البناء المستدام
Sustainable Building

Mostadam Rating System

Residential Buildings

(D+C)


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Sustainable Building

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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. 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 D+C and details its components, structure, applicability, methodology and credit requirements.

1.1 Mostadam and Vision 2030

Visions 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 design and construction that have been developed for Mostadam for Residential Buildings have been informed by the goals and objectives contained in Vision 2030.

Figure 1 Relationship between Vision 2030 and Mostadam for Residential Buildings D+C

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.

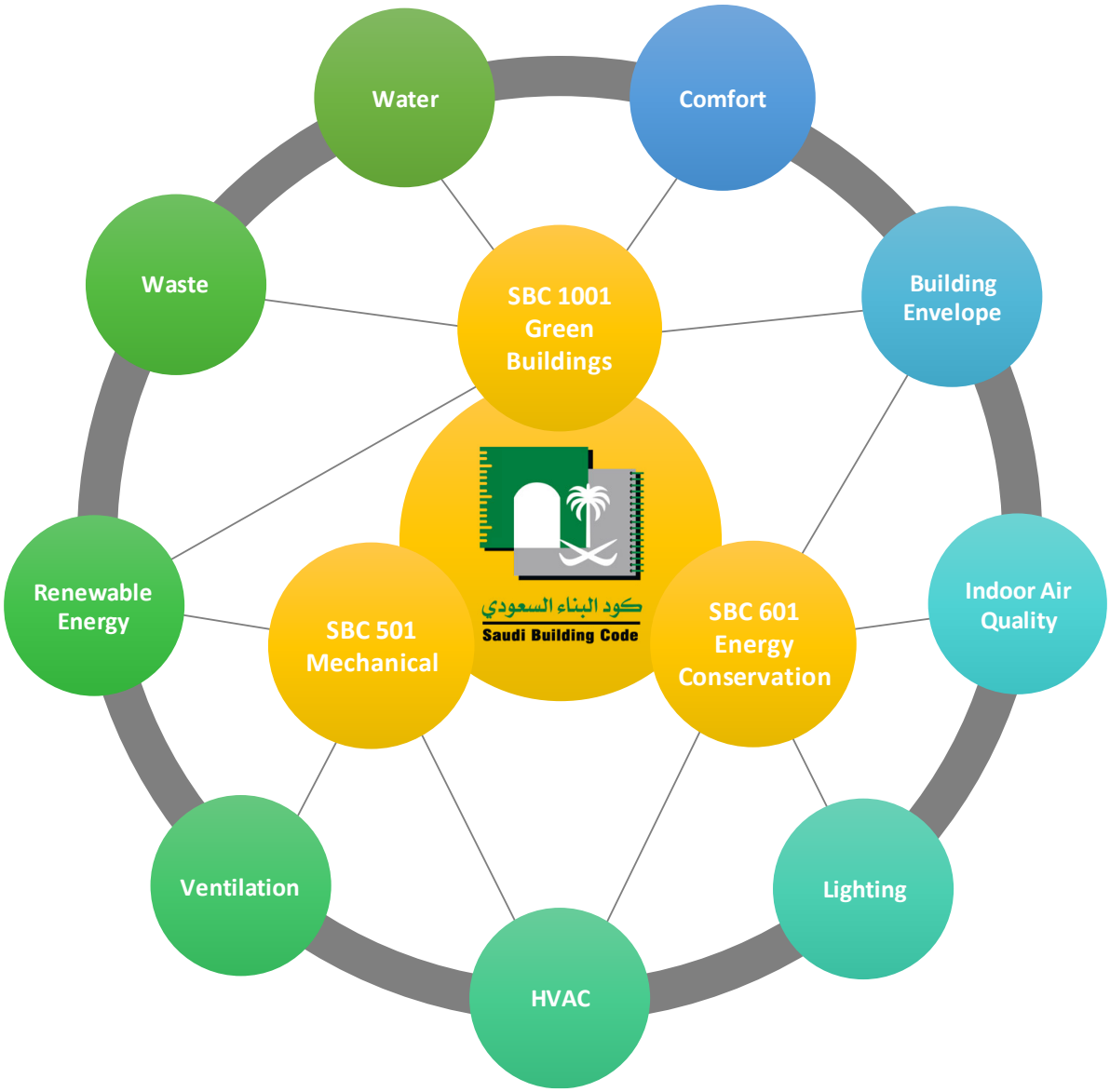


Figure 2 Relationship between SBC and Mostadam for Residential Buildings D+C

About Mostadam for Residential Buildings

2 About Mostadam for Residential Buildings

2.1 Applicability

Mostadam for Residential Buildings is applicable to any size of 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) (*this manual*)

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

Operation + Existing (O+E)

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 D+C is organized into nine categories of credits (Figure 3).

Figure 3 Mostadam for Residential Buildings D+C 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 D+C 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 10 core Keystone credits, the achievement of which results in a score of 20 points and a rating level of Mostadam Green. There are three additional Keystone credits that must be achieved for a rating level of Mostadam Silver or higher. The Keystone credits are listed in Table 2.

For the targeted rating level, a project must achieve the relevant Keystone credits in addition to achieving the minimum number of points for the targeted level. For example, if a project is targeting Mostadam Silver, it must achieve the Keystone credits for Silver and the Keystone credits for Green from Table 2, and additional or optional credits must be targeted to achieve the minimum of 50 points.

Table 2 Keystone credits

Credit Category	Keystone Credits	
	Green (Core Keystone Credits)	Silver (Additional Keystone Credits)
Site Sustainability	SS-01 Flood, Rainwater and Sewage Management SS-02 Ecological Assessment and Protection	
Energy	E-01 Energy Performance E-02 Systems Commissioning	E-04 Energy Metering
Water	W-01 Indoor Water Performance W-02 Outdoor Water Performance	W-04 Water Metering
Health and Comfort	HC-01 Outdoor Thermal Comfort HC-02 Indoor Thermal Comfort	HC-03 Ventilation
Education and Innovation	EI-01 Mostadam Guide	
Policies, Management and Maintenance	PMM-01 Residential Waste Management	

2.6 Credit layout

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

TC-04 Home Office

Keystone Credit	Total Number of Points Available
No	1

Aim

To provide the space and connections for a home office to promote 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 is provided in the living room, one of the bedrooms or another suitable area that can be used as a home office/study. **For dwellings/residential units with three or more bedrooms:** A separate room is provided 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
	Total	**1**	**1**

Design Stage Evidence

#	Evidence per Requirement
1	• For each dwelling or residential unit type, scaled drawings showing the location and dimensions of the home office/study and the connection points.

Construction Stage Evidence

#	Evidence per Requirement
1	• For each dwelling or residential unit type, as-built scaled drawings showing the location and dimensions of the home office/study and the connection points. • Date-stamped photographs of the home office/study and connection points.

7 **Supporting Guidance**

The following must be provided as a minimum for the home office/study room or zone:

- 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
- Two double power sockets.
- Access to data and telephone communications e.g. broadband socket, telephone socket.

8 **Credit Tool**

N/A

9 **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 for which rating level, 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 design stage submission.
6. Evidence per requirement for the construction stage submission.
7. Supporting guidance providing any relevant additional information.
8. Name of Credit tool (if any).
9. Details of relevant reference documents.

Implementing Mostadam for Residential Buildings

3 Implementing Mostadam for Residential Buildings

3.1 Submission and approval process

Submission

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

D+C (*this manual*)

Submission 1: after completion of detailed design

Submission 2: after construction completion

O+E

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).

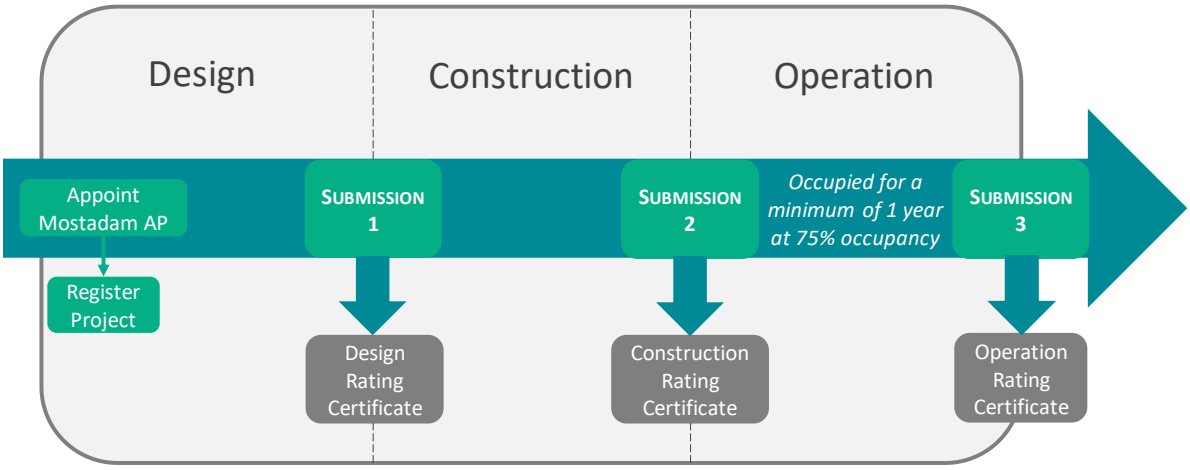


Figure 5 Submission process

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).

3.2 Communication protocol

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

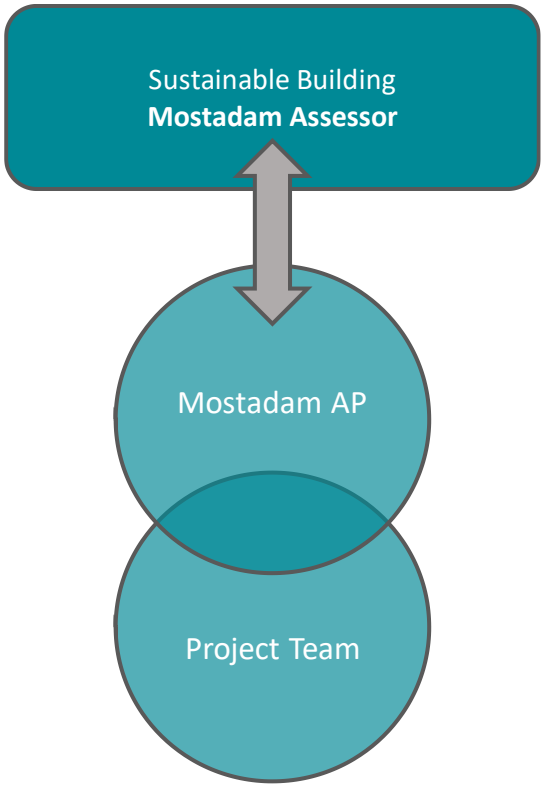


Figure 6 Communication protocol

3.3 Key roles and responsibilities

The roles and responsibilities of the various parties in the Mostadam for Residential Buildings' certification process are defined in Table 3.

Table 3 Mostadam roles and responsibilities

Role	Responsibility
Sustainable Building	• 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 *Sustainable Building* • 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
Project team	• Incorporates the targeted Mostadam for Residential Buildings credit requirements into the design and construction of the project • Maintains the required evidence and prepares the required documentation (including the completion of any credit tools), throughout the project stages and submits them to the Mostadam AP

Site Sustainability

4 Site Sustainability

As part of Vision 2030, KSA aims to protect and rehabilitate beaches, nature reserves and islands to increase the public's awareness of the country's natural assets. These assets provide "multiple functions and provide economic, social and environmental benefits, including fuel, soil stabilization, moisture and erosion protection, and climate mitigation and carbon storage."[1]

This aim is facilitated by Mostadam for Residential Building's Site Sustainability category which rewards the protection and enhancement of ecological assets on project development sites. Project teams that pursue Site Sustainability credits will use surveys, ecological assessments and construction best practices to reduce the impact of their development on the environment.

Figure 7 Site Sustainability credits

[1] The General Authority of Meteorology and Environmental Protection, The State of the Environment 2017: Responsibilities and Achievements

SS-01 Sewage, Flood and Rainwater Management

Keystone Credit	Total Number of Points Available
Green	2

Aim

To ensure an appropriate sewage strategy is in place and to minimize the risk of localized flooding, surface water run-off and water body/course pollution during peak rainwater discharge.

Requirements

#	Requirement	Points Available	
		Individual dwelling	Multi-residential
Keystone Requirement - achieve requirement #1 (1 credit point).			
1	Where possible, the building is connected to an existing sewage network. If there is no existing sewage network, a Sewage Treatment Plan is prepared and implemented.	1	1
2	The project is not located in a legally designated flood hazard area.	1	1
3	A rainwater management system is implemented that adopts either a site infiltration or rainwater redirection strategy.		
	Total	**2**	**2**

Design Stage Evidence

#	Evidence per Requirement
1	• Plan showing the existing sewage network and the point of connection for the project. OR • Sewage Treatment Plan.
2	• Flood Insurance Rate Map (FIRM) marked-up with the location of the project to show it is not within a flood hazard area.
3	• Rainwater Management Plan demonstrating the rainwater management system meets the credit requirements and has adopted either a site infiltration or rainwater redirection strategy.

Construction Stage Evidence

#	Evidence per Requirement
1	• As-built plan showing the existing sewage network and the point of connection for the project. OR • As-built drawings demonstrating implementation of the Sewage Treatment Plan.

2	• Flood Insurance Rate Map (FIRM) marked-up with the location of the project to show it is not within a flood hazard area.
3	• Updated Rainwater Management Plan. • Date-stamped photographs demonstrating the implementation of the rainwater management system.

Supporting Guidance

Sewage Management:

Dwellings which are not connected to the municipal sewage system need alternative sewage management procedures that are safe and reliable. Local sewage treatment, which can be applicable to the management of domestic sewage, is one of the acceptable solutions. Sewage treatment is a process where contaminants, micro-organisms and other types of pollutants from wastewater, primarily from household sewage, are removed by specialized procedures. This is done through physical, chemical and biological methods to remove contaminants and produce environmentally safe treated wastewater.

Sewage Treatment Plan:

The Sewage Treatment Plan should include the following as a minimum:

- Sewage drainage strategy.
- Details of sewage treatment system and minimum level/standard of treatment.
- Operation and maintenance requirements.

The Sewage Treatment Plan should detail the components of the proposed system that will collect and treat the wastewater, the acceptable environmental parameters of various chemicals, the composition of the chemicals as an input and the expected chemical composition after treatment. The proposed system must be able to collect all wastewater (blackwater and graywater) that is discharged from water systems in the dwelling. The estimated discharge from a dwelling will depend on the number of water systems and occupants. The plan should also include the management operational procedures including the type of treatment and the potential type and quantity of chemicals to be used for each treatment cycle among other regulatory governed operational parameters. Figure SS-01.1 provides an illustration of a wastewater treatment plant for an individual dwelling.

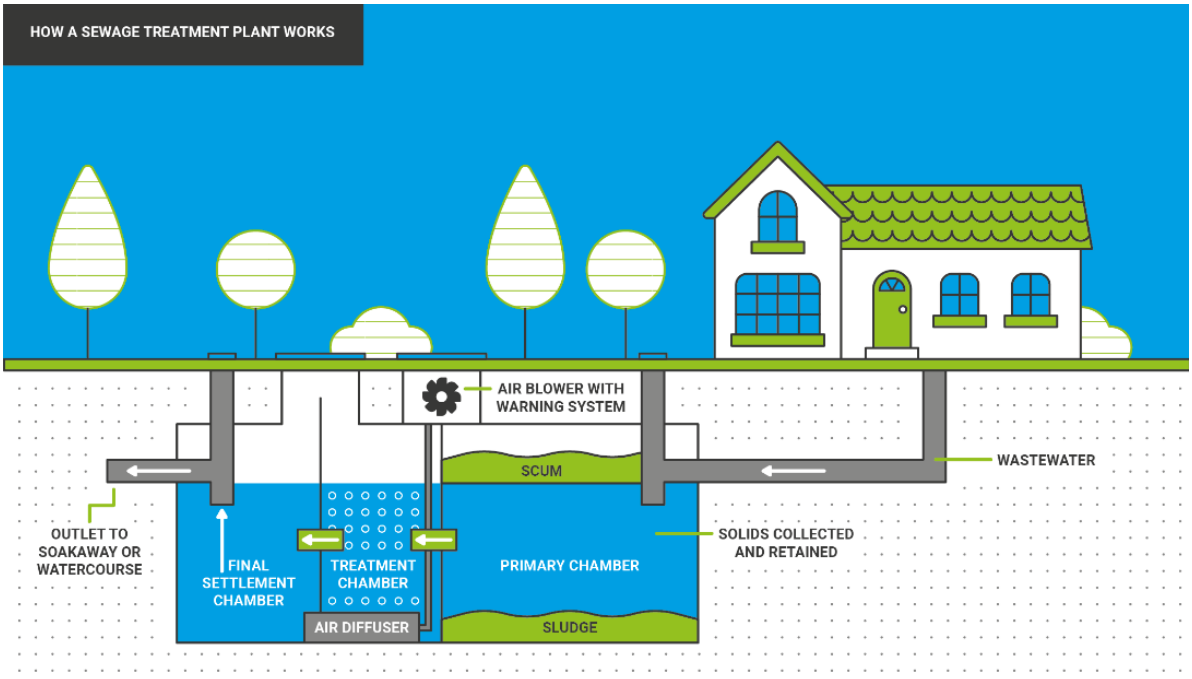


Figure SS-01.1 Wastewater treatment plan for an individual dwelling

Flood Hazard Area:

A legally designated flood hazard area is an area that is subject to a 1% or more chance of flooding in any given year. Flood hazard areas are designated in the Flood Insurance Rate Maps (FIRMS) established by the General Directorate of Civil Defense flood mitigation program.

Rainwater Runoff:

Rainwater runoff occurs when water overflows the ground and roof water storage basins due to excess stormwater or any other source of rainwater flow. Rainwater runoff can cause flooding and dispersion of pollutants outside of the property boundary and vicinity. Almost all roads, parking lots, rooftops and paved surfaces are impermeable surfaces that do not allow water to soak into the ground. Rainwater runoff can be minimized by:

- Increasing the pervious surface area on site to promote infiltration. Pervious surfaces include open grid paving systems and open graded aggregate systems.
- Capturing excess water from rain and irrigation into retention basins, rain barrels or underground cisterns.

Rainwater Management:

Rainwater management is the overall set of procedures that reduce runoff. It includes detaining, retaining, and/or providing a discharge point for rainwater to be reused or infiltrated into the ground. When designing a rainwater management system, it is important to assess the surrounding environment to ensure there is no contamination should water be discharged into any surrounding water bodies or preserved ecological assets.

