
		Individual dwelling	Multi-residential
1	Sustainable Cleaning Individual Dwelling: Sustainable cleaning products and materials are utilized for both regular and deep cleaning. Deep cleaning is undertaken twice per year. Multi-Residential Building: A Sustainable Cleaning Operational Procedure is developed and implemented addressing cleaning products and materials, regular cleaning, deep cleaning, cleaning schedules, monitoring and training.	2	2
2	Sustainable Pest Management Individual Dwelling: Regular pest inspections are undertaken. The dwelling is physically isolated to prevent pests entering and chemical prevention is only used when needed. Multi-Residential Building: An Integrated Pest Management Procedure is developed and implemented which covers non-chemical and chemical pest prevention and control.	2	2
	Total	4	4

Evidence

#	Evidence per Requirement
1	Individual Dwelling: - Schedule of cleaning product purchases (to be included in the Record Log of PMM-04 Sustainable Procurement). - Date-stamped photographs of deep cleaning.

	Multi-Residential Building: • Sustainable Cleaning Operational Procedure. • Date-stamped photographs of deep cleaning. • Record Log. • Schedule of cleaning product purchases (to be included in the Record Log of PMM-04 Sustainable Procurement).
2	Individual Dwelling: • Date-stamped photographs of physical isolation measures. • Date-stamped photographs of pest inspections. • Signed commitment letter. Multi-Residential Building: • Integrated Pest Management Procedure. • Record Log. • Schedule of chemical pest control purchases (to be included in the Record Log of PMM-04 Sustainable Procurement).

Supporting Guidance

Sustainable Cleaning (Individual Dwellings):

- Purchases of cleaning products should prioritize the attributes in Figure PMM-06.1.
- Purchases should avoid cleaning products containing chlorine bleach or petrochemical derivatives.
- All purchases of cleaning products must be documented within the Record Log of **PMM-04 Sustainable Procurement**.

Deep cleaning of non-standard spaces is to be undertaken twice a year. This includes all circulation areas, balconies, outdoor paving and inaccessible areas such as within cupboards and behind appliances/furniture. For dwellings that are tenanted, the Owner or Facility Manager is to contact the occupant to arrange a suitable time for the deep cleaning to be undertaken.

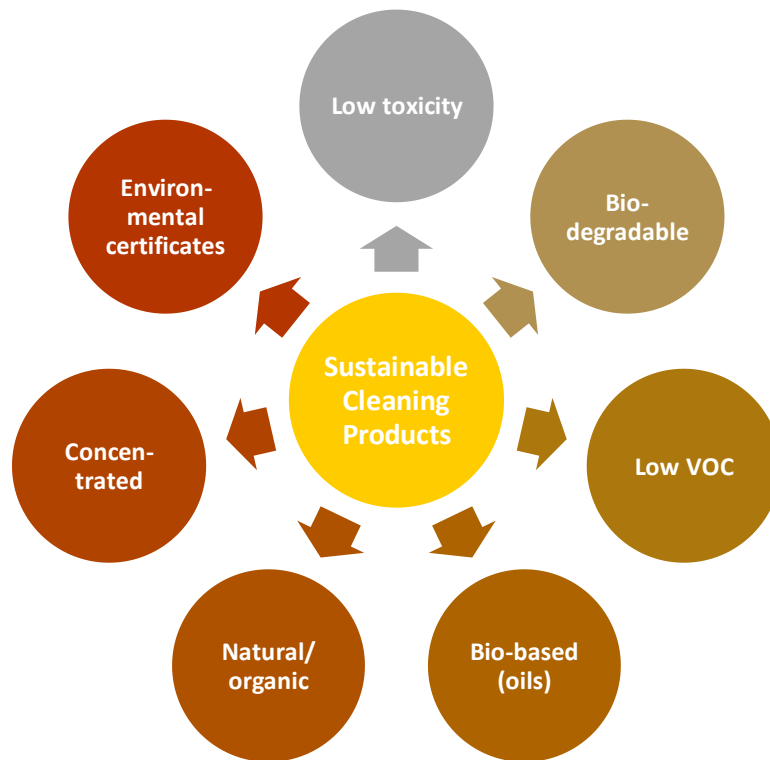


Figure PMM-06.1 Priority attributes for cleaning product purchases

Sustainable Cleaning (Multi-Residential Buildings):

The required contents of the Sustainable Cleaning Operational Procedure are detailed in Table PMM-06.1. The procedure must be written within the first 6 months of the Monitoring Period and implemented for the second 6 months and relevant evidence submitted. Thereafter the procedure must be continuously enforced.

Table PMM-06.1 Sustainable Cleaning Operational Procedure contents

Sustainable Cleaning Operational Procedure		
#	Section Title	Content Requirements and Guidance
1	Aims & Objectives	Aims and objectives of the procedure.
2	Roles & Responsibilities	Designated individuals (with contact details) responsible for procedure creation, procurement, cleaning activities, monitoring, training and annual overview. If cleaning is carried out by contractors, ensure that they agree to, and are bound by, the procedure.
3	Procurement Guidance	Introduction to the site including location, description of spaces, occupant types/numbers and typical cleaning requirements. In a table list each cleaning activity to be undertaken and state: - The regular cleaning and deep cleaning frequency based on use/activity level. Deep cleaning should be once per year as a minimum. - Recommended protocol to avoid unnecessary utility consumption

		by stating water volumes, dilution rates and duration/power settings of appliances. • Provide guidance on the protection of surfaces and finishes by stating cleaning equipment and protocol of use. • State the required storage and protective equipment for cleaning staff (gloves, boots, goggles, breathing mask etc.). • State deep cleaning special requirements in terms of items/spaces to be cleaned (including soft furnishings, carpets and glazed façades), techniques and any special access required (moving of obstructions, ladders, materials etc.).
		100% of cleaning consumables must have Material Safety Data Sheets (MSDS).
		50% of cleaning consumables (including paper towels for hand or surface drying) by cost must have an MSDS which conforms to at least one of the following standards: Green Seal, EPA Design for Environmental Protection Safer Choice, Cradle to Cradle Certified, EU Ecolabel or any eco-labelling compliant with ISO 14024.
		The purchasing of cleaning products should prioritize: • Low toxicity, biodegradable and low Volatile Organic Compound (VOC) products. • Bio-based oils and other natural cleaners (such as biodegradable cleaners, plant-based cleaners, organic soap etc.). • Concentrated agents to minimize transportation and packaging impacts.
		Purchasing of cleaning products containing chlorine bleach or petrochemical derivatives should be avoided.
		Soap or waterless alcohol gel to be provided in all non-private sinks/basins along with hand hygiene visual reminders at suitable locations.
4	Communication	To avoid unnecessary exposure or inconvenience to tenants or disruption to the procedure, provide 72 hours warning to all building occupants of deep cleaning. All communication should state the time and location of the deep cleaning, a large clear summary word, such as “Slippery Floor” or “Dust” and the FM contact.
		The general principles, good practice and any site specific considerations of the procedure should be communicated to all residential units at least annually.
		Communication should be by a public notice at the building entrances and emails or physical letters to all residential units.
5	Training	Provide training at least once a year to the individuals responsible for procurement, cleaning activity and monitoring.
		Include training content and attendance registry template within the appendix of the procedure.
6	Records	Provide a log template within the appendix of the procedure.

		Records must be kept in a well-structured electronic log. The Record Log will include documentation regarding: • Regular and deep cleaning schedules • Communications • Training content/attendance • Annual overview Documentation related to the procurement of cleaning products is to be included in the Record Log of PMM-04 Sustainable Procurement.
7	Sign-off & Management Overview	A one-page summary should list past and present results and efforts to improve on them for easy review. The procedures must be re-evaluated annually and updated as necessary to include new products, techniques, reoccurring issues and any occupant feedback. The Facilities Manager or Owner must review and sign-off the procedures on an annual basis.

Sustainable Pest Management (Individual Dwellings):

- Physically seal kitchen cupboards and utility outlets and ensure drains have mesh and plate seals. Ensure waste containers have well-fitting lids. Date-stamped photographs should be provided of all physical pest isolation measures.
- Prior to carrying out inspections, review the guidance from MOMRA and the National Pest Management Association (NPMA) to become familiar with the habitat, droppings and other evidence of common pests.
- Undertake pest inspections every 3 months and provide date-stamped photographs from each one. Likely potential pests will include common insects such as cockroaches, ants, termites and lice, as well as rodents. Images should include sheltered areas in kitchens and waste rooms such as the backs of cupboards and behind appliances. Inspections should also be undertaken at night to spot nocturnal pests such as cockroaches.
- Only use chemical control when pests are spotted. Do not engage pest control companies for calendar-based exterminations. Chemical control can be via a pest management company or via self-application if appropriate, e.g. ant powder, cockroach spray etc. The application instructions for each product must be carefully adhered to.
- Confirm, via a signed commitment letter, that all occupants of the dwelling have been informed about the need to keep areas tidy and hygienic to avoid providing food sources or shelter for pests.

Sustainable Pest Management (Multi-Residential Buildings):

The required contents of the Integrated Pest Management Procedure are detailed in Table PMM-06.2. The procedure must be written within the first 6 months of the Monitoring Period and implemented for the second 6 months and relevant evidence submitted. Thereafter the procedure must be continuously enforced.

Table PMM-06.2 Integrated Pest Management Procedure contents

Integrated Pest Management Procedure		
#	Section Title	Content Requirements and Guidance
1	Aims & Objectives	Aims and objectives of the procedure.
2	Roles & Responsibilities	State the designated individuals (with contact details) responsible for procedure creation, procurement, pest control activity, monitoring, communication, training and annual overview. If pest management is carried out by contractors, ensure that they agree to, and are bound by, the Integrated Pest Management Procedure.
3	Overview	Provide an introduction to the site including location, description of spaces and occupant types/numbers. Describe likely pest types and habitats, food sources and reproduction cycles. Likely potential pests will include common insects such as cockroaches, ants, termites and lice, as well as rodents and vegetation which is considered a weed (refer to SS-01 Ecological Management and Enhancement).
		For each pest, list all potential control methods considered starting with the lowest risk in terms of risks to the applicator, building occupants and the environment. This will include physical, cultural and chemical control methods as listed below.
		Specify inspections frequency (at least once per month for common areas), to confirm pest populations. Inspections should be carried out at a time which causes least disruption to tenant areas e.g. during tenancy change.
		Decide what represents a critical threshold of observation for pest control for each type. Note that a single sighting may not be a suitable threshold for all pest types.
4	Non-Chemical Pest Prevention & Control	Physical Prevention/Control - prevent pests from entering the area using methods such as barriers or traps.
		Cultural Prevention/Control - change conditions to be less favourable for pests: • Destroy known or possible pest food, shelter or breeding habitats. • Identify and fix sanitation issues which create water leakage. • Adjust waste storage volumes, collection frequency or containment measure related to pest management to avoid water or food sources. • Remove shelter such as untidy storage areas or, if applicable and necessary, change site vegetation types.
5	Chemical Pest Prevention & Control	Chemical Prevention – do not apply chemical control as regular preventative spraying.
		If routine inspections or reports indicate pest populations exceed critical thresholds, use the least toxic chemical control: • Prioritize bio-pesticides as these target specific pests and are usually less toxic. • Use general pesticide spraying only if these are ineffective.

		All chemical control should be either products screened by the Integrated Pest Management Programme, City and County of San Francisco and defined as Tier III (least hazardous), OR least toxic as defined by GHS Category 4 or 5 in accordance with The WHO Recommended Classification of Pesticides by Hazard and Guidelines to Classification 2009.
6	Communication	To avoid unnecessary exposure or inconvenience to building occupants, or disruption to the procedure, provide 72 hours warning to all building occupants of pest control. A 24-hour notice can be given in emergency cases. An emergency is when occupant health and safety or property is deemed to be at risk. All communication should state the time and location of the pest control, pesticide product name, active ingredient, a large clear summary word (such as “Danger” or “Caution”) and the FM contact. The general principles, good practice and any site-specific considerations of the procedure should be communicated to all residential units at least once per year. All communication should be by a public notice at the building entrances and emails or physical letters to all residential units.
7	Training	Provide training at least once a year to the individuals responsible for procurement, pest control activity and monitoring. Include training content and attendance registry template within the appendix of the procedure.
8	Records	Provide a log template within the appendix of the procedure. Records must be kept in a well-structured electronic log. The Record Log will include documentation regarding: - Pest monitoring, prevention and control. - Communications. - Training content/attendance. - Annual overview. Documentation related to the procurement of chemical pest control is to be included in the Record Log of PMM-04 Sustainable Procurement.
9	Sign-off & Management Overview	A one-page summary should list past and present results and efforts to improve on them for easy review. The procedures must be re-evaluated annually and updated as necessary to include new products, techniques, recurring issues and any occupant feedback. The Facility Manager or Owner must review and sign off the procedure on an annual basis.

Credit Tool

N/A

Reference Documents

1. Green Seal GS, <https://www.greenseal.org/standards/>
2. EPA Design for Environmental Protection Safer Choice, <https://www.epa.gov/saferchoice>
3. Cradle to Cradle Products Innovation Institute, <https://www.c2ccertified.org/>
4. EU Ecolabel, <http://ec.europa.eu/environment/ecolabel/>
5. ISO 14024:2018, Environmental Labels and Declarations: Type I Environmental Labelling - Principles and Procedures
6. How to Develop a Successful Plan to Combat Public Health Pests, MOMRA, 2015
7. The Basics of Integrated Rodent Control, MOMRA, 2015
8. The Best Ways to Detect Public Health Pests, MOMRA, 2015
9. National Pest Management Association (NSMA), <https://www.pestworld.org/>
10. San Francisco 2015 Reduced Risk Pesticide List, SF Environment
11. The WHO Recommended Classification of Pesticides by the Hazard and Guidelines to Classification, 2009
12. Integrated Pest Management, New South Wales Environmental Protection Agency, <https://www.epa.nsw.gov.au/your-environment/pesticides/integrated-pest-management>
13. Integrated Pest Management (IPM) Principles, United States Environmental Protection Agency, <https://www.epa.gov/safepestcontrol/integrated-pest-management-ipm-principles>

Energy

5 Energy

Per-capita energy consumption has been increasing every year in KSA with a 20% escalation between 2010 and 2016². Therefore, as the population of KSA grows, the overall energy consumption of KSA is also expected to grow substantially. Vision 2030 seeks to develop and implement policy and infrastructure that advocates for improved energy performance, increased energy efficiency and the adoption of renewable energy technologies. This will help diversify the economy, achieve sustainability goals and mitigate challenges associated with increased energy consumption.

Mostadam-certified buildings will support these goals by demonstrating their improved energy performance through evidence-based means and ensuring that the building continues to operate as intended. The monitoring and analyzing of energy consumption will be used to determine the energy performance of a building in operation. In addition, projects will be rewarded for adopting renewable energy technologies and providing energy efficient appliances, which aligns with policy initiatives aimed at strengthening the domestic market and diversifying the economy.

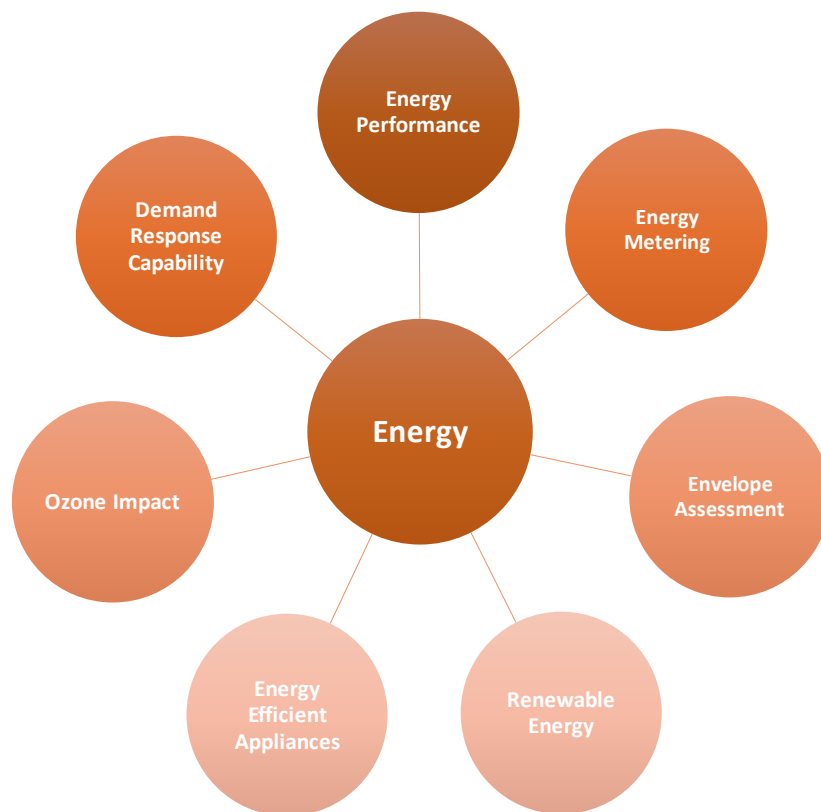


Figure 9 Energy credits

² Electricity consumption per capita 2010-2016, General Authority for Statistics

E-01 Energy Performance

Keystone Credit	Total Number of Points Available
Yes	12

Aim

To reduce the environmental and economic impacts associated with excessive energy use, and to promote informed decisions on the selection and installation of building components, by assessing the operational energy use within the building against minimum operating energy performance levels.

Requirements

#	Requirement	Points Available	
		Individual dwelling	Multi-residential
Keystone Requirement - achieve requirements #1 to #4 (4 credit points).			
1	Energy Consumption Assessment An energy consumption assessment is undertaken confirming the annual Energy Use Intensity (EUI) of the building in kWh by analyzing the previous 12 months’ fuel and electricity bills.	1	1
2	Energy Audit A Competent Professional undertakes an Energy Audit and provides costed energy efficiency measures for implementation. For multi-residential buildings, the % of the residential units assessed is based on the total number of units within the building: • 50% for buildings containing up to 10 residential units • 40% for buildings containing up to 50 residential units • 30% for buildings containing up to 100 residential units • 15% or 30 units (whichever is greater) for buildings containing more than 100 residential units	1	1
3	Energy Efficiency Measures All measures listed in the Energy Audit report that have a simple payback period of less than 6 years are implemented.	1	1
4	External Lighting External lighting is switched ON/OFF by adequate control systems taking into consideration the need for external lighting and operational requirements.	1	1
5	Appliances and Processes • For electrical appliances provided by the building Owner, the Owner makes a written commitment that all non-energy efficient appliances and process load equipment will be replaced within 5 years by energy efficient appliances and equipment.	1	1

	- The Owner makes a written commitment that elevators and escalators will be replaced with energy efficient elevators and escalators when these are replaced at the end of their operational life. - The Owner makes a written commitment that all future HVAC replacements will have a SASO rating of 'A' and all external lighting replacements will make use of only LED technology.		
6	Energy Consumption Benchmarking The Energy Use Intensity (EUI) of the building is compared to regional benchmarks. Credit points are awarded based on the operational energy consumption of the building relative to the benchmarks.	7	7
	Total	12	12

Evidence

#	Evidence per Requirement
1	- Twelve months of electricity bills from the utility provider with the first and last bills including an actual measurement and not an estimation OR monthly meter readings with date-stamped photographs for verification. - If sub-metering is present, date-stamped photographs of meters which are measuring external lighting, lifts and swimming pool plantroom energy consumption and other applicable process loads other than appliances, internal lighting and HVAC. - Drawings with measurements confirming the Gross Internal Area (GIA) of the building. - Energy Performance Tool.
2	- CV of Competent Professional. - Asset register of all systems and appliances which consume energy. - Manufacturers' data sheets for lighting (internal and external), HVAC systems and appliances, indicating the projected annual energy consumption. For appliances and HVAC, the datasheets must include a SASO rating or an Energy Star rating. If these are not available, indicate what the SASO rating would be based on manufacturer's literature for the same environmental conditions as per SASO. - A simple diagram, preferably a single line diagram, showing the energy consumption units under each distribution board and energy meter. - Date-stamped photographs of the lighting (internal and external), HVAC systems and appliances. - Energy Audit Report.
3	- Receipts for purchases of items listed in the Energy Audit Report that have a simple payback period of less than 6 years. - Date-stamped photographs of the newly installed fixtures, appliances and/or systems as per the Energy Audit Report recommendations.
4	- Date-stamped photographs of the external lighting-control systems. - Single line diagram of the external lighting indicating the type of control mechanism. - External areas plan, or image, indicating the locations of external light fittings and the locations of PIR-motion controllers and the PIR area of detection.

5	- For electrical appliances provided by the building Owner, manufacturers' data sheets for existing appliances. Data sheets must include a SASO rating or an Energy Star rating. If these are not available, indicate what the SASO rating would be based on manufacturer's literature for the same environmental conditions as per SASO. - Commitment letter written by the Owner, which clearly indicates the commitment for appliances (if provided by the Owner), elevators, escalators, external lighting and HVAC systems separately.
6	As per the evidence for requirement #1.

Supporting Guidance

Energy Consumption Assessment:

When a residential property is benchmarked, the most important metric is the energy use intensity (EUI). The EUI expresses a property's energy use as a function of its size or other characteristic. For Mostadam, EUI is expressed as energy use per square meter per year and is calculated as follows:

$$\text{Energy Use Intensity EUI (kWh/m}^2\text{)} = \frac{\text{Annual building energy consumption (kWh)}}{\text{Gross internal area (m}^2\text{)}}$$

The 'annual building energy consumption' is the overall energy consumption of the property excluding the energy consumption of external lighting and process loads. The Gross Internal Area (GIA) is the area of the building measured to the internal face of the perimeter walls at each floor level and includes areas occupied by:

- Internal walls and partitions
- Columns
- Piers
- Chimney breasts
- Stairwells
- Liftwells
- Vertical ducts
- Other internal projections

In the example in Figure E-01.1, the GIA is the area enclosed by the red line.

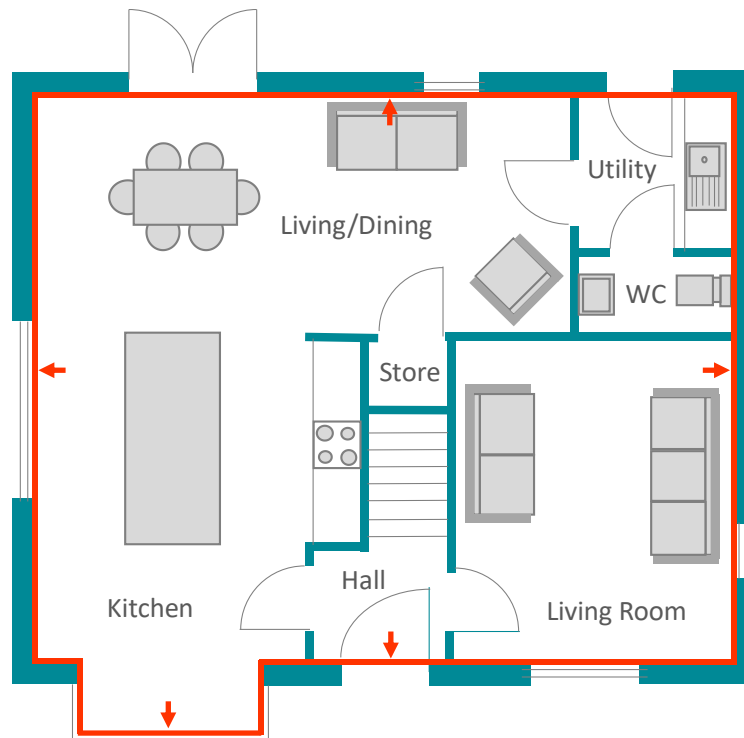


Figure E-01.1 Gross Internal Area (GIA) example

The EUI includes only the energy consumption which is directly linked to the Gross Internal Area (GIA) of the building. The EUI provides the best comparison value for dwellings as the comparison is made on a space-by-space basis taking into consideration that some dwellings have neither external lighting nor process loads. This approach is in line with the overarching framework of ASHRAE 90.2-2007 and ISO 52000-1:2017.

Energy Audit:

The Competent Professional shall have at least two years of experience of undertaking energy audits and must be at least:

- An Associate Engineer registered under the Saudi Council of Engineers;
- A Professional Engineer member of the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) or equivalent such as a Chartered Engineer Member of the Chartered Institution of Building Services Engineers (CIBSE);
- A Certified Energy Auditor of the Association of Energy Engineers (AEE); or
- A professional certified under another scheme which has received an approval by *Sustainable Building*.

The Energy Audit Report must include the following as a minimum:

- Date the building was designed/built and the energy efficiency code applicable at that time. If this is not known, an estimation should be provided by the Competent Professional.
- Interview with the occupants to understand how the home operates and learn about any problems. It must be noted that this is not a compulsory requirement and is not required for 100% of occupancy. However, it is strongly recommended that interviews are carried out as

occupants can provide in-depth insight on issues of the property in relation to energy consumption e.g. leaking windows, uninsulated surfaces etc.

- Evidence that occupants were informed about the audit process that was followed.
- Results of exterior inspection that checked the following as a minimum:
 - Air leaks around outlets, fixtures, doors and windows (or refer to the results of the Envelope Audit if credit **E-03 Envelope Assessment** is targeted).
 - Location of the external units of air-conditioning equipment.
 - Efficiency of the external air-conditioning units.
 - Wall insulation and framing type.
 - Type of external lighting and the switching control devices.
- Comparison between the installed external envelope specifications and the requirements of the latest Saudi Building Code, and especially SBC 601 and 602, in relation to heat transfer coefficients.
- Results of interior visual inspection that checked the following as a minimum:
 - Power consumption of electrical systems.
 - Electrical appliances' SASO rating or other energy scheme rating.
 - Filters of internally installed cooling units (i.e. split AC and Fan Coil Units).
 - Thermostat type and settings.
 - Monitoring of process load (e.g. lifts, swimming pool plant) energy consumption. If these are not monitored, evaluate the annual energy consumption of these process loads based on educated assumptions. The energy consumed by these process loads must not be included in the EUI.
- Comparison between the installed HVAC system energy efficiency and the requirements of the latest Saudi Building Code, and especially SBC 601 and 602, in relation to air-conditioning efficiencies and specific fan power of fans.
- Recommendations on ways to improve the building's energy efficiency to save money with a simple payback period (PBP) analysis including:
 - Initial costs.
 - Energy (in kWh) saved per year.
 - Annual financial savings.
 - Simple Payback Period.
 - Typical equipment life expectancy.

Energy Efficiency Measures:

The payback period is the length of time required to recover the cost of an investment and is calculated as follows:

$$\text{Simple Payback Period (years)} = \frac{\text{Cost of initial investment (SAR)}}{\text{Cost of energy savings per year (SAR)}}$$

The payback period of an energy efficiency investment is an important determinant of whether to undertake the replacement, on the basis that the electricity and fuel prices will remain the same within the payback period.

External Lighting:

- All external lighting shall have timers or photocells which switch-off external lighting during daylight hours.
- All security and main entrance/parking floodlighting shall be linked to passive infrared (PIR) sensors to be utilized as PIR-based motion detectors.
- External decorative lighting shall be switched on by timers and during non-daylit hours only.

Appliances and Processes:

For residential buildings with a very good energy efficiency design standard, a significant proportion of the energy consumed is linked to the appliances, external lighting and other processes. The commitment letter provides a continuous approach to overall energy performance of the residential assets. The period of five years stated is an indicative period between two potential Mostadam O+E assessments.

For electrical appliances provided by the building Owner, non-energy efficient appliances should be replaced as follows:

- Appliances which have a SASO rating of 'D' or less must be replaced by SASO 'A' or 'B' rated appliances (refer to credit **E-05 Energy Efficient Appliances**). The following appliance categories are covered:
 - Refrigerators
 - Freezers
 - Washing machines
 - Tumble dryers
- Pool pumps with an Energy Factor of less than 11 liters/Wh must be replaced with pumps with an Energy Factor of 14.38 liters/Wh or higher.

Energy Consumption Benchmarking:

The Energy Consumption Benchmarks have been derived from:

- Publicly available regional data on energy consumption.
- Information from the World Energy Council Energy Efficiency indicators based in GCC countries.

The number of points achieved is dependent on the level of energy efficiency compared to regional available data (Table E-01.1).

Table E-01.1 Energy benchmarks

Energy Efficiency Rating		Annual Energy Consumption ^[1,2]	Credits Points Available
Band A ⁺		less than 120 kWh/m ²	7
Band A		less than 150 kWh/m ²	5
Band B		less than 185 kWh/m ²	3
Band C		less than 225 kWh/m ²	1
Band D		less than 265 kWh/m ²	0
Band E		less than 320 kWh/m ²	0
Band F		more than 320 kWh/m ²	0

[1] m² refers to Gross Internal Area

[2] The benchmark values can be increased under the following two scenarios:

Scenario (A) External Lighting:

If external lighting cannot be excluded from the building's total annual energy consumption, i.e. it is not separately metered, the benchmark can be increased (in kWh/m²) to include external lighting by assuming a best practice external lighting use. The increase is equal to the number of lumens installed in the property as part of the external lighting, multiplied by 365 days and 4 hours per day, divided by 125,000 Lumens/kWh. The calculated energy consumption is then divided by the GIA in order to calculate the increase in kWh/m²:

$$\text{External lighting benchmark (kWh/m}^2\text{)} = \frac{\text{Sum of installed Lumens} \times 365 \times 4}{125,000} / \text{GIA}$$

Scenario (B) Process Loads (e.g. lifts, swimming pools etc.):

If process loads cannot be excluded from the building's total annual energy consumption, i.e. they are not separately metered, the benchmark can be increased (in kWh/m²) to include process loads by evaluating the process-related annual consumption through submetering measurements or detailed calculations of the annual energy consumption of these systems, taking into consideration the actual performance characteristics of the installed system. The measured or calculated energy consumption is then divided by the GIA in order to calculate the increase in kWh/m².

Credit Tool

Energy Tool

Reference Documents

1. Saudi Building Code (SBC) 601, Energy-Efficient Design of Buildings Except Low-Rise Residential Buildings in Saudi Arabia
2. Saudi Building Code (SBC) 602 Energy-Efficient Design of Low-Rise Residential Buildings in Saudi Arabia
3. ASHRAE Standard 90.1-2013 Energy Standard for Buildings Except Low-Rise Residential Buildings
4. ASHRAE Standard 90.2-2007 Energy Efficient Design of Low-Rise Residential Buildings
5. ASHRAE Handbook – Fundamentals, 2017
6. Air Conditioning, Heating, and Refrigeration Institute (AHRI) Standards:

- i. 550/590-2011: Performance Rating of Water-Chilling and Heat-Pump Water-Heating Packages Using the Vapor Compression Cycle
 - ii. 210/240-2008: Unitary Air Conditioning and Air-Source Heat Pump Equipment
 - iii. 340/360-2007: Performance Rating of Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment
 - iv. 310/380-2004: Packaged Terminal Air-Conditioners and Heat Pumps
 - v. 1230-2010: Performance Rating of Variable Refrigerant Flow (VRF) Multi-split Air-Conditioning and Heat Pump Equipment
7. ISO 52000-1:2017: Energy Performance of Buildings - Overarching EPB Assessment - Part 1: General Framework and Procedures

E-02 Energy Metering

Keystone Credit	Total Number of Points Available
Yes	2

Aim

To utilize energy meters with data ports for monitoring and influencing energy consumption.

Requirements

#	Requirement	Points Available	
		Individual dwelling	Multi-residential
Keystone Requirement - achieve requirement #1 (1 credit point).			
1	Energy meters are present to facilitate the monitoring and recording of energy consumption, as detailed in the Supporting Guidance.	1	1
2	Energy sub-meters are provided for particular end-uses, as detailed in the Supporting Guidance.	1	1
	Total	2	2

Evidence

#	Evidence per Requirement
1 & 2	- Energy distribution single-line schematic showing the type, extent, location and power capacity of all installed meters. - Manufacturer's specifications/data for the installed meters along with date-stamped photographs. - Mostadam Guide (refer to credit EI-01 Mostadam Guide) section on energy metering providing user support and understanding of the level of sub-metering installed, including remote access abilities and guidance on how to utilize the data to reduce consumption levels.

Supporting Guidance

All meters and sub-meters must:

- Be within a sealed location.
- Have clear readings of kWh.
- Have available data ports for connection to a smart monitoring device.
- Not have any functionality for manually changing the readings.
- Be clearly labelled and easily accessible with no special requirements needed to review the consumption.

Energy Metering:

- Individual dwellings: an energy meter must be installed per dwelling.

- Multi-residential buildings: an energy meter must be installed for each residential unit and for the landlord areas.
- District cooling: where the building is connected to a district cooling network, a BTU meter must be installed to monitor the energy demand of the building's cooling system.
- Alternative energy sources: all alternative energy sources such as liquid fuels, gaseous fuels, district cooling and/or waste energy must be installed with metering capabilities and have a high level of user interface connectivity for monitoring.

Energy Sub-Metering:

Table E-02.1 defines the sub-metering requirements for individual dwellings and multi-residential buildings.

Table E-02.1 Energy sub-metering requirements

Building End Use	Individual Dwelling	Multi-Residential	
		Landlord Areas ³	Tenant Areas
Centralized Air conditioning and Air Handling Units ¹	✓	✓	
Water heating		✓	✓
Lighting system			
Receptacle and process loads $\geq 10\text{kW}^2$	✓	✓	✓
Elevators and Lifts	✓	✓	
Energy generation/renewables	✓	✓	✓
Swimming Pool Plantroom	✓	✓	
Common Areas		✓	

¹ This includes all external condensers and associated pumps and air handling units.

² All panels that supply 90% of a specific energy load must be metered. Any end-use that takes less than 10% of the power load of the panel need not be sub-metered.

³ This includes common areas such as lobbies, swimming pools, gyms, community centers and outdoor areas.

Data Acquisition:

All energy meters shall have the capability to be connected to a data acquisition and monitoring system which can be remotely connected to *Sustainable Building*. All data will be treated as confidential. This requirement should be included in the Mostadam Guide (credit **EI-01 Mostadam Guide**) as information for the building's residents. The data monitoring system could provide hourly, daily, weekly, monthly and annual energy consumption for each end-use and be able to compare consumption levels to previous data. The system could also be capable of alerting occupants to unusually high consumption levels.

Energy Sub-metering Strategy:

Energy sub-metering can inform operators and occupants of the systems and areas that have higher energy consumption than expected. The following should be considered to ensure a comprehensive strategy that complies with the requirements of this credit:

- The sub-metering strategy will consider all sources of energy. Any alternative sources such as on-site energy generation, liquid fuels, gaseous fuels, or waste to energy systems must be identified and considered in the strategy.
- Only building systems that are serving the residential dwelling and the related common areas are to be considered in the strategy. Building systems feeding small retail or specialty spaces should not be considered in the strategy. However, it is expected that these are metered in the case where these are connected to a common supply and not directly to the utility provider.
- Landlord areas and tenant areas must be clearly defined and relevant systems must be sub-metered separately. For example, receptacles in the corridor between dwellings should not be combined on the same sub-meter of the same end use within the tenancy area, and vice versa.
- The total energy demand required for each end-use needs to be identified in order to estimate the annual energy demand required by the project.
- Any end use / distribution board (DB) that supplies less than 10% of the total power demand does not need to be sub-metered.
- Single room (studio) and one-bedroom residential dwellings are excluded from the sub-metering requirements.

Figure E-02.1 shows how energy sub-meters are annotated in Electric Single Line Diagram drawings.

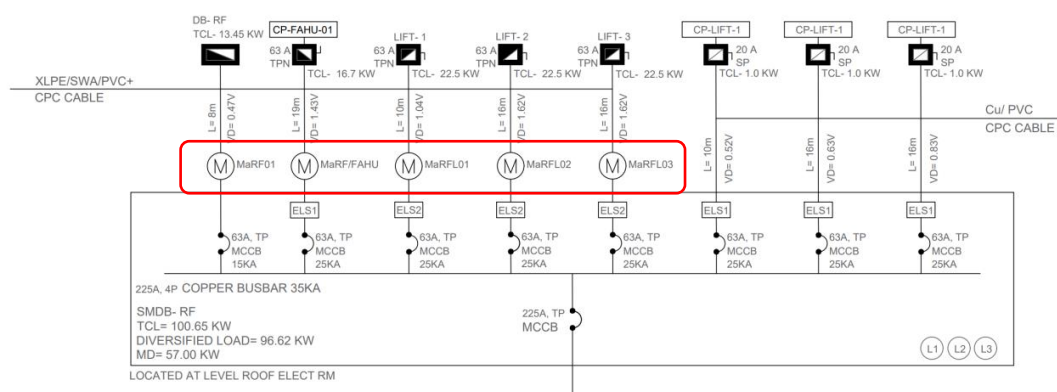


Figure E-02.1 Annotated electric single line diagram drawing

Credit Tool

N/A

Reference Documents

1. Saudi Building Code (SBC) 1001 Green Buildings, Chapter 6 Energy Conservation, Efficiency and CO_{2e} Emission Reduction
2. Saudi Building Code (SBC) 801 Fire Code
3. NFPA 70 National Electrical Code
4. CIBSE TM39 2009, Building Energy Metering

E-03 Envelope Assessment

Keystone Credit	Total Number of Points Available
Yes	3

Aim

To improve building energy efficiency, avoid accelerated building fabric deterioration and improve indoor environmental quality.

Requirements

#	Requirement	Points Available	
		Individual dwelling	Multi-residential
Keystone Requirement - achieve requirement #1 (1 credit point).			
1	A Competent Professional undertakes a basic audit of the building envelope. The audit includes water infiltration testing and identifies any recommended improvements.	1	1
2	An infra-red imaging survey is undertaken for the building envelope and recommended improvements are identified.	1	1
3	An air pressure test is undertaken for the individual dwelling or a representative sample of units in a multi-residential building. The recorded air leakage rate is less than 5m ³ /(h.m ²) at 50 pascals of pressure.	1	1
	Total	3	3

Evidence

#	Evidence per Requirement
1	- Envelope audit contract and CV of appointed Competent Professional. - Envelope audit survey including: - Results of basic audit including date-stamped photographs. - Water ingress images and documentation. - Recommendations for any improvements. - Remedial action documentation.
2	- Infra-red imaging survey contract and CV of appointed Competent Professional. - Infra-red images, conclusions and recommendations for any improvements. - Remedial action documentation.
3	- Air pressure test contract and CV of appointed Competent Professional. - Air pressure test results, conclusions and recommendations for any improvements. - Remedial action documentation.

Supporting Guidance

Air Leakage:

Air leakage occurs when there is a difference in pressure between the interior and exterior of a building combined with an air leakage path (gaps in the building envelope). The pressure differential can be caused by wind, stack effect or mechanical systems, as illustrated in Figure E-03.1.

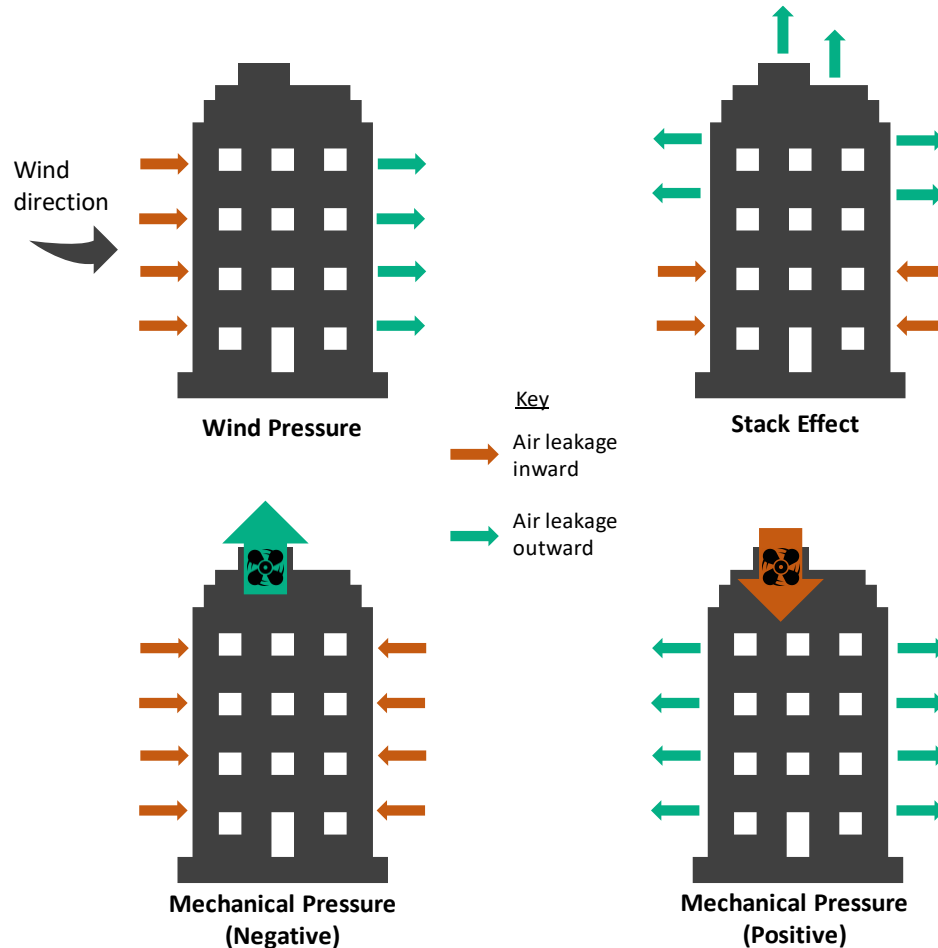


Figure E-03.1 Causes of pressure differentials in buildings

To determine the level of air leakage, an air pressure test is undertaken using a blower door. A blower door consists of a flexible panel which fits into a doorway, a calibrated fan and a pressure gauge. The fan pulls air out of the dwelling, creating a negative pressure differential between the inside and outside. This pressure difference forces air through gaps and penetrations in the building envelope. The greater the air tightness of the dwelling, the less air needs to be extracted by the blower door fan to create a change in building pressure. There are three types of blower door test (as illustrated in Figure E-03.2):

- **Compartmentalization** – the test is conducted on a single residential unit within a multi-residential building. The test results will include air leakage via the exterior envelope and also inter-unit air leakage (leakage via the surrounding individual dwellings).
- **Whole building** – the test is conducted on an individual dwelling or an entire multi-residential building. Several blower doors are used to depressurize the entire building and measure all exterior air leakage.

- Guarded blower door – the test is conducted on a single residential unit within a multi-residential building, however the surrounding residential units are also depressurized to the same level using additional blower doors. This prevents any inter-unit leakage and the test results therefore represent air leakage via the exterior envelope only.

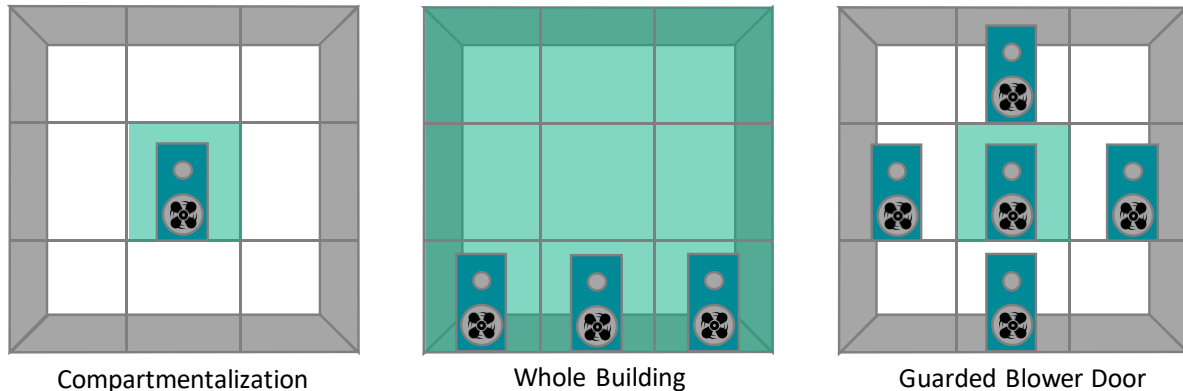


Figure E-03.2 Types of blower door test

Competent Professionals:

- Envelope audit: the Competent Professional must have at least two years of experience in undertaking similar audits and be qualified as per ISO 18436:7.
- Infra-red imaging survey: the Competent Professional must have at least two years of experience in undertaking similar services.
- Air pressure test: the Competent Professional must have at least two years of relevant experience and be qualified by an industry standard such as ATTMA or a UKAS-accredited organization.

Envelope Audit Survey:

The basic audit should be undertaken by the Competent Professional in accordance with BS EN 13187, ASTM C1060-90 or ISO 6781.

- Water Ingress Test
 - The test should be undertaken in accordance with ASTM E2128-17.
 - The water ingress test should be performed with the application of water from the outside of closed doors and windows using a hose or bucket, with any ingress of water recorded from the inside.
 - The water ingress test may show issues such as misaligned framing/hanging, missing sealing, missing or damaged rubber seals or inadequate weather stripping.
 - The test should recommend any relevant improvements and provide detailed guidance on how to implement these.
- Infra-red Imaging Survey (if undertaken)
 - The infra-red imaging should be carried out during a period of significant difference in indoor and outdoor temperature, i.e. between 12.00 and 15.00 during July and August, when the building is fully air conditioned.
 - The infrared images may show issues such as cold bridging, missing insulation, air leakage or slipped insulation.

- The survey should recommend any relevant improvements and provide detailed guidance on how to implement these.
- Air Pressure Test (if undertaken)
 - The test should be undertaken in accordance with either CIBSE TM23: Testing Buildings for Air Leakage, ISO 9972, ASTM E-779 or E-1827-96. For individual dwellings, the whole building must be tested. For multi-residential buildings, a representative sample of the units must be tested (a minimum of 10%) in addition to the landlord areas.
 - For best results, schedule the air pressure test and infra-red imaging together as the increased air pressure will magnify air movements and further highlight air leakage.
 - Consider if any significant existing faults may be covered by the Contractor's defects liability period or under building insurance.
 - The test should recommend any relevant improvements and provide detailed guidance on how to implement these.
 - Typical air leakage areas for remedial action include wall mounted AC units, sockets, window frames, door frames, piping and interwall utility connections.
 - If an individual dwelling fails the pressure test, the low and medium cost items with medium and high impact should be implemented and the building re-tested.
 - If any of the tested units in a multi-residential building fail the pressure test, the low and medium cost items with medium and high impact should be implemented (in all units) and the building re-tested.

Remedial Action Documentation (for all tests/surveys undertaken):

The remedial action documentation should be prepared by the Owner or Facility Manager and comprise:

- Checklist of Recommendations
 - Action checklist of items from the envelope audit, infra-red imaging survey and/or air pressure test, ordered based on cost/impact priority and also displayed in a Gantt chart with expected positive impact (low, medium, high) plotted against expected cost. Refer to Figure E-03.3 for an example.
 - Confirmation of which items have been implemented. At a minimum, all low and medium cost items with medium and high impact must be implemented.
- Evidence of Installation
 - Date-stamped photographs of each implemented item.
 - Receipts or documents for all installed items.
- Communication (for multi-residential buildings)
 - To avoid unnecessary exposure or inconvenience to building occupants, or disruption to the procedure, provide 72 hours warning to all building occupants of assessments which will significantly disrupt building system functionality.
 - All communication should state the time and location of the services, a large clear summary word (such as "No Access" or "Limited Function") and the FM contact.
 - The general principles, good practice and any site-specific considerations of the procedure should be communicated to all residential units at least annually.
 - All communication should be by a public notice at the building entrances and emails or physical letters to all residential units.

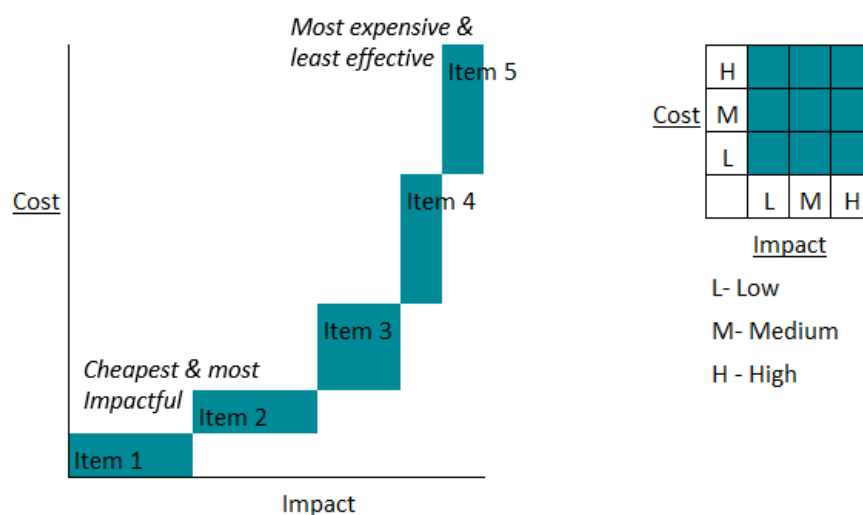


Figure E-03.3 – Example of Gantt Chart layout

Credit Tool

N/A

Reference Documents

1. ASTM E2128-17 Standard Guide for Evaluating Water Leakage of Building Walls
2. ISO 18436-7:2014 Condition Monitoring and Diagnostics of Machines, Requirements for Qualification and Assessment of Personnel, Part 7: Thermography
3. BS EN 13187:1999 Thermal Performance of Buildings, Qualitative Detection of Thermal Irregularities in Building Envelopes - Infrared Method
4. ASTM C1060-90 Standard Practice for Thermographic Inspection of Insulation Installations in Envelope Cavities of Frame Buildings, 2003
5. ISO 6781-3 Performance of Buildings - Detection of Heat, Air and Moisture Irregularities in Buildings by Infrared Methods, Part 3: Qualifications of Equipment Operators, Data Analysts and Report Writers, 2015
6. CIBSE TM23 Testing Buildings for Air Leakage, 2000
7. ISO 9972:2015 Thermal Performance of Buildings - Determination of Air Permeability of Buildings - Fan Pressurization Method
8. ASTM E779-10 Standard Test Method for Determining Air Leakage Rate by Fan Pressurization, 2018
9. ASTM E1827-11 Standard Test Methods for Determining Airtightness of Buildings Using an Orifice Blower Door, 2017

E-04 Renewable Energy

Keystone Credit	Total Number of Points Available
No	7

Aim

To encourage the use of clean renewable energy, thus reducing reliance on fossil fuels and reducing the impact on the environment due to the associated carbon emissions.

Requirements

#	Requirement	Points Available	
		Individual dwelling	Multi-residential
1	Solar Water Heating Individual dwelling: Solar hot water (SHW) panels provide a minimum percentage of the individual dwelling's overall hot water demand: 1 point: 30% of hot water demand 2 points: 50% of hot water demand Individual dwelling and multi-residential building: If the building has a swimming pool which requires heating, SHW panels are installed to provide a minimum of 50% of the pool's heating demand along with that of any associated shower facilities.	2	2
2	On-site Electricity Generation Photovoltaic (PV) panels provide a percentage of the total annual building energy demand. The number of points awarded is dependent on the percentage of energy generated by the PV panels. The renewable energy generated by the PV panels can either be used on-site or exported to the grid.	5	5
	Total	7	7

Evidence

#	Evidence per Requirement
1	- Drawings or diagrams confirming the location and number of SHW panels. - Manufacturer's technical datasheets for the SHW panels. - Date-stamped photographs of the SHW panels. - Annual hot water consumption of the building based on meter readings or estimates. - Annual solar hot water generation based on meter readings or estimates, and the resulting % of hot water demand that is provided by the SHW panels.

2	• Drawings or diagrams confirming the location and number of PV panels. • Manufacturer's technical datasheets for the PV panels. • Date-stamped photographs of the PV panels. • Annual energy consumption of the building based on meter readings. • Annual energy generation based on meter readings or estimates, and the resulting % energy demand provided by PV system.
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Supporting Guidance

Solar Water Heating:

- The percentage of the hot water demand that is provided by solar energy is calculated as follows:

$$\% \text{ hot water demand provided by SHW panels} = \frac{\text{Annual hot water generated by SHW panels}}{\text{Annual hot water demand}}$$

- For hot water within individual dwellings, all generation and consumption within the project must be included. This includes the demand from any swimming pools and associated showers.
- For hot water within multi-residential buildings, only the hot water generation and consumption related to swimming pools and associated shower facilities need to be included in the calculation.
- Associated showers refers to any non-private showers for pool users.
- If hot water generation and hot water consumption is metered and over 12 months of data has already been collected, critical inputs should be based on actual records.
- If sufficient records are not available, consumption estimates from design documentation, manufacturer's calculations or a commercially available software should be used.
- Manufacturers' technical data sheets must show that the solar water heating installation:
 - Is compliant with Chapter 14 of SBC 501 Mechanical and either UL 174 or 1453.
 - Has integrated pressure relief valves designed and set for the specific installation.
 - Includes a top-up/back-up immersion heater.

On-Site Electricity Generation:

- The percentage of the annual energy consumption that is provided by PV panels is calculated as follows:

$$\% \text{ energy consumption provided by PV panels} = \frac{\text{Annual energy generated by the PV System}}{\text{Annual energy consumption}}$$

- The annual energy consumption is determined as per the Energy Consumption Assessment for **E-01 Energy Performance**.
- The number of credit points awarded for the renewable energy generated is as per Table E-04.1 for individual dwellings and Table E-04.2 for multi-residential buildings.

Table E-04.1 Points available for percentage achieved - individual dwellings

Percentage of Annual Energy Consumption	Points Achieved
4%	1
7%	2
10%	3
15%	4
25%	5

Table E-04.2 Points available for percentage achieved - multi-residential buildings

Percentage of Annual Energy Consumption	Points Achieved
4%	1
6%	2
9%	3
12%	4
15%	5

- All electricity generation and consumption within the project must be included. This excludes thermal energy from gas or off-site chilled water from district cooling.
- If renewable energy generation and total energy consumption is metered and over 12 months of data has already been collected, critical inputs should be based on actual records.
- If sufficient records are not available, consumption estimates from design documentation or from manufacturer's calculations should be used.
- Manufacturers' technical data sheets must show that the PV system, including existing installations, complies with the Electricity and Cogeneration Regulatory Authority (ECRA) regulations, including the Small-Scale Solar PV Systems Regulations version 1 (2017).
- The calculation of electrical power generation shall include efficiencies of all equipment i.e. the power generation must be based on overall system efficiency.