Rainwater Management Plan:

Where applicable, the Rainwater Management Plan must include:

- Geotechnical study addressing flood risk or equivalent document from a governing authority.
- Details of the municipal drainage network.
- Softscape and hardscape plans.
- Rainwater drainage system specifications.
- Rainwater treatment and reuse plan.
- Storage tank specifications.
- Water body/course pollution prevention measures.
- Specific instructions that coal tar sealants are not to be used on any surfaces that will be exposed to rainwater.
- Calculations demonstrating the site's capacity to retain the volume of a single storm equivalent to the 95th-percentile rainfall event based on data for the building's location from the NOAA National Centers for Environmental Information (NCEI).
- Where rainwater redirection has been adopted: strategy for maintaining and ensuring that post-construction runoff rate, volume and duration does not exceed pre-development rates. This rainwater management option requires a design strategy based on a hydrologic analysis of the site.

Calculating the Site's Capacity to Retain Rainwater:

The 95th percentile of rainfall events is the measured precipitation depth accumulated over 24 hours that ranks as the 95th percentile based on the range of all daily event occurrences during the period of record. This can be calculated using historical rainfall data from the NOAA National Centers for Environmental Information (NCEI). Expected runoff for the 95th percentile storm from roof and exterior hardscape can be calculated using the following formula:

$$Runoff = Rainfall - Depression\ Storage - Infiltration$$

Depression storage is calculated using the following:

$$F_t = f_{min} + (f_{max} - f_{min})e^{-kt}$$

F_t = Infiltration rate at time t (mm/hr)

f_{min} = Minimum or saturated infiltration rate (mm/hr)

f_{max}= Maximum or initial infiltration rate (mm/hr)

k= Infiltration rate decay factor (1/hr)

t= Time (hr) measured from time runoff first discharged into infiltration area

Infiltration rate is the velocity at which water enters the soil. Sandy soil will allow for rapid water infiltration. Once rainwater runoff has been defined, the area of retention can be calculated to verify that the rainwater management procedures are appropriate for the estimated runoff.

Credit Tool

N/A

Reference Documents

1. Saudi Building Code (SBC) 1001 Green Buildings, Section 403 Stormwater Management
2. Saudi Building Code (SBC) 1001 Green Buildings, Section 408.2.4 Pervious Pavement and Permeable Unit Pavement
3. General Directorate of Civil Defense (Flood Insurance Rate Maps)
4. NOAA National Centers for Environmental Information (NCEI), https://www.ncdc.noaa.gov/
5. Victorian Stormwater Committee (1999), Urban Stormwater: Best-practice Environmental Management Guidelines

SS-02 Ecological Assessment and Protection

Keystone Credit	Total Number of Points Available
Green	2

Aim

To ensure that existing ecological conditions and assets associated with the site are identified and protected.

Requirements

#	Requirement	Points Available	
		Individual dwelling	Multi-residential
1	An Ecological Assessment is undertaken by a qualified Environmental Professional prior to the start of the design process and site clearance to identify: • Valuable natural assets located onsite, including any located off-site that may be affected by the development • Potential ecological impacts from the development • Opportunities for enhancement of the site • Protection and mitigation measures for the identified valuable natural assets	1	1
2	An Ecological Protection Plan is developed prior to the start of the construction phase by a qualified Environmental Professional and is implemented by the Contractor.	1	1
	Total	**2**	**2**

Design Stage Evidence

#	Evidence per Requirement
1	• Ecological Assessment Report including narratives, maps and date-stamped photographs as listed in the Supporting Guidance. • CV of the appointed qualified Environmental Professional.
2	• Ecological Protection Plan that includes the proposed protection and mitigation measures, the identification of the area(s) that need to be protected, and the number of assets that will be compensated for due to unavoidable damage. • Development map that includes GPS coordinate points for all valuable natural assets that are to be protected on site, including setback zones. • Specification extracts for all ecological protection, mitigation and compensation requirements. • CV of the appointed qualified Environmental Professional, if different to the professional who completed the Ecological Assessment Report.

Construction Stage Evidence

#	Evidence per Requirement
1	• No evidence required at the construction stage.
2	• Updated Ecological Protection Plan, including evidence of the implemented protection and mitigation measures, calculations demonstrating the area(s) protected, the number of assets compensated for, and date-stamped site photographs of successfully protected assets. • CV of the appointed qualified Environmental Professional, if different to the professional who completed the design stage submission. • Updated development map that includes GPS coordinate points for all valuable natural assets protected on site, including setback zones.

Supporting Guidance

Ecological Assessment Report:

The Ecological Assessment is to be based on a field survey and a desktop study using historical data and studies to establish the existing baseline conditions of the project site and surrounding area. The report is to cover, at a minimum, the following:

- Review of the project site against Environmental Protection Standards and relevant jurisdiction requirements with all related communication and approvals included.
- Ecological and environmental components likely to be affected:
    - Flora, fauna and habitats
    - Topography, geology, soils and hydrology
    - Marine and coastal conditions
    - Waste and contamination
    - Microclimate, noise and air quality
    - Archaeological and cultural heritage features
- Identification of natural ecological assets.
- Date-stamped site photographs and development map that includes GPS coordinate points of all valuable natural assets identified on site, including setback zones.
- Potential impacts and level of disturbance the development poses on the project site.
- Protection and mitigation measures that include the identification of the area(s) to be protected and the number of assets to be compensated for (refer to the guidance provided under Ecological Protection Plan).
- Opportunities for site enhancement.
- List of all historical data and studies reviewed and a list of any expected or ongoing environmental studies and/or surveys to be conducted on the site.

Ecological Protection Plan:

The Ecological Protection Plan is to be based on the findings of the Ecological Assessment Report and any other environmental study and/or survey (e.g. geotechnical survey or contaminated land assessment) completed after the submission of the Ecological Assessment Report or during the construction phase that directly impacts the ecological conditions of the site. The Ecological Protection Plan is to cover, at a minimum, the following:

- Updated list of all environmental studies and surveys reviewed.

- Protection strategy that details the measures to protect the valuable natural assets identified in the Ecological Assessment Report. Should unavoidable removal or damage of the valuable natural asset(s) occur, as verified by the relevant jurisdiction, the appropriate mitigation and/or compensation strategy is to be developed and implemented:
    - Mitigation strategy that details the measures to mitigate against any damage to, or destruction of, the valuable natural assets.
    - Compensation strategy for any healthy native trees or shrubs identified as valuable natural assets, which should be compensated for at a replacement ratio of 2:1.
- Date-stamped site photographs and an updated development map that includes GPS coordinate points of all valuable natural assets protected on site, including setback zones.
- Calculations that demonstrate the total site area that has been protected, mitigated and/or compensated.
- All applicable communication and approvals from the relevant jurisdiction.

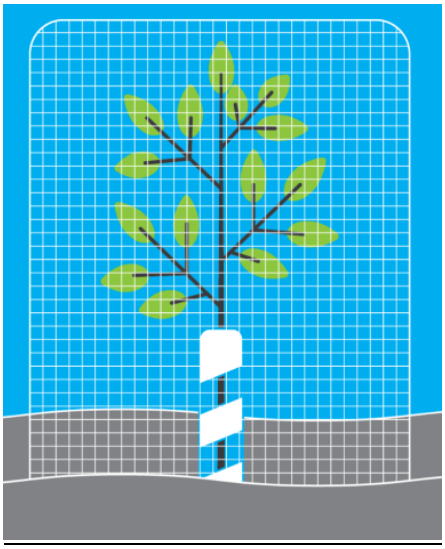


Figure SS-02.1 Example of fence protection for trees

Valuable Natural Asset:

The following are considered to be valuable natural assets:

- Land possessing natural value important to the community as designated by the relevant jurisdiction or KSA municipal government, which includes but is not limited to wildlife habitats, forest or other significant vegetation, steep slopes, ground water recharge areas, riparian corridors or wetland.
- A species noted to be protected, critically endangered, endangered, vulnerable or near threatened by the International Union for Conservation of Nature (IUCN) or any national KSA lists of threatened species.
- An ecological or cultural heritage asset, including healthy native trees or shrubs.

Setback Requirements:

Setback requirements need to be established for any ecological asset found onsite or in the surrounding area that may be impacted by the development. These requirements must be determined by the qualified Environmental Professional in consultation with the relevant jurisdiction. In the event that

setback guidelines are not established for a specific habitat, the development should adhere to the following:

- Setback is at least 100m from wildlife habitats.
- Setback is at least 30m from watercourses.
- Setback from protected trees is either at the outer edge of the branch spread or half the height of the tree, whichever is greater.

The setback requirements must be implemented by the construction team throughout the duration of construction activities. It can be useful to incorporate setback requirements in the mobilization layout in order to prevent damaging or contaminating any identified ecological asset.

Environmental Studies and Surveys:

Environmental studies and/or surveys used to establish the existing baseline conditions of the project site and surrounding area should include, but are not limited to, the following:

- Marine ecology survey
- Terrestrial ecology survey
- Geotechnical study
- Geophysical survey
- Topography survey
- Flood risk assessment
- Bathymetry survey
- Water quality testing
- Contaminated land assessment
- Air quality testing
- Noise survey
- Archaeological survey

Environmental Professional:

A qualified Environmental Professional is someone who is registered with the General Authority of Meteorology & Environmental Protection and has achieved the following:

- An environmental degree or relevant 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 mitigation measures.

The Environmental Professional does not need to be an independent third party and may be part of the Design Consultant's team.

Credit Tool

N/A

Reference Documents

1. Saudi Building Code (SBC) 1001 Green Buildings, Section 402 Preservation of Natural Resources
2. Saudi Building Code (SBC) 1001 Green Buildings, Section 405.2.1 Vegetation and Soil Protection Plan

3. General Authority of Meteorology & Environmental Protection, General Environmental Regulations and Rules for Implementation
4. TCIA/ANSI A300 Tree Protection Zones (TPZ)
5. International Union for Conservation of Nature, IUCN, www.iucn.org

SS-03 Construction Environmental Management

Keystone Credit	Total Number of Points Available
No	1

Aim

To reduce the adverse environmental and social impacts of construction activities by implementing environmental management best practices.

Requirements

#	Requirement	Points Available	
		Individual dwelling	Multi-residential
1	A Construction Environmental Management Plan (CEMP) is developed and implemented to address the environmental and social impacts of the construction activities. The CEMP must be developed in accordance with the General Authority of Meteorology & Environment Protection's regulations and must be evaluated and approved by a qualified Environmental Professional.	1	1
	Total	**1**	**1**

Design Stage Evidence

#	Evidence per Requirement
1	• Extract from project tender specifications confirming that a CEMP must be produced by the Contractor prior to the start of construction activities on site. • CV of qualified Environmental Professional.

Construction Stage Evidence

#	Evidence per Requirement
1	• CEMP developed in accordance with the General Authority of Meteorology & Environment Protection's regulations. • Site audit report provided by the Contractor which includes date-stamped photographs verifying compliance with the CEMP.

Supporting Guidance

<u>Construction Environmental Management Plan:</u>

The CEMP must include the following as a minimum:

- Comprehensive Environmental Impact Assessment (EIA)
    - The EIA should address the impact of the project on air quality, soil, topography, surface water, ground water, land environment (flora/fauna), marine and coastal environment and land-use purpose.

    - The EIA should build upon the Ecological Assessment Report and Ecological Protection Plan created for credit **SS-02 Ecological Assessment and Protection** and include an assessment of any significant impacts not covered by these documents and the associated mitigation measures.
- Construction dust control plan
    - Perform onsite measurement of particulate matter in the air during peak construction activity.
    - Particulate limits must follow National Ambient Air Quality Standards (NAAQS) from the Environmental Protection Agency.
    - Isolate dust-producing activities.
- Construction noise pollution plan
    - Conduct planned monitoring of noise levels at a 15-meter buffer from construction activity.
    - Noise limits follow BS 5228-1:2009+A1:2014, Code of Practice for Noise and Vibration Control on Construction and Open Sites, Part 1 Noise.
- Construction waste management plan
    - Refer to credit **MW-01 Construction Waste Management**.
    - Implementation of proper hazardous waste handling measures based on technical specifications.
    - Controlled onsite segregation and storage of hazardous waste from non-hazardous waste.
    - An approved waste hauler is retained for transporting waste from the project site.
- Construction energy and water consumption reduction plan
    - Energy conservation – implement at least two of the following conservation strategies:
        - Use of certified energy efficient generators, fuel-efficient transportation methods, renewable energy sources, and/or automated lighting controls.
        - Workers living within a 25km radius of the construction site and/or coordination of transportation requirements.
        - Controlled operation of temporary air-conditioning systems.
        - Monitoring and record-keeping of energy usage against a pre-determined baseline, and implementation of mitigation measures if consumption levels exceed expected range.
    - Water conservation – implement at least two of the following conservation strategies:
        - Use of water efficient fixtures.
        - Create a water conservation strategy which minimizes wastage of water through user negligence, inefficient operation and/or leakages.
        - Use of non-potable water for construction processes e.g. secondary treatment and recycling of greywater or blackwater for irrigation, dust control, and flushing.
        - Limit access of water-using equipment to trained users only.
        - Monitoring and record-keeping of water consumption against a pre-determined baseline, and implementation of mitigation measures if consumption levels exceed expected range.
- Construction materials transportation and procurement plan
    - Use of materials that are extracted, processed and/or manufactured within the Gulf Cooperation Council (GCC) area.

- Site Audit Plan
    - Audits should be conducted regularly. The frequency is to be determined by the Contractor based on the total length of construction time and the duration of specific activities which might require more supervision.
    - A report is to be produced following each site audit. The site audit report must include:
        - Date-stamped photographs.
        - An update on all priority CEMP plans: dust control, noise control, non-hazardous and hazardous waste management, and energy and water conservation.
        - Responses to observed deviations from the CEMP with mitigation and remediation measures.
        - Verification that all mitigation and remediation measures have been implemented.

Environmental Professional:

A qualified 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/certification in sustainable construction.
- A minimum of three years of relevant experience in implementing sustainable construction methods as well as acting in an advisory role to provide recommendations for construction best practices and mitigation measures.

The Environmental Professional does not need to be an independent third party and may be part of the Design Consultant's team.

Credit Tool

N/A

Reference Documents

1. Saudi Building Code (SBC) 1001 Green Buildings, Section 502 Construction Material Management
2. General Environmental Regulations and Rules for Implementation, The General Authority of Meteorology and Environmental Protection, 15 October 2001
3. BS 5228-1:2009+A1:2014, Code of Practice for Noise and Vibration Control on Construction and Open Sites, Part 1 Noise
4. Environmental Protection Agency (EPA), National Ambient Air Quality Standards (NAAQS)

SS-04 Ecological Enhancement

Keystone Credit	Total Number of Points Available
No	1

Aim

To ensure that the ecological value of the site is preserved and enhanced.

Requirements

#	Requirement	Points Available	
		Individual dwelling	Multi-residential
1	A management strategy is created by a qualified Environmental Professional to ensure the survival and enhancement of the natural landscape and includes plans for: • Soil enhancement and protection from erosion, pollution or increases in salinity. • Low demand for resources by ensuring a minimum of 80% of newly landscaped species are classified as native, drought tolerant or saline tolerant. • Low maintenance requirements due to a lesser need for fertilization and pesticide management. • Protection of natural assets as identified in **SS-02 Ecological Assessment and Protection** through the creation of adequate habitat areas. • Water efficient irrigation strategy developed in line with **W-02 Outdoor Water Performance**.	1	1
	Total	**1**	**1**

Design Stage Evidence

#	Evidence per Requirement
1	• Ecological Enhancement Report written by a qualified Environmental Professional that includes: ○ A narrative of the enhancement strategies that will be adopted for the entire site. ○ Planting schedule and calculations that demonstrate 80% of the total number of species are classified as native, drought tolerant or saline tolerant. ○ Landscape drawings showing the layout and location of habitat areas and the distribution of plant species. ○ Irrigation strategy and landscape maintenance procedures in line with **W-02 Outdoor Water Performance**.

Construction Stage Evidence

#	Evidence per Requirement

1	• Updated Ecological Enhancement Report that includes:
	  ○ Updated narrative of the enhancement strategies implemented.
	  ○ Date-stamped photographs of the site showing the species planted.
	  ○ As-built drawings that illustrate the location and layout of the habitat areas and planted species, with calculations that demonstrate 80% of the total number of species are classified as native, drought tolerant or saline tolerant.
	  ○ As-built drawings and material data sheets of the water efficient irrigation system and equipment.
	• Letter of commitment or confirmation that:
	  ○ A qualified entity/organization has been appointed to maintain the landscape in line with the enhancement strategy.
	OR
	  ○ Maintenance is to be undertaken by the local municipality.

Supporting Guidance

Calculations and Methodology:

- Plant habitat layout and design must be influenced by the assessment undertaken for credit **SS-02 Ecological Assessment and Protection**.
- Calculations for landscaped species must also include and vegetative roof covering/shades.
- All entities/organizations retained to maintain the landscape must undertake regular soil testing to:
  - Determine nutrient and salinity levels and their proper management.
  - Determine water retention capacity.
  - Promote low fertilizer requirements through good composting methods.
- Species with similar soil, irrigation and microclimatic requirements must be planted together.
- Maintenance duties carried out by qualified professionals must include the generation, survival and protection of all landscape/habitat areas considering the species type, soil type and irrigation requirements.
- All invasive species must be removed regularly.

Native Species Selection:

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 palette. Selected plant species should be checked against the Saudi Building Code 1001 classification and all documents listed in the Reference Documents section of this credit.

Drought Tolerant and Saline Tolerant:

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.

Planting Schedule:

A planting schedule is to be provided and must cover all landscaped areas within the development and include the following information as a minimum:

- Common and botanical plant names.
- Code reference that links to the landscape drawings.
- Classification: native, drought tolerant, saline tolerant or N/A.
- Irrigation demand.
- Trees and palms: overall height, minimum caliper, spread, quantity and remarks.
- Shrubs, groundcovers, succulents and grasses: spread, overall height, spacing, quantity and remarks.

Irrigation Strategy:

An irrigation strategy is to be provided with the intent to reduce the overall irrigation demand of the site and include the following as a minimum:

- Specification of a water efficient irrigation system such as drip irrigation or a sub-surface system. Spray irrigation is not permitted.
- Specification of water efficient technology such as soil moisture, rain sensors and controllers as applicable to the development.
- Landscape and irrigation maintenance procedures to ensure water efficiency is achieved during operation.