Design and Installation of Renewable Energy Systems During Operation:

- Any installation during operation should be undertaken by competent and certified designers and installers.
- Installations of solar water heating shall be sized to serve no more than the maximum demand of a typical day. Solar photovoltaic installation should be designed and sized against the site's electricity baseline load.
- Designers should use commercially available simulation software, which provide more accurate calculations and result in a better system design. Some examples of such software are provided in Table E-04.3.
- System specifications should include the parameters listed in Table E-04.4.

Table E-04.3 Simulation software for solar water heating and PV panels

Solar Water Heating Software	Solar PV Software
TRNSYS	INSEL
POLYSUN solar thermal	Helios 3D
TRANSOL	SolarPro
T*SOL Pro	PVScout
GetSolar	PV-Design-PRO
	PVSyst
	PV F_Chart
	PV Sol Premium

Table E-04.4 System specification parameters for solar water heating and PV panels

Solar Water Heating	Solar PV Panels
Azimuth and inclination	
Installation structure	
Potential surrounding shadows	
Size of the panels and technical datasheets inclusive of operational coefficients	Size of the panels and datasheet information on kWp per panel
Volume of thermal storage and heat exchange methodology	Manufacturer, model and number of units
Storage type and annual thermal losses	Inverter, capacity, efficiency and losses
Overall system thermal efficiency	Overall system efficiency
Total thermal energy utilized under climatic conditions and the system's thermal losses	Electric power generated under sized climatic conditions
Percentage reduction of electrical power from the grid (or generators)	Percentage reduction of electrical power from the grid (or generators)

Maintenance:

O&M manuals for any SHW or PV systems, including the methods for cleaning the systems and how to cover the SHW panels if occupants will be away for a period of time, are to be included in the Mostadam Guide (refer to credit **EI-01 Mostadam Guide**).

Credit Tool

Energy Tool

Reference Documents

1. Saudi Building Code (SBC) 501 Mechanical, Chapter 14 Solar Systems
2. SASO IEC 62817:2018 Photovoltaic Systems
3. KACST PV Solar Reliability Laboratory

4. ECRA: Small-Scale Solar PV Systems Regulations, 2017
5. UL 174 Standard for Household Electric Storage Tank Water Heaters
6. UL 1453 Standard for Electric Booster and Commercial Storage Tank Water Heaters

E-05 Energy Efficient Appliances

Keystone Credit	Total Number of Points Available
No	2

Aim

To reduce a building's energy consumption through the use of energy efficient appliances.

Requirements

#	Requirement	Points Available	
		Individual dwelling	Multi-residential
1	For those electrical appliances purchased by the building Owner/Facility Manager: The electrical appliances have an Energy Efficiency Label from the Saudi Standards, Metrology and Quality Organization (SASO) with a minimum rating of B. For those appliance categories not currently covered by SASO, the appliances are Energy Star certified. A policy is created and implemented for the future replacement of appliances and included in the Sustainable Procurement Policy (PMM-04 Sustainable Procurement). For those electrical appliances purchased by the tenant: Information is provided to the tenant on the energy efficiency labelling scheme of SASO and the Energy Star scheme and their benefits, with the recommendation that all appliances have a SASO Energy Efficiency Label rating of B or are Energy Star certified. This should form part of the Mostadam Guide (credit EI-01 Mostadam Guide).	2	2
	Total	2	2

Evidence

#	Evidence per Requirement
1	For those electrical appliances purchased by the building Owner/Facility Manager: - List of the appliances in each dwelling/residential unit and the manufacturer, model and type of energy certification for each one. - Manufacturer's literature for each appliance confirming the energy efficiency rating. - Date-stamped photographs or purchase orders/receipts for each appliance. - Purchasing policy for appliances, to be included in the Sustainable Procurement Policy (PMM-04 Sustainable Procurement). For those electrical appliances purchased by the tenant: - Mostadam Guide with relevant section highlighted (refer to credit EI-01 Mostadam

	Guide).
--	---------

Supporting Guidance

The following appliance categories are covered by this credit:

- Refrigerators
- Freezers
- Washing machines
- Tumble dryers
- Dishwashers
- Water coolers
- Televisions

If an appliance category is covered by SASO's Energy Efficiency Label regulation, all appliances in that category must have a SASO Energy Efficiency Label with a minimum rating of B. If an appliance category is not covered by SASO's Energy Efficiency Label regulation, all appliances in that category must be Energy Star certified.

SASO Energy Efficiency Label:

The Energy Efficiency Label is an awareness label granted by SASO that provides consumers with the ability to make comparisons of electrical appliances according to their energy efficiency. This is expressed by letters A to G, with A being the most energy efficient and G the least. The Energy Efficiency Label also includes product information such as the type of device, model and brand, electric energy consumption and test standard. An example of the label is shown in Figure E-05.1.

محافظة كفاءة الطاقة
ENERGY EFFICIENCY LABEL

FREEZER | المجمدة

أ
ب
ج
د
هـ
و
ز

سعة التجميد
CAPACITY OF FREEZER
LITERS | لتر
(Cubic Feet) | (قدم مكعب)

سعة التبريد
CAPACITY OF REFRIGERATION
NOT APPLICABLE

الاستهلاك السنوي للطاقة
ANNUAL ENERGY CONSUMPTION
kWh | كيلووات ساعة

مصدر المنتج | BRAND NAME | المودل التجارية

رقم المودل | MODEL NUMBER | رقم المودل

معايير الاختبار | TEST STANDARD | رقم المعايير الدولية

إزالة أو تغطية أو العبث بهذه البطاقة قبل البيع يجعلك عرضة للمسؤولية النظامية
Removing, covering or altering this label before sale can subject you to legal liability

Figure E-05.1 SASO Energy Efficiency Label

Energy Star:

If the appliance is not covered by SASO's Energy Efficiency Label, the appliance must be Energy Star certified. Energy Star is a voluntary energy efficiency scheme run by the US Environmental Protection Agency. All Energy Star products meet the minimum energy efficiency requirements set by Energy Star. There are no rating levels in the Energy Star certification system. Therefore, to find out how Energy Star products compare to each other in terms of energy efficiency and their annual energy consumption, refer to www.energystar.gov or consult appliance details. All Energy Star certified products will have a sticker indicating that they meet the Energy Star requirements.

Purchasing Policy for Appliances:

The purchasing policy for appliances should contain the following information:

- List of all appliance types covered by the policy (i.e. all the appliance types covered by this credit, as a minimum)
- Minimum energy efficiency requirements for each appliance:
 - For all appliances covered by SASO's Energy Efficiency Label regulation, a minimum rating of B.
 - For all other appliances, Energy Star certified.
- Template for the individual responsible for purchasing appliances (Owner or Facility Manager) to document all relevant appliance purchases in a table containing the following information:
 - Appliance type
 - Manufacturer
 - Model
 - Type of energy certification and rating level
 - Supplier
 - Purchase order/receipt
 - Location of appliance within the building

The purchasing policy for appliances should be included in the Sustainable Procurement Policy (**PMM-04 Sustainable Procurement**).

Credit Tool

N/A

Reference Documents

1. Saudi Standards, Metrology and Quality Organization (SASO) Energy Efficiency Label:
 - i. SASO 2892: 2018 for Refrigerators and Freezers
 - ii. SASO 2885: 2018 for Washing Machines
 - iii. SASO 2883: 2018 for Clothes Dryers
2. Energy Star, <https://www.energystar.gov/>

E-06 Ozone Impact

Keystone Credit	Total Number of Points Available
No	1

Aim

To ensure refrigerants, fire suppression systems and maintenance gases have an Ozone Depletion Potential (ODP) of zero.

Requirements

#	Requirement	Points Available	
		Individual dwelling	Multi-residential
1	A policy is created and implemented for the future replacement of refrigerants, fire suppression system gases and maintenance gases, to be included in the Sustainable Procurement Policy (PMM-04 Sustainable Procurement).	1	1
2	A procedure is developed for refrigerant and fire suppression system maintenance, to be included in the Sustainable Maintenance Procedure (PMM-03 Sustainable Maintenance and Servicing). Information is included in the Mostadam Guide (credit EI-01 Mostadam Guide) to advise residents on the replacement and maintenance of AC refrigerants.		
	Total	1	1

Evidence

#	Evidence per Requirement
1	Purchasing policy for refrigerants, fire suppression system gases and maintenance gases, to be included in the Sustainable Procurement Policy (PMM-04 Sustainable Procurement).
2	- Maintenance procedure for refrigerants and fire suppression systems, to be included in the Sustainable Maintenance Procedure (PMM-03 Sustainable Maintenance and Servicing). - Mostadam Guide with relevant section highlighted (credit EI-01 Mostadam Guide).

Supporting Guidance

Purchasing Policy for Refrigerants, Fire Suppression System Gases and Maintenance Gases:

The purchasing policy should contain the following information:

- List of all systems present in the building that are covered by the policy and their location.
- Minimum requirements for the purchasing of refrigerants, fire suppression system gases and maintenance gases:

- All refrigerants must comply with the list of acceptable and unacceptable refrigerants published by the US Environmental Protection Agency (EPA) under the Significant New Alternatives Policy (SNAP) evaluation criteria (Table E-06.1).
- All gases used in fire suppression systems and for maintenance purposes must have an ODP of zero. Table E-06.2 table lists acceptable and unacceptable gases.
- The use of CFCs or halon-based materials is prohibited.
- Template for the individual responsible for purchasing refrigerants, fire suppression system gases and maintenance gases (Owner or Facility Manager) to document all relevant purchases in a table containing the following information:
 - System for which the refrigerant or gas is being purchased.
 - Name of refrigerant or gas.
 - ODP of refrigerant and confirmation of whether it complies with the SNAP criteria.
 - ODP of fire suppression system gas or maintenance gas.
 - Supplier.
 - Purchase order/receipt.
 - Location within the building.

The purchasing policy should be included in the Sustainable Procurement Policy (**PMM-04 Sustainable Procurement**).

Maintenance Procedure for Refrigerants and Fire Suppression Systems:

The maintenance procedure should contain the following information:

- Strategy for phasing out any existing refrigerants that do not comply with the US Environmental Protection Agency (EPA) under the Significant New Alternatives Policy (SNAP) evaluation criteria, or that are only acceptable until a specified year (Table E-06.1).
- Strategy for phasing out any unacceptable fire suppression system gases and maintenance gases. Table E-06.2 table lists acceptable and unacceptable gases.
- During the maintenance of the refrigerant systems:
 - Prohibit venting and/or direct discharging of any refrigerant equipment at all times.
 - All refrigerants should be recovered, recycled or reused.

The maintenance procedure should be included in the Sustainable Maintenance Procedure (**PMM-03 Sustainable Maintenance and Servicing**).

Table E-06.1 Acceptable and unacceptable refrigerants

Refrigerant	ODP	Building Application	Status
Chlorofluorocarbons			
CFC-12	1	Refrigerators and chillers	Not acceptable
Hydrochlorofluorocarbons (HCFC)			
HCFC-22/R-22	0.055	Air-conditioners and chillers	Not acceptable
HCFC-123	0.02	CFC-11 replacement	Acceptable until 2020
Hydrofluorocarbons (HFC)			

HFC-134a	0	CFC-12 and HCFC-22 replacement	Acceptable until 2021
HFC-152a	0	Refrigeration	Acceptable
HFC-245fa	0	Insulating agent, centrifugal chillers	Acceptable until 2024
HFC-407c	0	HCFC-22 replacement	Acceptable until 2024
HFC-410a	0	Air conditioning	Acceptable until 2024
HFC-417a	0	HCFC-22 replacement	Acceptable until 2024
HFC-427a	0	HCFC-22 replacement	Acceptable
HFC-450a	0	HFC-134a replacement	Acceptable
Natural Refrigerants			
Carbon Dioxide (CO ₂)	0	Refrigeration	Acceptable
Ammonia (NH ₃)	0	Refrigeration	Acceptable
Propane (C ₃ H ₈)	0	Air conditioning	Acceptable
Isobutene	0	Refrigeration	Acceptable
Air	0	Refrigeration	Acceptable
Water	0	Refrigeration	Acceptable

Table E-06.2 Acceptable and unacceptable fire suppression system gases and maintenance gases

Fire Suppression System and Maintenance Gases	
Acceptable	Unacceptable
Inergen/ IG-541	Halon 1211
FM200/ HFC-227ea	Halon 1301
Novec 1230	HBFC-22B1/FM-100
ATK OS-10	HCFC-22/R-22
Carbon Dioxide	HFC-32
Firebane® 1179	CFC-11
HFC-125/FE 25	HFC-123
IG -01, 55, 100	
N2 Towers® System	
PhostrEx	

Credit Tool

N/A

Reference Documents

1. Montreal Protocol - Kigali Amendment
2. US EPA Significant New Alternatives Policy (SNAP), <https://www.epa.gov/snap>

E-07 Demand Response Capability

Keystone Credit	Total Number of Points Available
No	2

Aim

To support reducing the need for new electricity power supplies, at national generation and transmission level, by reducing domestic electricity consumption during periods when the demand on the national power network is at its highest.

Requirements

#	Requirement	Points Available	
		Individual dwelling	Multi-residential
1	A Demand Response Capability Plan is developed which includes recommendations on the electricity loads that can be reduced during national power grid peak demand season by: - Modifying consumption from various end-use systems. - Rescheduling housekeeping and operational activities. - Providing electricity through solar renewable energy supplies. The recommendations of the Demand Response Capability Plan are implemented for at least two months and the total electricity savings achieved during this period are estimated.	1	1
2	A smart meter is utilized (refer to credit PMM-05 Building Performance Monitoring) to prove that the peak demand (kW) and hourly electricity consumption (kWh) during national power grid peak demand season is less than readings during the rest of the day for the months of June, July, August and September.	1	1
	Total	2	2

Evidence

#	Evidence per Requirement
1	- Demand Response Capability Plan written by an Electrical Engineer with the input and approval of the measures by the building occupants. The Plan must include: - List of the electricity loads within the building and their typical power consumption during an hour and their potential peak demand. - List of the electricity loads whose consumption can be modified or rescheduled. - Performance requirements (e.g. a schedule of temperature set-points) for the various systems. - Summary of the potential installation of a solar photovoltaic system (refer to credit E-04 Renewable Energy) and the projected energy savings and financial benefits. - Findings of two audits during the months of June, July, August and September, including

	date-stamped photographs and the auditor's confirmation that all the agreed demand reduction measures listed in the Plan are fully implemented between 9.00 and 17.00.
2	• Data sheet of the installed smart meter(s) confirming the installed smart metering device can provide hourly demand (in kWh) and peak demand (in kW) with the ability to store data for at least one week. • Outputs from the smart metering devices and energy monitoring systems confirming that the peak electricity consumption during national power grid peak demand season is less than the peak demand during the rest of the day.

Supporting Guidance

Power utilization, from source to end-use, is most efficient under the specific generator's and electrical power transmission's conditions. The most efficient overall power grid operational point is, in many cases, well below the maximum demand that can be serviced by the generators and the transmission grid. During peak demand, the power generation and electrical power transmission system may provide electricity in a less efficient way when considering the overall end-user power consumption against the overall fuel input used at the source of generation.

In KSA the power demand between 09.00 and 17.00 is significantly higher for the months of June, July, August and September when the hourly demand is compared against annual trends. Peak demand characteristics include spikes in power usage, which are the effects of turning on all the lights at the same time or starting many domestic appliances at the same time. Information on national power grid peak demand trends is provided within Chapter 4 – Baseline Analysis of "Electricity & Co-generation Regulatory Authority (2011), Bring Demand-Side Management to the Kingdom of Saudi Arabia" report. More examples are also available within "Electricity & Co-generation Regulatory Authority (2010), Annual Statistical Booklet on Electricity Industry".

The Owners and occupants can support the energy efficiency optimization of, and the reduction of future investments in, power generation by consuming electricity during hours of lower national demand by implementing the following strategies:

- Modifying consumption from various end-use systems during national power grid peak demand season:
 - Set thermostats to 26°C when rooms and dwellings/residential units are not occupied.
 - Switch off fresh air ventilation during the daytime when the dwelling/residential units are not occupied.
 - Switch-off lights and make maximum use of daylighting.
 - Install a timer on swimming pool equipment to operate outside of the above referenced hours.
- Rescheduling housekeeping and operational activities within national power grid peak demand season:
 - Schedule dishwashing equipment to operate outside the period 09.00 to 17.00.
 - Schedule laundry and drying equipment to operate outside the period 09.00 to 17.00.
 - Schedule charging of the batteries of electric cars outside the period 09.00 to 17.00.
- Providing electricity by solar renewable energy:
 - Install a solar photovoltaic system which generates electricity during the daytime taking into consideration the baseline electricity power demand of the building.

Credit Tool

N/A

Reference Documents

1. Annual Statistical Booklet on Electricity Industry, Electricity & Cogeneration Regulatory Authority, 2010
2. Bringing Demand-Side Management to the Kingdom of Saudi Arabia, Electricity & Co-generation Regulatory Authority, 2011

Water

6 Water

The per capita demand for water has increased approximately 15% in the past 5 years³ and the upward trend is expected to continue. Water is a precious resource in KSA and Vision 2030 promotes the optimal use of water resources by establishing policies and infrastructure that reduce the consumption of potable water and increase the use of treated and renewable water.

Mostadam also rewards projects that demonstrate a sustained reduction in water consumption when the building is in operation. This reduction can be achieved through efficient products and systems as well as the use of alternative water sources. Project are also rewarded for monitoring and analyzing their consumption as the first step to understanding their building's water consumption patterns.

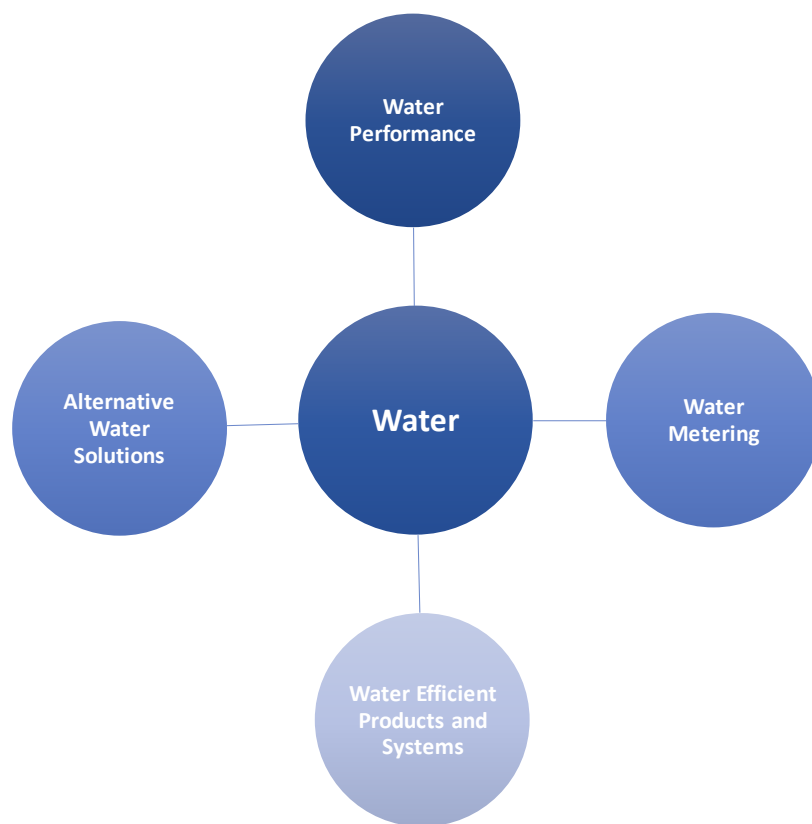


Figure 10 Water credits

³ Statistical Yearbook of 2016, General Authority for Statistics

W-01 Water Performance

Keystone Credit	Total Number of Points Available
Yes	12

Aim

To reduce indoor and outdoor water consumption and reduce the load on wastewater systems.

Requirements

#	Requirement	Points Available	
		Individual dwelling	Multi-residential
Keystone Requirement - achieve requirement #1 (4 credit points).			
Indoor Water Consumption			
1	The indoor water consumption is at least 10% less than the baseline.	4	4
2	The indoor water consumption is further reduced compared to the baseline. The number of points awarded is dependent on the percentage improvement over the baseline.	4	4
Outdoor Water Consumption			
3	The water consumption of the irrigation system is reduced compared to the midsummer baseline. The number of points awarded is dependent on the percentage improvement over the baseline.	4	4
	Total	12	12

Evidence

#	Evidence per Requirement
1 & 2	- Measurements of the actual flowrates of all installed fixtures. - Manufacturers' data sheets for all installed appliances, indicating the water consumption per cycle. - Date-stamped photographs of the fixtures and appliances. - Water Tool.
3	- Irrigation plan showing planted areas, irrigation zones and their water requirements, and the location of smart controllers and/or soil moisture sensors. - Manufacturers' data sheets for the irrigation system including the smart controllers and/or soil moisture sensors. - Date-stamped photographs of the irrigation system. - Water Tool.

Supporting Guidance

Indoor Water Consumption:

The number of credit points achieved is dependent on the percentage reduction of indoor water consumption compared to the baseline (Table W-01.1).

Table W-01.1 Points available for percentage reduction achieved

Percentage Reduction	Points Achieved
10%	4
20%	5
30%	6
40%	7
50%	8

The baseline water consumption criteria are based on the maximum flow rates in Table W-01.2.

Table W-01.2 Maximum flow rate or volume for each water fixture and appliance

Fixture	Maximum Flow Rate/Volume
Kitchen faucet	6.84 lpm at 414 KPa
Lavatory faucet	5.7 lpm at 414 KPa
Water closet – tank type	4.86 lpf Watersense labeled
Water closet – flushometer type	4.86 lpf
Showerhead / hand-held spray	7.6 lpm at 552 KPa Watersense labeled
Drinking fountain (manual)	2.66 lpm
Washing machine	125.9 lpc
Dishwasher	24 lpc

lpm: liters per minute, **lpf:** liters per flush, **lpc:** liters per cycle

The water use of faucets, showerheads, hand-held sprays and drinking fountains is measured using flowrate, which is the amount of water used in one minute with the units of liters per minute (lpm). The water use of water closets is measured in flushrates, which is the amount of water used per flush, with the units of liters per flush (lpf). The water use of washing machines and dishwashers is measured in liters per cycle (lpc). The water use can be found in the product specifications. For lavatory and kitchen faucets, the flowing pressure is set at 414KPa as this is the most common water pressure in most households.

The Water Tool must be filled in with the actual measured flow rates of the installed fixtures, and the water use of the installed appliances based on manufacturers' datasheets. The Water Tool will calculate the percentage improvement over the baseline and determine the resulting number of points achieved.

Measuring Flowrate:

- The actual flowrate of faucets, shower heads and/or drinking fountains can be measured using a timer and a container. Record the amount of time (in seconds) it takes to fill a container of known volume such as a measuring jug or bucket (the larger the container the better). Take an average of at least 3 readings per fixture type. The flowrate is then calculated as follows:

$$\text{Flowrate (lpm)} = \frac{\text{Capacity of container (liters)}}{\text{Time taken to fill container (seconds)}} \times 60$$

- The actual flush rate (liters per flush) of water closets can be measured using a bucket flow test. Make a temporary mark at the cistern water level. Empty the flush volume from the cistern by activating a flush while keeping the ball valve in the raised position to avoid refill water from entering. Use a container(s) of known volume to fill the cistern up to the water mark and record the volume - this value is the flush rate. Take an average of at least 3 tests per water closet type.
- If the Water Tool shows that the Keystone requirement of 10% improvement is not achieved, fixtures, fittings and/or appliances should be replaced with low-flow equivalents to achieve the minimum of 10% improvement over the baseline.

Outdoor Water Consumption:

The number of credit points achieved is dependent on the percentage reduction of outdoor water consumption compared to the midsummer baseline (Table W-01.3).

Table W-01.3 Points available for percentage reduction achieved

Percentage Reduction	Points Achieved
50%	1
60%	2
70%	3
80%	4

The Water Tool must be filled in with details of the landscaping and the irrigation type. The Water Tool will calculate the percentage improvement over the baseline and determine the resulting number of points achieved.

Credit Tool

Water Tool

Reference Documents

1. Saudi Building Code (SBC) 1001 Green Buildings, Chapter 7 Water Resource, Conservation, Quality and Efficiency
2. Saudi Building Code (SBC) 701 Sanitary Code - Plumbing
3. WaterSense Irrigation Program, <https://www.epa.gov/watersense>

W-02 Water Metering

Keystone Credit	Total Number of Points Available
Yes	2

Aim

To utilize water meters for monitoring internal and external water use, and to use the data to encourage effective management of consumption levels.

Requirements

#	Requirement	Points Available	
		Individual dwelling	Multi-residential
Keystone Requirement - achieve requirement #1 (1 credit point).			
1	Water meters are present to facilitate the monitoring and recording of water consumption, as detailed in the Supporting Guidance.	1	1
2	Water sub-meters are provided for particular end-uses, as detailed in the Supporting Guidance.	1	1
	Total	2	2

Evidence

#	Evidence per Requirement
1 & 2	- Single line schematic showing the type and location of all water meters. - Manufacturer's specifications/data for the installed water meters along with date-stamped photographs. - Mostadam Guide (refer to credit EI-01 Mostadam Guide) section on water metering providing user support and understanding of the level of sub-metering installed, including remote access abilities and guidance on how to utilize the data to reduce consumption.

Supporting Guidance

All meters and sub-meters must:

- Be within a sealed location.
- Have a system that adequately seals the top cover, body joint and calibration ports.
- Measure cold water flow in one direction only.
- Have a pulsed output.
- Have clear readings of liters and m³.
- Have available data ports for connection to a smart monitoring device.
- Not have any functionality for manually changing the readings.
- Be clearly labelled and easily accessible with no special requirements needed to review the consumption.

Water Metering:

- Individual dwellings: a water meter must be installed per dwelling.
- Multi-residential buildings: a water meter must be installed for each residential unit and for the landlord areas.

Water Sub-Metering:

Table W-02.1 defines the sub-metering requirements for individual dwellings and multi-residential buildings.

Table W-02.1 Water sub-metering requirements

Building End Use	Individual Dwelling	Multi-Residential	
		Landlord Areas	Tenant Areas
Internal water usage ¹	✓	✓	✓
External water usage ²	✓	✓	
Swimming pool (if present)	✓	✓	

¹ Examples of internal water usage in landlord areas include public showers and toilets for the gym or swimming pool, or guard's toilet. In this situation, only a single meter is required for all uses, separate sub-metering is not required.

² External water usage refers to all water consumed outside the building envelope. This includes any water usage on the roof (e.g. water bib taps to clean HVAC equipment) or in landscaped areas. Examples of external water usage in landlord areas include fountains and water bib taps near the garage or on the roof.

Data Acquisition:

All water meters shall have the capability to be connected to a data acquisition and monitoring system which can be remotely connected to *Sustainable Building*. All data will be treated as confidential. This requirement should be included in the Mostadam Guide (credit **EI-01 Mostadam Guide**) as information for the building's residents. The data monitoring system could provide hourly, daily, weekly, monthly and annual water consumption for each end-use and have logging capabilities for comparison of consumption levels to previous data. The system could also be capable of alerting occupants to unusually high consumption levels.

Credit Tool

N/A

Reference Documents

1. Saudi Building Code (SBC) 1001 Green Buildings, Chapter 7 Water Resource, Conservation, Quality and Efficiency

W-03 Water Efficient Products and Systems

Keystone Credit	Total Number of Points Available
No	5

Aim

To minimize environmental impact of water consumption via demand reduction, well maintained systems and efficient use.

Requirements

#	Requirement	Points Available	
		Individual dwelling	Multi-residential
1	The requirement for future purchases of indoor water fixtures to exceed the performance criteria (refer to Supporting Guidance) is included in the Sustainable Procurement Policy (PMM-04 Sustainable Procurement).	1	1
2	No sprinklers are used within the property and any irrigation is by a drip system.	1	1
3	The irrigation system is controlled by smart controllers and/or soil moisture sensors.	1	1
4	There are no turfed areas or outdoor water features within the project boundary.	1	1
5	Leak detection is undertaken for key elements.	1	1
	Total	5	5

Evidence

#	Evidence per Requirement
1	- Extract from the Sustainable Procurement Policy (refer to PMM-04 Sustainable Procurement) confirming that future procurement will exceed the minimum performance criteria for indoor water fixtures. - Extract from Record Log (refer to PMM-04 Sustainable Procurement) showing compliance documentation for any purchases made during the monitoring period. If no purchases have been made, this must be confirmed in writing.
2	- Irrigation drawing/plan showing planted areas and the irrigation type. - Manufacturers' datasheet for the irrigation system. - Date-stamped photographs of the irrigation system.
3	- Irrigation drawing/plan showing planted areas, irrigation zones and their water requirements, and the location of smart controllers and/or soil moisture sensors. - Manufacturers' datasheet for the irrigation system including the smart controllers and/or soil moisture sensors.

	• Date-stamped photographs of the irrigation system. • Short report of functionality, recording smart controllers operating as per the programming and sensors responding to the introduction of water.
4	• Date-stamped photographs confirming that no turf or outdoor water features are present.
5	Individual Dwelling: • Records of leak detection via water monitoring. • Commitment letter signed by the Owner confirming that leak detection via water monitoring will be undertaken every 3 months. Multi-Residential Building: • Leak Detection Systems Report including: ○ Explanation of the choice of leak detection system. ○ Evidence of the installation and functionality of the leak detection system (BMS screengrabs and/or water sensor alarm functionality confirmation, system drawings and manufacturer's data sheets, methodology followed if the leak detection analysis was based on an alternative methodology). ○ Record of results from the leak detection system. ○ Details of rectification measures in response to detected leaks (if any).

Supporting Guidance

Indoor Water Fixtures:

All future purchases of indoor water fixtures must improve upon the values in Table W-03.1 by at least 10%. This requirement must be included in the Sustainable Procurement Policy.

Table W-03.1 Flow rate or volume for each water fixture and appliance

Fixture	Maximum Flow Rate or Volume
Kitchen faucet	6.84 lpm at 414 KPa
Lavatory faucet	5.7 lpm at 414 KPa
Water closet – tank type	4.86 lpf Watersense labeled
Water closet – flushometer type	4.86 lpf
Showerhead / hand-held spray	7.6 lpm at 552 KPa Watersense labeled
Drinking fountain (manual)	2.66 lpm
Washing machine	125.9 lpc
Dishwasher	24 lpc

lpm: liters per minute, **lpf:** liters per flush, **lpc:** liters per cycle

Irrigation System:

- Turf refers to both accessible and inaccessible grass areas.
- Outdoor water features refer to both decorative and functional water devices. These may include fountains, ornate waterfalls, decorative falaj channels and pools (unless naturally spring fed), paddling pools and swimming pools.

- The date-stamped photographs should be numbered and the viewpoint included within the diagram. Sufficient images should be provided to cover all outdoor areas. Refer to Figure W-03.1.

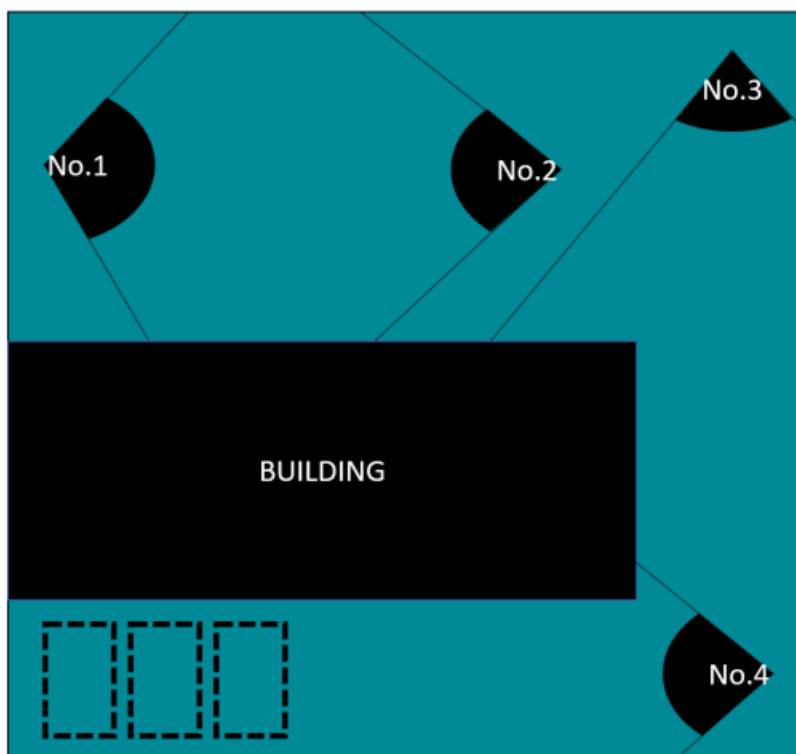


Figure W-03.1 Example of photograph view-points diagram

Leak Detection (Individual Dwelling):

- Identify the building's water meter(s) and become familiar with the meter output to be able to identify the smallest units of water consumption.
- During a planned period of no consumption, record the meter readings every 15 minutes over a 1-hour period to identify any baseline leaks. Common leaks can be from running toilets, dripping taps, water tanks, swimming pools and irrigation systems.
- Check the main water supply line by turning off the main supply within the house and recording any consumption. Guidance of how to record the tests for the first monitoring cycle is provided below. Undertake additional monitoring cycles and leak identification and fixing as needed. Other methods of leak detection are acceptable provided they offer an equivalent or improved level of leak detection.

Date of Test	
Name of Tester	
Contact Number of Tester	
Role (tenant/Owner/other)	

Period	Time	Water Reading	Difference from previous (if any)
Start			N/A
At 15 minutes			
At 30 minutes			
At 45 minutes			
At 60 minutes			

If differences are detected, describe actions undertaken to identify and fix leak

Figure W-03.2 Example of leak detection method

Leak Detection (Multi-Residential Building):

- Identify the building's key water system elements which require leak detection. These may include non-consuming elements and often inaccessible areas such as main water supply lines, conduit spaces and water tanks. These may also include non-private water consuming systems such as ablution facilities, toilet facilities, irrigation systems and swimming pools. All systems present should be monitored.
- Consider which is the most appropriate form of leak detection from a financial and risk management point of view. Leak detection and monitoring can be in the form of direct sensors or via flow monitoring. Other methods of leak detection are acceptable provided they offer an equivalent or improved level of leak detection.
- Direct sensors will measure for moisture/water at key locations including the floor of vertical risers and underneath storage tanks.
- Flow monitoring requires BMS-connected meters to measure for consumption differences or continuous baseline consumption between two meters. For non-consuming elements this needs to be before and after the key water system e.g. for water tanks this would be at the feed-in and outlet pipes. For consuming systems, the meter will be strategically located to capture consumption e.g. toilet facilities will have a single meter. The BMS must be programed to monitor for any consumption outside of set parameters. For non-consuming elements such as water tanks, this would be zero. For consuming systems this would be a constant baseline consumption.
- A system for alarm notification must be provided. For sensors this can be an audio-alarm or BMS alert. For flow monitoring this can be via BMS alerts.
- The leak detection system should be checked quarterly and the Leak Detection Systems Report updated.

Credit Tool

N/A

Reference Documents

1. Saudi Building Code (SBC) 1001 Green Buildings, Chapter 7 Water Resource, Conservation, Quality and Efficiency
2. Saudi Building Code (SBC) 701 Sanitary Code - Plumbing

W-04 Alternative Water Solutions

Keystone Credit	Total Number of Points Available
No	3

Aim

To reduce dependence on potable water by utilizing innovative water conservation solutions.

Requirements

#	Requirement	Points Available	
		Individual dwelling	Multi-residential
1	Air Conditioning Water Condensate Air conditioning water condensate from the following AC systems is recovered and reused on-site for WC flushing or irrigation: - Indoor units (for individual dwellings) - Fresh Air Handling Units (for multi-residential buildings)	1	1
2	Graywater Recycling Graywater from showers, sinks, washing machines and dishwashers is collected, recycled and used on-site for WC flushing or irrigation.	1	1
3	Treated Wastewater At least 50% of wastewater is treated on-site and infiltrated or used on-site for irrigation.	1	1
	Total	3	3

Evidence

#	Evidence per Requirement
1	- Water Tool. - System schematics confirming the end-destination of the recovered condensate (i.e. irrigation tank or water tank for WC flushing). - Confirmation of the amount of water condensate recovered from the AC units.
2	- Water Tool. - System schematics confirming the collection, treatment and usage of graywater. - Manufacturer's data for the graywater treatment system. - Water balance calculations confirming the amount of graywater recovered.
3	- Water Tool. - System schematics confirming the collection, treatment and usage of wastewater. - Manufacturer's data for the wastewater treatment system. - Water balance calculations confirming the volume of wastewater from the project.

Supporting Guidance

The amount of recycled water generated should be entered in the Water Tool. The Water Tool will incorporate this data into the calculation of the percentage reduction in water consumption for **W-01 Water Performance**.

Air Conditioning and Cooling Coil Water Condensate:

Condensation occurs when the evaporative coil in the air conditioning unit cools down the warm air blown over it and moisture is formed on the coil. This is similar to how water droplets form on a cold water bottle kept outside on a hot day. In hot and humid weather, an air conditioner may produce up to 75 litres of water per day. This water is typically piped to the floor drain / sewage system. However, air conditioning condensate water is of good quality and ideal for WC flushing and irrigation. AC condensate water is not safe for human consumption.

The system should capture condensate from all air conditioning units in the building and transfer the water to the relevant end-use.

Graywater Recycling:

Graywater is wastewater from showers, sinks, washing machines, dishwashers etc. It can be collected and treated to be used on-site for WC flushing and/or irrigation (Figure W-04.1).

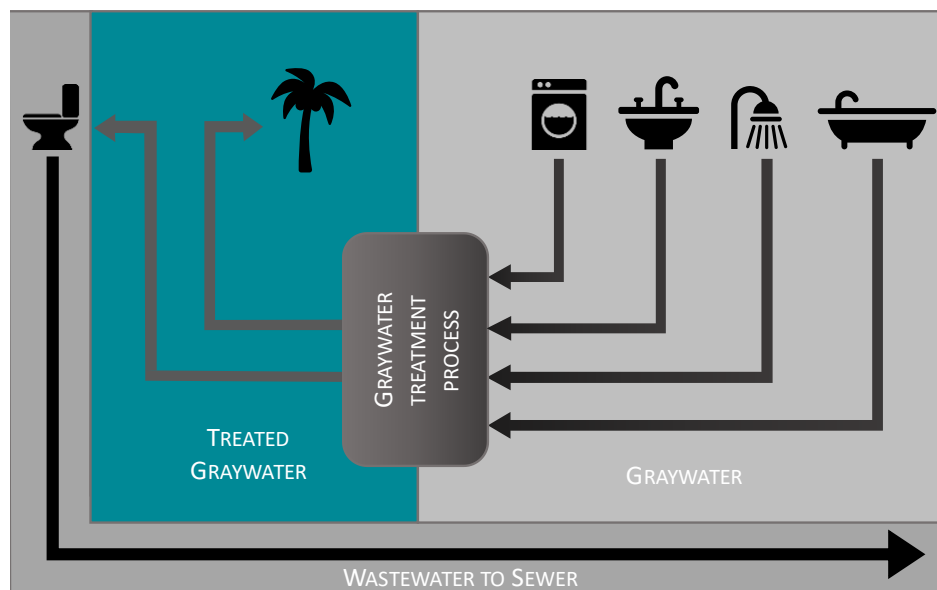


Figure W-04.1 Graywater recycling schematic

When utilizing a graywater recycling system, it is important to consider the following:

- **System should not store graywater for more than 24hrs**
Any nutrients in the graywater will break down if the graywater is stored for long periods of time and this can create bad odors.
- **Contact with graywater should be minimized**

The system network should soak graywater into the ground and away from any human contact or water outlets that are for domestic use.

- **Flushing and irrigation demand**

If the amount of recycled graywater is not sufficient to meet the flushing and irrigation demand, an additional supply of potable water must be available. If the network is mixed, the potable water must be separated from the graywater to prevent contamination and human contact.

Treated Wastewater:

Wastewater can undergo three levels of treatment:

1. Primary treatment, which includes screens to remove solids, sedimentation, and grit.
2. Secondary treatment, which includes the removal of carbonaceous organic matters, nutrients and separation of biomass from liquid.
3. Tertiary treatment, which includes a filtering and disinfecting process that improves the water quality before it is recycled or infiltrated.

If credit requirement #3 is targeted, i.e. wastewater is treated on-site and infiltrated or used for irrigation, the wastewater must undergo tertiary treatment. Tertiary treatment is the highest form of wastewater treatment and includes the removal of organics, solids, and nutrients such as phosphorus and nitrogen, as well as biological or chemical polishing, generally to effluent limits of:

- Biological oxygen demand (BOD) of 10 mg/L
- Total suspended solids (TSS) of 10 mg/L

Credit Tool

Water Tool

Reference Documents

1. US Environmental Protection Agency (USEPA) Onsite Wastewater Treatment Systems Manuals

Health and Comfort

7 Health and Comfort

Vision 2030 aims to create and maintain a vibrant society in which citizens live fulfilling lives. The built environment has profound effects on human health, and homes can be powerful promoters of health, comfort and well-being. For example, comfort can include thermal comfort, visual comfort and indoor air quality, and achieving these will have the added benefit of promoting physical and mental health.

Health and Comfort provides a number of mechanisms through which the goals and objectives of Vision 2030 are supported. These include the promotion of good indoor air quality through ventilation and the use of non-polluting materials to ensure occupant health, wellbeing and overall satisfaction with their surroundings. Moreover, this category aims to push the boundaries of physical accessibility through innovative and ingenious design strategies to foster inclusivity in its approach. Another aspect of this category is the provision of cooler outdoor environments where projects are rewarded based on their strategies of developing an outdoor setting that is comfortable for residents throughout the year.



Figure 11 Health and Comfort credits

HC-01 Outdoor Thermal Comfort

Keystone Credit	Total Number of Points Available
Yes	2

Aim

To improve outdoor thermal comfort and encourage more active lifestyles.

Requirements

#	Requirement	Points Available	
		Individual dwelling	Multi-residential
1	A minimum of 50% shading cover is provided to the following where they exist within the plot: • Front entrances, patios and courtyards • Hard-standing amenity spaces (including balconies and roof amenity spaces and excluding pedestrian walkways and playgrounds)	2	2
	A minimum of 75% shading cover is provided to the following where they exist within the plot: • Pedestrian walkways • Playgrounds • Car and bicycle parking		
	Total	2	2

Evidence

#	Evidence per Requirement
1	• List of all applicable areas within the plot and corresponding date-stamped photographs of the shading device (tree, shade structure etc.). • Measurements, calculations and date-stamped photographs taken on the appropriate days and times demonstrating that the minimum shading cover is achieved.

Supporting Guidance

- Shading measurements and date-stamped photographs must be taken between 12:00 and 14:00 within one week of the equinox (either vernal or autumnal) and summer solstice:
 - Equinox: the time at which the sun crosses the celestial equator, when day and night are of equal length (around 20th March for the vernal equinox and 22nd September for the autumnal equinox).
 - Summer Solstice: when the sun reaches its highest position in the sky and the day with the longest period of daylight (21st or 22nd June).

- The dimensions of each space under consideration (courtyard, walkway, playground etc.) should be measured using a tape measure, measuring wheel or laser distance meter as appropriate and the total area calculated. The area of the space that is shaded should then be calculated (from measurements taking using the same instrument) and compared to the total area in order to determine the percentage that is shaded.
- If trees providing shading have been in place for less than 5 years, calculations may be submitted demonstrating the predicted the amount of shading at 5 years' growth.
- Where structural shading is provided, it shall comply with the requirements of credit **SS-02 Heat Island Effect**.

Credit Tool

N/A

Reference Documents

1. ASTM E1980-11 Standard Practice for Calculating Solar Reflective Index of Horizontal and Low Sloped Opaque Surfaces
2. ASTM C1549-16 Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer
3. ASTM E 408-13 Standard Test Methods for Total Normal Emittance of Surfaces Using Inspection-Meter Techniques

HC-02 Indoor Thermal Comfort

Keystone Credit	Total Number of Points Available
Yes	1

Aim

To improve building energy efficiency and improve thermal comfort via system calibration and testing.

Requirements

#	Requirement	Points Available	
		Individual dwelling	Multi-residential
1	On-site calibration and testing is undertaken for the thermostatic controls and occupancy sensors.	1	1
	Total	1	1

Evidence

#	Evidence per Requirement
1	- On-site calibration and testing contract and CV of Competent Professional. - Calibration Report.

Supporting Guidance

On-site Calibration and Testing:

The Competent Professional must have at least two years of relevant experience and be engaged to undertake calibration and testing in accordance with ASHRAE 111-2008 Measurement, Testing, Adjusting and Balancing of Building HVAC.

The Calibration Report, written by the Competent Professional, should contain the following:

- Confirmation of which controls and sensors require testing and calibrating based on the following:
 - 100% of occupancy sensors linked to air conditioning systems must be verified as working and the temperature setting of non-occupied areas confirmed (26°C recommended).
 - If feedback is available from **EI-02 Occupant Engagement**, review for potential issues with systems or areas.
 - For multi-residential buildings, 100% of other sensors linked to the BMS must be calibrated such as temperature and relative humidity (RH).
- Test results and corresponding calibration (if required) for all relevant controls and sensors.
- Date-stamped photographs of each sensor/control.
- Confirmation (with appropriate evidence) that all calibration test equipment is itself regularly calibrated by a laboratory as per the equipment manufacturer's recommendations.

- Schedule for future testing and calibration. All designated controls and sensors are to be calibrated either every 5 years or as per the manufacturers' recommendation, whichever is less.

Credit Tool

N/A

Reference Documents

1. ASHRAE 111 Measurement, Testing, Adjusting, and Balancing of Building HVAC

HC-03 Daylight and Visual Comfort

Keystone Credit	Total Number of Points Available
No	2

Aim

To maximize the use of natural light and minimize glare to improve occupant wellbeing.

Requirements

#	Requirement	Points Available	
		Individual dwelling	Multi-residential
1	Daylight A minimum daylight illuminance of 200 lux is achieved for at least 50% of the net floor area of each living area and each bedroom. Artificial Lighting The illuminance and uniformity targets specified in the Supporting Guidance are achieved.	1	1
2	Glare Control Manual or automated glare-control devices are present on all windows of regularly occupied spaces.	1	1
	Total	2	2

Evidence

#	Evidence per Requirement
1	- Floor plans highlighting all living areas and bedrooms. - Measurements and date-stamped photographs demonstrating that a minimum daylight illuminance of 200 lux is achieved for at least 50% of the net floor area of each living area and bedroom. - Measurements and date-stamped photographs demonstrating that the artificial lighting illuminance and uniformity targets are achieved.
2	- Floor plans highlighting all regularly occupied spaces. - Date-stamped photographs of all glare control devices for each regularly occupied space.

Supporting Guidance

Artificial Lighting:

All artificial lighting in the relevant space types must achieve the illuminance and uniformity targets in Table HC-03.1.

Table HC-03.1 Illuminance and uniformity targets for artificial lighting

Space Type	Horizontal Illuminance Target (lux)	Vertical Illuminance Target (lux)	Uniformity Target (avg:min)
Living Room	30	30	5:1
Bedroom	50	30	3:1
Dining Room	50	20	4:1
Kitchen	50	20	5:1
Circulation	30	6	5:1
Stairs	50	N/A	5:1
Foyer	100	30	3:1

Measuring Light Levels:

- Daylight levels and artificial light levels must be measured by someone with experience in undertaking lighting measurements, and an appropriately tested and calibrated lux meter must be used.
- Daylight levels and artificial light levels must be measured 0.75 meters above the floor at the following horizontal spacings (the measurement grid):
 - For spaces that are 15m² or smaller, measurements should be taken on a 1-meter square grid.
 - For spaces larger than 15m², measurements should be taken on a 2-meter square grid.
 - Figure HC-03.1 shows the measurement grids for two sample rooms. The first room has a floor area of 12m² and therefore requires a 1-meter square measurement grid, giving a total of 12 measurement points. The second room has a floor area of 45m² and therefore requires a 2-meter square measurement grid, giving a total of 15 measurement points.

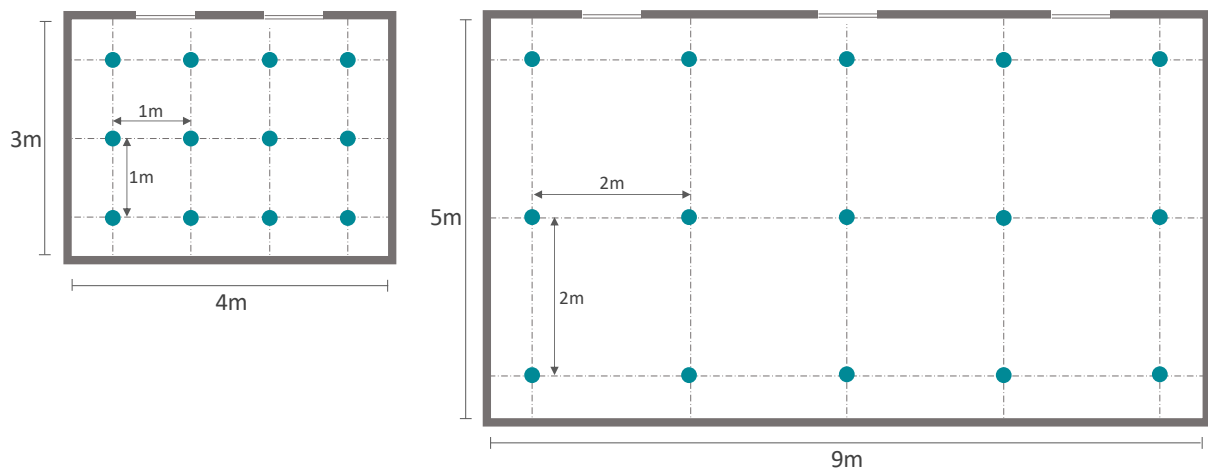


Figure HC-03.1 Measurement grid examples

- For daylight levels:
 - Lux levels must be measured at 12pm within one week of the equinox (either vernal or autumnal) and summer solstice:
 - Equinox: the time at which the sun crosses the celestial equator, when day and night are of equal length (vernal equinox: around 20th March, autumnal equinox: 22nd September).
 - Summer Solstice: when the sun reaches its highest position in the sky and the day with the longest period of daylight (21st or 22nd June).
 - Artificial lighting must be off when the measurements are taken.
- For artificial light levels:
 - Sources of daylight must be completely shielded to ensure daylight is not contributing to the measured lux levels, or the measurements are taken at night.

Glare Control:

- Glare control devices must be operable by occupants to control unpredicted glare.
- Regularly occupied spaces are living rooms, majlis, kitchens, dining rooms, studies, bedrooms and maid's rooms. They do not include hallways, bathrooms, storage rooms, laundry rooms or garages.
- Translucent or diffused glazing systems do not require glare control devices.
- Automated glare control devices can be connected to the building automation system in multi-residential buildings.
- Acceptable and unacceptable glare control devices are listed in Table HC-03.1.

Table HC-03.1 Glare control devices

Acceptable Devices	Unacceptable Devices
Window blinds	Fixed exterior overhangs
Curtains	Fixed fins
Shades	Fixed Louvers
Movable exterior louvers	Mashrabiya
Movable awnings	Dark tinted glazing
Movable screens	Fritted glazing

Credit Tool

N/A

Reference Documents

1. IES Lighting Measurements (LM) 83-12
2. IES The Lighting Handbook, 10th edition, Section 33 Lighting for Residences

HC-04 Acoustics

Keystone Credit	Total Number of Points Available
No	1

Aim

To reduce noise disturbance and improve occupant wellbeing by achieving low ambient sound levels in internal spaces.

Requirements

#	Requirement	Points Available	
		Individual dwelling	Multi-residential
1	On-site measurement of internal ambient noise levels demonstrates compliance with the following requirements: Individual Dwelling Internal ambient noise levels are less than 35dB(A)_{Leq} in bedrooms and less than 40dB(A)_{Leq} in other areas. Multi-Residential Building Internal ambient noise levels are less than 35dB(A)_{Leq} in residential units and less than 45dB(A) _{Leq} in common areas.	1	1
	Total	1	1

Evidence

#	Evidence per Requirement
1	- CV of qualified Acoustic Engineer and confirmation of their appointment. - Field test reports (in accordance with ASTM E336) by the Acoustic Engineer confirming the noise levels in relevant areas meet the requirements. If the noise level readings do not comply with the credit requirements: - A remediation report by the Acoustic Engineer identifying the improvements to be made to reduce noise to acceptable levels. - Upon completion of remediation works, field test reports (in accordance with ASTM E336) by the Acoustic Engineer confirming the noise levels in relevant areas meet the requirements.

Supporting Guidance

Noise Measurements:

- On-site noise measurements are to be conducted within the first 6 months of the Monitoring Period.
- Only external noises and building system noises should be considered. All windows and external and internal doors should be closed during testing.
- Occupant and household equipment/appliance noise must be excluded from noise measurements.

- For individual dwellings: testing must be conducted in all rooms with a wall adjacent to where high sound levels are expected e.g. near a busy street, near areas with potential construction noise.
- For multi-residential buildings: testing must be conducted in at least 50% of the residential units, representing the various floors and orientations within the building. Within each of these residential units, testing must be conducted in all rooms with a wall adjacent to where high sound levels are expected.
- For both typologies: if the structure has a mechanical/electrical generator adjacent to the building envelope, testing should be conducted near the generator to ensure that interior sound levels do not exceed required decibel limits.

Acoustic Engineer:

The Acoustic Engineer must possess one of the following:

- A degree in acoustics or equivalent certification in sound testing and acoustics.
- A minimum of three years of relevant experience in the building construction industry and expertise in providing recommendations for optimal acoustic performance as well as mitigation measures.