Environmental Professional:

A qualified Environmental Professional is someone who is registered with the General Authority of Meteorology & Environmental Protection and has achieved the following:

- An environmental degree or relevant 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 mitigation measures.

The Environmental Professional does not need to be an independent third party and may be part of the Design Consultant's team.

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-05 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 the hardscape, shade structures and roofs meet the following: • Hardscape: 90% of the hardscape covering has an SRI ≥ 45. • Shade structures: 100% of the shade structures have an SRI ≥ 75. • Roofs: 100% of the roof covering has an SRI ≥ 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**

Design Stage 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. • Extracts from specifications indicating the required SRI values.
2	• Drawings showing the areas of roof and shade structures that will have a vegetative covering and the associated irrigation system. • Calculations in table format showing that the requirements are met. • List of selected plant types and their water needs.

Construction Stage Evidence

#	Evidence per Requirement
1	• As-built drawings illustrating the areas of compliant and non-compliant hardscape, shade structures and roofs. • Calculations in table format showing that the requirements are met. • Product data sheets showing the SRIs for the materials used. • Date-stamped photographs of the installed hardscape, shade structures and roofs.

2	• As-built 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):

- Manufacturers' data sheets must confirm that the SRI values of materials have been determined using ASTM E1980 at a facility independent of the manufacturer.
- 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.
- The three year-aged SRI is found in the Product Data Sheet that can be obtained from the manufacturer. If this information is not available, the material can be tested at an independent laboratory according to the requirements of ASTM E1980. Based on the example in Table SS-05.1, the white roofing tile would contribute towards this credit however the yellow roofing would not.

Table SS-05.1 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

- 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-04 Ecological 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 Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces

SS-06 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

<table>
<tr><th rowspan="2">#</th><th rowspan="2">Requirement</th><th colspan="2">Points Available</th></tr>
<tr><th>Individual dwelling</th><th>Multi-residential</th></tr>
<tr><td>1</td><td>

Uplight Rating

The luminaire uplight rating does not exceed the values below for the relevant light pollution zone.

<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>

**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>

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:

</td><td>1</td><td>1</td></tr>
</table>

	<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>B3 G1</td><td>B4 G2</td><td>B5 G3</td><td>B5 G4</td></tr><tr><td>$h_m < H_{LB} \leq 2h_m$</td><td>B2 G1</td><td>B3 G2</td><td>B4 G3</td><td>B4 G4</td></tr><tr><td>$0.5h_m \leq H_{LB} \leq h_m$</td><td>B1 G1</td><td>B2 G2</td><td>B3 G3</td><td>B3 G4</td></tr><tr><td>$H_{LB} < 0.5h_m$</td><td>B0 G1</td><td>B0 G2</td><td>B1 G3</td><td>B2 G4</td></tr></table> *h_m = mounting height: the distance above finished grade at which a luminaire is mounted, measured to the midpoint of the luminaire.*		
	Total	**1**	**1**

Design Stage Evidence

#	Evidence per Requirement
1	• External lighting drawings. • Specifications with requirements for luminaires highlighted. • Calculations demonstrating the maximum luminaire uplight ratings are not exceeded. • Confirmation that the relevant glare and backlight ratings are not exceeded.

Construction Stage Evidence

#	Evidence per Requirement
1	• As-built external lighting drawings. • Purchase orders/receipts for approved luminaires. • External lighting fixtures datasheet for installed lighting with lumens levels at different angles.

Supporting Guidance

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 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 wayfinding, 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.

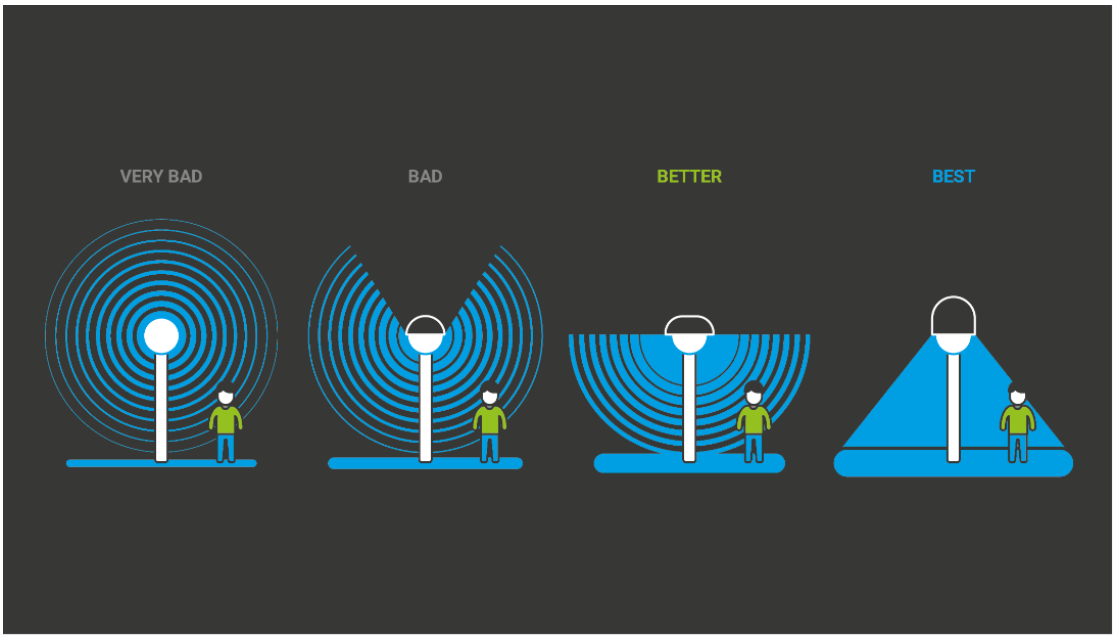


Figure SS-06.1 Impact of shields and cut-off angles

Uplight, Glare and Backlight:

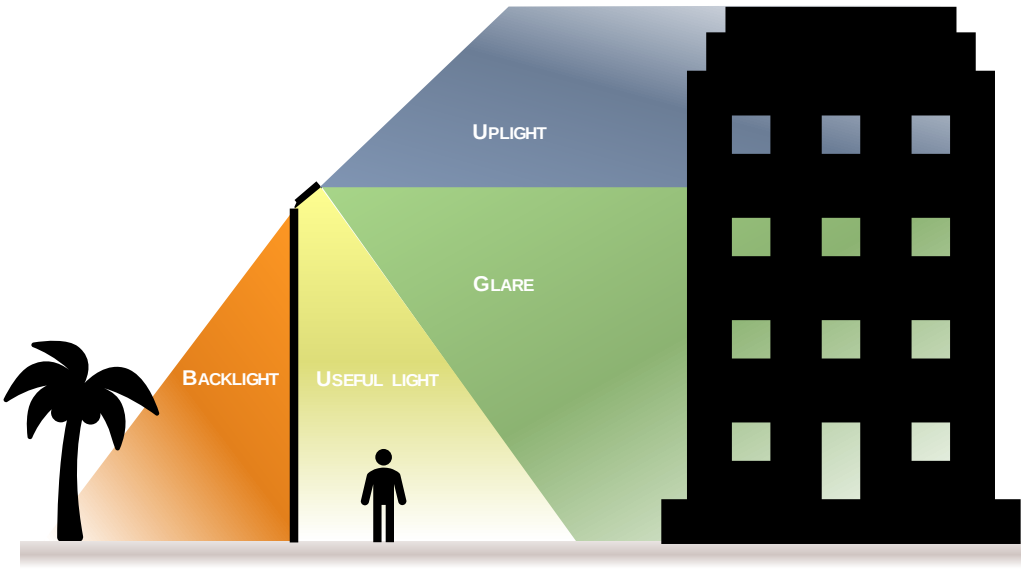


Figure SS-06.2 Uplight, glare and backlight

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.

<u>Mounting Heights:</u>

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.

A luminaire with a mounting height of 5m is considered as an example. As the backlight and glare ratings indicate that this luminaire should be between one and two mounting heights from the lighting boundary, the luminaire must be located between 5m to 10m from the nearest lighting boundary.

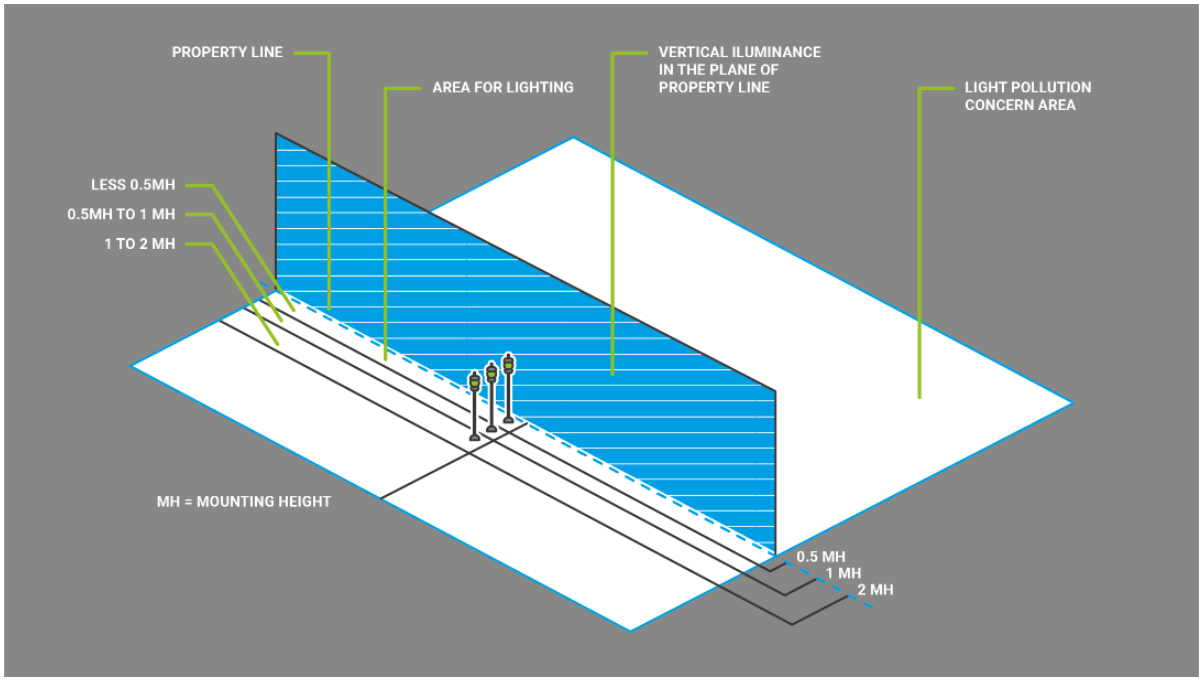


Figure SS-06.3 Mounting Height

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-06.4, the lighting boundary is defined by the orange line.

Figure SS-06.4 Lighting Boundary

Light Pollution Zones:

The light pollution zones (LPZ) are defined in Table SS-06.1.

Table SS-06.1 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.

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 for a short period 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 Appendix A: Backlight, Uplight and Glare Ratings
4. CIBSE LG9 Lighting for Communal Residential Buildings

Transportation and Connectivity

5 Transportation and Connectivity

Public transportation provision is due to increase significantly under Vision 2030, where the aim is to enhance annual transit ridership per capita from 0 to 15[2]. Moreover, under Vision 2030, new urban planning methods are now prioritizing “citizen-centric cities”, where residents can enjoy safe pedestrian pathways and reliable public transportation. Mostadam for Residential Buildings rewards developments that are located near existing or planned public transit to benefit from the infrastructure investments across the country. The credits under Transportation and Connectivity further complement the goal of Vision 2030 by promoting healthy lifestyles through rewarding the provision of bicycle facilities and a proximity to local amenities that encourages walking/cycling.

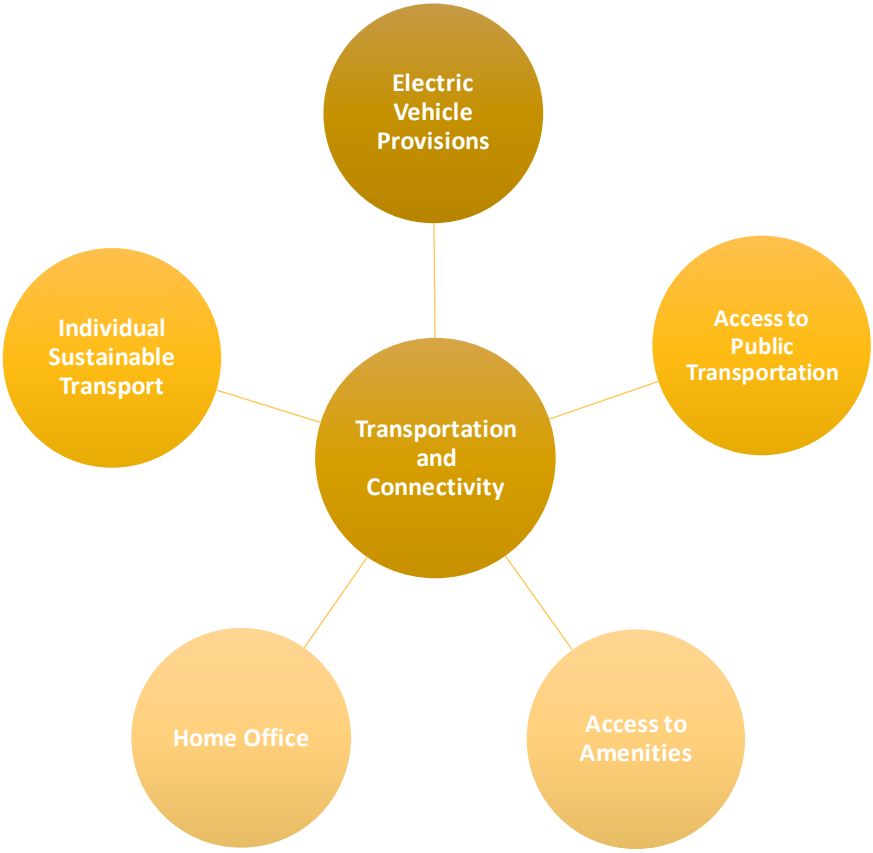


Figure 8 Transport and Connectivity credits

[2] Saudi Quality of Life Program 2020: Delivery Plan

TC-01 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	Electric Vehicle Supply Equipment (EVSE) is installed for at least one vehicle per household.	1	N/A
2	Electric Vehicle Supply Equipment (EVSE) is installed 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.	N/A	1
	Total	**1**	**1**

Design Stage Evidence

#	Evidence per Requirement
1	• Drawing showing the location of the Electric Vehicle Supply Equipment (EVSE). • Specification for the EVSE.
2	• Site plan identifying the location of each parking space reserved for electric vehicles and calculations demonstrating that the minimum number of spaces is achieved. • Drawing showing the shading requirements for each EVSE parking space. • Specification for the EVSE and shading.

Construction Stage Evidence

#	Evidence per Requirement
1	• As-built drawing showing the location of the EVSE. • Date-stamped photographs and purchase receipts for the EVSE.
2	• As-built site plan identifying the location of each parking space reserved for electric vehicles and calculations demonstrating that the minimum number of spaces is achieved. • As-built drawing showing the shading for each EVSE parking space. • Date-stamped photographs and purchase receipts for the EVSE and shading.

Supporting Guidance

- Calculations must be rounded upwards to the nearest whole number. If the project will rely on parking facilities outside the project boundary, these must be included in the calculations.
- All parking spaces reserved for electric vehicles must be clearly identified by signage or pavement markings.
- All parking spaces reserved for electric vehicles must be fully shaded. Refer to credit **SS-05 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 regional or local standard 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.
- Receive approval for the connection of the Electricity Charging units from the electricity network.

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-02 Access to Public Transportation

Keystone Credit	Total Number of Points Available
No	2

Aim

To promote transportation efficiency and active living by ensuring all residents and visitors can easily access public transportation.

Requirements

#	Requirement	Points Available	
		Individual dwelling	Multi-residential
1	The building is located within the following distances of a bus stop or a metro/commuter rail station. The minimum day-time service frequency of the bus stop and the station must be at least 30 minutes. • **Individual dwelling**: 350 meters safe walking distance of a bus stop OR 700m safe walking distance of a metro/commuter rail station. • **Multi-residential building**: 350m safe walking distance of a bus stop OR metro/commuter rail station. Future expansions to transit service may qualify if they are already planned, funded, and expected to be operational within 3 years of building occupancy.	1	1
2	In addition to requirement #1, the day-time service of the bus stop or the metro/commuter rail station is more frequent than 30 minutes.	1	1
	Total	**2**	**2**

Design Stage Evidence

#	Evidence per Requirement
1 & 2	• Site plan identifying each pedestrian entrance, the location of the applicable transit station or stop, and the actual safe walking distance in meters. • Most recent official schedules of service frequency for the transit station or stop. • For future expansions, official confirmation of funding, construction schedule, and planned date of full operation.

Construction Stage Evidence

#	Evidence per Requirement
1 & 2	• As-built site plan identifying each pedestrian entrance, the location of the applicable transit station or stop, and the actual safe walking distance in meters. • Date-stamped photographs of each sidewalk along the shortest pedestrian route.

	• Most recent official schedules of service frequency for the transit station or stop. • For future expansions, official confirmation of funding, construction schedule, and planned date of full operation (updated as necessary).

Supporting Guidance

- The safe walking distance is measured from the building entrance (i.e. a pedestrian entrance available to all residents and visitors) to the entrance of the transit station or stop. The building entrance does not include external pedestrian gates or building entrances inside vehicle parking structures.
- For the walking distance to be classified as "safe", it must be a route along a dedicated pedestrian walkway at least 1.8m wide with safe roadway crossings e.g. traffic lights, stop signs or marked pedestrian crossings (refer to Figure TC-02.1).
- The minimum day-time service frequency is for a one-way service between 6 AM and 10 PM, on both weekdays and weekends.
- Transit routes must run in both directions.

Figure TC-02.1 Safe walking route

For further information regarding safe walking distances, refer to the Supporting Guidance in **TC-03 Access to Amenities**.

Credit Tool

N/A

Reference Documents

1. Transit Oriented Development, High Commission for the Development of Arriyadh, April 2018
2. Institute for Transportation & Development Policy (ITDP), TOD Standard
3. EMBARQ TOD Guide for Urban Communities

TC-03 Access to Amenities

Keystone Credit	Total Number of Points Available
No	2

Aim

To promote vibrant communities, active living and transportation efficiency through easy access to neighborhood amenities.