Remediation and Re-Testing:

- If any noise level readings do not comply with credit requirements, a remediation report must be prepared identifying the areas which do not comply and the corresponding noise level measurements in dB(A)_{L_{eq}}.
- The report must detail the strategies for remediation and provide calculations to show compliance with the noise level requirements.
- Once the remediation work has been undertaken, the subject areas must be re-tested by the Acoustic Engineer following the Noise Measurement guidance above.
- The remediation work and subsequent re-testing must be undertaken before the end of the Monitoring Period.

Credit Tool

N/A

Reference Documents

1. Saudi Building Code (SBC) 1001 Green Buildings, Section 807 Acoustics
2. ASTM E492-09 Standard Test Method for Laboratory Measurement of Impact Sound Transmission Through Floor-Ceiling Assemblies Using the Tapping Machine
3. ASTM E336-17a Standard Test Method for Measurement of Airborne Sound Attenuation between Rooms in Buildings

HC-05 Ventilation

Keystone Credit	Total Number of Points Available
No	1

Aim

To ensure all occupied spaces have adequate fresh air and to enhance the indoor environment and improve human comfort.

Requirements

#	Requirement	Points Available	
		Individual dwelling	Multi-residential
1	Mechanical Ventilation If a space is mechanically ventilated, the fresh air flow rates and exhaust rates comply with Saudi Building Code (SBC) 601 Section 8 Indoor Air Quality and Ventilation Systems. Natural Ventilation If a space is naturally ventilated, the minimum openable area to the outdoors is 5% of the floor area being ventilated.		
2	Demand Controlled Ventilation (DCV) CO ₂ sensors are present in all densely occupied areas of the building larger than 100m ² . The sensors modulate the fresh air supply rates for these areas as required, through an appropriate ventilation system. If a densely occupied area is naturally ventilated, the CO ₂ sensor shall be connected to a visual alarm which indicates Yellow for readings above 1000ppm, Orange for readings above 2000ppm and Red for readings above 5000ppm. On-site calibration and testing is undertaken for the CO ₂ sensors.	1	1
	Total	1	1

Evidence

#	Evidence per Requirement
1	Mechanical Ventilation: - Mechanical schedules confirming the fresh air flow rates of the AHUs/FAHUs. - Tabulated results comparing the actual fresh air flow rates to the SBC 601 levels. - Date-stamped photographs of the installed AHUs/FAHUs. Natural Ventilation: - Plans and elevations highlighting the occupied spaces which are naturally ventilated, their GFA and the location of the openable windows. - Window schedule confirming the openable free area.

	• Tabulated results comparing the GFA to the openable free area for each occupied space demonstrating that the 5% requirement is achieved. • Date-stamped photographs of the openable windows.
2	• Plans highlighting the densely occupied areas of the building larger than 100m² and showing the locations of the CO₂ sensors. • System schematic showing the CO₂ sensors and their link to the ventilation system to modulate the fresh air supply rate. • Date-stamped photographs of the CO₂ sensors. • Date-stamped photographs of the visual alarm (for naturally ventilated spaces). • Calibration and testing contract and CV of Competent Professional. • Calibration report.

Supporting Guidance

Mechanical Ventilation:

If a space has mechanical ventilation it must achieve the fresh air flow rates and exhaust rates specified in SBC 601 Section 8 Indoor Air Quality and Ventilation Systems. This is applicable regardless of whether the space also has natural ventilation/openable windows.

For occupied spaces (bedroom, living room, etc.), SBC 601 defines specific values for fresh air rates that need to be achieved by the ventilation system. Calculations should be provided to show the amount of fresh air required by SBC 601 based on the area and occupancy for each space, compared to the actual fresh air flow rate for that space. Table HC-05.1 contains an example fresh air calculation for a bedroom in a multi-residential building.

Table HC-05.1 Sample Fresh Air Calculation

Space	Location	Area (m ²)	Occupancy (Persons)	Fresh Air Rate / Person	Fresh Air Rate / Area	Total SBC 601 required Fresh Air (L/s)	Proposed Fresh Air rate
Bedroom	First Floor	20	2	2.5	0.3	$(2 \times 2.5) + (0.3 \times 20)$ = 11 L/s	12 L/s

Natural Ventilation:

Natural ventilation is the movement of air into and out of an indoor space without using mechanical systems. It refers to the flow of external air into an indoor space as a result of pressure differences arising from natural forces. If a space is naturally ventilated (i.e. there is no mechanical ventilation present), the minimum openable area to the outdoors must be at least 5% of the floor area of the space.

Naturally Ventilated Space – Adjoining Spaces:

Where rooms and spaces, without openings to the outdoors, are ventilated through an adjoining room, the opening to the adjoining rooms shall be unobstructed and shall have an area not less than 8% of the floor area of the interior room or space, and not less than 2.3m². The minimum operable area to the outdoors shall be based on the total floor area being ventilated.

Openable Free Area:

The openable free area is the ventilation area created when a ventilation device, e.g. window, is open to its full extent (Figure HC-05.1). It is not the total window/glazed area or the area of the part of the window that opens (unless it is fully openable).

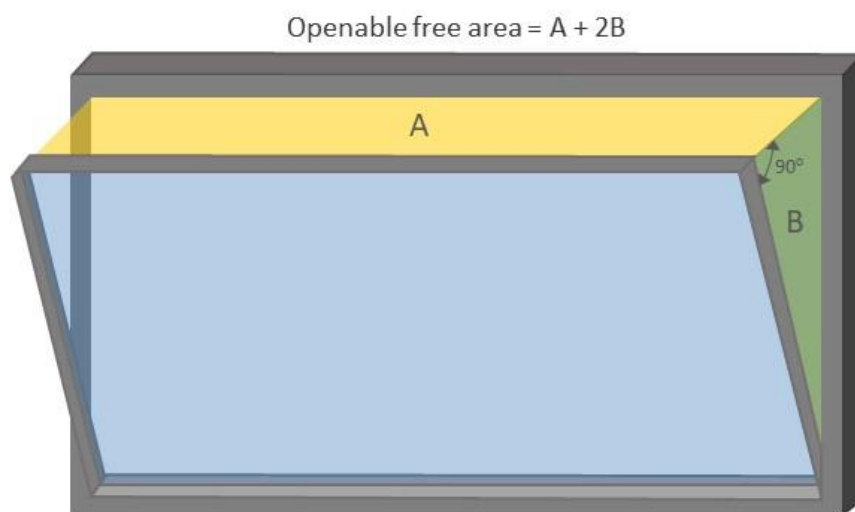


Figure HC-05.1 Openable free area

Demand Controlled Ventilation:

Demand controlled ventilation systems include CO₂ sensors. CO₂ sensors provide data to smart controllers, or a building energy management system, which monitors the levels within the building and modulates the fresh air ventilation rates accordingly. Spaces are thus provided with an appropriate amount of fresh air in the most efficient way to prevent energy waste. Such a system should be considered for densely occupied areas.

Densely occupied areas are those with an occupant density greater than 1 person per 4m² (0.25 persons per m²). In multi-residential buildings, these may include gymnasiums, community centers and multi-purpose rooms. CO₂ sensors must be installed at an appropriate height from the floor within the breathing zone (1m to 2m above finished floor level FFL) and programmed to maintain a setpoint of 1000ppm. As a minimum, there must be one CO₂ monitor per densely occupied area or one per ventilation zone, whichever is greater.

Calculating Occupant Density:

Consider a gym space that is designed to be 129m² with an expected occupancy of 30 people.

$$\text{Occupant Density} = \frac{30}{129} = 0.23$$

The occupant density in this scenario is 0.23 persons per m², which is less than the requirement of 0.25, therefore CO₂ sensors are not required.

Consider another example using the same gym space of 129m² but with an expected occupancy of 55 people.

$$\text{Occupant Density} = \frac{55}{129} = 0.42$$

The occupant density is 0.42 persons per m², which is higher than 0.25. Therefore, CO₂ sensors will be required in this example.

Calibration and Testing of CO₂ Sensors:

The Competent Professional must have at least two years of relevant experience and be engaged to undertake on-site calibration and testing of all CO₂ sensors.

The Calibration Report, written by the Competent Professional, should contain the following:

- Calibration documentation and test results for all CO₂ sensors.
- Confirmation (with appropriate evidence) that all calibration test equipment is itself regularly calibrated by a laboratory as per the equipment manufacturer's recommendations.
- Schedule for future testing and calibration. All CO₂ sensors are to be calibrated either every 5 years or as per the manufacturers' recommendation, whichever is less.

Credit Tool

N/A

Reference Documents

1. Saudi Building Code (SBC) 501 Mechanical, Chapter 4 Ventilation
2. International Mechanical Code, 2015

HC-06 Indoor Air Quality

Keystone Credit	Total Number of Points Available
No	1

Aim

To enhance the indoor environment by improving air-tightness and air quality.

Requirements

#	Requirement	Points Available	
		Individual dwelling	Multi-residential
1	All external doors are weather-stripped. For multi-residential buildings, all doors between residential units and common areas are weather-stripped. Cleanable entry way systems such as mats or grills are provided at the main building entrances.	1	1
2	For buildings using gas for heating or cooking, tests are conducted to check for gas leaks.		
	Total	1	1

Evidence

#	Evidence per Requirement
1	• Date-stamped photographs of weather-stripping for all external doors. • For multi-residential buildings, date-stamped photographs of weather stripping for all doors between residential units and common areas. • Date-stamped photographs of cleanable entry way systems such as mats or grills. • For multi-residential buildings, a schedule of weekly cleaning for the mats or grills.
2	• Schedule of gas leak checks and, for multi-residential units, Mostadam Guide (EI-01 Mostadam Guide) containing guidance for occupants.

Supporting Guidance

Weather-stripping:

Weather-stripping is the process of sealing air leaks around movable building components such as doors. Weather-stripping has two primary benefits:

- To minimize energy waste due to the loss of conditioned air from the residential units.
- To minimize infiltration of tobacco smoke, sand and dust into the residential units.

There are several types of weather-strips (e.g. V strip, felt, foam, door sweeps). All sides of the door are required to be equipped with weather-strips. When weather-stripping doors:

- Choose the appropriate door sweeps and thresholds for the bottom of the doors.

- Weather-strip the entire door jamb.
- Apply one continuous strip along each side.
- Make sure the weather-stripping meets tightly at the corners.
- Use a thickness that causes the weather-stripping to press tightly between the door and the door jamb when the door closes without making it difficult to shut.

Cleanable Entrance Way System:

Entrance way systems should be cleanable mats or cleanable grills and be applied to all main external entrances. These should be at least 3m long in the direction of travel or the maximum feasible length given entryway dimensions. The schedule of weekly cleaning should list all entryway systems, date cleaned and the signature of the responsible cleaner. If cleaning is carried out by a cleaning company, provide the contract showing the schedule of work and methods used.

Gas Leaks:

A gas leak check should be undertaken for buildings that use gas for cooking or heating. The gas leak check can be performed by the Owner of Facility Manager. A professional gas leak detector with gooseneck articulating sensors sensitive to multiple gas types should be used.

Guidance for all residential units should be included in the Mostadam Guide (**EI-01 Mostadam Guide**) and should explain the following:

- Appliances are to be installed by competent and trained professionals from the equipment supplier or a suitable contractor.
- The connection between the appliance and gas supply should have foam from soapy water applied so that any movement of foam or bubbles will highlight the escape of gas.
- In the event that a gas leak is suspected during operations, the gas should be turned off at the main switch, the area well-ventilated and the Facility Manager informed.

All communication should be by a public notice at the building entrances and emails or physical letters to all residential units.

Credit Tool

N/A

Reference Documents

1. ASTM D5197-16 Standard Test Method for Determination of Formaldehyde and Other Carbonyl Compounds in Air
2. ASTM D5466-15 Standard Test Method for Determination of Volatile Organic Compounds in Atmospheres
3. ASTM D6196-15e1 Standard Practice for Choosing Sorbents, Sampling Parameters and Thermal Desorption Analytical Conditions for Monitoring Volatile Organic Chemicals in Air
4. ASTM D6345-10 Standard Guide for Selection of Methods for Active, Integrative Sampling of Volatile Organic Compounds in Air
5. ISO 7708 Air Quality - Particle Size Fraction Definitions for Health-related Sampling

HC-07 VOCs and Low Emitting Materials

Keystone Credit	Total Number of Points Available
No	2

Aim

To reduce the concentration of volatile organic compounds (VOCs) in the indoor environment, contributing to better indoor air quality and increased occupant welfare.

Requirements

#	Requirement	Points Available	
		Individual dwelling	Multi-residential
1	Adhesives, Sealants, Paints and Coatings A policy is created and implemented for the future procurement of adhesives, sealants, paints and coatings and is included in the Sustainable Procurement Policy (PMM-04 Sustainable Procurement). Information is included in the Mostadam Guide (EI-01 Mostadam Guide) to advise residents on sustainable purchases for adhesives, sealants, paints and coatings. For all renovation, refurbishment and extension works: - A minimum of 95% (by weight) of all adhesives and sealants used in the building interior do not exceed the VOC limits of SCAQMD Rule 1168. - A minimum of 95% (by weight) of all paints and coatings used in the building interior do not exceed the VOC limits of SCAQMD Rule 1113, Green Seal GS-03 & GS-11.	1	1
2	Formaldehyde Reduction A policy is created and implemented for the future procurement of composite wood and suspended ceiling systems and is included in the Sustainable Procurement Policy (PMM-04 Sustainable Procurement). For all renovation, refurbishment, and extension works: - All internal composite wood materials have maximum formaldehyde emissions as per the Supporting Guidance. - All internal suspended ceiling systems have a maximum formaldehyde limit of 13.5 ppb (or 16.5 µg/m³).	1	1
	Total	2	2

Evidence

#	Evidence per Requirement
1	Purchasing policy for adhesives, sealants, paints and coatings, to be included in the Sustainable Procurement Policy (PMM-04 Sustainable Procurement).

	• Mostadam Guide with relevant section highlighted (refer to credit EI-01 Mostadam Guide). For renovation, refurbishment and extension works: • Purchase orders for all interior adhesives, sealants, paints and coatings. • Material safety datasheets and technical datasheets for all interior adhesives, sealants, paints and coatings with VOC content highlighted.
2	• Purchasing policy for composite wood and suspended ceiling systems, to be included in the Sustainable Procurement Policy (PMM-04 Sustainable Procurement). For renovation, refurbishment and extension works: • As-built interior finishes schedule highlighting products containing formaldehyde. • Purchase orders for all interior wood finishes and suspended ceilings. • Material safety datasheets and technical datasheets for all interior wood finishes and suspended ceilings with formaldehyde level highlighted.

Supporting Guidance

Purchasing Policy for Adhesives, Sealants, Paints and Coatings:

The purchasing policy should contain the following information:

- Minimum requirements for the purchasing of adhesives and sealants:
 - Adhesives and sealants must not exceed the VOC limits of SCAQMD Rule 1168 (Table HC-07.1).
- Minimum requirements for the purchasing of paints and coatings:
 - Paints and coatings must not exceed the VOC limits of SCAQMD Rule 1113, Green Seal GS-03 and GS-11 (Table HC-07.2).
- Template for the individual responsible for purchasing adhesives, sealants, paints and coatings (Owner or Facility Manager) to document all relevant purchases in a table containing the following information:
 - Type of product (adhesive, sealant, paint or coating)
 - Manufacturer
 - Name of product
 - VOC level
 - Supplier
 - Purchase order/receipt
 - Location to be applied within the building

The purchasing policy should be included in the Sustainable Procurement Policy (**PMM-04 Sustainable Procurement**).

Table HC-07.1 VOC limits for adhesives and sealants

Maximum VOC Limits – grams per litre (g/L), less water			
Architectural Applications		Specialty Applications	
Indoor carpet adhesives	50	PVC welding	510
Carpet pad adhesives	50	CPVC welding	490
Wood flooring adhesives	100	ABS welding	325

Rubber floor adhesives	60	Plastic cement welding	250
Subfloor adhesives	50	Adhesive primer for plastic	550
Ceramic tile adhesives	65	Contact adhesive	80
Drywall and panel adhesives	50	Special purpose contact adhesive	250
Cove base adhesives	50	Structural wood member adhesive	140
Multipurpose construction adhesives	70	Top and trim adhesive	250
Structural glazing adhesives	100		
Substrate specific applications		Sealants	
Metal to metal	30	Architectural	250
Plastic foams	50	Non-membrane roof	300
Porous materials (except wood)	50	Roadway	250
Wood	30	Singly-ply roof membrane	450
Fiberglass	80	Other	420
		Sealant Primers	
		Architectural non-porous	250
		Architectural porous	775
		Other	750

Table HC-07.2 VOC limits for paints and coatings

Maximum VOC Limits – grams per litre (g/L), less water	
Anti-corrosive/anti-rust paint	250
Clear wood finish: lacquer	550
Clear wood finish: sanding sealer	350
Clear wood finish: varnish	350
Clear Brushing lacquer	680
Pigmented lacquer	550
Floor coating	100
Interior flat paint/coating/primer	50
Interior non-flat paint/coating/primer	150
Sealers and undercoaters	200
Shellac: clear	730
Shellac: pigmented	550
Stain	250
Concrete curing compounds	350
Japans/faux finishing coatings	350
Low solids coatings	120
Magnesite cement coatings	450
Wood preservatives	350
Waterproofing concrete/masonry sealers	400
Waterproofing sealers	250

Adhesives and Sealants for Renovation, Refurbishment and Extension Works:

For renovation, refurbishment and extension works, a minimum of 95% (by weight) of all adhesives and sealants used in the building interior (i.e. inside the weatherproofing system) must not exceed the VOC limits of the South Coast Air Quality Management District (SCAQMD) Rule 1168. The VOC limits are provided in Table HC-07.1. The percentage of compliant adhesives and sealants is calculated as follows:

$$\% \text{ Compliant adhesives and sealants} = \frac{\text{Weight of adhesives and sealants not exceeding VOC limits}}{\text{Total weight of all adhesives and sealants}}$$

Paints and Coatings for Renovation, Refurbishment and Extension Works:

For renovation, refurbishment and extension works, a minimum of 95% (by weight) of all paints and coatings used in the building interior (i.e. inside the weatherproofing system) must not exceed the VOC limits of the South Coast Air Quality Management District (SCAQMD) Rule 1113, Green Seal GS-03 & GS-11. The VOC limits are provided in Table HC-07.2. The percentage of compliant paints and coatings is calculated as follows:

$$\% \text{ Compliant paints and coatings} = \frac{\text{Weight of paints and coatings not exceeding VOC limits}}{\text{Total weight of all paints and coatings}}$$

Purchasing Policy for Composite Wood and Suspended Ceiling Systems:

The purchasing policy should contain the following information:

- Minimum requirements for the purchasing of composite wood:
 - Maximum formaldehyde emissions as per Table HC-07.3.
- Minimum requirements for the purchasing of suspended ceiling systems:
 - Maximum formaldehyde limit of 13.5 ppb (or 16.5 µg/m³).
- Template for the individual responsible for purchasing composite wood and suspended ceiling systems (Owner or Facility Manager) to document all relevant purchases in a table containing the following information:
 - Type of product (composite wood or suspended ceiling system)
 - Manufacturer
 - Formaldehyde emissions
 - Name of product
 - VOC level
 - Supplier
 - Purchase order/receipt
 - Location within the building

The purchasing policy should be included in the Sustainable Procurement Policy (**PMM-04 Sustainable Procurement**).

Table HC-07.3 Formaldehyde limits for composite wood

Product	Formaldehyde Limit (ppm)
Hardwood plywood	0.05
Particle board	0.09
Medium-density Fiberboard (MDF)	0.11

Composite Wood for Renovation, Refurbishment and Extension Works:

All internal composite wood materials must have maximum formaldehyde emissions as detailed in Table HC-07.3. The basic test method used to determine the formaldehyde emissions of products is ASTM E1333.

Suspended Ceiling Systems for Renovation, Refurbishment and Extension Works:

All internal suspended ceiling systems must have a maximum formaldehyde limit of 13.5 ppb (or 16.5 $\mu\text{g}/\text{m}^3$). Ceiling systems such as ceramic/concrete tiles, organic-free mineral based systems, gypsum plaster, concrete, and metal are deemed to automatically comply with the formaldehyde credit requirements.

Credit Tool

N/A

Reference Documents

1. Saudi Building Code (SBC) 1001 Green Buildings, Section 806 Material Emissions and Pollutant Control
2. South Coast Air Quality Management District (SCAQMD) Rule 1168 Adhesive and Sealant Applications
3. South Coast Air Quality Management District (SCAQMD) Rule 1113 Architectural Coatings
4. GC-3 Green Seal Environmental Criteria for Anti-Corrosive Paints
5. GS-11 Green Seal Standard for Paints and Coatings
6. ASTM Standard E1333 Standard Test Method for Determining Formaldehyde Concentrations in Air and Emission Rates from Wood Products Using a Large Chamber

HC-08 Non-Polluting Insulation Materials

Keystone Credit	Total Number of Points Available
No	1

Aim

To encourage the use of insulation materials with a low impact on the environment and human health.

Requirements

#	Requirement	Points Available	
		Individual dwelling	Multi-residential
1	A policy is created and implemented for the future procurement of insulation materials and included in the Sustainable Procurement Policy (PMM-04 Sustainable Procurement). For all renovation, refurbishment and extension works, thermal and acoustic insulation meet the following requirements: - Manufactured without the use of chlorofluorocarbons (CFCs) or hydrochlorofluorocarbons (HCFCs). - An Ozone Depletion Potential of zero (ODP = 0) and a Global Warming Potential of less than five (GWP ≤ 5). Compliance is required for any blowing agent used to manufacture the insulation product or to spray it in place. 13.5 parts per billion (ppb) or less of added formaldehyde. - Non-toxic and does not release toxic fumes during combustion.	1	1
	Total	1	1

Evidence

#	Evidence per Requirement
1	- Purchasing policy for insulation materials, to be included in the Sustainable Procurement Policy (PMM-04 Sustainable Procurement). For renovation, refurbishment and extension works: - Summary sheet listing all uses of insulation installed as part of the renovation, refurbishment or extension works. - Purchase orders for all insulation products installed in the project. - Material safety datasheets, technical datasheets and/or third-party test reports for all insulation products confirming compliance with each of the credit requirements.

Supporting Guidance

Ozone Depletion Potential (ODP):

The ODP of a chemical compound is a relative value that indicates the potential of a substance to destroy the ozone layer compared with the potential of chlorofluorocarbon-11 (CFC-11), which is assigned a reference value of 1. Thus, a substance with ODP of 2 is twice as harmful as CFC-11.

Global Warming Potential (GWP):

GWP is a measure of how much energy the emissions of 1 ton of a gas will absorb over a given period, relative to the emissions of 1 ton of carbon dioxide (CO₂). The larger the GWP, the more that a given gas warms the Earth compared to CO₂ over that timeframe.

Blowing Agents:

Certain types of insulation incorporate “blowing agents” which are high-performing insulating gases blown to fill the voids within the insulation cellular structure. This results in an overall higher thermal performance of the final insulation materials. Blowing agents may be harmless such as carbon dioxide or sodium bicarbonate, or may be associated with ozone layer depletion and high impacts on global warming, such as CFCs and HCFCs. The Montreal Protocol on Substances that Deplete the Ozone Layer is an international treaty with an aim to protect the ozone layer by gradually phasing out harmful compounds including CFCs and HCFCs. To assess a blowing agent’s impacts on the environment, its Ozone Depletion Potential (ODP) and Global Warming Potential (GWP) are determined.

Material Information:

Information regarding CFC, HCFC, formaldehyde, toxicity, ODP and GWP can be found in material safety datasheets or technical datasheets. If this information is not available, results from a third-party lab can be used.

Purchasing Policy for Insulation Materials:

The purchasing policy should contain the following information:

- Minimum requirements for the purchasing of insulation materials:
 - Manufactured without the use of chlorofluorocarbons (CFCs) or hydrochlorofluorocarbons (HCFCs).
 - An Ozone Depletion Potential of zero (ODP = 0) and a Global Warming Potential of less than five (GWP ≤ 5). Compliance is required for any blowing agent used to manufacture the insulation product or to spray it in place.
 - 13.5 parts per billion (ppb) or less of added formaldehyde.
 - Non-toxic and does not release toxic fumes during combustion.
- Template for the individual responsible for purchasing insulation materials (Owner or Facility Manager) to document all relevant purchases in a table containing the following information:
 - Type of insulation (thermal or acoustic)
 - Manufacturer
 - Name of the insulation
 - Relevant properties of the insulation (ODP, GWP, added formaldehyde level etc.)
 - Supplier
 - Purchase order/receipt

- Location of installation within the building

The purchasing policy should be included in the Sustainable Procurement Policy (**PMM-04 Sustainable Procurement**).

Credit Tool

N/A

Reference Documents

1. Saudi Building Code (SBC) 1001 Green Buildings, Section 806.6 Insulation
2. The Montreal Protocol on Substances that Deplete the Ozone Layer

HC-09 Access for All

Keystone Credit	Total Number of Points Available
No	2

Aim

To ensure residents and visitors of all physical abilities have easy access to all building facilities.

Requirements

#	Requirement	Points Available	
		Individual dwelling	Multi-residential
1	The building complies with the requirements of the Lifetime Homes standard.	2	2
	Total	2	2

Evidence

#	Evidence per Requirement
1	- Checklist of the 16 Lifetime Homes criteria, with notes explaining how the project currently meets each, signed by the building's Owner or Facility Manager. The notes should clearly reference relevant supporting documents. - Clearly labelled date-stamped photographs, drawings and purchase receipts to support the checklist. - An Alternative Compliance Report (where necessary).

Supporting Guidance

The 16 criteria of the Lifetime Homes standard are listed below. Refer to the Lifetime Homes Design Guide and the website for full, detailed requirements and latest updates.

1. Parking (width or widening capability)
2. Approach to dwelling from parking (distance, gradients and widths)
3. Approach to all entrances
4. Entrances
5. Communal stairs and lifts
6. Internal doorways and hallways
7. Circulation Space
8. Entrance level living space
9. Potential for entrance level bed-space
10. Entrance level WC and shower drainage
11. WC and bathroom walls
12. Stairs and potential through-floor lift in dwelling
13. Potential for fitting of hoists and bedroom / bathroom

14. Bathrooms
15. Glazing and window handle heights
16. Location of service controls

If a particular criterion is prohibitively expensive to achieve, this must be demonstrated by the building Owner/Facility Manager and an alternative strategy may be proposed that clearly meets the intent of the Lifetime Homes' criterion. This proposal must be supported by an Alternative Compliance Report containing professional cost estimates and labelled drawings and photographs showing in detail how the intent of the criterion is met.

Credit Tools

N/A

Reference Documents

1. The Lifetime Homes Design Guide, 2010
2. Lifetime Homes, <http://www.lifetimehomes.org.uk/>

Education and Innovation

8 Education and Innovation

In order to cultivate a long-lasting culture of sustainability and create value for well-operated and sustainable homes, Mostadam ensures that residents of Mostadam-certified homes are aware of how their homes are being operated sustainably. In addition, guidance on living sustainably is provided to residents thus providing them with knowledge of sustainability that can be carried into other aspects of their lives outside the home.

Projects are rewarded for providing occupants with the opportunity to engage with the facility management team and provide feedback on the building's operations. Such engagement further contributes to the cultivation of a culture of sustainability, as residents are active contributors towards ensuring sustainable operation of the building. This category also gives Owners and project teams a certain degree of freedom to exceed existing credit requirements or to pursue sustainable ideas that are not currently covered by the rating system, thus further pushing the frontier of sustainability in KSA.

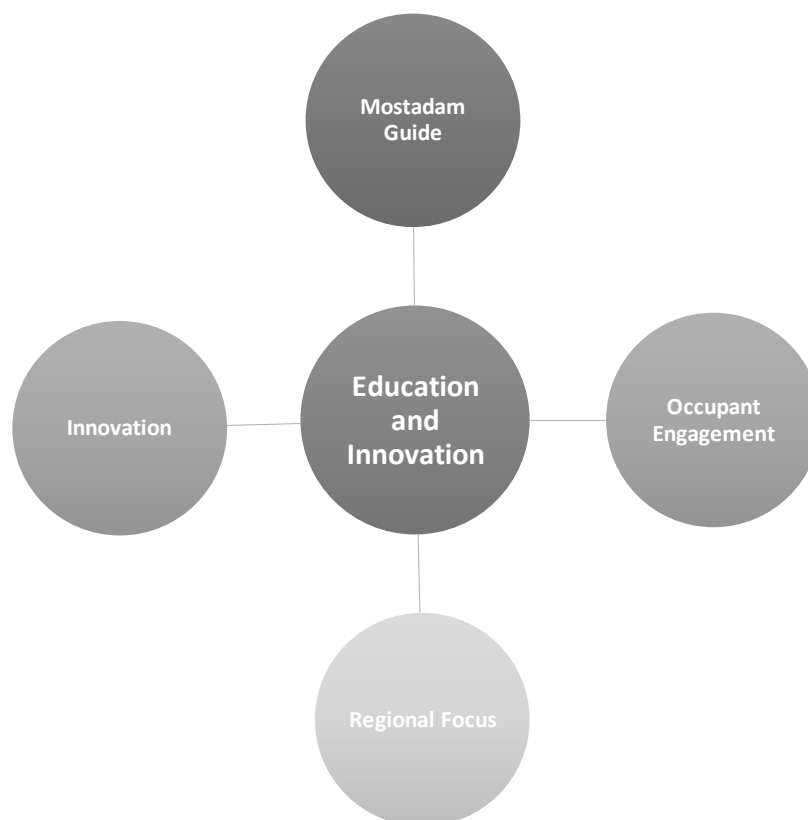


Figure 12 Education and Innovation credits

EI-01 Mostadam Guide

Keystone Credit	Total Number of Points Available
Yes	1

Aim

To promote the efficient operation of Mostadam-certified homes by providing information which enables the residents and operators to play an integral part in the building's sustainable performance.

Requirements

#	Requirement	Points Available	
		Individual dwelling	Multi-residential
1	A Mostadam Guide is developed in English and Arabic which communicates the building's sustainable credentials to residents and to the Facility Manager (for multi-residential buildings) and provides guidance on how to live more sustainably.	1	1
	Total	1	1

Evidence

#	Evidence per Requirement
1	- Mostadam Guide that describes the building's targeted credits and the role of the occupants and the Facility Manager (for multi-residential buildings) in ensuring the continuous sustainable performance of the building. - Arabic translation of the Mostadam Guide.

Supporting Guidance

The Mostadam Guide must contain the sections detailed in Table EI-01.1 (as a minimum).

Table EI-01.1 Contents of Mostadam Guide

No.	Section	Description
0	Introduction	- Summary of the sustainable features of the building and the positive impact of sustainability on the environment. - Summary of the role of the occupants and the FM (for multi-residential buildings) in ensuring the building's continuous sustainable performance. - Narrative describing the positive impacts on occupant well-being and building longevity that are achieved as a result of proper maintenance and servicing of the building and its systems.
1	Policies, Management	- Description of the targeted credits and how they are achieved. - Comprehensive waste and recycling guideline for the occupants including:

	and Maintenance	○ Sorting requirements and guidance on what is and is not acceptable within each waste stream. ○ For multi-residential buildings, the communal waste storage area's location and access times. ○ Location of local waste and recycling centers. • Maintenance requirements for installed features and servicing schedule for relevant building systems. System servicing requirements e.g. air conditioning filters, ducting, general mold inspection, hot/cold water tanks, hot water heating unit, smoke detectors and fire safety equipment. • Guidance on the sustainable procurement of the following materials and products: ○ Finishes ○ Fixtures ○ Fittings ○ Furnishings ○ Equipment ○ Appliances ○ Consumables (cleaning, pest management, refrigerants, fire suppression gases) ○ Maintenance (composite wood, suspended ceilings, insulation) • Economic, social and environmental benefits of supporting local businesses and establishments. • Lifestyle tips and guidance on how occupants can lower their energy and water consumption, with particular emphasis on how occupant behavior affects the building performance.
2	Energy	• Description of the targeted credits and how they are achieved. • Energy efficiency commitments of the building and the role of the occupants in meeting them. • User guidance on the level of sub-metering installed, remote access abilities and how data can be used to reduce consumption levels. • Instruction that energy consumption data is to be shared with <i>Sustainable Building</i> and that all data will be treated as confidential. • Manuals for all installed appliances. • Solar hot water or PV O&M manuals including cleaning methods and how to cover or configure SHW panels if the occupants will be away for a period of time.
3	Water	• Description of the targeted credits and how they are achieved. • Water efficiency commitments of the building and the role of the occupants in meeting them. • For water metering, user support and information on the level of sub-metering installed, including remote access abilities and guidance on how to utilize the data to reduce consumption levels. • Instruction that water consumption data is to be shared with <i>Sustainable Building</i> and that all data will be treated as confidential. • Manuals for all installed appliances.

4	Health and Comfort	• Description of the targeted credits and how they are achieved. • Elimination of indoor pollutants and VOCs and the resulting positive impact on health and wellbeing. • Instructions on the optimal use of the thermostatic controls and guidance on optimal set points.
5	Education and Innovation	• Description of the targeted credits and how they are achieved.
6	Site Sustainability	• Description of the targeted credits and how they are achieved. • Guidance on the management and maintenance of the landscaped areas to ensure the survival and enhancement of the natural landscape and habitat areas, including soil enhancement, vegetation maintenance and enhancement (planting list), invasive species removal, organic pesticide use, prevention of desertification and water efficient irrigation.
7	Transportation and Connectivity	• Description of the targeted credits and how they are achieved. • Comprehensive transportation and mobility guideline for the occupants including information on the local transport options. • Directory of local establishments within a 20 km radius of the project for the following categories: ○ Municipal amenities: police station, fire station, city council ○ Healthcare providers ○ Schools ○ Retail: grocers, restaurants, retailers ○ Recreational amenities: parks, beaches and resorts The list should contain a maximum of ten under each category.

Credit Tool

N/A

Reference Documents

1. Saudi Vision 2030, www.vision2030.gov.sa
2. Greener Living, www.epa.gov/environmental-topics/greener-living

EI-02 Occupant Engagement

Keystone Credit	Total Number of Points Available
No	2

Aim

To promote occupant health and wellbeing and minimize environmental impacts via reporting and feedback on faults and issues.

Requirements

#	Requirement	Points Available	
		Individual dwelling	Multi-residential
1	Survey An Occupant Satisfaction Survey is conducted at least twice per year to determine the perceived level of occupant comfort and level of satisfaction in relation to the internal environment. If more than 20% of occupants are dissatisfied with an element, changes are implemented to improve occupant satisfaction.	1	1
2	Feedback Meetings Regular meetings are scheduled between the Owner/Facility Manager and the occupants to discuss building-related issues including occupant health, wellbeing and environmental impacts. A mechanism is in place to address any reported issues and feedback the results to the building occupants.	1	1
	Total	2	2

Evidence

#	Evidence per Requirement
1 & 2	• Occupant Engagement Procedure. • Record Log.

Supporting Guidance

This credit is applicable to multi-residential buildings of any size, including sub-divided villas and townhouses. It is not applicable to single-family dwellings i.e. villas or townhouses occupied by one family.

Occupant Engagement Procedure:

The required contents of the Occupant Engagement Procedure are detailed in Table EI-02.1. The procedure should be written within the first 6 months of the Monitoring Period.

Table EI-02.1 Occupant Engagement Procedure contents

Occupant Engagement Procedure		
#	Section Title	Content Requirements and Guidance
1	Aims & Objectives	Aims and objectives of the procedure.
2	Roles & Responsibilities	For Surveys, state the designated individuals (with contact details), responsible for procedure creation, survey collection, survey analysis, remedial actions, remedial action follow up, training, communication and annual overview. If the survey is carried out by contractors, ensure that they agree to, and are bound by, this procedure.
		For Feedback Meetings, state the designated individuals (with contact details) responsible for procedure creation, hosting meetings, recording meetings, deciding corrective actions, communicating meeting summaries, monitoring implementation and annual overview.
3	Implementation Guidance	For Surveys, at least 1 survey is to be held within the second 6 months of the Monitoring Period and relevant evidence submitted. Thereafter the survey will be carried out at least twice per year: once during the winter and once during the summer.
		For Feedback Meetings, at least 2 meetings are to be held within the second 6 months of the Monitoring Period and relevant evidence submitted. Thereafter the procedure must be continuously enforced with at least 1 meeting per quarter.
4	Survey Procedure	Provide an introduction to the site including location, description of spaces, occupant types and numbers.
		The survey should be obtained over a period of no more than two weeks with responses from at least 50% of residential units and 75% of staff.
		The survey should be collected anonymously but identify if the respondent is a resident or a member of staff and include their approximate location within the building. Written/online responses are suitable if sufficient measures are included for anonymity and there is provision for additional notes/remarks to be given by the respondent on the details of any issue.
		The survey should ask occupants their level of satisfaction on a scale of one to five with 1 being very dissatisfied, 2 dissatisfied, 3 neutral, 4 satisfied and 5 very satisfied.
		At a minimum the items listed in Table EI-02.2 should be included in the survey. Table EI-02.2 also provides examples of issues and responses for each item.
		If 20% or more occupants are dissatisfied or very dissatisfied with a particular element, investigate and list potential remedial actions starting with the lowest impact considering the building occupants, cost and utility resources. Changes should be implemented as appropriate to improve occupant satisfaction.
		It should be noted that not all issues will be directly controllable by the building Owner/Facility Manager. For example, the residential unit's air

		conditioning may be installed/managed by the unit's Owner if the building does not have a central ducted air conditioning system, or general air quality may be a result of local land-use and not building-related. In these situations, valid limitations of control should be noted (and communicated to residents), however measures to guide and influence the issues should also be engaged with.
		The survey should be repeated for any dissatisfactory items within 3 months.
		The survey template is to be included within the appendix of the procedure.
5	Feedback Meetings Procedure	Provide an introduction including location, description of spaces, occupant types/numbers and likely occupant issues.
		Provide the meeting agenda within the appendix of the procedure. At a minimum the meeting agenda should include: • Welcome. • Aims and brief description of the initiative. • Introductions for those present, particularly from the management hosts. • Reading of the previous meeting's summary and list of required actions. • Brief announcements from building management. • Feedback from occupants in the form of observations, suggestions or complaints. The management may delay their response until the post meeting summary. • Date of next session.
		The number of residents attending the meetings will vary, with less residents attending when they are satisfied and have no particular issues to raise. It is recommended that an attendance rate of 50% of residential units is targeted, with a minimum of 20% of residential units being represented at each meeting.
		The Owner/Facility Manager must acknowledge each item raised and confirm its validity to the scope of occupant wellbeing and environmental impact.
		If valid, the Owner/Facility Manager must state what remedial action is required and when it will be completed.
		Organize building events by actively communicating at least one environmental or social event that is in accordance with occupants' representative cultures. Example events are Earth Hour (24 th March), World Wildlife Day (3 rd March), Global Recycling Day (18 th March), National Day (23 rd September) and regular monthly gatherings or any local park days.
5	Communication	For Surveys, provide 1 month's advance notice of pending surveys. The general principles, good practice, summary of survey results, remedial actions (if any) and site-specific considerations of the procedure should be

		communicated to all building users no later than one month after the survey is undertaken. This should specify the causes of any issues, such as external causes, building design, maintenance or occupant use.
		For Feedback Meetings, provide 1 months' notice of each engagement meeting time and location, and allow occupants to raise issues in advance of the meeting to enable the Owner/Facility Manager to consider the issue and provide an appropriate response during the meeting. Within 1 week of the engagement meeting, provide a summary of the meeting minutes and any remedial actions.
		All communication should be by a public notice at the building entrances and emails or physical letters to all residential units.
6	Training	For Surveys, provide training at least once a year to the individuals responsible for conducting the survey including engagement to ensure a high response rate, keeping respondents suitably anonymous and asking questions using neutral wording to avoid biased responses.
		For Feedback Meetings, provide training at least once a year to the individuals responsible for hosting meetings, including how to engage with feedback positively, obtain useful information and ensure all attendees have the opportunity to speak.
		Include training content and attendance registry template within the appendix of the procedure.
7	Records	Provide a log template within the appendix of the procedure.
		Records must be kept in a well-structured electronic log and updated for each cycle of meetings. The Record Log will include: • Survey responses with time and date. • Survey analysis and remedial actions/follow-up (if any). • Feedback meeting minutes. • Feedback meeting tracker of actions to be undertaken, when these actions are completed and by whom. • Communications. • Training content/attendance. • Annual management overview.
8	Sign-off & Management Overview	A one-page summary should list past and present results and efforts to improve on them for easy review.
		The plan and feedback must be re-evaluated annually and updated as necessary to address reoccurring issues and any new mitigation techniques.
		The Owner or Facility Manager must review and sign off the procedure on an annual basis.

Table EI-02.2 Examples of issues and responses

Item	Issue	Response
Temperature	Too cold or too hot	Re-adjust set points.
Humidity	Excessive humidity or mold	Check air conditioning performance/ envelope tightness. (refer to HC-02 Indoor Thermal Comfort)
Air velocity	Excessive duct velocity Wind concentrated effects from buildings	Adjust dampers. Redirect grills. (refer to HC-02 Indoor Thermal Comfort)
Noise	Outside noise Occupant noise Equipment noise	Engage with any construction, nearby land uses. Set/enforce community code of conduct. Review duct supports and air velocity. (refer to HC-04 Acoustics)
Air quality	Perception of fresh air Evidence of sand/dust	Adjust dampers (central systems) and extract rates (all systems). Check envelope tightness. Check air conditioning filters. (refer to HC-06 Indoor Air Quality and PMM-06 Hygienic Operations)
Olfactory comfort	Smells from occupant cooking or smoking Smells from waste storage rooms	Check extracts, recirculating filters, weather stripping of residential units, inter-unit air tightness, active pressure on communal air supply or exhaust and waste management practices. (refer to HC-06 Indoor Air Quality and PMM-02 Residential Waste Management)
Daylight	Low daylight levels	Check external obstructions and window films, install light shelves. (refer to HC-03 Daylight and Visual Comfort)
Glare	High levels of glare	Check reflections from other buildings and internal surfaces. Consider additional shading, blinds, curtains or vegetation. (refer to HC-03 Daylight and Visual Comfort)
Artificial lighting quality	Flickering or broken fixtures	Check fixture connection, replace with high frequency ballasts. Check voltage and use of dimmer switches. Replace and monitor. (refer to HC-03 Daylight and Visual Comfort)
User controls	Lack of controllability to respond to daily changes in thermal comfort needs	Identify controls and arrange controlled access (if appropriate). (refer to HC-02 Indoor Thermal Comfort)
Public spaces/ facilities	Access to or availability of gym, swimming pool, changing rooms, foyer etc.	Identify lack of access or availability. Arrange controlled access as appropriate.

Maintenance/ cleanliness	Dirty or irregularly cleaned areas, no warning of cleaning or signage	Schedule regularly cleaning, provide cleaning signage. (refer to PMM-03 Sustainable Maintenance and Servicing and PMM-06 Hygienic Operations)
Additional items relevant to the site or occupants		

Credit Tool

N/A

Reference Documents

N/A

EI-03 Regional Focus

Keystone Credit	Total Number of Points Available
No	2

Aim

To encourage projects to address sustainability issues that are considered a priority for the region in which they are located.

Requirements

#	Requirement	Points Available	
		Individual dwelling	Multi-residential
1	The project achieves credit(s) identified as Regional Focus credits for the climate zone in which the project is located.	2	2
	Total	2	2

Evidence

#	Evidence per Requirement
1	As per the evidence for the credit(s) identified as a priority for the climate zone in which the project is located.

Supporting Guidance

Regional Focus credits have been identified for each of the three climate zones (Table EI-03.1). A project will be awarded 1 credit point for achieving one of the Regional Focus credits and 2 credit points for achieving two of the Regional Focus credits. The climate zones are shown in Figure EI-03.1.

Table EI-03.1 Regional Focus credits per climate zone

Region	Regional Focus Credits
Climate Zone 1	E-01 Energy Performance (<i>min. 7 credit points</i>) E-03 Envelope Assessment E-045 Renewable Energy (<i>min. 2 credit points</i>) W-01 Water Performance (<i>min. 7 credit points</i>) W-03 Water Efficient Products and Systems SS-01 Ecological Management and Enhancement SS-02 Heat Island Effect (<i>requirement #1</i>)
Climate Zone 2	E-01 Energy Performance (<i>min. 6 credit points</i>) E-03 Envelope Assessment W-01 Water Performance (<i>min. 6 credit points</i>)

	W-03 Water Efficient Products and Systems SS-01 Ecological Management and Enhancement
Climate Zone 3	E-01 Energy Performance (<i>min. 6 credit points</i>) E-03 Envelope Assessment W-01 Water Performance (<i>min. 6 credit points</i>) W-03 Water Efficient Products and Systems SS-01 Ecological Management and Enhancement

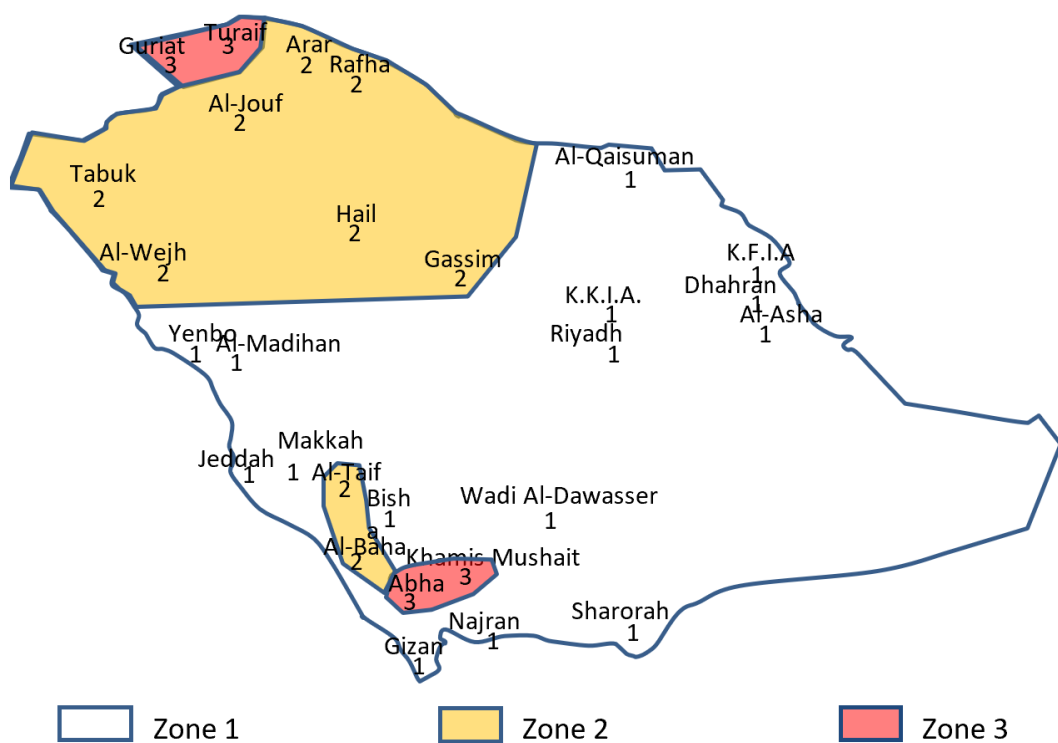


Figure EI-03.1 KSA climate zones (source: Saudi Building Code)

Credit Tool

N/A

Reference Documents

1. Saudi Building Code (SBC) 601 and 602, Energy-Efficient Design, Section 11 Climatic Data

EI-04 Innovation

Keystone Credit	Total Number of Points Available
No	2

Aim

To encourage and recognize innovative sustainability practices, particularly those which promote durability and low maintenance.

Requirements

#	Requirement	Points Available	
		Individual dwelling	Multi-residential
1	Option 1 The requirements of an eligible Mostadam credit are surpassed.	2	2
	Option 2 An innovative operational solution is adopted that improves the durability or reduces the maintenance requirements of the building.		
	Total	2	2

Evidence

#	Evidence per Requirement
1	Option 1: - Narrative specifying the selected Mostadam credit(s) and the percentage/numerical improvement achieved over and above the existing requirements. Option 2: - Innovation report containing: - Description of the innovation and its purpose/benefits. - Technical narrative explaining how the innovation is not covered by any other credit. - Proof of achievement (see Supporting Guidance). - Data sheets with calculations/relevant information. - Relevant drawings and material/product specifications.

Supporting Guidance

Option 1:

- 1 credit point is awarded for surpassing the requirements of one eligible Mostadam credit and 2 credit points are awarded for surpassing the requirements of two eligible Mostadam credits.
- The numerical/percentage improvement achieved for any eligible Mostadam credit must follow the incremental sequence provided within the credit.

- If a sequence of numerical/percentage increments is not present, a 20% improvement must be achieved on the percentage or numerical requirement stated in the credit.
- The eligible Mostadam credits are listed in Table EI-04.1.

Table EI-04.1 Eligible credits

Category	Eligible Credits	Innovation Requirement
Policies, Management and Maintenance	PMM-02 Residential Waste Management	A minimum of 60% of operational waste (by weight or volume) is diverted from landfill via recycling or reuse.
	PMM-04 Sustainable Procurement	EITHER Of the materials and products purchased during the operation of the building, 96% comply with the Sustainable Procurement Policy. OR Of the materials and products purchased during the operation of the building, 36% (by cost) are regional.
Energy	E-01 Energy Performance	Annual energy consumption is less than 96 kWh/m ² .
	E-04 Renewable Energy	EITHER Solar Water Heating: Individual dwellings: SHW panels provide 60% of the individual dwelling's hot water demand. Individual dwellings and multi-residential buildings: SHW panels are installed to provide a minimum of 60% of the pool's heating demand along with that of any associated shower facilities. OR On-Site Electricity Generation: Individual dwellings: PV panels provide a minimum of 35% of the total annual building energy demand. Multi-residential buildings: PV panels provide a minimum of 18% of the total annual building energy demand.
Water	W-01 Water Performance	Indoor Water Consumption: Indoor water consumption is 60% less than the baseline. Outdoor Water Consumption: Outdoor water consumption is 90% less than the baseline.
	W-04 Alternative Water Sources	A minimum of 60% of wastewater is treated on-site and infiltrated or used on-site for irrigation.
Health and Comfort	HC-01 Outdoor Thermal Comfort	Provide a minimum of 90% shading cover to the following where they exist within the plot: • Pedestrian walkways • Playgrounds • Car and bicycle parking
	HC-03 Daylight and Visual	A minimum daylight illuminance of 200 lux is achieved for 60%

	Comfort	of the net floor area of each living area and each bedroom.
	HC-04 Acoustics	Individual dwelling: Internal ambient noise levels are less than 28dB(A)_{Leq} in bedrooms and less than 32dB(A)_{Leq} in other areas. Multi-residential building: Internal ambient noise levels are less than 28dB(A)_{Leq} in residential units and less than 36dB(A) _{Leq} in common areas.
Transportation and Connectivity	TC-03 Electric Vehicle Provisions	Individual dwelling: For individual dwellings and small multi-residential buildings (≤ 3 storeys), there is a minimum of two parking spaces with Electric Vehicle Supply Equipment (EVSE). Multi-residential building: EVSE is present for at least 4% of the total parking spaces, or at least three spaces, whichever is greater.

Option 2:

The innovative solution must improve the durability or reduce the maintenance requirements of the building. The innovative solution must be qualified by providing evidence and a report which conforms to the following structure:

- **Measured:** SMART criteria for setting the objective: Specific, Measurable, Achievable, Relevant, and Time-bound.
- **Analyzed:** the innovative practice should produce data that can be analyzed for comparison with an existing baseline so that improvements can be identified.
- **Reported:** the innovative practice should be reported for wider industries and stakeholders to benefit. Sufficient disclosure of technical information is required without compromising sensitive commercial information, however *Sustainable Building* will encourage full disclosure where possible.
- **Replicated:** the innovative practice can be replicated by other Mostadam projects where appropriate.
- **Improved** (for future developments): *Sustainable Building* reserves the right to include any innovation submitted in future iterations of Mostadam.

Credit Tool

N/A

Reference Documents

N/A

Site Sustainability

9 Site Sustainability

A variety of ecosystems can be found in KSA including mangroves, beaches, deserts and mountains. These natural assets provide a range of services such as climate mitigation, carbon storage, buffering against extreme weather and erosion protection. In addition, they are a storehouse for biological diversity and have immense economic and ecological value. Natural assets are at risk due to rapid urbanization and agriculture, therefore it is crucial that they be protected and enhanced. Vision 2030 seeks to protect and preserve natural resources and the environment due to their significant impact on the quality of life for current and future generations.

The development and subsequent operation of homes can have a number of impacts on the surrounding areas including loss of habitat and biodiversity, creation of urban heat islands and excessive external lighting. Mostadam seeks to alleviate these impacts by rewarding projects that show a continued commitment to reducing the impact of their development on the environment through ecological enhancement, reduction of the urban heat island effect and minimization of light pollution.