Requirements

#	Requirement	Points Available	
		Individual dwelling	Multi-residential
1	A pedestrian entrance is located within 350m safe walking distance of the following amenities: • A mosque • A grocery store Amenities planned for the future may qualify if they are already zoned, funded/leased, and expected to be operational within 3 years of building occupancy.	1	1
2	In addition to #1: **Individual dwellings** have a pedestrian entrance located within 700m safe walking distance of 3 additional amenities. **Multi-residential buildings** have a pedestrian entrance located within 350m safe walking distance of 3 additional amenities.	1	1
	Total	**2**	**2**

Design Stage Evidence

#	Evidence per Requirement
1 & 2	• Site plan identifying each building entrance, the location of the applicable amenities and the actual safe walking distance in meters. • For planned amenities, confirmation of zoning, committed tenant and planned date of full operation, signed by the relevant building owner or tenant.

Construction Stage Evidence

#	Evidence per Requirement
1 & 2	• As-built site plan identifying each building entrance, the location of the applicable amenities and the actual safe walking distance in meters. • Date-stamped photographs of each sidewalk along the shortest pedestrian route. • For planned amenities, confirmation of zoning, committed tenant and planned date of

	full operation (updated as necessary), signed by the relevant building owner or tenant.

Supporting Guidance

- The safe walking distance is measured from the building entrance (i.e. a pedestrian entrance available to all residents and visitors) to the entrance of the amenity. The building entrance does not include external pedestrian gates or building entrances inside vehicle parking structures.
- For the walking distance to be classified as "safe", it must be a route along a dedicated pedestrian walkway at least 1.8m wide with safe roadway crossings e.g. traffic lights, stop signs or marked pedestrian crossings (refer to Figure TC-03.1).
- 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 five types of fresh fruits and vegetables.
- Additional amenities are as follows (only one of each type may be counted):
    - Bank with ATM
    - Barber
    - Cafe
    - School
    - Daycare
    - Government Service Centre
    - Gym
    - Laundry
    - Library
    - Medical Clinic
    - Post Office
    - Pharmacy
    - Public Park or Open Space
    - Restaurant
    - School
    - Other Retail
- Retail areas must be permanent facilities that are regularly open to the public.

<u>Safe Walking Routes:</u>

The following are examples of routes that <u>do not qualify</u> as being safe:

- Pedestrians are using uncontrolled sandy paths to cross through the area and reach the amenity or transit stop.
- Pedestrians are using the side lane of a road to reach to amenity or transit stop.
- Pedestrians are using a 1.8m walkway but is required to cross a highway that does not have a proper pedestrian crossing.

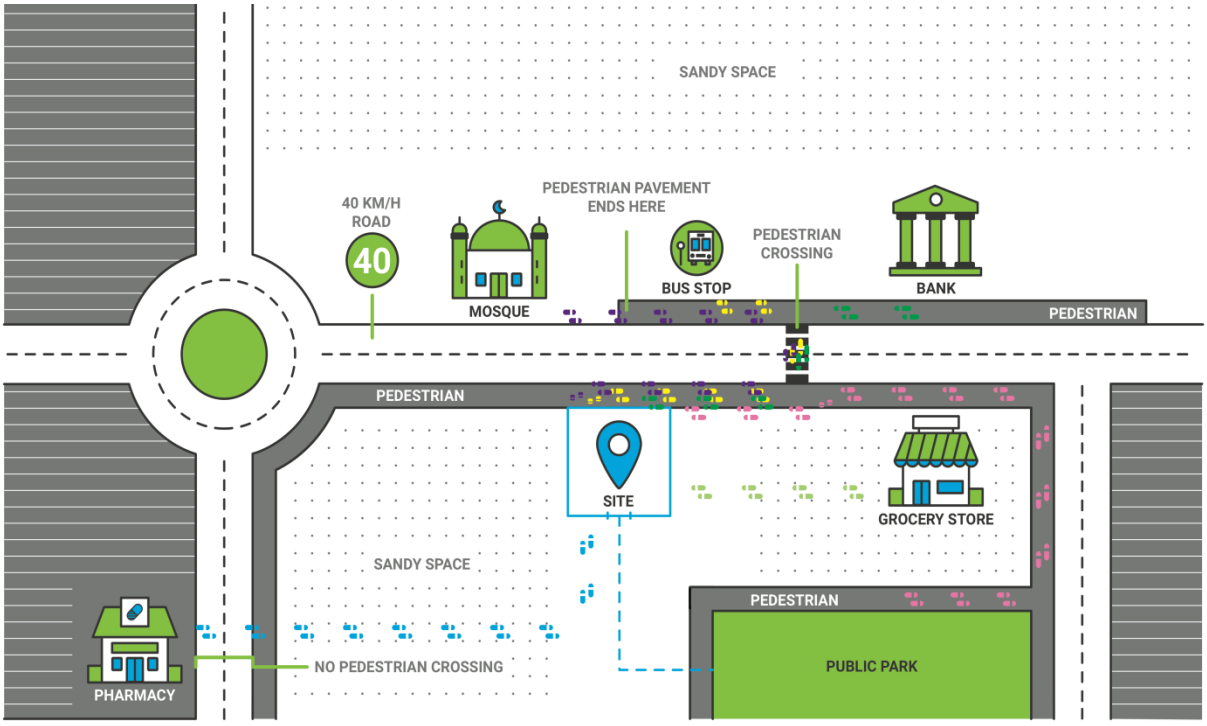


Figure TC-03.1 Walking routes

In Figure TC-03.1, the following routes are considered as safe routes:

- Pedestrians use the pavement to reach the public park and grocery store
- Pedestrians use the pavement and pedestrian crossing to reach the bank
- Pedestrians use the pavement and pedestrian crossing to reach the bus stop

In Figure TC-03.1, the following routes are not considered as safe routes:

- The route to the pharmacy as there is no pedestrian crossing
- The route to the mosque (there is no continuous pavement and a pedestrian would have to walk along the side of the road)
- The route across the sandy space to the grocery store

Credit Tool

N/A

Reference Documents

1. Ministry of Municipal and Rural Affairs (MOMRA), The Enhancement of Traffic Performance on Streets and Roads in the Kingdom of Saudi Arabia
2. National Association of City Transportation Officials (NACTO), Urban Street Design Guide
3. U.S. Environmental Protection Agency (EPA), Smart Growth Program
4. Pedestrian and Bicycle Information Center, http://www.pedbikeinfo.org/
5. Walkscore® Methodology, https://www.walkscore.com/methodology.shtml
6. Walkable Communities Inc., https://www.walkable.org/

TC-04 Home Office

Keystone Credit	Total Number of Points Available
No	1

Aim

To provide the space and connections for a home office to promote 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 is provided in the living room, one of the bedrooms or another suitable area that can be used as a home office/study. **For dwellings/residential units with three or more bedrooms:** A separate room is provided 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
	Total	**1**	**1**

Design Stage Evidence

#	Evidence per Requirement
1	• For each dwelling or residential unit type, scaled drawings showing the location and dimensions of the home office/study and the connection points.

Construction Stage Evidence

#	Evidence per Requirement
1	• For each dwelling or residential unit type, as-built scaled drawings showing the location and dimensions of the home office/study and the connection points. • For each dwelling or residential unit type, date-stamped photographs of the home office/study and connection points.

Supporting Guidance

The following must be provided as a minimum for the home office/study room or zone:

- 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
- Two double power sockets.
- Access to data and telephone communications e.g. broadband socket, telephone socket.

Credit Tool

N/A

Reference Documents

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

TC-05 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. **Multi-residential building:** For every 20 residents: • One permanent fully shaded bicycle rack is installed within 30m of a building entrance. • One parking area is reserved for other individual transportation modes.	1	1
2	The building is located within 180m actual bicycling distance of a bicycle network that connects directly to five amenities within 5km. Planned bicycle networks may qualify if they are already fully planned, funded, and expected to be operational within 3 years of building occupancy.		
	Total	**1**	**1**

Design Stage Evidence

#	Evidence per Requirement
1	**Individual dwelling:** • Design drawings identifying the location of the reserved parking area. • Specifications confirming compliance with the dimensions, demarcation and shading criteria. **Multi-residential building:** • Site plan identifying the building entrance, the location of each permanent bicycle rack, the actual walking distance (in meters) and the location of each reserved parking area. • Design drawings and specifications confirming the dimensions and shading requirements for each bicycle parking rack, as well as the dimensions, demarcation and shading of each

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

Construction Stage Evidence

#	Evidence per Requirement
1	**Individual dwelling:** • As-built drawings identifying the location of the reserved parking area. • Date-stamped photographs and purchase receipts confirming compliance with the dimensions, demarcation and shading criteria. **Multi-residential building:** • As-built site plan identifying the building entrance, the location of each permanent bicycle rack, the actual walking distance (in meters) and the location of each reserved parking area. • Date-stamped photographs and purchase receipts confirming the dimensions and shading requirements for each bicycle rack, as well as the dimensions, demarcation and shading of each reserved parking area.
2	• As-built site plan identifying the location of each permanent bicycle rack, the location of the bicycle network, the location of applicable amenities and the actual bicycling distance (in meters). • Date-stamped photographs or other official confirmation that the bicycle network comprises a clearly marked bicycle lane at least 3m wide, or a street with a design speed of 40 km/h or less. • For planned bicycle networks, official confirmation of funding, construction schedule and planned date of full operation (updated as necessary).

Supporting Guidance

- 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-05 Heat Island Effect** for the minimum SRI requirements of 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 <u>not</u> recommended include: Wave, Schoolyard, Coathanger, Wheelwheel, 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.
- 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.
- Parking areas dedicated for other individual transportation modes must be clearly reserved by pavement markings and additional shaded area.
- Actual bicycling distance 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 are defined in credit **TC-03 Access to Amenities**.

<u>Calculating the Number of Bicycle Racks Required:</u>

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):

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

Credit Tool

N/A

Reference Documents

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

Region and Culture

6 Region and Culture

The Region & Culture category focuses on the promotion of KSA's heritage and culture. It also recognizes the importance of involving the individual municipalities in the Mostadam for Residential Buildings' rating system by providing them with the opportunity to determine which credits are most important to their region. In line with Vision 2030, Mostadam for Residential Buildings also encourages a sense of community by rewarding projects that are located near establishments and amenities that enable participation in activities and events to cultivate a sense of belonging and nurture vibrant societies collectively.

Figure 9 Region and Culture credits

RC-01 Thriving Economy

Keystone Credit	Total Number of Points Available
No	2

Aim

To give preference to the purchase of materials that benefit the local economy and provide the added benefit of reduced transportation impacts.

Requirements

#	Requirement	Points Available	
		Individual dwelling	Multi-residential
1	A minimum of 20% of the construction materials (by cost) are sourced from within KSA.	1	1
2	A minimum of 30% of the construction materials (by cost) are sourced from within KSA.	1	1
	Total	**2**	**2**

Design Stage Evidence

#	Evidence per Requirement
1 & 2	• Calculations of the cost of compliant materials against the total cost of materials, demonstrating that either the 20% or 30% requirement is achieved. • Specifications highlighting the requirement for materials to be sourced within KSA. • Draft Bill of Quantities (BoQ) demonstrating total cost of applicable materials.

Construction Stage Evidence

#	Evidence per Requirement
1 & 2	• Updated calculations of the cost of compliant materials against the total cost of materials, demonstrating that either the 20% or 30% requirement is achieved. • Purchase orders and proof of materials sourced within KSA. • Final Bill of Quantities (BoQ) demonstrating total cost of applicable materials.

Supporting Guidance

- Applicable construction materials include the following:
  - Materials used for the substructure
  - Materials used for the superstructure
  - Finishes
  - Fixtures
  - Fittings
  - Furnishing

- Equipment/appliances
- For a construction material to be compliant with the credit requirements (i.e. 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
- 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.
- Labour and equipment costs must be excluded from the total material costs.
- Include the following divisions from the Construction Specification Institute (CSI): Division 03 Concrete, Division 04 Masonry, Division 05 Metals, Division 06 Wood, Plastics, and Composites, Division 07 Thermal and Moisture Protection, Division 08 Openings, Division 09 Finishes, Division 10 Specialties, Division 31 Earthwork, and Division 32 Exterior Improvements.
- 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.
- Table RC-01.1 contains an example cost analysis of construction materials to assess a project's compliance with the credit requirements. In this example, 65% of the material cost can be attributed to materials sourced in KSA, therefore the project would be eligible for 2 points.

Table RC-01.1 Sample cost analysis of construction materials

CSI	Description of Material	Product	Supplier	Local Material Cost (SAR) (exc. labour & equipment)
03 Concrete				
03300	Cast-in-place concrete	Concrete grade C10/10	Supplier 1	650,000
03400	Precast concrete	Concrete grade 50/20	Supplier 2	200,000
04 Masonry				
042000	Masonry unit	Concrete masonry units	Supplier 3	250,000
05 Metals				
051223	Structural steel for buildings	Reinforcing steel bars, high yield steel deformed bars	Supplier 4	600,000
07 Thermal/Moisture Protection				
072719	Polythene sheet	1000gauge, 0.25mm thick polyethylene	Supplier 7	20,000
08 Doors & Windows				
08200	Wood & plastic doors	Wooden doors	Supplier 8	70,000
08500	Windows	Aluminium windows	Supplier 9	120,000
			Local Material Cost (SAR)	**1,910,000**
			Total Material Cost (SAR) (to be supported by Bill of Quantities)	**2,940,000**
			% Local Materials	**65%**

Credit Tool

N/A

Reference Documents

1. Construction Specification Institute (CSI) Division Specification

RC-02 Heritage and Culture

Keystone Credit	Total Number of Points Available
No	2

Aim

To promote design practices that reflect KSA's cultural, regional heritage and traditions, and to showcase authentic KSA architecture and vernacular.

Requirements

#	Requirement	Points Available	
		Individual dwelling	Multi-residential
1	The building design harmoniously aligns with the local cultural and regional identities and traditions.	2	2
	Total	**2**	**2**

Design Stage Evidence

#	Evidence per Requirement
1	• Concept narrative outlining the design strategy, demonstrating how the cultural and regional elements are incorporated into the design of the building, signed by a registered architect with experience of preserving Saudi heritage and culture. • Drawings and/or visualizations communicating the design strategy.

Construction Stage Evidence

#	Evidence per Requirement
1	• Updated narrative demonstrating how the cultural and regional elements have been incorporated into the design of the building. • Date-stamped photographs of the implementation of the specific cultural and regional elements.

Supporting Guidance

The following are considered cultural and/or regional features and at least two must be incorporated into the building's design:

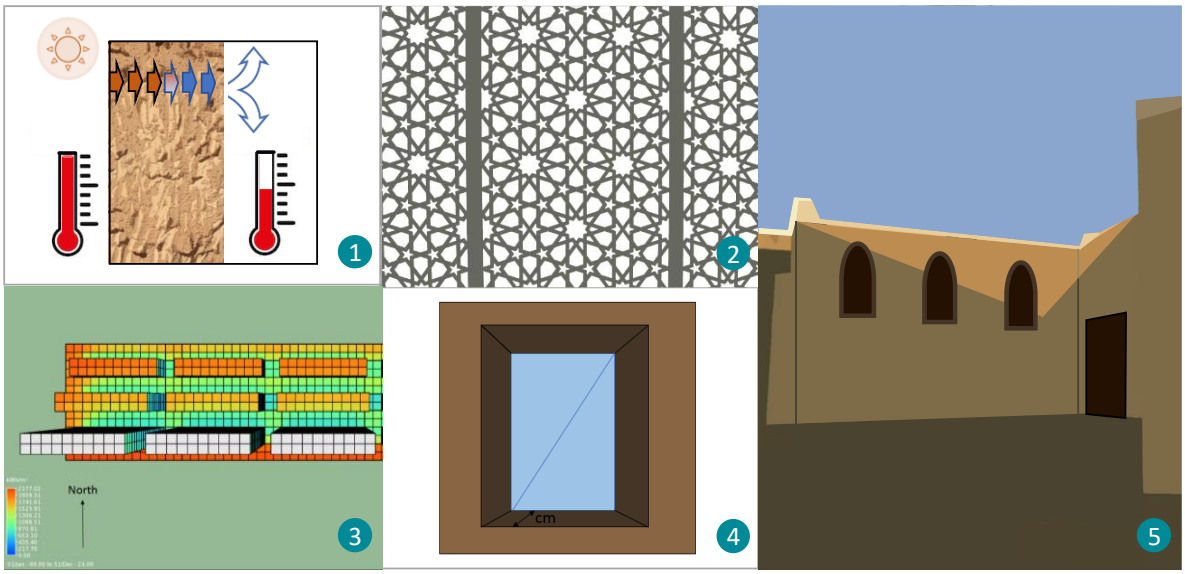
- **Mashrabiya**

  An architectural element consisting of geometric patterns and typically made from wood, concrete, brick or metal. Mashrabiya can have several different functions:

  - Shading element to control heat gain
  - Screen to provide privacy
  - Structural element as a truss in a lattice girder

    - Screen to control airflow
    - Architectural decoration
- **Deep window reveals**
  Recessed windows which provide passive shading and reduce heat gain and glare.
- **Islamic geometric motifs on the building façade and/or interior**
  Geometric designs based on Islamic art, often consisting of combinations of repeated squares and circles, which may be overlapped and interlaced. These geometric designs can be combined with arabesques to form intricate and complex patterns including a wide variety of tessellations.
- **Local materials with high thermal mass**
  Materials that have a greater ability to absorb and store heat energy and that are locally available. Materials with a high thermal mass include concrete, bricks and tiles.
- **Majlis rooms for communal gatherings**
  A private space where guests are received and entertained. Traditionally visitors sit on cushions arranged along the walls, placed either directly on the floor or upon a raised shelf.
- **Interior courtyards naturally lit and shaded**
  An outdoor space that is surrounded on at least three sides by the building. The space is naturally daylit and shading is provided by the surrounding building. The courtyard is generally used as a private garden or outdoor living space.
- **Low water demand planting in 'transitional' spaces**
  Transitional, or transient, spaces connect two different types of accommodation or act as buffer spaces between the interior and exterior environment.
    - External corridor
    - Foyer/lobby
    - Courtyard/atrium
    - Balcony/terrace
    - Porch

  These transitional spaces should contain native and/or drought tolerant plant species.
- **Orientation to reduce direct sunlight and utilize prevailing winds**
  The orientation of a building will influence the amount of direct sunlight a building receives and can be used to reduce solar gain, thereby reducing the amount of energy required for cooling the building. Orientation can also be used to take advantage of prevailing winds to provide passive cooling.