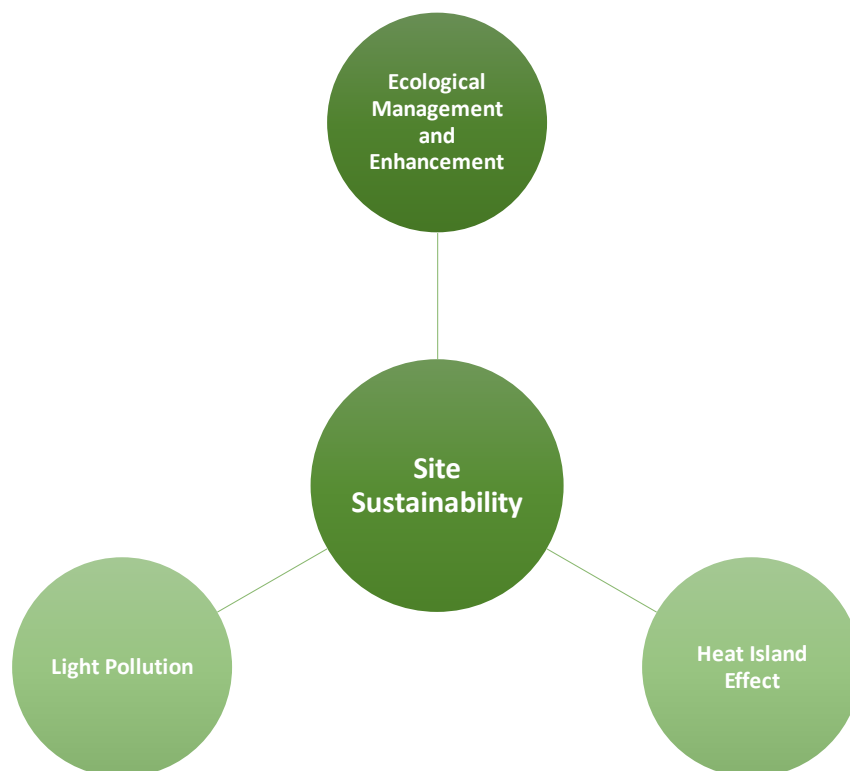


Figure 13 Site Sustainability credits

SS-01 Ecological Management and Enhancement

Keystone Credit	Total Number of Points Available
No	2

Aim

To ensure the integrity of the natural landscape and habitat areas is maintained through appropriate site management and operational practices.

Requirements

#	Requirement	Points Available	
		Individual dwelling	Multi-residential
1	An Ecological Management and Enhancement Plan is developed by a suitable qualified professional to ensure the survival and enhancement of the natural landscape and habitat areas. The plan sets out site-specific long-term objectives and provides clear instructions for management, maintenance and enhancement.	2	2
2	An Ecological Management and Enhancement Compliance Report is compiled which demonstrates the requirements of the Ecological Management and Enhancement Plan have been implemented.		
	Total	2	2

Evidence

#	Evidence per Requirement
1	- Ecological Management and Enhancement Plan written by a suitable qualified professional. - For multi-residential buildings, confirmation that a qualified contractor has been appointed to maintain the landscape in line with the Ecological Management and Enhancement Plan OR confirmation that maintenance is undertaken by the local municipality.
2	An Ecological Management and Enhancement Compliance Report written by the Owner or Facility Manager.

Supporting Guidance

Ecological Management and Enhancement Plan:

The plan must be drafted within the first six months of the Monitoring Period and contain the following:

- A site assessment to establish the existing landscape conditions, supported by date-stamped photographs.
- A site plan that clearly illustrates all key elements of the natural landscape, habitat areas and other landscaped areas:

- Softscape areas: trees, shrubs, groundcover, lawns and vegetative roofs
- Hardscape areas
- Irrigation system and components
- Organic waste collection points and storage
- Equipment storage and maintenance areas
- Any other area or element of concern
- A softscape strategy that identifies the percentage of existing softscape species that are classified as native or drought tolerant and the actions required to increase the percentage to a minimum of 80%. The softscape strategy is to include the following:
 - Calculations to determine the distribution of native and adaptive species, which is to be based on area (m²).
 - Landscape layouts that clearly illustrate the existing softscape distribution and the enhanced softscape distribution. The landscape layouts are to include a color-coded legend for all plant species present.
 - Planting schedule containing all plant species, their classification and areas.
 - An action plan that details how the native and adaptive species distribution on site is to be increased to the required percentage, including the criteria for selecting the species to be removed and appropriate disposal methods. The action plan is to include all relevant roles, responsibilities and schedules.
- Landscape management and maintenance requirements that cover the following and include all relevant instructions, checklists, log-book requirements, schedules and performance criteria:
 - Soil testing.
 - Soil enhancement techniques (including manure and composting).
 - Approved fertilizers and pesticides with minimum harm to the environment and humans, with directions for their application.
 - Erosion and desertification control.
 - Vegetation maintenance procedures.
 - Planting schedule.
 - Log-book template for potential new species to be added to increase the ecological value.
 - List of invasive species and their management and removal procedures.
 - Water efficient irrigation strategy.
 - Organic waste management.
 - Chemical storage.
- An organizational chart that highlights key personnel, assignment of responsibilities and tasks, communication protocol and the quality assurance mechanism.

Ecological Management and Enhancement Compliance Report:

The Ecological Management and Enhancement Compliance Report is written by the Owner or Facility Manager and documents the implementation of the Ecological Management and Enhancement Plan within the second six months of the Monitoring Period. The compliance report must contain the following:

- Narrative on how each landscape management and maintenance requirement, and the softscape strategy, has been achieved, including all relevant dates, performance criteria, calculations, results and site plans.
- Completed log books and signed/stamped checklists.

- Receipts and/or delivery notes of all items procured to illustrate the implementation of the landscape management and maintenance requirements.
- Updated site plan if any significant alterations to the landscape have taken place.

Soil Testing:

- Soil testing should be conducted and based on an appropriate schedule for each of the following:
 - Major nutrients: nitrogen, phosphorus and potassium
 - Secondary nutrients: sulfur, calcium, magnesium
 - Minor nutrients: iron, manganese, copper, zinc, boron molybdenum chlorine
 - pH levels
 - Soil salinity
 - Water content
- Soil tests should be conducted by an independent state-operated or university-operated laboratory with experience in soil science, soil testing and plant nutrition and the capability to conduct the testing indicated. Soil testing and analysis shall be carried out in line with the standards of the Saudi Standards, Metrology and Quality Organization (SASO).
- The soil enhancement and landscape maintenance techniques should be indicative to the results of the soil analysis.

Planting Schedule:

An approved planting schedule is to be developed that is site-specific and consists of native and/or drought tolerant species. The schedule should support the softscape plan and is to be referenced if any replacement of plant material is required during or beyond the Monitoring Period. The planting schedule should include the following information as a minimum:

- Common and botanical plant names
- Classification: native, drought tolerant, saline tolerant
- Irrigation demand

Plant Classification:

- Native species can include but are not limited to those species identified by any of the following:
 - Approved city, province or regional lists.
 - Saudi Standards, Metrology and Quality Organization (SASO).
 - Classified as locally occurring or the origin is noted as from the region (as per the documents listed under Reference Documents).
- No species classified as invasive and/or toxic shall be included in the planting schedule.
- Selected plant species should be checked against the Saudi Building Code 1001 classification and all documents listed in the Reference Documents section.
- A drought tolerant and saline tolerant species is a species with a proven track record of surviving in drought and saline conditions of a similar environment. The general classifications are as follows:
 - Drought tolerant: the ability of a plant to endure long periods of dry weather or lack of moisture.

- Saline tolerant: the ability of a plant to withstand moderate or high concentrations of salt.
- Documented proof is to be provided from a reliable source for all species classification.

Irrigation Strategy:

An irrigation strategy is to be developed with the intent to reduce the overall irrigation demand of the site and is to include the following:

- Overview of the irrigation system and any water efficient technology such as soil moisture sensors, timers and controllers.
- Confirmation and calculation of the existing irrigation demand, supported by metering data, water bills or similar.
- Proposed irrigation schedule and measures to reduce the quantity of water utilized for irrigation purposes.

Suitable Qualified Professional:

A suitable qualified professional is either an Environmental Professional or a Landscape Specialist:

- An Environmental Professional is someone who is registered with the General Authority of Meteorology & Environmental Protection and has achieved the following:
 - An environmental degree or equivalent qualification in ecology.
 - A minimum of three years of relevant experience in carrying out habitat surveys as well as acting in an advisory role to provide recommendations for ecological protection, enhancement and management measures.
- A Landscape Specialist is someone who is has achieved the following:
 - A Landscape Architectural degree or relevant qualification in horticulture, botany or plant biology.
 - A minimum of three years of relevant experience in the management of ecological landscapes with technical knowledge in the care and maintenance of plants.

Qualified Contractor:

For multi-residential buildings, a Contractor is to be appointed that is qualified to carry out all requirements outlined in the Ecological Management and Enhancement Plan and can provide all relevant and valid licenses.

Credit Tool

N/A

Reference Documents

1. Saudi Building Code (SBC) 1001 Green Buildings, Chapter 2 Definitions
2. Saudi Building Code (SBC) 1001 Green Buildings, Section 404 Landscape Irrigation and Outdoor Fountains
3. Saudi Standards, Metrology and Quality Organization (SASO)
4. Reports and publications published by the Saudi Wildlife Authority (SWA)
5. Landscape Plants for Arriyadh Region: A Reference Guide, 2014, High Commission for the Development of Arriyadh

SS-02 Heat Island Effect

Keystone Credit	Total Number of Points Available
No	2

Aim

To improve the microclimate of residential areas through material selection.

Requirements

#	Requirement	Points Available	
		Individual dwelling	Multi-residential
1	The three-year aged Solar Reflectance Index (SRI) values of hardscape, shade structures and roofs meet the following: - Hardscape: 90% of the hardscape covering has an SRI $\geq$ 45. - Shade structures: 100% of the shade structures have an SRI $\geq$ 75. - Roofs: 100% of the roof covering has an SRI $\geq$ 75.	1	1
2	The unused roof area and/or structures used for shading have a vegetative covering over a minimum of 70% of their surface area.	1	1
	Total	2	2

Evidence

#	Evidence per Requirement
1	- Drawings illustrating all areas of compliant and non-compliant hardscape, shade structures and roofs. - Calculations in table format showing that the requirements are met. - Schedule of surfaces/structures listing the type of surface or structure (roof, elevation cladding, hardscape etc.), location, finish (material/coating) and the respective compliant SRI. - If the surface/structure is new, provide purchase orders and product datasheets showing the SRIs for the materials used. If the surface/structure is older and product data sheets are not available, provide data sheets of similar materials and colors for commercially available surfaces/structures. - Date-stamped photographs of the hardscape, shade structures and roofs.
2	- Drawings showing the areas of roof and shade structures that have a vegetative covering and the associated irrigation system. - Calculations in table format showing that the requirements are met. - Date-stamped photographs of the installed vegetative covering.

Supporting Guidance

Solar Reflectance Index (SRI):

- The SRI of a material demonstrates the material's ability to stay cool in the sun as it absorbs less heat and reflects more sunlight. The higher the SRI, the better the material is at staying cool in the sun.
- The three year-aged SRI is typically lower than the initial SRI as it accounts for weathering and soiling which reduces the material's ability to stay cool in the sun. As much of the weathering and soiling occurs within the first three years, the aged value is a more accurate measure of the material's ability to stay cool in the sun. If the three year-aged SRI is unavailable, the initial SRI can be provided.
- For new surfaces and structures: product data sheets must confirm that the SRI values of materials have been determined using ASTM E1980 at a facility independent of the manufacturer. Based on the example in Table SS-02.1, the white roofing tile would contribute towards this credit however the yellow roofing would not.

Table SS-02.1 Sample of a section of product data sheet for roofing tiles

	Initial SRI	Three year-aged SRI
Roofing Tile - White	93	87
Roofing Tile - Yellow	73	65

- For older surfaces and structures where product data sheets are not available: color photographs must be provided along with information from manufacturers of similar products and colors, including their SRI. For roofing materials, the Cool Roof Rating Council can be used which has a database of roof coatings and materials and their SRI.
- Typical SRI values for common surface coverings are provided in Table SS-02.2.

Table SS-02.2 Typical SRIs for common surface coverings

Surface Covering	Typical SRI
Black paint	0
New asphalt	0
Aged asphalt	6
New concrete	38-52
Aged concrete	19-35
Green areas	13-33
Glazing	12-57
Swimming pool	20-25

- Hardscape areas include paths, walkways, car parking and play and amenity areas. Areas of pervious, permeable or concrete (without added color) hardscape automatically comply with the credit requirement.
- The hardscape of parking areas that are shaded (where the shading meets the required SRI values) automatically comply with the credit requirement.

- The areas of the roof used for services, access and/or renewable energy sources are excluded from the requirements and calculations.

Vegetative Roof Covering:

- Plant species should be native where possible and must be drought tolerant. Refer to credit **SS-01 Ecological Management and Enhancement** for guidance.
- The selected plant species must be capable of being sustained throughout the year by providing adequate irrigation and safe means of access to the roof structure for maintenance including the transportation of plant-care equipment.
- The installation of the vegetation must be in accordance with the roof covering manufacturer's instructions and Saudi Fire Protection Code 801.

Credit Tool

N/A

Reference Documents

1. Saudi Building Code (SBC) 201 Architectural, Section 6 Roof Assemblies and Rooftop Structures
2. Saudi Building Code (SBC) 801 Fire Protection Requirements, Section 5C.4 Access to Building Openings and Roofs
3. Saudi Building Code (SBC) 1001 Green Buildings, Section 408.3 Roof Surfaces
4. ASTM E1980 – 11 Standard Practice for Calculating Solar Reflective Index of Horizontal and Low-Sloped Opaque Surfaces
5. ANSI/ASHRAE/USGBC/IES Standard 189.1-2014: Standard for the Design of High-Performance Green Buildings Except Low-Rise Residential Buildings
6. Cool Roof Rating Council, <https://coolroofs.org>

SS-03 Light Pollution

Keystone Credit	Total Number of Points Available
No	1

Aim

To reduce the pollution impact of external lighting and reduce the light trespass from within the project boundary to the sky and surrounding developments.

Requirements

#	Requirement	Points Available																											
		Individual dwelling	Multi-residential																										
1	All external lighting within the project boundary complies with the following requirements:	1	1																										
	Uplight Rating																												
	The luminaire uplight rating does not exceed the values below for the relevant light pollution zone (refer to the Supporting Guidance).																												
	<table><tr><th rowspan="2"></th><th colspan="4">Light Pollution Zone (LPZ)</th></tr><tr><th>A</th><th>B</th><th>C</th><th>D</th></tr><tr><td>Maximum Luminaire Uplight Rating</td><td>10 *</td><td>50 *</td><td>500 *</td><td>1000 *</td></tr></table>				Light Pollution Zone (LPZ)				A	B	C	D	Maximum Luminaire Uplight Rating	10 *	50 *	500 *	1000 *												
					Light Pollution Zone (LPZ)																								
				A	B	C	D																						
	Maximum Luminaire Uplight Rating			10 *	50 *	500 *	1000 *																						
	*Maximum zonal lumens																												
	Glare and Backlight Rating																												
	Where luminaires are mounted on buildings with their backlight oriented towards the building, such luminaires do not exceed the following glare ratings:																												
<table><tr><th rowspan="2">Horizontal Distance to Lighting Boundary (H_{LB})</th><th colspan="4">Light Pollution Zone (LPZ)</th></tr><tr><th>A</th><th>B</th><th>C</th><th>D</th></tr><tr><td>$H_{LB} > 2h_m$</td><td>G1</td><td>G2</td><td>G3</td><td>G4</td></tr><tr><td>$h_m < H_{LB} \leq 2h_m$</td><td>G0</td><td>G1</td><td>G1</td><td>G2</td></tr><tr><td>$0.5h_m \leq H_{LB} \leq h_m$</td><td>G0</td><td>G0</td><td>G1</td><td>G1</td></tr><tr><td>$H_{LB} < 0.5h_m$</td><td>G0</td><td>G0</td><td>G0</td><td>G1</td></tr></table>	Horizontal Distance to Lighting Boundary (H_{LB})	Light Pollution Zone (LPZ)				A	B	C	D	$H_{LB} > 2h_m$	G1	G2	G3	G4	$h_m < H_{LB} \leq 2h_m$	G0	G1	G1	G2	$0.5h_m \leq H_{LB} \leq h_m$	G0	G0	G1	G1	$H_{LB} < 0.5h_m$	G0	G0	G0	G1
Horizontal Distance to Lighting Boundary (H_{LB})		Light Pollution Zone (LPZ)																											
	A	B	C	D																									
$H_{LB} > 2h_m$	G1	G2	G3	G4																									
$h_m < H_{LB} \leq 2h_m$	G0	G1	G1	G2																									
$0.5h_m \leq H_{LB} \leq h_m$	G0	G0	G1	G1																									
$H_{LB} < 0.5h_m$	G0	G0	G0	G1																									
h_m = mounting height: the distance above finished grade at which a luminaire is mounted, measured to the midpoint of the luminaire.																													
Other exterior luminaires do not exceed the following backlight and glare ratings:																													

	Horizontal Distance to Lighting Boundary (H_{LB})	Light Pollution Zone (LPZ)					
		A	B	C	D		
	$H_{LB} > 2h_m$	B3 G1	B4 G2	B5 G3	B5 G4		
	$h_m < H_{LB} \leq 2h_m$	B2 G1	B3 G2	B4 G3	B4 G4		
	$0.5h_m \leq H_{LB} \leq h_m$	B1 G1	B2 G2	B3 G3	B3 G4		
	$H_{LB} < 0.5h_m$	B0 G1	B0 G2	B1 G3	B2 G4		
h_m = mounting height: the distance above finished grade at which a luminaire is mounted, measured to the midpoint of the luminaire. A policy for the future procurement of external lighting that complies with the above requirements is included in the Sustainable Procurement Policy (PMM-04 Sustainable Procurement).							
		Total				1	1

Evidence

#	Evidence per Requirement
1	- Purchasing policy for external lighting, to be included in the Sustainable Procurement Policy (PMM-04 Sustainable Procurement). For newly installed lighting: - Drawings showing the locations of external lighting and the fixture types. - Purchase orders/receipts for approved luminaires. - External lighting fixtures datasheet for installed lighting with lumens levels at different angles. - Date-stamped photographs of installed lighting fixtures with each fixture labelled as per the datasheet. For existing lighting: - Date-stamped photographs showing that no lighting is directed upwards or is reflecting up a wall. - Lux level measurements on the luminaire perpendicular surface, demonstrating that the lux level measurement is below the threshold values listed in the requirement (refer to the Supporting Guidance).

Supporting Guidance

Measuring Uplight, Glare and Backlight:

- Measurements must be taken by a Competent Professional with at least 2 years of relevant experience in undertaking lighting measurements. An appropriately tested and calibrated Lux meter must be used.

- Measurements to be made based on zonal lumen calculations for secondary solid angles defined in IES TM-15-11.
- Lux level measurements are to be taken on the luminaire perpendicular surface, within the Useful Light area at the maximum illuminance point. The Lux level measurement within 1m² is below the threshold values listed in the requirements [1 Lumen = 1 Lux x 1m²].

Light Pollution and Light Trespass:

Light pollution is the presence of artificial light in the night environment. It is intensified by excessive, misdirected or obtrusive uses of light. Light pollution competes with starlight in the night sky, disrupts ecosystems and has adverse health effects.

Light trespass occurs when direct beams from artificial light have a negative impact outside the project or site boundary. For example, luminaires for external site-specific environments that are adjacent to roadways should not create any glare on the road and external lighting that is adjacent to parks should not spill to park areas to avoid disturbing the natural habitat.

A well-designed exterior lighting system fully considers the placement, direction and mounting height of luminaires. It also offers provisions for way-finding, safety and security without causing light pollution. A gradual change in the lighting levels allows for people's eyes to adjust and reducing direct views of lamps reduces glare. The use of shields and cut-off angles can be considered as part of the exterior lighting system to reduce misdirected light.

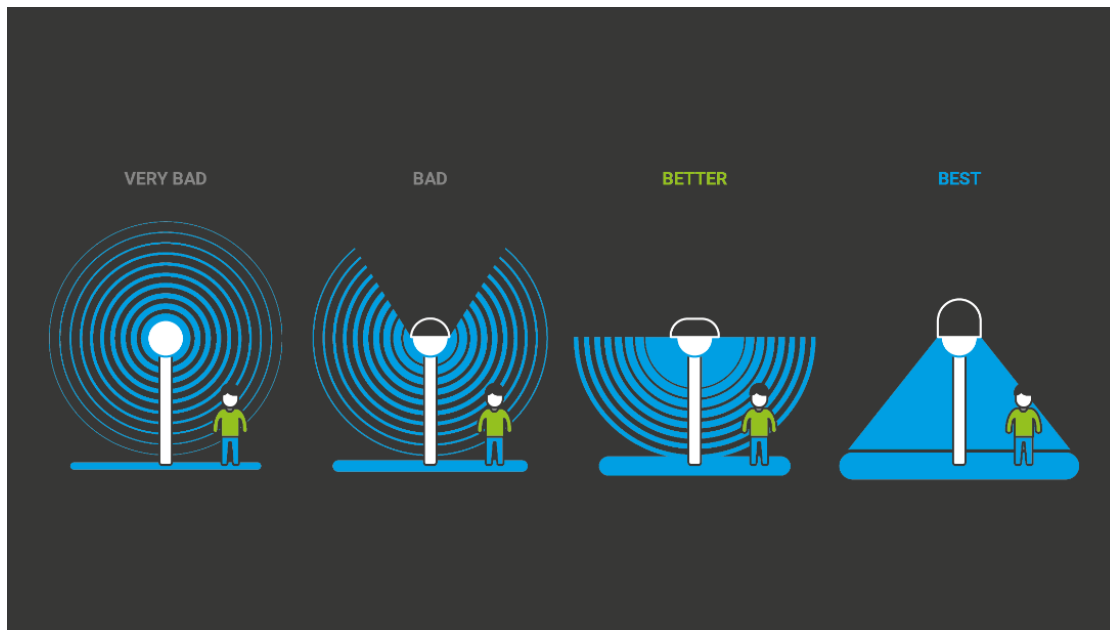


Figure SS-03.1 Impact of shields and cut-off angles

Uplight, Glare and Backlight:

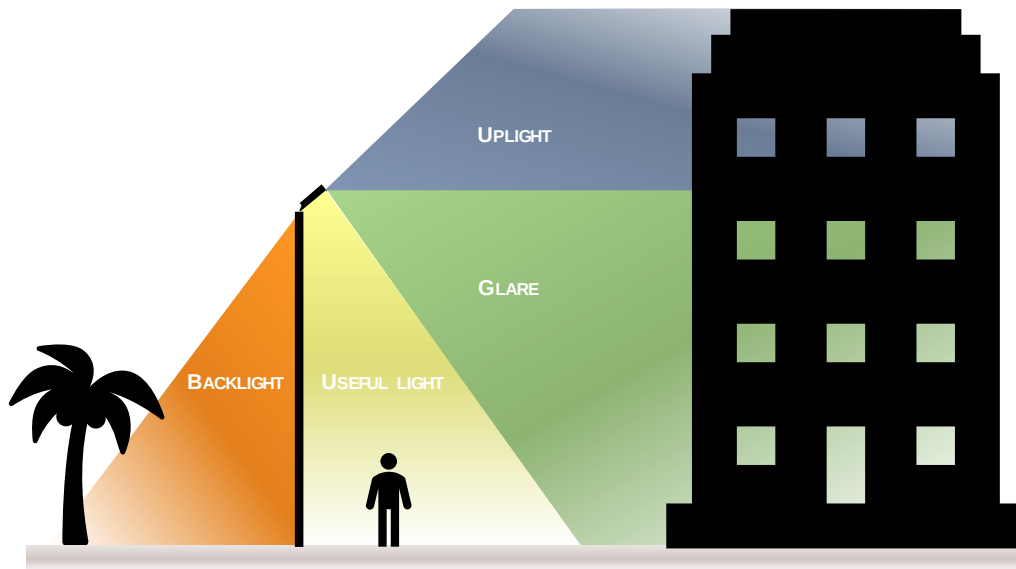


Figure SS-03.2 Uplight, glare and backlight

Uplight

- Uplight is either exterior lighting that is directed upwards to illuminate the building or landscape features, or unwanted light produced above a downward facing light source.
- The luminaire uplight rating is determined using the Illuminating Engineering Society's TM-15-11 Addendum A standard for the classification of outdoor luminaires.
- The rating shall be determined by the actual photometric geometry in the specified mounting orientation.
- For complex external lighting design solutions, a lighting calculation software may be required to demonstrate compliance.

Glare and Backlight

- Glare is excessive brightness caused by the luminaire. Increasing the brightness of the luminaire does not always result in increased visibility and can cause visual discomfort.
- Backlight is light that is not directed in the desired direction and can cause light trespass.
- Glare (G) and Backlight (B) ratings are defined by IES TM-15-11 Addendum A.
- The rating shall be determined by the actual photometric geometry in the specified mounting orientation.
- Luminaires located two mounting heights or less from the lighting boundary shall be installed with backlight towards the nearest lighting boundary, unless lighting a roadway, bikeway or walkway that intersects a public roadway.
- Exterior lighting shall also comply with SBC 601, Section 9.4.3 Exterior Building Lighting Power.
- More information can be found in the SBC 1001, Section 409.3 Light Trespass and Glare.

Mounting Heights:

The mounting height is the distance above the finished grade at which a luminaire is mounted, measured to the midpoint of the luminaire. For a given lighting boundary, the greater the mounting height, the more stringent the required glare and backlight ratings.

As an example, consider a luminaire with a mounting height of 5 meters. If the backlight and glare ratings indicate this luminaire should be between one and two mounting heights from the lighting boundary, then it should be located between 5 to 10 meters from the nearest lighting boundary.

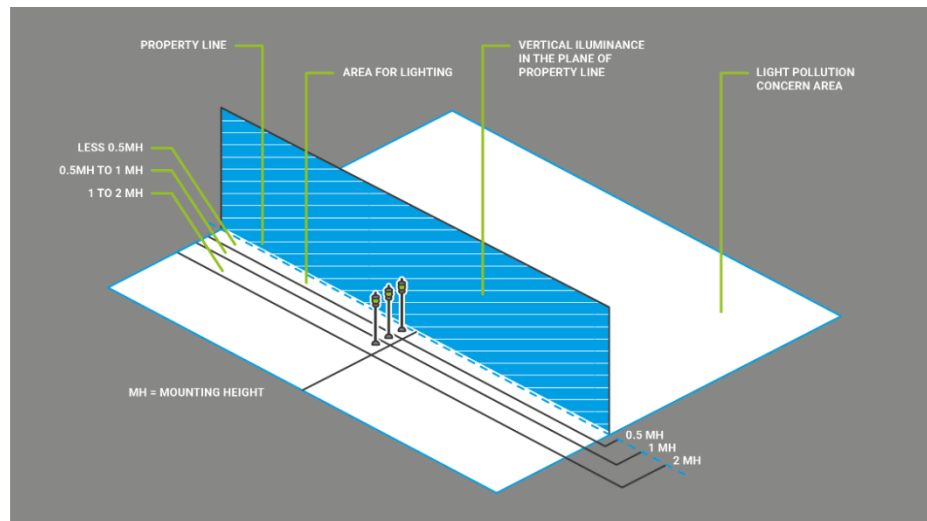


Figure SS-03.3 Mounting Height

Lighting Boundary:

- The lighting boundary is typically the property line.
- If the adjoining use is a pedestrian pathway, bikeway or parking facility, the lighting boundary is extended 1.5m beyond the property line.
- If the property is adjacent to a roadway or transit corridor, the lighting boundary is extended to the centerline of the roadway or transit corridor.
- In Figure SS-03.4, the lighting boundary is defined by the orange line.



Figure SS-03.4 Lighting Boundary

Light Pollution Zones:

The light pollution zones (LPZ), as defined in the Saudi Building Code (SBC) 1001, are shown in Table SS-03.1.