1. Local materials with high thermal mass
2. Mashrabiya
3. Orientation to reduce direct sunlight
4. Deep window reveals
5. Interior courtyards naturally lit and shaded

Figure RC-02.1 Examples of cultural/regional features

Credit Tool

N/A

Reference Documents

N/A

RC-03 Vibrant Society

Keystone Credit	Total Number of Points Available
No	1

Aim

To provide access to a residents' community center or other society-promoting establishments to facilitate a sense of belonging and encourage a more vibrant society.

Requirements

#	Requirement	Points Available	
		Individual dwelling	Multi-residential
1	The individual dwelling is located near to at least three establishments that promote cultural and/or social activities.	1	N/A
2	A community center is provided within the building or plot for use by residents for family gatherings, community celebrations, entertainment etc. The space is private, or capable of being screened off, to cater for women-only events.	N/A	1
	Total	**1**	**1**

Design Stage Evidence

#	Evidence per Requirement
1	• Scaled map showing the location and distance between the individual dwelling and at least three society-promoting establishments.
2	• Scaled drawing showing the location and size (m^2) of the community center. • Design details demonstrating that the community center is private or capable of being screened off. • Calculations demonstrating that the community center is adequately sized as per the Supporting Guidance.

Construction Stage Evidence

#	Evidence per Requirement
1	• Scaled map showing the location and distance between the individual dwelling and at least three society-promoting establishments.
2	• As-built scaled drawing showing the location and size (m^2) of the community center. • Date-stamped photographs showing that the community center is private or capable of being screened off.

Supporting Guidance

Individual Dwellings:

Individual dwellings should be located near establishments and amenities that enable social interaction and encourage participation in activities and events, thereby facilitating a sense of belonging and promoting vibrant and inclusive societies. Qualifying establishments are listed in Table RC-03.1 with the corresponding maximum distance from the dwelling. The dwelling must be located within the specified distance of at least three of the establishments.

Table RC-03.1 Distance criteria for society-promoting establishments

Establishment	Maximum Distance from Dwelling (m)
Local mosque	250
Children's play area	300
Park or public beach	500
Jumah mosque	1,000
Cultural center or heritage site	2,000
Entertainment venue (e.g. movie theatre, sports venue)	3,000
Community majlis	3,700
Youth center / community social center	3,700
Retail hub (mall, café or restaurant)	3,700

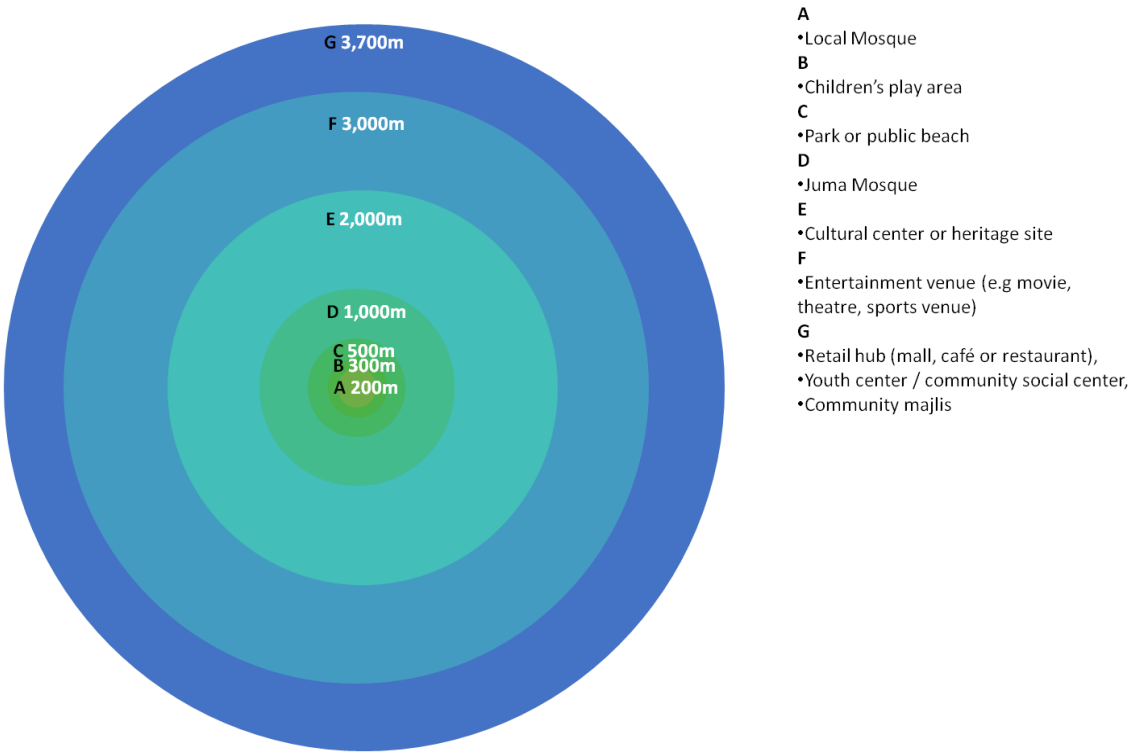


Figure RC-03.1 Distance criteria for society-promoting establishments

Multi-Residential Buildings:

The community center must be adequately sized to accommodate a minimum of 50% of the building's design occupancy at one time.

Credit Tool

N/A

Reference Documents

1. The 2nd Executive Plan for Provision of Public Services in Riyadh, 2017
2. Metric Handbook: Planning and Design Data, 6th Edition

RC-04 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**

Design Stage 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.

Construction Stage 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 RC-04.1). 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 RC-04.1.

Table RC-04.1 Regional Focus credits per climate zone

Region	Regional Focus Credits
Climate Zone 1	SS-04 Ecological Enhancement SS-05 Heat Island Effect *(requirement #1)* E-01 Energy Performance *(min. 8 credit points)* E-03 Envelope Commissioning E-06 Renewable Energy *(min. 2 credit points)*

	W-01 Indoor Water Performance *(min. 6 credit points)* W-02 Outdoor Water Performance *(min. 5 credit points)*
Climate Zone 2	SS-01 Sewage, Flood and Rainwater Management *(requirements #2 and #3)* SS-04 Ecological Enhancement E-01 Energy Performance *(min. 7 credit points)* E-03 Envelope Commissioning W-01 Indoor Water Performance *(min. 5 credit points)* W-02 Outdoor Water Performance *(min. 4 credit points)*
Climate Zone 3	SS-01 Sewage, Flood and Rainwater Management *(requirements #2 and #3)* SS-04 Ecological Enhancement E-01 Energy Performance *(min. 7 credit points)* E-03 Envelope Commissioning W-01 Indoor Water Performance *(min. 5 credit points)* W-02 Outdoor Water Performance *(min. 4 credit points)*

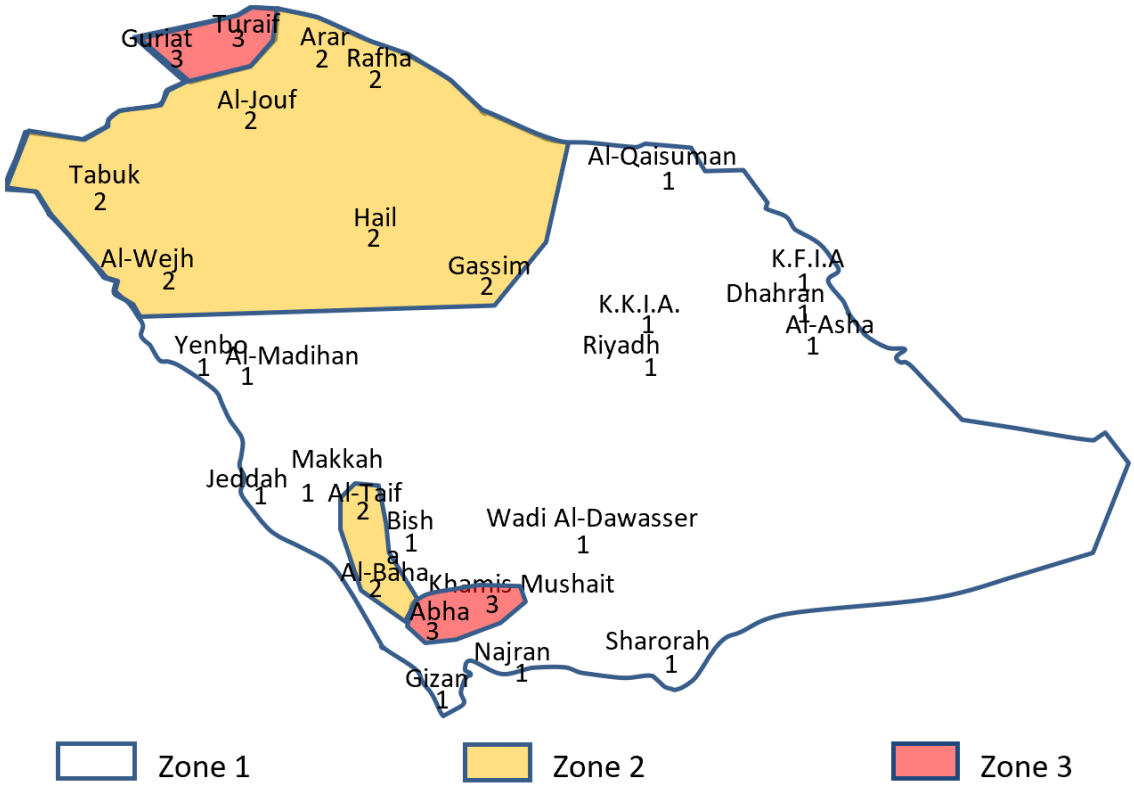


Figure RC-04.1 KSA climate zones (source: Saudi Building Code)

Credit Tool

N/A

Reference Documents

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

Energy

7 Energy

The goals and objectives of Vision 2030 are effecting rapid change in KSA. In January 2018, electricity tariffs were increased throughout the region, generating a subsequent increase in the demand for energy efficiency. To support Vision 2030, all Mostadam-certified individual dwellings and multi-residential buildings will have achieved a minimum level of energy performance and undertaken commissioning activities to ensure the building is operating efficiently and as intended. Mostadam for Residential Buildings also aligns with KSA's new net-metering regulation for small-scale PV, whereby developments are rewarded for generating renewable electricity. Projects that install energy efficient appliances are also rewarded to encourage further reductions in energy usage.

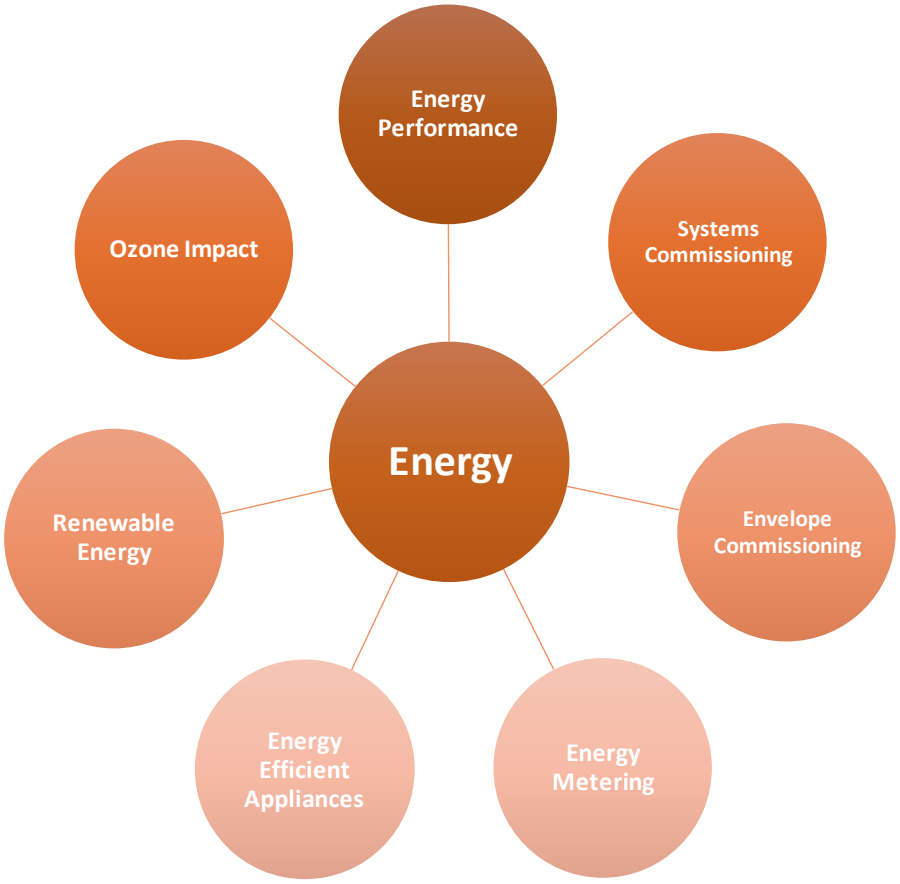


Figure 10 Energy credits

E-01 Energy Performance

Keystone Credit	Total Number of Points Available
Green	15

Aim

To promote informed decisions on the selection and installation of building components that achieve improved levels of energy efficiency and reduced carbon emissions.

Requirements

A project may pursue either the **Prescriptive Option** or the **Performance Option**.

Prescriptive Option			
#	Requirement	Points Available	
		Individual Dwelling	Multi-Residential
Keystone Requirement - achieve requirement #1 (5 credit points).			
1	Comply with the following Saudi Building Code (SBC) section: • **Individual dwelling:** comply with SBC Section 602 Low-Rise (Residential) Building Energy Conservation: Energy-Efficient Design of Low-Rise Residential Buildings in Saudi Arabia. • **Multi-residential building:** comply with SBC Section 601 Buildings Except Low-Rise Residential Buildings Conservation: Energy-Efficient Design of Buildings Except Low-Rise Residential Buildings in Saudi Arabia.	5	5
	Total	**5**	**5**

Performance Option			
#	Requirement	Points Available	
		Multi-Residential	Individual Dwelling
Keystone Requirement - projects must consume no more energy than the ASHRAE baseline building (5 credit points).			
1	Dynamic energy modeling is conducted, using appropriate energy modeling software, to compare the total building energy consumption (kWh) to a baseline prescribed by: • **Individual dwelling:** ASHRAE Standard 90.2-2007 • **Multi-residential building:** ASHRAE Standard 90.1-2013 The number of points awarded is dependent on the percentage	15	15

	improvement over the baseline.		
	Total	**15**	**15**

Design Stage Evidence

Prescriptive Option	
#	Evidence per Requirement
1	• Drawings, specifications and calculations demonstrating compliance with: ○ **Individual dwelling:** SBC 602 ○ **Multi-residential building:** SBC 601 • Prescriptive Energy Tool.

Performance Option	
#	Evidence per Requirement
1	• Performance Energy Tool.

Construction Stage Evidence

Prescriptive Option	
#	Evidence per Requirement
1	• As-built drawings and calculations, technical datasheets and purchase orders/receipts demonstrating compliance with: ○ **Individual dwelling: SBC 602** ○ **Multi-residential building: SBC 601** • Prescriptive Energy Tool.

Performance Option	
#	Evidence per Requirement
1	• Performance Energy Tool.

Supporting Guidance

Performance Option:

To determine the number of points achieved under this credit, a qualified Energy Modeller must develop a detailed energy model of two buildings:

- ***Baseline*** building as prescribed by:
  - ASHRAE Standard 90.2-2007, Section 8 (for individual dwellings).
  - ASHRAE Standard 90.1-2013, Appendix G (for multi-residential buildings).
- ***Proposed*** building based on the design specifications and drawings.

The total annual energy consumption is determined (kWh per year) for both buildings. The percentage improvement of the proposed building over the baseline building is calculated using the following equation:

$$\%\ Improvement = \frac{Baseline\ Annual\ Energy\ Consumption\ -\ Proposed\ Annual\ Energy\ Consumption}{Baseline\ Annual\ Energy\ Consumption}$$

The number of credit points awarded for the percentage improvement achieved is as per Table E-01.1 for individual dwellings and Table E-01.2 for multi-residential buildings.

Table E-01.1 Points available for percentage improvement achieved - individual dwellings

Percentage Improvement	Points Achieved
0%	5
5%	6
10%	7
15%	8
20%	9
25%	10
30%	11
35%	12
40%	13
45%	14
50%	15

Table E-01.2 Points available for percentage improvement achieved - multi-residential buildings

Percentage Improvement	Points Achieved
0%	5
3%	6
6%	7
10%	8
14%	9
18%	10
22%	11
26%	12
30%	13
35%	14
40%	15

Additional Modelling Clarifications:

- The proposed and baseline simulations must use the same energy modelling software and the same weather data file.

- The energy modelling software for individual dwellings must meet the minimum requirements of ASHRAE Standard 90.2-2007 Section 8.
- The energy modelling software for multi-residential buildings must meet the minimum requirements of ASHRAE Standard 90.1-2013 Appendix G (Section G2.2).
- The simulation program shall be capable of performing design load calculations to determine required HVAC equipment capacities and air and water flow rates in accordance with generally accepted engineering standards and handbooks for both the proposed design and baseline building.
- The correct climate zone must be considered for the project's location as per the list of zones defined in the ASHRAE Standards. KSA is generally categorized as Climate Zone 1, which is "Very Hot". However, the sub-zone must be accurately identified depending on the weather conditions at the project's location. Subzone 1A shall be used for humid cities such as Jeddah, whereas subzone 1B shall be used for dry cities such as Riyadh.
- District Cooling:
    - Buildings served by district cooling shall obtain the seasonal coefficient of performance (sCOP) from the district cooling provider. The sCOP should incorporate any thermal losses within the network.
    - If the design team is not able to obtain the sCOP from the network provider, a seasonal average COP of 4.5 must be assumed for the proposed building. The baseline building cooling system efficiency is determined using ASHRAE Standard 90.1-2013 Appendix G.
- Renewable Energy: whilst renewable energy is separately assessed under credit E-06 Renewable Energy, any onsite renewable energy technologies (e.g. solar hot water panels, photovoltaic panels) may be accounted for in this credit by subtracting the annual renewable energy generated (whether used on-site or exported to the grid) from the total proposed annual energy consumption.

<u>Qualified Energy Modeller:</u>

A qualified energy modeller must have a minimum of 3 years of relevant experience and a recognized qualification or chartership. The professional's expertise should be sufficient to cover all required technical aspects to ensure the energy model is appropriate and reflects the actual performance of the building. It is recommended that the modeller's qualifications and experiences are carefully reviewed to ensure the professional can undertake the modelling exercise and report accurate and reliable results for the percentage improvement in energy consumption against the baseline. Previous experience in modelling of residential projects will be ideal as defining geometry, zoning, and building systems performance parameters are crucial steps which require judgment and awareness of principles of residential buildings design considerations.

<u>Preliminary Energy Model:</u>

In the early stages of concept design, it is recommended that a preliminary energy model is developed by a qualified energy modeler to provide the following benefits:

- An estimated projection of energy usage depending on various options proposed for building elements. This will support further design development activities.
- Identification of the best efficiency measures of building design and performance parameters to avoid inaccurate sizing of building systems, especially HVAC, and other architectural design aspects of the building.

Thermal Performance of the Building Envelope:

Thermal conductivity (U-value) is the measurement of the flow of heat through a building material. It is defined as the rate of heat flow in watts (W) through an area of 1 square meter (m^2) for a temperature difference across the structure of 1 degree centigrade (C) or Kelvin (K). The U-value unit of measurement is therefore W/m^2K.

The following procedure is recommended for a comprehensive calculation of the area-weighted U-value of the envelope's opaque surfaces, which typically accounts for more than 50% of the envelope. It must be properly assessed to ensure the building is designed for efficiency in energy performance.

1. The different sectional details of each exterior wall need to be identified at all levels and elevations. It is recommended that color coded drawings are generated to define the different types of exterior walls and its related area for all four elevations (Figure E-01.1).

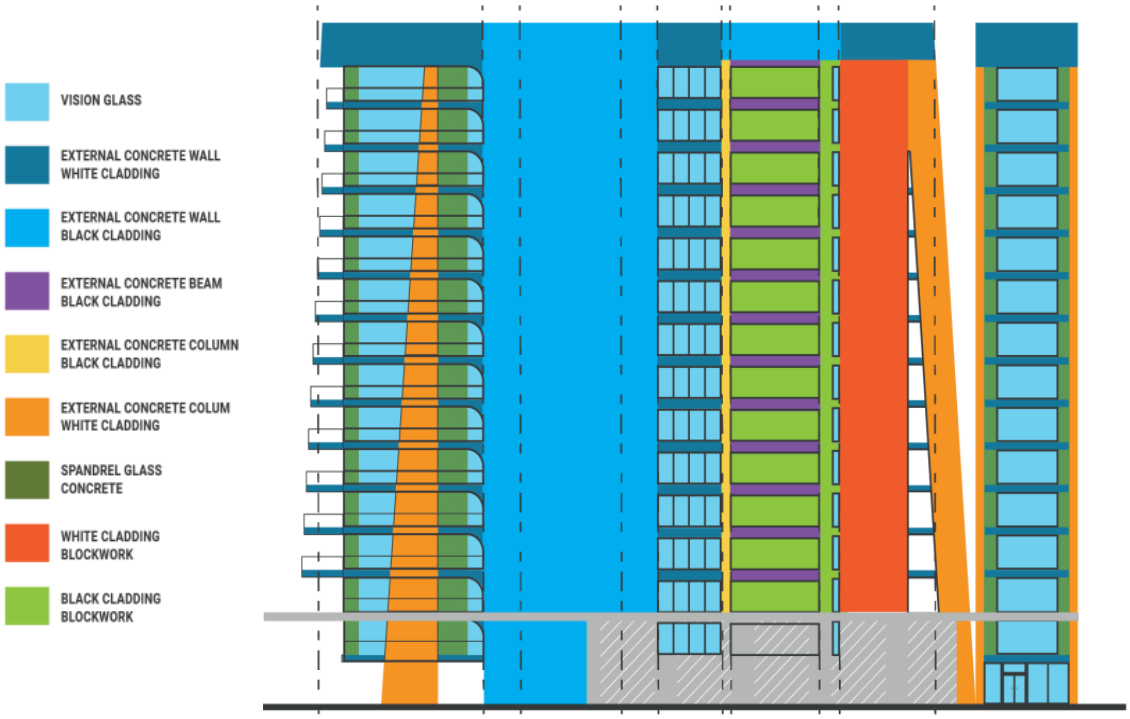


Figure E-01.1 Color-coded drawing defining different types of exterior walls

2. Once the different wall types areas are identified, it is important to define sectional details of each wall type by defining the materials and related thicknesses.
3. The suppliers of the proposed materials should be contacted to provide the thermal conductivity (K-value) of each type of material in order to build up the information for the area-weighted U-value calculations.
4. Using the sectional details, the thermal resistance of the wall section can be calculated using the following formula:

$$R - value\ (m^2K/W) = \frac{Material\ Thickness\ (m)}{Thermal\ Conductivity\ (W/mK)}$$

5. Once the sectional R-value is identified, the U-value of the same section is calculated using the following equation (this methodology is appropriate for tall buildings with a single continuous façade system):

$$U - value\ (W/m^2K) = \frac{1}{R - value\ (m^2K/W)}$$

Table E-01.3 Example of R-value and U-value calculations

Material	Layer Thickness (m)	Thermal Conductivity (W/mK)	R-Value (m^2K/W)
Outside air film	-	-	0.050
Fiber cladding	0.020	0.200	0.100
Airgap	0.030	1.060	0.028
Hydrophobized mineral fiber cladding insulation	0.050	0.032	1.56
RCC	0.300	1.900	0.158
Plaster	0.015	0.160	0.094
Inside air film	-	-	0.130
Total R-value	-	-	2.120
U-value (W/m^2K)	**0.472**		

6. Once the sectional U-values have been calculated, the Average Area-Weighted U-value can be calculated using the following formula:

$$Weighted\ U - value(W/m^2K) = \frac{\sum A \times U}{\sum A}$$

Table E-01.4 Example of average area-weighted U-value calculations

Wall Type	Area (m^2)	U-value (W/m^2K)	A*U
EW 1	693.36	-	0
EW 2	330.36	0.47	155.27
EW 3	823.62	0.47	387.10
EW 4	102.20	0.44	44.97
EW 5	33.67	0.47	15.82
EW 6	367.67	0.47	172.80
EW 7	-	0.36	0
EW 8	244.72	0.37	90.55
EW 9	266.83	0.132	35.22
EW 10	306.07	0.132	0
Total	**3168.50**	**-**	**901.73**

$$Weighted\ U-value(W/m^2K) = \frac{901.74}{3168.50} = 0.28$$

7. Transparent, or semitransparent, glass is not considered as the above calculation is for opaque surfaces only. Transparent, or semitransparent, glass U-values must be calculated separately due to the different thermal performance of glazing and taking into consideration the thermal bridging of the frame as part of the overall U-value calculations.

Credit Tool

Prescriptive Energy Tool

Performance 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:
    - 550/590-2011: Performance Rating of Water-Chilling and Heat-Pump Water-Heating Packages Using the Vapor Compression Cycle
    - 210/240-2008: Unitary Air Conditioning and Air-Source Heat Pump Equipment
    - 340/360-2007: Performance Rating of Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment
    - 310/380-2004: Packaged Terminal Air-Conditioners and Heat Pumps
    - 1230-2010: Performance Rating of Variable Refrigerant Flow (VRF) Multi-split Air-Conditioning and Heat Pump Equipment

E–02 Systems Commissioning

Keystone Credit	Total Number of Points Available
Green	1

Aim

To ensure the installed building systems are operating efficiently and as intended.

Requirements

#	Requirement	Points Available	
		Individual dwelling	Multi-residential
1	**Individual dwelling:** A Competent Professional is retained to oversee basic systems verification. **Multi-residential building:** An independent Commissioning Agent (CxA) is retained to produce a Commissioning Plan and oversee advanced systems verification.	1	1
2	All systems and controls have been installed, and are operating, as intended. The commissioning certificates, list of installed systems and operation and maintenance instructions are included in the Mostadam Guide (credit **EI-01 Mostadam Guide**).		
	Total	**1**	**1**

Design Stage Evidence

#	Evidence per Requirement
1 & 2	**Individual dwelling:** • CV of Competent Professional and confirmation of appointment. • Narrative prepared by the Competent Professional describing the building systems and their relevant testing requirements. **Multi-residential building:** • CV of independent Commissioning Agent (CxA) and confirmation of appointment. • Commissioning Plan prepared by the CxA.

Construction Stage Evidence

#	Evidence per Requirement
1 & 2	• CV of Competent Professional or independent CxA. • Testing certificates for all systems and controls installed in the building. • Relevant sections of the Mostadam Guide containing commissioning certificates, list of systems installed and operation and maintenance instructions.

	• Signed report by Competent Professional or signed commissioning report by CxA with detailed results on systems verification and confirming that systems are operating as designed.

Supporting Guidance

Commissioned Systems:

The building's systems that are covered by this credit are:

- HVAC systems: heating, ventilation, air conditioning, chillers, boilers, refrigeration and chilled water from district cooling.
- Electrical power systems: distribution, emergency and backup power.
- Lighting and lighting controls (internal and external).
- Automated controls, building management systems, building automation systems, direct digital controllers, supervisory control and data acquisition.
- Onsite water systems: hot and cold water, irrigation water, water features, swimming pools and water treatment systems.
- Metering systems.
- Onsite renewable systems or alternative energy systems.
- Fire and life safety systems.

Competent Professional for Individual Dwellings:

- The Competent Professional must have a minimum of two years of relevant experience in building systems commissioning.
- The Competent Professional may be an employee of the owner, the supervision consultant, an independent consultant, design company, construction management company or project management company.
- For projects comprising more than ten individual dwellings, the appointment of an independent CxA is mandatory.

Independent Commissioning Agent (CxA) for Multi-Residential Buildings:

- The independent Commissioning Agent (CxA) must be appointed prior to the start of the commissioning review process in the design phase.
- The CxA must have a minimum of five years of experience in commissioning building systems.
- The CxA may be an employee of the owner, an independent consultant, design company, construction management company or project management company, and must report directly to the owner.
- The CxA may not be an employee of the project's Contractor or sub-contractor.
- The CxA must not be involved in the design or construction process of the project in any other capacity.

Basic Commissioning for Individual Dwellings:

- The Competent Professional will review the project specifications in relation to the commissioning process.
- The Competent Professional will review and approve the inspections, testing and commissioning activities.

Advanced Commissioning for Multi-Residential Buildings:

The independent Commissioning Agent (CxA) will oversee the inspections, testing and commissioning requirements identified in SBC 1001 Green Buildings and undertake the following:

- Review the OPR, BOD and specifications.
- Develop and maintain the Commissioning Plan.
- Review and approve the commissioning program submitted by the Contractor against the resource schedule for testing and balancing. Once commissioning activities commence, the CxA will report directly to the Owner/Owner's Representative regarding any deviation or proposed changes that will impact commissioning duration and/or commissioning quality.
- Compile and review the commissioning method statements.
- Develop the inspection and test processes.
- Witness key testing and commissioning activities.
- Provide the Pre-Certificate of Occupancy report.
- Provide the Final Commissioning report.
- Chair commissioning meetings and issue minutes of commissioning meetings.

Sample Testing:

- For a large community of individual dwellings, the commissioning requirements can be undertaken for 40% of the individual dwellings within each typology group.
- For large multi-residential buildings, the commissioning requirements can be undertaken for 50% of the individual residential units within each typology group.

Credit Tool

N/A

Reference Documents

1. Saudi Building Code (SBC) 1001 Green Buildings, Chapter 9 Commissioning, Inspections, Operation and Maintenance
2. Saudi Building Code (SBC) 601 Energy-Efficient Design of Buildings Except Low-Rise Residential Buildings in Saudi Arabia

E–03 Envelope Commissioning

Keystone Credit	Total Number of Points Available
No	1

Aim

To ensure the building envelope performs as intended.

Requirements

#	Requirement	Points Available	
		Individual dwelling	Multi-residential
1	**Individual dwelling:** A Competent Professional is retained to oversee basic building envelope verification. **Multi-residential building:** An independent Building Envelope Commissioning Agent (CxA) is retained to produce an Envelope Commissioning Plan and oversee advanced building envelope verification.	1	1
2	The building envelope is tested for condensation, water ingress, air infiltration and thermal bridging to ensure performance is as designed and in accordance with ASTM E779 and ASTATT standards. All installed products, including custom-made cladding systems, have a pre-testing certificate.		
	Total	**1**	**1**

Design Stage Evidence

#	Evidence per Requirement
1 & 2	**Individual dwelling:** • CV of Competent Professional and confirmation of appointment. • Narrative prepared by the Competent Professional describing the envelope testing requirements for the building. **Multi-residential building:** • CV of the independent Building Envelope Commissioning Agent (CxA) and confirmation of appointment. • Details of the envelope testing requirements for the building, prepared by the CxA and to be included in the Envelope Commissioning Plan.

Construction Stage Evidence

#	Evidence per Requirement
1 & 2	• CV of Competent Professional or Building Envelope CxA. • Pre-testing certificates for relevant installed products. • Signed verification report by the Competent Professional or Building Envelope CxA detailing the results of the tests conducted and confirming that the building envelope is installed and performs as designed.

Supporting Guidance

Commissioned Elements:

- The building elements covered by this credit include:
  - Fenestrations
  - Walls
  - Wall crawl spaces
  - Roofs
  - Basements
  - Floors
- The building envelope is to be tested for the following to ensure performance is as designed and in accordance with ASTM E779 and ASTATT standards:
  - Condensation
  - Water ingress
  - Air infiltration
  - Thermal bridging.
- Both air-tightness tests and thermal bridge detection (thermography) must be undertaken by qualified and certified professionals.
- Tests are recommended to be carried out before construction completion in case any remedial work is required.
- All installed products, including custom-made cladding systems, have a pre-testing certificate.

Competent Professional for Individual Dwellings:

- The Competent Professional must have a minimum of two years of relevant experience in building envelope commissioning.
- The Competent Professional may be an employee of the owner, the supervision consultant, an independent consultant, design company, construction management company or project management company.
- For projects comprising more than ten individual dwellings, the appointment of an independent Building Envelope CxA is mandatory.

Independent Building Envelope Commissioning Agent (CxA) for Multi-Residential Buildings:

- The independent Building Envelope Commissioning Agent (CxA) must be appointed prior to the start of the commissioning review process in the design phase.
- The CxA must have a minimum of five years of experience in building envelope verification.
- The CxA may be an employee of the owner, an independent consultant, design company, construction management company, or project management company, and must report directly to the owner.

- The CxA may not be an employee of the project's Contractor or sub-contractor.
- The CxA must not be involved in the design and construction process of the project in any other capacity.

Basic Envelope Commissioning for Individual Dwellings:

- The Competent Professional will review the project specifications in relation to the commissioning process.
- The Competent Professional will review and approve building envelope tests for condensation, water ingress, air infiltration and thermal bridging.

Advanced Envelope Commissioning for Multi-Residential Buildings:

The independent Building Envelope Commissioning Agent (CxA) will oversee the building envelope tests for condensation, water ingress, air infiltration and thermal bridging and undertake the following:

- Review the OPR, BOD and specifications.
- Develop and maintain the Building Envelope Commissioning Plan.
- Detail the envelope testing requirements and include these in the Building Envelope Commissioning Plan.
- Review and approve the envelope commissioning program submitted by the Contractor. Once commissioning activities commence, report directly to the Owner/Owner's Representative regarding any deviation or proposed changes that will impact commissioning duration and/or commissioning quality.
- Compile and review the commissioning method statements.
- Develop the inspection and test processes.
- Witness key testing and commissioning activities.
- Chair commissioning meetings and issue minutes of commissioning meetings.

Sample Testing:

- For a large community of individual dwellings, the commissioning requirements can be undertaken for 40% of the individual dwellings within each typology group.
- For large multi-residential buildings, the commissioning requirements can be undertaken for 50% of the individual residential units within each typology group.
- Envelope commissioning must be undertaken on the same buildings that have been selected for systems commissioning under credit **E-02 Systems Commissioning**.

Credit Tool

N/A

Reference Documents

1. Saudi Building Code (SBC 1001) Green Buildings, Chapter 9 Commissioning, Inspections, Operation and Maintenance
2. ASHRAE Guideline 0-2013, The Commissioning Process
3. NIBS Guideline 3-2012, Building Enclosure Commissioning Process, BECx
4. ASTM E779 - 10 Standard Test Method for Determining Air Leakage Rate by Fan Pressurization
5. ASTM E1105 - 15 Standard Test Method for Field Determination of Water Penetration
6. ATTMA TSL1 September 2016 Edition – Air Testing Standard for Residential Dwellings

7. ASTATT1 Prepare to Carry Out Air Tightness Testing
8. ASTATT2 Prepare Building for Air Tightness Testing
9. ASTATT3 Carry Out Air Tightness Testing for Single Dwellings and Other Small Buildings
10. ASTATT4 Carry Out Air Tightness Testing for Non-simple Buildings
11. ASTATT5 Prepare and Issue the Air Tightness Test Report
12. ASTATT6 Calculate the Area of Building Envelopes
13. ASTATT7 Manage all Calibrated Equipment
14. ASTATT8 Initiate and Progress Contracts with Clients to Carry Out Air Tightness Testing
15. ASTATT9 Quality Assure the Air Tightness Testing Process
16. ASTATT10 Carry Out Air Tightness Testing on Large and Complex, High-rise and Phased Hand-over Zonal Buildings
17. AAMA 502 Voluntary Specification for Field Testing of Newly Installed Fenestration Products

E-04 Energy Metering

Keystone Credit	Total Number of Points Available
Silver	1

Aim

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

Requirements

#	Requirement	Points Available	
		Individual dwelling	Multi-residential
1	A metering strategy is created and implemented which monitors the building's energy usage and conforms to SBC 1001 Chapter 6.	1	1
	Total	**1**	**1**

Design Stage Evidence

#	Evidence per Requirement
1	• Energy distribution schematic showing the type, extent and location of all meters. • Specifications with meter requirements highlighted. • 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.

Construction Stage Evidence

#	Evidence per Requirement
1	• As-built energy distribution schematic showing the type, extent and location of all installed meters. • Manufacturer's data sheets for the installed meters along with date-stamped photographs. • Mostadam Guide (refer to credit **EI–01 Mostadam Guide)** section on energy metering providing updated 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.

Metering and Sub-Metering:

The following table defines the end-use metering requirements:

Table E-04.1 Metering requirements

Building End Use	Individual Dwelling	Multi-Residential	
		Landlord Areas[3]	Tenant Areas[4]
Air conditioning[1]	✓	✓	✓
Water heating	✓	✓	✓
Lighting system	✓	✓	
Receptacle and process loads ≥ 10kW[2]	✓	✓	✓[5]
Energy generation	✓	✓	✓

[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.

[4] This excludes single-room and one-bedroom residential units.