Table SS-03.1 Light pollution zones

Light Pollution Zone	Description
A	Rural and low-density residential areas such as, but not limited to: agricultural districts, one- and two-family residential communities, business parks, rural town centers, commercial or industrial areas with limited nighttime activity and the developed areas within parks and open space preserves.
B	Light commercial business districts and high-density mixed-use residential districts and high-density or mixed-use residential districts, such as, but not limited to: neighborhood, business districts, light industrial areas with moderate nighttime activity, multi-family residential uses, institutional residential uses, hospitals, hotels, motels, mosques, schools and neighborhood recreation facilities.
C	High-density commercial business districts, and heavy industrial or manufacturing areas such as, but not limited to: business districts in large cities, commercial corridors, high-density suburban commercial areas, town center mixed-use areas, industrial uses and shipping and rail yards with high night time activity, high-use recreation facilities, gas stations, and other exterior retail areas with high night time activity.
D	Areas such as but, not limited to: high-density entertainment districts and heavy industrial areas, where approved by the code official.

Purchasing Policy for External Lighting:

The purchasing policy for external lighting should contain the following information:

- List of all appliance types covered by the policy (i.e. all the appliance types covered by this credit, as a minimum)
- Minimum requirements for:
 - Uplight rating
 - Glare and backlight rating
- Template for the individual responsible for purchasing external lighting (Owner or Facility Manager) to document all relevant purchases in a table containing the following information:
 - Lighting type
 - Manufacturer
 - Model
 - Uplight, glare and backlight rating
 - Supplier
 - Purchase order/receipt
 - Location/position of lighting

The purchasing policy for external lighting should be included in the Sustainable Procurement Policy (**PMM-04 Sustainable Procurement**).

Exemptions:

The following types of exterior lighting are exempt from the credit requirements:

- Specialized signal, directional and marker lighting associated with transportation.
- Lighting integral to equipment or instrumentation and installed by its manufacturer.
- Athletic playing areas where lighting is equipped with hoods or louvers for glare control.
- Temporary lighting (including security lighting that is linked to PIR controllers and only operates when movement is detected).
- Roadway lighting required by the government.
- Lighting for swimming pools and water features.
- Lighting for the national flag (except pollution zone A).

Credit Tool

N/A

Reference Documents

1. Saudi Building Code (SBC) 1001 Green Buildings, Tables 409.2 and 409.3
2. Saudi Building Code (SBC) 601 Energy Conservation, Section 9.4.3
3. IES TM-15-11 Luminaire Classification System for Outdoor Luminaires
4. IES TM-15-11 Addendum A: Backlight, Uplight and Glare (BUG) Ratings
5. CIBSE LG9 Lighting for Communal Residential Buildings

Transportation and Connectivity

10 Transportation and Connectivity

Vision 2030 aims to enhance the provision of public transportation through upgraded infrastructure and reliable services, and incentivize the use of alternative means of transport. Furthermore, under Vision 2030 new urban planning schemes are to prioritize “people-centric cities”, providing an opportunity to plan and build cities that foster safe pedestrian connectivity and working and playing spaces that respond to citizens’ needs and desires.

Mostadam aligns with these objectives by rewarding projects that include facilities for alternative transport such as electric vehicles and bicycles and demonstrate their sustained use. Developments that are located near existing or planned transit nodes can benefit from the investment in infrastructure across the country, and therefore positively influence the environment by minimizing emissions linked to private vehicle transportation. Transportation and Connectivity further compliments Vision 2030 and promotes healthy lifestyles through credits that benefit aspects of planning including the provision of bicycle facilities that encourage physical activity through cycling as well as walking.

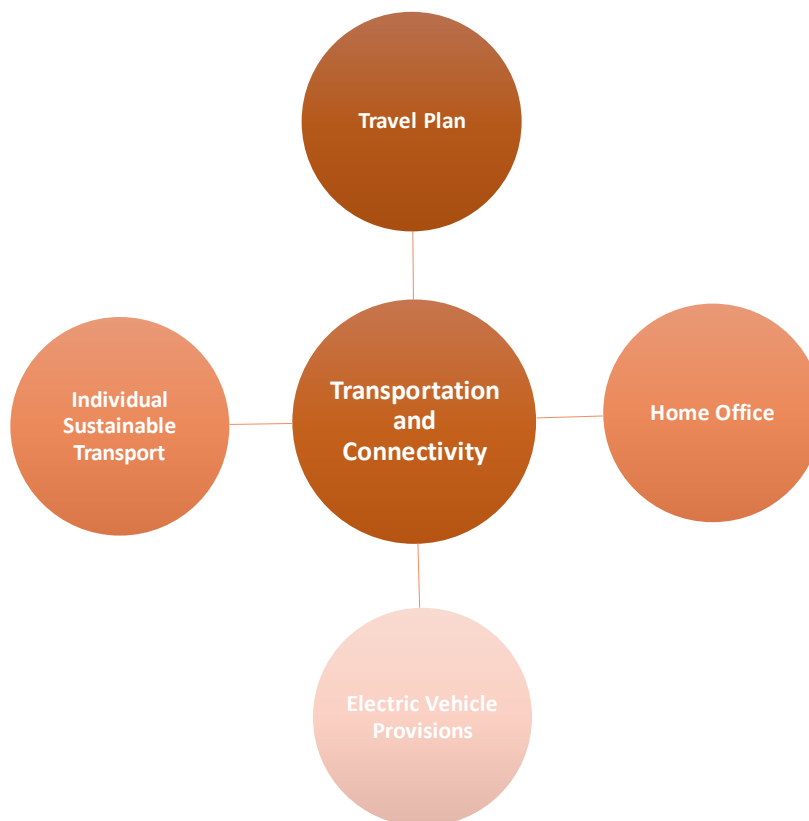


Figure 14 Transport and Connectivity credits

TC-01 Travel Plan

Keystone Credit	Total Number of Points Available
No	1

Aim

To support transportation choices, reduce air pollution, and promote active living via ongoing transportation management.

Requirements

#	Requirement	Points Available	
		Individual dwelling	Multi-residential
1	A Transportation Assessment is undertaken to determine the available public transport options. Based on the findings of the Assessment, a Travel Plan is developed and implemented to reduce single-occupancy vehicle trips.	1	1
	Total	1	1

Evidence

#	Evidence per Requirement
1	- Transportation Assessment report. - Travel Plan.

Supporting Guidance

This credit is applicable to multi-residential buildings of any size, including sub-divided villas and townhouses. It is not applicable to single-family dwellings i.e. villas or townhouses occupied by one family.

Transportation Assessment:

The Transportation Assessment must include the following as a minimum:

- Description of the existing transportation options for residents, including nearby bicycle infrastructure and local public transit service routes and schedules.
- Map of the local transportation infrastructure, including routes, stops and stations, as well as bicycle storage, bicycle ways and walkways on site.
- Map of typical destinations for the residents including (where relevant):
 - Bank/ATM
 - Daycare
 - Government service center
 - Grocery store/supermarket
 - Gym

- Library
- Medical clinic
- Mosque
- Post office
- Pharmacy
- Public park or open space
- Restaurant
- School
- Other retail
- Consultation with residents and staff (on an entirely voluntary basis) on their various modes of transportation.
- Feedback obtained and suggestions for improved transportation choices and the reduction of single-occupancy vehicle trips.

Travel Plan:

The Travel Plan must be based on the Transportation Assessment and any feedback gained from residents and staff and include the following:

- A summary of the Transportation Assessment results.
- Solutions for increasing the use of alternatives to personal vehicles (especially single-occupancy vehicle trips) based on consideration of the following:
 - Available mode choices (e.g. public transit, bicycle/individual sustainable transport, carpool, taxi or walking) and the approximate distances of the following trips:
 - i. Primary daily commute (two-ways).
 - ii. Grocery or food shopping trips.
 - iii. Regular weekend trips (e.g. Friday prayer, public parks).
 - iv. Other routine daily or weekly trips to amenities (e.g. mosque, school pick-up/drop-off, gym).
- Information Pack for residents including:
 - Transportation and amenity maps (refer to Figure TC-01.1 for an example).
 - Recommendations and/or solutions introduced by the building Owner/Facility Manager to promote alternatives to personal vehicle use.
 - Description of the positive impacts that will result from the Travel Plan's implementation to encourage residents to adopt the Travel Plan.

The Travel Plan, including the Information Pack, must be updated at least once per year to capture any changes to public transit and amenities. The Information Pack must be communicated to residents at least once per year.

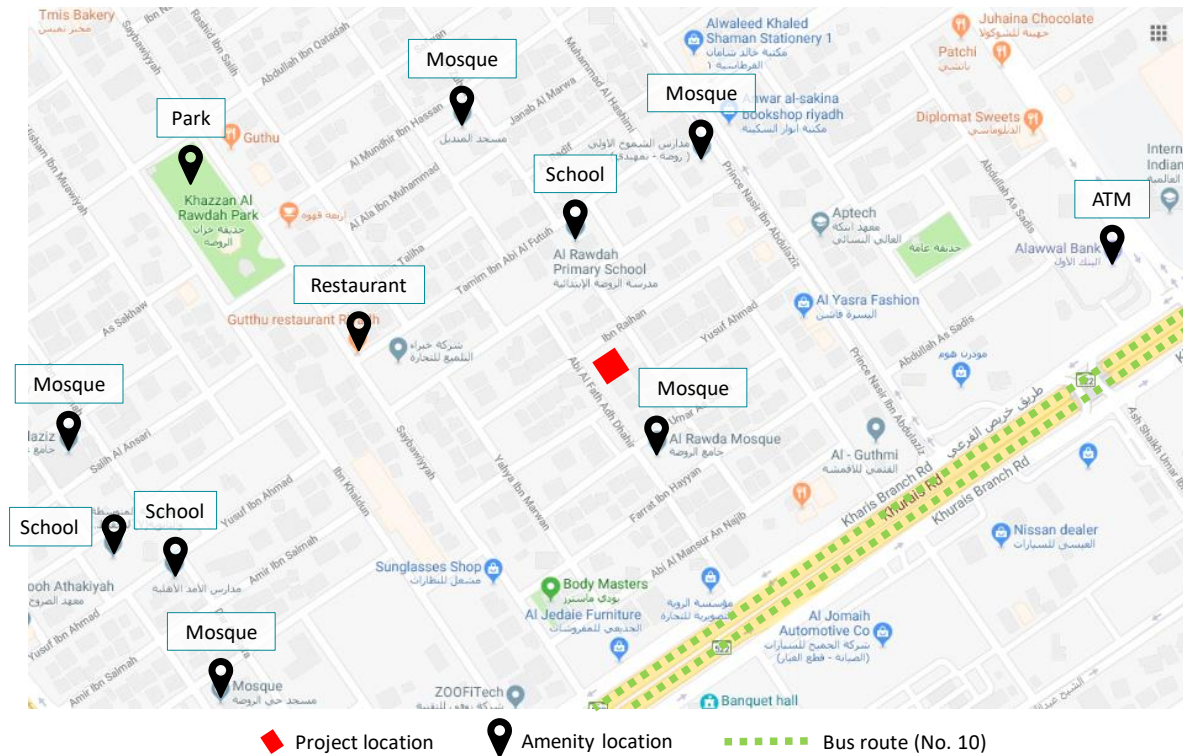


Figure TC-01.1 Example amenities and transport map

Credit Tool

N/A

Reference Documents

1. Sustainable Urban Transport Project (SUTP), <https://sutp.org>
2. European Institute for Sustainable Transport (EURIST), <https://www.eurist.info/>
3. California South Coast Air Quality Management District, Rule 2202 – On-Road Motor Vehicle Mitigation Options-Employee Commute Reduction Program Guidelines, 2016

TC-02 Home Office

Keystone Credit	Total Number of Points Available
No	1

Aim

To facilitate and promote working from home to encourage flexible working and reduce the pollution associated with commuting.

Requirements

#	Requirement	Points Available	
		Individual dwelling	Multi-residential
1	For dwellings/residential units with up to two bedrooms: A zone in the living room, one of the bedrooms or another suitable area can be used as a home office/study. For dwellings/residential units with three or more bedrooms: A separate room is allocated for use as a home office/study. The home office/study, whether a separate room or a dedicated zone within another room, must have the provisions listed in the Supporting Guidance.	1	1
2	Provide information in the lobby/reception of the building on the benefits of working from home and promoting home offices.	N/A	
	Total	1	1

Evidence

#	Evidence per Requirement
1	- For each dwelling or residential unit type, scaled plans showing: - The location and size of the home office/study, demonstrating compliance with provision #1 in the Supporting Guidance. - The location of provisions #2 and #3 in the Supporting Guidance. - For each dwelling or residential unit type, date-stamped photographs of provisions #2 and #3 in the Supporting Guidance.
2	Date-stamped photographs of the required information displayed in the lobby/reception of the building.

Supporting Guidance

Home Office:

The home office/study room or zone must have the following provisions:

- Adequate space for:
 - A desk, chair and filing cabinet or bookshelf.

- Movement around the front of the desk.
 - Safe use of the chair and filing cabinet.
- 2. Two double power sockets.
- 3. Data and telephone communications e.g. broadband socket, telephone socket.

Information on the Benefits of Home Working:

The information displayed in the lobby/reception must promote flexible working and communicate the benefits of working from home. It should highlight the positive impact that home working has on the environment, the economy and health and wellbeing.

Credit Tool

N/A

Reference Documents

1. Metric Handbook: Planning and Design Data, 6th edition

TC-03 Electric Vehicle Provisions

Keystone Credit	Total Number of Points Available
No	1

Aim

To reduce air pollution by supporting electric-powered vehicles.

Requirements

#	Requirement	Points Available	
		Individual dwelling	Multi-residential
1	For individual dwellings and small multi-residential buildings (≤ 3 storeys), there is a minimum of one parking space with Electric Vehicle Supply Equipment (EVSE). The EVSE parking space is fully shaded and reserved for the sole use of electric vehicles.	1	N/A
2	EVSE is present for at least 3% of the total parking spaces, or at least two spaces, whichever is greater. The EVSE parking spaces are fully shaded and reserved for the sole use of electric vehicles. Information is provided in the lobby/reception of the building on the benefits of electric vehicles.	N/A	1
	Total	1	1

Evidence

#	Evidence per Requirement
1 & 2	- Date-stamped photographs and site plans showing the location of the Electric Vehicle Supply Equipment (EVSE) and, for multi-residential buildings, calculations demonstrating that the minimum number of EVSE parking spaces is achieved. - Date-stamped photographs showing the shading provision for each EVSE parking space. - Purchase receipts and manufacturer's datasheet demonstrating compliance with EVSE and shading criteria.

Supporting Guidance

- Calculations must be rounded upwards to the nearest whole number.
- All parking spaces reserved for electric vehicles must be clearly identified by signage or floor markings.
- All parking spaces reserved for electric vehicles must be fully shaded. Refer to credit **SS-02 Heat Island Effect** for the minimum Solar Reflectance Index (SRI) of any shade awnings or canopies. The shaded area cast by trees should be based on their canopy size at a maximum of 5 years post-construction.

Electric Vehicle Supply Equipment (EVSE):

Electric Vehicle Supply Equipment (EVSE) supplies electric energy for the recharging of plug-in electric vehicles. Charging stations provide a range of heavy duty or special connectors that conform to a variety of standards. Subject to the recharging time required, a single charging station may need up to 65kVA power connection based on units currently available in the market. It is important that the charging stations have sufficient fire safety and emergency response infrastructure (as per relevant emergency authority requirements) as many of the commercially available electric cars have high-voltage systems.

The installed EVSE must:

- Provide a Level 2 charging capacity or greater.
- Comply with the relevant national and international standards for electrical connectors, such as SAE Surface Vehicle Recommended Practice J1772, SAE Electric Vehicle Conductive Charge Coupler or IEC 62196 of the International Electrotechnical Commission.
- All connections must be certified by a competent electrician with previous experience. The competent electrician shall have a training certificate, or an attestation, from the supplier of the power charger. In addition, their professional license must cover electrical installations with a kW rating equal to or greater than the power rating of the charger.
- The charging capacity (for fast charging times) must be well below the capacity of the distribution board and the connection capacity of the property to the mains.

Information on the Benefits of Electric Vehicles:

The information displayed in the lobby/reception must promote the use of electric vehicles and communicate their benefits. It should highlight the positive impact on the environment and the community.

Credit Tool

N/A

Reference Documents

1. SASO GSO IEC 62196 Plugs, Socket-outlets, Vehicle Connectors and Vehicle Inlets - Conductive Charging of Electric Vehicles
2. SAE Surface Vehicle Recommended Practice J1772, SAE Electric Vehicle Conductive Charge Coupler
3. 2016 California Green Building Standards Code, Part 11 (5.106.5.3 Electric Vehicle (EV) Charging)

TC-04 Individual Sustainable Transport

Keystone Credit	Total Number of Points Available
No	1

Aim

To promote active living and transportation choices by providing convenient parking for bicycles and other individual transportation modes.

Requirements

#	Requirement	Points Available	
		Individual dwelling	Multi-residential
1	Individual Dwelling One fully shaded parking area is reserved for a bicycle or other individual transportation mode.	1	1
	Multi-Residential Building For every 20 residents: - There is one permanent, fully shaded bicycle rack within 30 meters of a building entrance. - There is a reserved parking area for other individual transportation modes. Information is provided in the lobby/reception of the building on the benefits of individual transportation modes.		
2	The building is located within 180m actual bicycling distance of a bicycle network that connects directly to five amenities within 5km. Bicycle networks currently under construction may qualify if they are expected to be operational within one year.		
	Total	1	1

Evidence

#	Evidence per Requirement
1	Individual Dwelling: - Plans identifying the location, dimensions and shading of the reserved parking area. - Date-stamped photographs of the reserved parking area. Multi-Residential Building: - Calculations of the required number of bicycle racks and parking areas based on the number of residents. - Drawings identifying the building entrance, location, dimensions and shading of each permanent bicycle rack and the actual walking distance (in meters). - Drawings identifying the location, dimensions and shading of each reserved parking

	area. • Date-stamped photographs of each bicycle rack and reserved parking area.
2	• Site plan identifying the location of each permanent bicycle rack, bicycle network and applicable amenities and the actual bicycling distance (in meters). • Date-stamped photographs or other official confirmation that the bike network comprises a clearly marked bike lane at least 3m wide, or a street with a speed limit of 40 km/h or less. • For bicycle networks under construction, official confirmation of date of full operation.

Supporting Guidance

Bicycle Racks:

Bicycle racks must have the following characteristics:

- Each bicycle space must be at least 2m x 0.75m, with an aisle at least 1.5m wide (alternative designs that comply with the Association of Pedestrian and Bicycle Professionals (APBP) Bicycle Parking Guidelines are also accepted).
- Stands must be permanently fixed and allow two points of contact, such that a single U-lock can capture both the bicycle frame and a wheel.
- Stands in public racks should be constructed with tamper-resistant and weather-resistant materials, such as stainless steel or galvanized steel. Square tubing, rather than round tubing, should be used.
- All bicycle racks must be fully shaded (refer to credit **SS-02 Heat Island Effect** for the minimum SRI requirements for the shading).
- If the bicycle racks are not visible from both the street and the building, clear signage must be provided.
- Recommended bicycle rack designs include Inverted U (or Stable Loop), the Post & Ring, and the Wheel-wheel-secure. For high- density, space-constrained situations: Staggered Wheelwell-secure, Vertical, and Two-Tier.
- Bicycle rack designs that are not recommended include: Wave, Schoolyard, Coathanger, Wheel-well, Bollard, Spiral, and Swing Arm Secured.
- Bicycle rack capacity provided outside the project boundary, or specifically allocated for non-resident tenants, may not be counted.

Calculating the Number of Bicycle Racks Required:

To identify the number of bicycle racks required, the following need to be determined and identified:

- Determine the types of units in the building (studio, 1 bedroom, 2 bedrooms, etc.) and the number of units of each type.
- Identify the number of residents based on the number and types of units. For example, a 1-bedroom unit will accommodate 2 residents.

If a multi-residential building can accommodate 350 residents, the number of bicycle racks required is as follows (the number of bicycle racks required should be rounded up to the nearest whole number):

$$\begin{aligned}
 \text{Total number of bicycle racks required} &= \frac{350}{20} \\
 &= 17.5 \\
 &\approx 18 \text{ bicycle racks}
 \end{aligned}$$

Other Individual Transport Modes:

Other individual transport modes include push-scooters and dockless shared-bicycles. These can include “power-assist” vehicles with regenerative braking and/or no hub motor. “Full-power” vehicles that use a hub motor and require an external fuel source, such as mopeds, motor bikes, motorcycles, neighborhood electric vehicles and golf carts, cannot be included.

Parking areas dedicated for other individual transportation modes must be of the same area as each bicycle parking space (e.g. at least 2m x 0.75m, with an aisle at least 1.5m wide) and must be fully shaded. The parking areas must be clearly reserved by signage, floor markings and additional shaded area.

Amenities:

The actual bicycling distance to an amenity is the route along a clearly marked bike lane at least 3m wide, or a street with a speed limit of 40 km/h or less. Amenities include the following (only one of each type may be counted):

- Bank with ATM
- Barber
- Cafe
- Daycare
- Government Service Centre
- Grocery store
- Gym
- Laundry
- Library
- Medical Clinic
- Mosque
- Post Office
- Pharmacy
- Public Park or Open Space
- Restaurant
- School
- Other Retail

Amenities provided inside the building qualify, however, a prayer room does not count as a mosque. A grocery store may qualify only if it sells more than 5 types of fresh fruits and vegetables. Retail areas must be permanent facilities that are regularly open to the public.

Information on the Benefits of Individual Transportation Modes:

The information displayed in the lobby/reception must promote the use of individual transportation modes (bicycles, scooters etc.) and communicate their benefits. It should highlight the positive impact on health and wellbeing, the environment and the community.

Credit Tool

N/A

Reference Documents

1. The Association of Pedestrian and Bicycle Professionals (APBP) Bicycle Parking Guidelines

Glossary

11 Glossary of Terms

	Definition
As-built drawing	Drawing which represents the final constructed building, usually prepared by the contractor.
Biodegradable	Material that can be broken down naturally by microorganisms.
Blowing agent	A high-performing insulating gas blown to fill the voids within the cellular structure of insulation to provide a higher thermal performance of the insulation material.
Building envelope	The barrier/shell that separates a building's conditioned space from unconditioned space, usually comprising of the exterior façade, roof and ground floor.
Building Management System (BMS)	An automated central system used to control the operation of electrical and mechanical systems in a building.
Commissioning Agent	A certified professional responsible for delivering the commissioning process.
Compost	Organic material that has been decomposed through a composter and can be used for fertilizer.
Condensate	In the context of HVAC, condensate is liquid water which is formed as a result of warm humid air contacting a cooling coil.
Dashboard	A digital display that communicates the performance of a building to its occupants (including but not limited to energy and water performance).
Demand Controlled Ventilation (DCV)	An automated system which controls the volume of fresh air into a space based on time schedules, CO ₂ monitoring, occupancy readers or other smart readers.
District Cooling	A cooling system whereby a central cooling plant delivers chilled water to individual buildings in a district through an insulated underground piping network. The central plant houses large, highly efficient and industrial grade equipment to produce chilled water.
Electric vehicle	A vehicle with electric motors powered by rechargeable batteries.
Electronic waste	Waste that is generated through discarded electrical and electronic equipment such as laptops, mobile phones, light bulbs etc.
Environmental Product Declaration (EPD)	A standardized method of quantifying the environmental impact of a product during its lifecycle.
FSC certified	Forest Stewardship Council certified. This is a method of certifying wood that has been sourced through responsible forest management.
Glare	An uncomfortable phenomenon that results from too much daylight penetrating through a glazed assembly. This could be directly through the glazing, or from daylight reflecting off an interior surface.
Global Warming Potential (GWP)	GWP is a measure of how much heat the emissions of 1 ton of a gas will absorb over a given period of time, relative to the emissions of 1 ton of

	carbon dioxide (CO ₂). The larger the GWP, the more that a gas warms the Earth compared to CO ₂ over the same timeframe.
Graywater	Waste water from non-toxic sources such as sinks and showers. This water can be reused in the building and for landscaping.
Greenhouse gas	Gases in the atmosphere that trap and hold heat from the sun due to their ability of absorbing infrared radiation from the sun. An increase in greenhouse gases in the atmosphere leads to global warming.
Gross Internal Area (GIA)	The total floor area of all conditioned areas within a building, including corridors and service areas, measured to the internal face of the perimeter walls. It does not include underground parking.
Gross Floor Area (GFA)	The total floor area of the building, including unconditioned areas such as basements and service areas which are accessible, measured to the external face of the perimeter walls.
Hazardous material	Waste that may have toxic and harmful effects on human health and the environment if not managed with proper care.
Heat island effect	A phenomenon where urban areas and city temperatures are warmer than their surrounding suburbs.
Illuminance	A measurement of lighting level which represents the total amount of visible light incident upon a surface or imaginary plane, per unit area from all directions above the surface. The measurement unit for Illuminance is "lux".
Individual dwelling	A residential structure that is on an individual plot of land that houses one family e.g. a villa or a townhouse.
Landfill	An area where large quantities of waste (usually waste collected from urban areas/municipal waste) is disposed and typically buried.
Life Cycle Assessment	The assessment of a product's environmental impact through all stages of its life from raw material extraction to its disposal or recycling (cradle to grave).
Luminaire uplighting	Light that is directed upwards from a luminaire due to its placement and the shape of the fixture. A higher up-lighting rating causes lighting pollution in outdoor lighting.
Majlis	Directly translated from Arabic as "place of sitting". An area typically found in Middle Eastern residences used for social and special gatherings.
Mashrabiya	An Arabian architectural shading element with a lattice type appearance which is applied to windows.
Multi-residential building	A building which contains multiple dwellings e.g. an apartment building.
Occupancy sensor	An electronic device which detects human presence and is usually used to control a building's lighting and/or mechanical systems.
Ozone Depletion Potential (ODP)	The ODP of a chemical compound is a relative value that indicates the potential of a substance to destroy the ozone layer compared to the potential of chlorofluorocarbon-11 (CFC-11), which is assigned a reference value of 1. Thus, a substance with ODP of 2 is twice as harmful

	as CFC-11.
Regularly occupied space	Regularly occupied spaces include living rooms, majlis, kitchens, dining rooms, studies, bedrooms and maids' rooms. They do not include hallways, bathrooms, storage rooms, laundry rooms or garages.
Renewable energy	Energy collected from resources that do not deplete or can be renewed within the human life scale. Sources such as solar, wind and geothermal heat are considered renewable.
Smart meter	An electronic device that records consumption of select end uses and communicates the information for monitoring and/or billing. Smart meters typically record on at least an hourly basis.
Thermal comfort	Occupants' perception of thermal satisfaction in their environment.
Thermostat	An electronic device that measures temperature and controls the heating or cooling system accordingly.
Variable Air Volume (VAV)	A type of HVAC system where the air volume is varied to meet the setpoint temperature in a thermal zone.
Wastewater treatment	The process of treating waste water to enable it to be reused.
Water fixture	Plumbing fixtures which deliver water to the consumer such as faucets, shower heads etc.
Weather-stripping	The process of sealing air leaks around movable building components such as doors.



البناء المستدام
Sustainable Building