[5] This can be combined with the metering for lighting.

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 on-site energy generation, liquid fuels, gaseous fuels, district cooling and/or waste energy must be installed with metering capabilities and have high level of user interface connectivity for monitoring.

Data Acquisition:

- All energy meters should be connected to a data acquisition and monitoring system which is capable of being 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 should 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 should also be capable of alerting occupants to unusually high consumption levels.

Energy Sub-metering Strategy:

Energy sub-metering will inform operators and occupants of systems and areas that have higher energy consumption than expected. The development of an energy sub-metering strategy should start at the schematic design stage. 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 will not be considered.
- 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 in 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.
- Ensure that at least 90% of the total energy demand of the building, as well as the major end uses listed below, are sub-metered:
    - Air conditioning
    - Water heating
    - Lighting systems
    - Receptacle and process loads > 10K
    - Energy generation
- 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.

Consider as an example an individual dwelling where the total connected load is 1300 kW and that sub-meters were provided for 90% of this total load for all building end uses except water heating. This would not be acceptable as water heating is considered a major energy end use system and this should be sub-metered to monitor its consumption and prevent wastage. Therefore, an additional sub-meter will be required for water heating. This will result in more than 90% of the total load being monitored, unless it is possible to re-arrange the monitored DBs by removing one of the lighting or receptacle DBs to maintain cost and efficiency.

Figure E-04.1 shows how energy sub-meters are annotated in Electric Single Line Drawings.

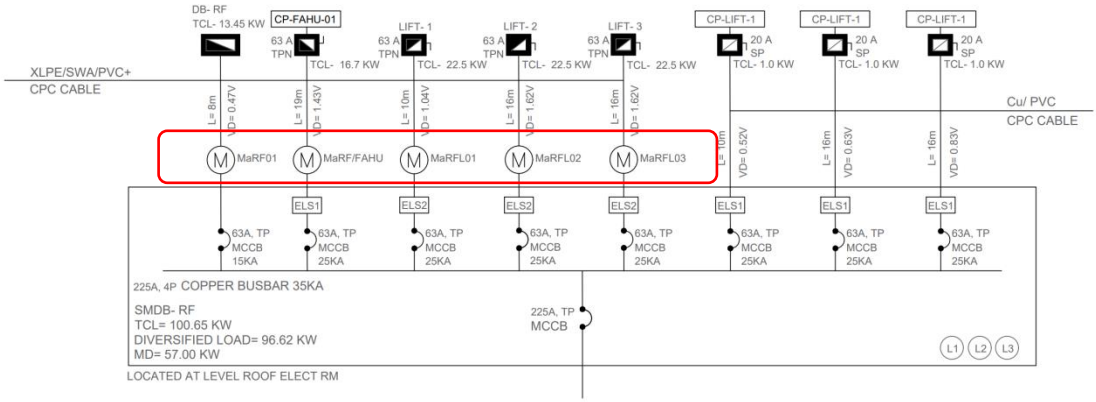


Figure E-04.1 Annotated Electric Single Line Drawing

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 801 Fire Code
3. NFPA 70 National Electrical Code
4. CIBSE TM39 2009, Building Energy Metering

E-05 Energy Efficient Appliances

Keystone Credit	Total Number of Points Available
No	1

Aim

To reduce a building's energy consumption through the provision or purchase of energy efficient appliances.

Requirements

#	Requirement	Points Available	
		Individual dwelling	Multi-residential
1	**For those electrical appliances provided by the developer:** All relevant electrical appliances have an Energy Efficiency Label from the Saudi Standards, Metrology and Quality Organization (SASO) with a minimum rating as per the Supporting Guidance. For those appliance categories not currently covered by SASO, the appliances are Energy Star certified. **For those electrical appliances not provided by the developer:** Information is provided to the occupant on the energy efficiency labelling scheme of SASO and the Energy Star scheme and their benefits. This should form part of the Mostadam Guide (credit **EI-01 Mostadam Guide**).	1	1
	Total	**1**	**1**

Design Stage Evidence

#	Evidence per Requirement
1	For those electrical appliances provided by the developer: • Specifications stating the minimum energy efficiency rating of all appliances. For those electrical appliances not provided by the developer: • Mostadam Guide section (refer to **EI-01 Mostadam Guide**) providing information on the SASO labelling scheme and Energy Star.

Construction Stage Evidence

#	Evidence per Requirement
1	For those electrical appliances provided by the developer: • List of installed appliances and the manufacturer, model, type of energy certification and energy rating for each one. • Date-stamped photographs or purchase orders/receipts for each installed appliance.

	• Manufacturer's literature for each installed appliance confirming the energy efficiency rating. For those electrical appliances not provided by the developer: • Mostadam Guide section (refer to **EI-01 Mostadam Guide**) providing information on the SASO labelling scheme and Energy Star.

Supporting Guidance

The following appliance categories are covered by this credit:

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

Electrical Appliances Provided by the Developer:

If an appliance category is covered by SASO's Energy Efficiency Label regulation, then all appliances in that category must have a SASO Energy Efficiency Label. The SASO Energy Efficiency Label is currently being updated. During the interim period when both versions of the label are valid, the appliances can have a minimum rating of either 4 Stars (old label) or B (new label). Once the new label is fully enforced, all appliances must have a minimum rating of B. If an appliance category is not covered by SASO's Energy Efficiency Label regulation, all installed 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. In the original version of the label, this is expressed by the number of stars from 1 to 6, with 6 being the most energy efficient and 1 the least. In the new version of the label, this is expressed by the 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. Examples of the original and new label are shown in Figure E-05.1.

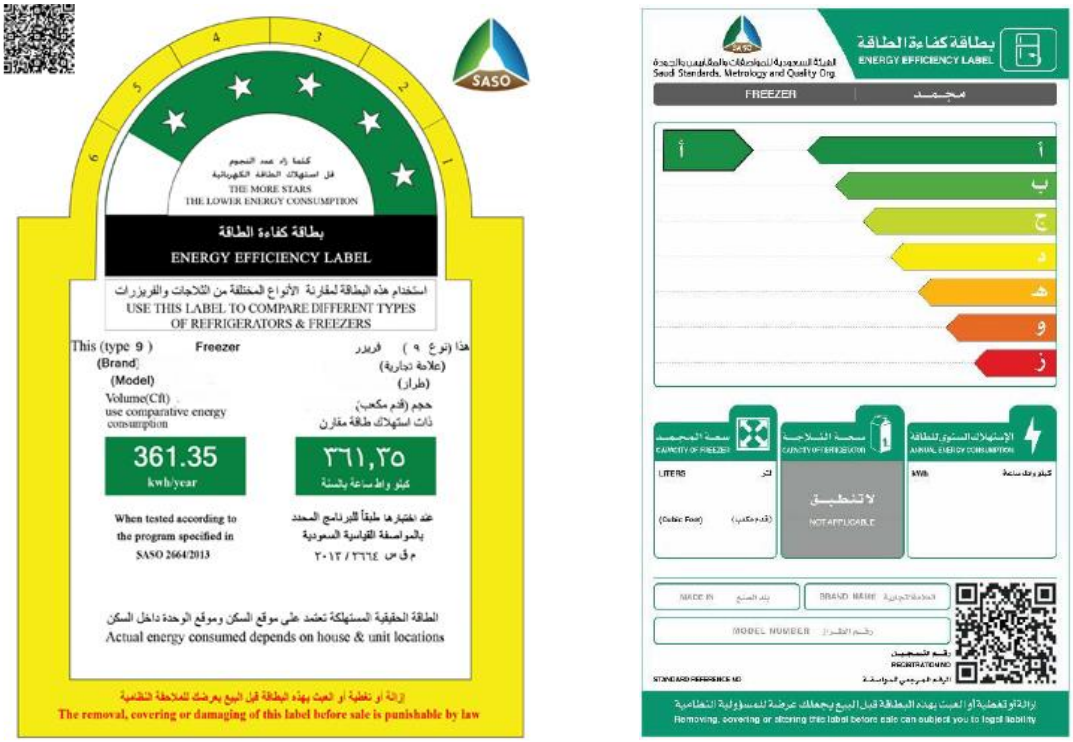


Figure E-05.1 Original (L) and new (R) SASO Energy Efficiency Label

Energy Star:

If the appliance is not covered by SASO's Energy Efficiency Label, then 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 out 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, use www.energystar.gov or consult appliance details. All Energy Star certified products will have a sticker indicating that they meet the EnergyStar requirements.

Credit Tools

N/A

Reference Documents

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

E-06 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 are specified and installed to provide a minimum percentage of the individual dwelling's hot water demand, as follows: • 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 are specified and installed onsite and 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**

* These credit points are only available for projects pursuing the Performance Option of credit **E-01 Energy Performance**.

Design Stage Evidence

#	Evidence per Requirement
1	• Drawings showing the location of the SHW panels. • Specifications for the SHW panels. • Software simulations confirming the estimated annual hot water demand, and estimated

	annual pool heating demand (if present), of the project along with the estimated annual hot water generated by the SHW system. • Supplier's datasheet confirming the annual thermal efficiency of the SHW system.
2	• Drawings indicating the location of the PV panels, the shading from surrounding surfaces and the azimuth angle and slope of the panels. • Specifications for the PV panels. • Software simulations confirming the estimated annual electricity consumption of the project along with the estimated annual electricity generated by the PV system, taking into consideration balance-of-system and dust-related losses. • If the renewable energy generated by the PV panels is to be used on-site, provide a narrative describing the planned end use(s) of the energy.

Construction Stage Evidence

#	Evidence per Requirement
1	• As-built drawings showing the location of the SHW panels. • As-built calculations confirming the estimated annual hot water demand, and estimated annual pool heating demand (if present), of the project along with the estimated annual hot water generated by the SHW system. • Manufacturer's technical datasheets for the SHW panels.
2	• As-built drawings indicating the location of the PV panels, the shading from surrounding surfaces and the azimuth angle and slope of the panels. • As-built calculations confirming the estimated annual electricity consumption of the project along with the estimated annual electricity generated by the PV system, taking into consideration balance-of-system and dust-related losses. • Manufacturer's technical datasheets for the PV panels. • Commissioning certificate of the system.

Supporting Guidance

Solar Water Heating:

The solar water heaters must comply with the technical requirements of Chapter 14 of SBC 501 Mechanical, in addition to UL 174 or 1453. All solar water heating systems must have integrated pressure relief valves that are designed and set for the specific installation. All solar water heating systems must be provided with top-up/back-up immersion heaters. The design and installation of the system shall be undertaken by competent and certified designers and installers.

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

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

On-Site Electricity Generation:

To determine the number of points achieved, the Electrical Engineer or PV specialist must provide detailed calculations and/or simulations to predict the annual electricity generated by the PV system (kWh per year). This is then divided by the proposed building annual energy consumption determined by the energy model of credit **E-01 Energy Performance**, taking into consideration all PV system losses and projected annual efficiency reduction, as per the following equation:

$$\%\ Renewable\ energy = \frac{Energy\ generated\ by\ the\ PV\ System}{Proposed\ building\ annual\ energy\ consumption}$$

The number of credit points awarded for the renewable energy generated is as per Table E-06.1 for individual dwellings and Table E-06.2 for multi-residential buildings.

Table E-06.1 Points available for percentage achieved - individual dwellings

Percentage Reduction	Points Achieved
4%	1
7%	2
10%	3
15%	4
25%	5

Table E-06.2 Points available for percentage achieved - multi-residential buildings

Percentage Reduction	Points Achieved
4%	1
6%	2
9%	3
12%	4
15%	5

Renewable Energy Systems Specifications:

All on-site electricity generation systems must comply with the Electricity and Cogeneration Regulatory Authority (ECRA) regulations, including the Small-Scale Solar PV Systems Regulations version 1 (2017). As a minimum, the design stage specifications of the renewable energy systems shall include the following parameters:

- Azimuth and inclination of the SHW or PV panels
- Size of the SHW or PV panels
- Type of SHW or PV panels
- Number of SHW or PV panels
- Storage tank size for SHW system
- Percentage of hot water to be met by the SHW system, or percentage of electricity to be generated by the PV system

Simulation Software:

The renewable energy systems must be designed using approved simulation software, which provide more accurate calculations and result in a better system design. Some examples of such software include:

- T*SOL for SHW systems
- PVsyst for PV systems
- Polysun for SHW and PV systems

Maintenance:

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

Credit Tools

Performance 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–07 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	All refrigerants, fire suppression systems and maintenance gases installed and used within the project boundary have an ODP of zero. The use of CFCs or halon-based materials is prohibited.	1	1
	Total	**1**	**1**

Design Stage Evidence

#	Evidence per Requirement
1	• Specifications for all proposed refrigerants, fire suppression systems and maintenance gases highlighting the requirement for zero ODP. • Specifications prohibiting the use of CFCs or halon-based materials.

Construction Stage Evidence

#	Evidence per Requirement
1	• Manufacturer's data for all purchased refrigerants, fire suppression systems and maintenance gases confirming zero ODP. • Confirmation that no CFCs or halon-based materials have been used.

Supporting Guidance

Projects must comply with the list of acceptable refrigerants published by the US Environmental Protection Agency (EPA) under the Significant New Alternatives Policy (SNAP) evaluation criteria (Table E-07.1).

Table E-07.1 Common 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_3H_8)	0	Air conditioning	Acceptable
Isobutene	0	Refrigeration	Acceptable
Air	0	Refrigeration	Acceptable
Water	0	Refrigeration	Acceptable

Projects must comply with the list of acceptable gases for fire suppression systems and for maintenance purposes (Table E-07.2). All acceptable gases have an ODP of zero.

Table E-07.2 Fire suppression system 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)

Water

8 Water

The demand for water in KSA has increased exponentially due to growths in population, urbanization and agriculture. More specifically, the increase in per capita water consumption now "poses a threat to the traditional water share"[3] in the country, which is already impeded by climate change stresses such as droughts and seawater intrusion in coastal aquifers due to increased depletion.

As a result, Vision 2030 promotes the optimal use of water resources by enabling policies and infrastructure that reduce the consumption of potable water and increase the use of treated and renewable water. The Water category enables building owners to capitalize on the financial incentives brought forth by Vision 2030 as the market for efficient fittings and fixtures is strengthened. Mostadam for Residential Buildings also rewards projects that recycle water and monitor and analyze their indoor and outdoor water use.

Figure 11 Water credits

[3] The General Authority of Meteorology and Environmental Protection, The State of the Environment 2017: Responsibilities and Achievements

W-01 Indoor Water Performance

Keystone Credit	Total Number of Points Available
Green	10

Aim

To reduce indoor water consumption and reduce the load on wastewater systems through the installation of efficient fixtures, fittings and appliances.

Requirements

#	Requirement	Points Available	
		Individual dwelling	Multi-residential
Keystone Requirement - achieve requirement #1 (3 credit points).			
1	Indoor water consumption is reduced by 10% compared to the baseline.	3	3
2	Indoor water consumption is further reduced compared to the baseline. The number of points awarded is dependent on the percentage improvement over the baseline.	7	7
	Total	**10**	**10**

Design Stage Evidence

#	Evidence per Requirement
1 & 2	• Water Tool. • Specifications for plumbing fixtures, fittings and appliances confirming the required flow rates and water use.

Construction Stage Evidence

#	Evidence per Requirement
1	• Water Tool. • Manufacturers' data for all installed fixtures, fittings and appliances indicating flow rates and flow regulation systems. • Purchase orders/receipts and date-stamped photographs confirming the installation of the fixtures, fittings and appliances.

Supporting Guidance

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%	3
15%	4
20%	5
25%	6
30%	7
35%	8
40%	9
45%	10

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 per water fixture

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

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. Table W-01.3 provides an example of a section of the product specifications for a kitchen faucet.

Table W-01.3 Sample of a section of product specifications for a kitchen faucet

Technical Information	
Flow rate (lpm)	5.7
Pressure (KPa)	414

Credit Tool

Water Tool

Reference Documents

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

W-02 Outdoor Water Performance

Keystone Credit	Total Number of Points Available
Green	10

Aim

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

Requirements

#	Requirement	Points Available	
		Individual dwelling	Multi-residential
Keystone Requirement - achieve requirement #1 (2 credit points).			
1	The irrigation system is designed and installed to reduce potable water use by 50% compared to the midsummer baseline.	2	2
2	The irrigation system is designed and installed to further reduce potable water use compared to the midsummer baseline. The number of points awarded is dependent on the percentage improvement over the baseline.	3	3
3	The irrigation system is controlled by smart controllers and/or soil moisture sensors.	2	2
4	There are no turfed areas within the project boundary.	2	2
5	There are no outdoor water features within the project boundary.	1	1
	Total	**10**	**10**

Design Stage Evidence

#	Evidence per Requirement
1, 2 & 3	• Water Tool. • Irrigation plan showing planted areas, irrigation zones and their water requirements, and the location of any smart controllers and/or soil moisture sensors. • Specification for the irrigation system.
4	• Site plan showing that no turf is present.
5	• Site plan showing that no outdoor water features are present.

Construction Stage Evidence

#	Evidence per Requirement
1, 2 & 3	• Water Tool. • As-built irrigation plan showing planted areas, irrigation zones and their water requirements, and the location of any smart controllers and/or soil moisture sensors. • Manufacturers' data for the irrigation system.

	• Date-stamped photographs of the installed irrigation system.
4	• As-built site plan confirming that no turf is present.
5	• As-built site plan confirming that no outdoor water features are present.

Supporting Guidance

The number of credit points achieved is dependent on the percentage reduction of outdoor water consumption compared to the midsummer baseline (Table W-02.1).

Table W-02.1 Points available for percentage reduction achieved

Percentage Reduction	Points Achieved
50%	2
60%	3
70%	4
80%	5

- All irrigation systems must be planned and installed by a certified professional who is accredited by a WaterSense program or an equivalent national or international program.
- Irrigation zones must be planned by grouping plants of similar water use together.
- The use of native plant species is addressed in credit **SS-04 Ecological Enhancement**.

Credit Tool

Water Tool

Reference Documents

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

W-03 Alternative Water Solutions

Keystone Credit	Total Number of Points Available
No	3

Aim

To reduce dependence on potable water by encouraging projects to seek 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 and recycled to be 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**

Design Stage Evidence

#	Evidence per Requirement
1	• Water Tool. • Calculations confirming the amount of water condensate recovered from the AC units. • Mechanical drawings confirming the end-destination of the recovered condensate (i.e. irrigation tank or water tank for WC flushing).
2	• Water Tool. • Water balance calculations confirming the estimated amount of graywater to be recovered. • Mechanical drawings detailing the collection, treatment and usage of graywater. • Technical specifications of the graywater treatment system.
3	• Water Tool. • Water balance calculations confirming the estimated volume of wastewater from the project.

	• Mechanical drawings detailing the collection, treatment and usage of wastewater. • Technical specifications of the wastewater treatment system.

Construction Stage Evidence

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

Supporting Guidance

The design and calculations for the water recycling systems are to be undertaken by a specialist consultant with previous experience of designing and specifying water recycling systems for residential applications. 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 Indoor Water Performance** and **W-02 Outdoor Water Performance**.

<u>Air Conditioning and Cooling Coil Water Condensate:</u>

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).

When designing a system to capture air conditioning condensate, it is important that the system captures condensate from all air conditioning units in the building and the piping network is properly designed to transfer water to the relevant water system.

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-03.1).

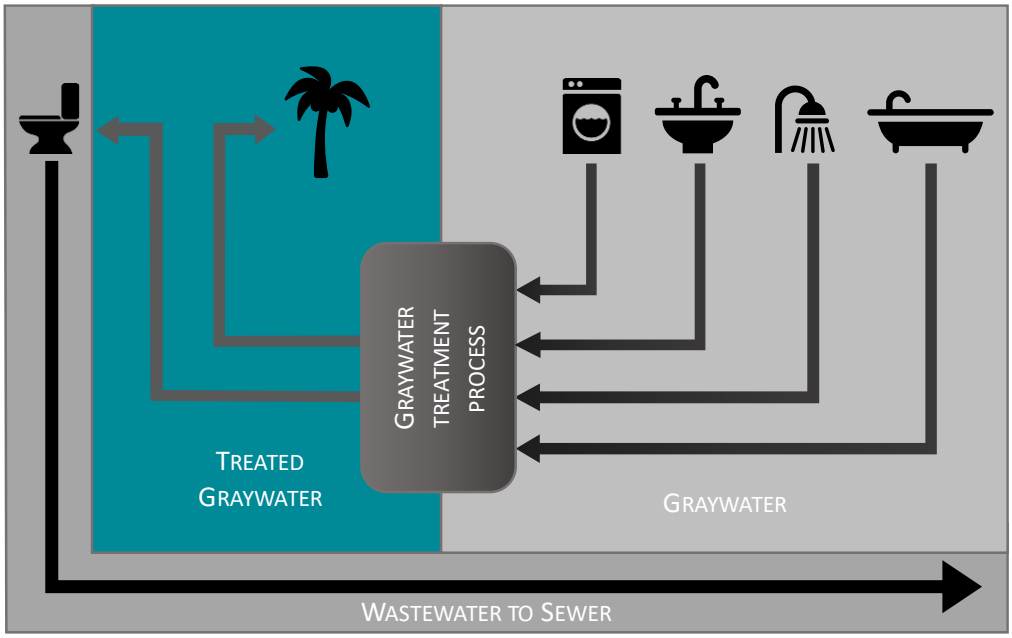


Figure W-03.1 Graywater recycling schematic

When designing a system to capture and reuse graywater, 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 odors. Therefore, the amount of water required for flushing and irrigation should be properly calculated to define the estimated volume of graywater that will be recycled.
- **Contact with graywater should be minimized**
  The system network should be designed to soak graywater into the ground and away from any human contact or water outlets that are for domestic use.
- **Assess flushing and irrigation demand**
  It is important to quantify the water demand required for flushing and irrigation. If the amount of recycled graywater is not sufficient, an additional supply of potable water must be considered. When designing a mixed network, 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 Onsite Wastewater Treatment Systems Manuals

W-04 Water Metering

Keystone Credit	Total Number of Points Available
Silver	1

Aim

To install 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
1	A metering strategy is created and implemented which monitors the building's internal and external water usage and conforms to SBC 1001 Chapter 7.	1	1
	Total	**1**	**1**

Design Stage Evidence

#	Evidence per Requirement
1	• Drawings showing the type, extent and location of all water meters. • Specifications with water meter requirements highlighted. • 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 levels.

Construction Stage Evidence

#	Evidence per Requirement
1	• As-built drawings showing the type, extent and location of all water meters. • Manufacturer's 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 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.

Metering and Sub-Metering:

- The following sub-meters must be provided for individual dwellings:
    - One water meter for internal water usage
    - One water meter for external water usage
- The following sub-meters must be provided for multi-residential buildings:
    - One water meter per residential unit
    - One water meter for internal water usage of landlord areas
    - One water meter for external water usage of landlord areas
- Internal water usage refers to all water consumed within the building envelope. Examples of internal water usage in landlord areas include public showers and toilets for the gym or swimming pool, or guard's toilet.
- External water usage refers to all water consumed outside the building envelope. 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 must be connected to a data acquisition and monitoring system which is capable of being remotely connected to *Sustainable Building*. All data will be treated as confidential. This requirement should be included in the Mostadam Guide (**EI-01 Mostadam Guide**) as information for the building's residents.
- The data monitoring system must provide hourly, daily, weekly, monthly and annual water consumption for each meter and have logging capabilities for comparison of consumption levels to previous data.
- The system must 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

Health and Comfort

9 Health and Comfort

Vision 2030 aims to encourage widespread participation in sports and athletic activities to increase the ratio of individuals exercising once a week from 13% to 40%. This will have long-term benefits of reducing the incidences of chronic illnesses such as diabetes and obesity and alleviate stresses on the healthcare system. Currently, 17.9% of the population are diabetic and 28.7% are obese[4].

The Health and Comfort category provides several platforms that support Vision 2030 including promoting equal opportunities for women and for people with disabilities and providing more comfortable outdoor environments. The credit topics also go beyond outdoor activity by addressing the quality of the indoor environmental and occupant wellbeing with developments being encouraged to provide comfortable, well-lit and environmentally safe indoor environments to promote health and wellbeing.

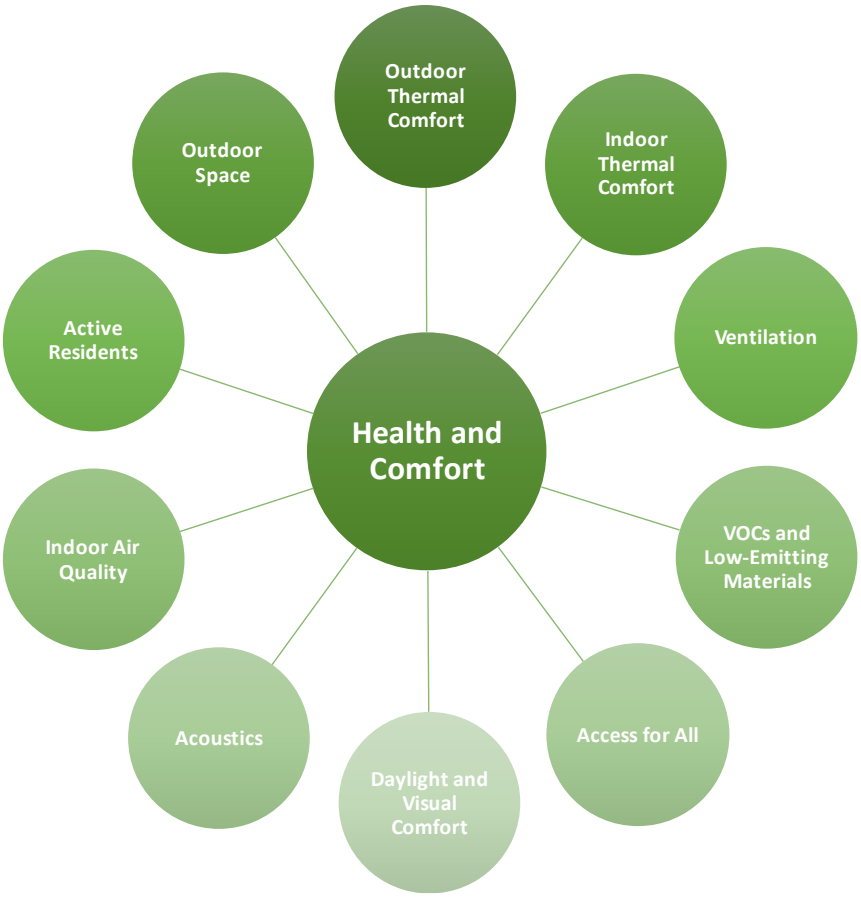


Figure 12 Health and Comfort credits

[4] Saudi Quality of Life Program 2020: Delivery Plan

HC-01 Outdoor Thermal Comfort

Keystone Credit	Total Number of Points Available
Green	2

Aim

To improve outdoor thermal comfort and encourage more active lifestyles.

Requirements

#	Requirement	Points Available	
		Individual dwelling	Multi-residential
1	An Outdoor Thermal Comfort Strategy is developed and implemented that includes consideration of the following: • Prevailing wind and seasonal weather • Building location, orientation and pedestrian connectivity • Shading (from buildings and shade structures) • Selection of solar reflective materials	N/A	1
2	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)	1	N/A
3	A minimum of 75% shading cover is provided to the following where they exist within the plot: • Pedestrian walkways • Playgrounds • Car and bicycle parking	1	1
	Total	**2**	**2**

Design Stage Evidence

#	Evidence per Requirement
1	• Outdoor Thermal Comfort Strategy including visualizations of the development and the strategies employed.
2	• Drawings highlighting the areas that require shading. • Tabulated calculations (with supporting simulation results) demonstrating that a minimum of 50% shading cover is achieved.
3	• Drawings highlighting the areas that require shading. • Tabulated calculations (with supporting simulation results) demonstrating that a minimum of 75% shading cover is achieved.

Construction Stage Evidence

#	Evidence per Requirement
1	• Updated Outdoor Thermal Comfort Strategy including date-stamped photographs of the strategies employed.
2	• As-built drawings highlighting the areas that require shading. • Updated calculations (with supporting simulation results) demonstrating that a minimum of 50% shading cover is achieved.
3	• As-built drawings highlighting the areas that require shading. • Updated calculations (with supporting simulation results) demonstrating that a minimum of 75% shading cover is achieved.

Supporting Guidance

Outdoor Thermal Comfort Strategy:

The following strategies can be implemented on-site to enhance outdoor thermal comfort by cooling the exterior microclimate:

- Shading
- Ventilation
- Orientation
- High-albedo surfaces
- Evaporative cooling
- Thermal mass
- Radiative cooling

The Outdoor Thermal Comfort Strategy shall include:

- A description of how the credit requirements are met.
- Examples of the shading strategies to be employed.
- Relevant images/visualizations.

Shading Calculations:

- Shading calculations are to be undertaken using simulation software and must be based on the sun's position at midday on the equinox and the 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 it is the day with the longest period of daylight (21st or 22nd June).
- An example of tabulated shading calculations (using the results from simulation software) is provided in Table HC-01.1.

Table HC-01.1 Example of shading simulation results

Area Type	Area (m^2)	Shaded Area - Summer Solstice - 1pm	Shaded Area - Equinox - 1pm	Shading % Summer Solstice	Shading % Equinox	Mostadam Keystone Requirement
Front entrance, patios and courtyard	680	440	448	65%	66%	50%
Hard standing amenity space	N/A	-	-	-	-	50%
Pedestrian walkway	16	16	16	100%	100%	75%
Playground	N/A	-	-	-	-	75%
Surface Parking	50	45	44	90%	88%	75%
Bicycle Parking	10	9	8	90%	80%	75%

- The shaded area cast by trees can be based on their canopy size at a maximum of 5 years post-construction.
- Grid or lattice structures that create dappled shading and provide more than 75% shade can be considered as providing 100% shade. Otherwise, shaded areas under a grid or lattice that provide less than 75% shade must only calculate the actual shaded portion.
- Where structural shading is provided, it shall comply with the requirements of credit **SS-05 Heat Island Effect**.

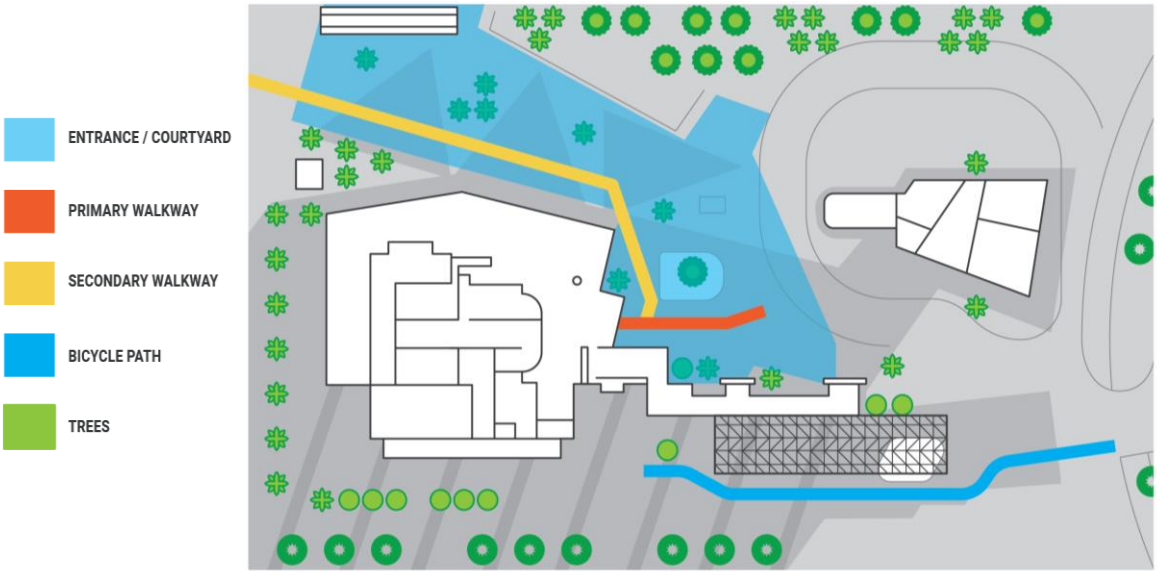


Figure HC-01.1 Shading provided in a project

Credit Tool

N/A

Reference Documents

1. ASTM E1980-11 Standard Practice for Calculating Solar Reflectance 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
Green	2

Aim

To increase thermal comfort by providing occupants with control over their indoor environment.

Requirements

#	Requirement	Points Available	
		Individual dwelling	Multi-residential
Keystone Requirement - achieve requirement #1 (1 credit point).			
1	Separate thermostatic controls are provided in each regularly occupied space.	1	1
2	Occupancy sensors are provided in each living area and are linked to the air conditioning system. Communal areas such as lobbies, gyms, swimming pools and community spaces have designated thermal zones with thermostatic controls. Occupancy sensors are provided in these zones and are linked to the air conditioning system.	1	1
	Total	**2**	**2**

Design Stage Evidence

#	Evidence per Requirement
1	• Drawings highlighting the regularly occupied spaces and showing the locations of the thermostatic controls.
2	• Drawings highlighting the living areas and showing the locations of the occupancy sensors. • Drawings highlighting all communal areas and showing the thermal zones and the location of the thermostatic controls and occupancy sensors.

Construction Stage Evidence

#	Evidence per Requirement
1	• As-built drawings highlighting the regularly occupied spaces and showing the locations of the thermostatic controls. • Date-stamped photographs of the thermostatic controls.
2	• As-built drawings highlighting the living areas and showing the locations of the occupancy sensors. • As-built drawings highlighting all communal areas and showing the thermal zones and

	the location of the thermostatic controls and occupancy sensors. • Date-stamped photographs of the thermostatic controls and occupancy sensors.

Supporting Guidance

- Thermal comfort is used to describe the state of mind associated with satisfaction with the thermal environment.
- The following are classed as regularly occupied spaces:
    - Living rooms
    - Majlis
    - Kitchens
    - Dining rooms
    - Studies
    - Bedrooms
    - Maids' rooms
- Regularly occupied spaces do not include hallways, bathrooms, storage rooms, laundry rooms or garages.
- Thermostatic controls must, at a minimum, allow occupants to adjust the air temperature and air speed within the occupied space.
- The following are classed as living areas:
    - Living rooms
    - Majlis
    - Dining rooms
    - Studies
- Occupancy sensors must be linked to the air conditioning system to enable the temperature and air flow rate to be adjusted based on the detected occupancy in the living area.
- The building mechanical systems, controls and thermal envelope should comply with the conditions stated in ASHRAE 55 Sections 6.1 and 6.2.

Credit Tool

N/A

Reference Documents

1. ASHRAE 55-2010 Thermal Environmental Conditions for Human Occupancy
2. ASHRAE 62.1-2016 Ventilation for Acceptable Indoor Air Quality
3. ASHRAE 62.2-2016 Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings

HC-03 Ventilation

Keystone Credit	Total Number of Points Available
Silver	1

Aim

To provide adequate fresh air to all occupied spaces 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.	1	1
2	**Demand Controlled Ventilation (DCV)** CO_2 sensors are installed in all densely occupied areas of the building larger than 100m^2. The sensors are capable of modulating the fresh air supply rates for these areas as required through an appropriate ventilation system.		
	Total	**1**	**1**

Design Stage Evidence

#	Evidence per Requirement
1	Mechanical ventilation: • Mechanical schedules confirming the fresh air flow rates of the proposed AHUs/FAHUs. • Tabulated results comparing the fresh air flow rates to the SBC 601 levels. Natural ventilation: • Architectural 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.
2	• Drawing highlighting the densely occupied areas of the building larger than 100m^2 and showing the locations of the CO_2 sensors. • System schematic showing the CO_2 sensors and their link to the ventilation system to

	modulate the fresh air supply rate.

Construction Stage Evidence

#	Evidence per Requirement
1	Mechanical ventilation: • As-built mechanical schedules and manufacturer's technical datasheets confirming the fresh air flow rates of the proposed AHUs/FAHUs. • Tabulated results comparing the fresh air flow rates to the SBC 601 levels. • Date-stamped photographs of the installed AHUs/FAHUs. Natural ventilation: • As-built architectural plans and elevations highlighting the occupied spaces which are naturally ventilated, their GFA and the location of the openable windows. • As-built window schedule confirming the openable free area. • Tabulated results comparing the GFA to the openable free area for each occupied space confirming that the 5% requirement is achieved.
2	• As-built drawing highlighting the densely occupied areas of the building larger than 100m^2 and showing the locations of the CO_2 sensors. • As-built system schematic showing the CO_2 sensors and their link to the ventilation system to modulate the fresh air supply rate.

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. When designing ventilation systems to provide fresh air for occupied spaces, it is important to maintain efficiency in sizing to optimize performance and prevent additional energy consumption.

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. To demonstrate compliance with this requirement, it is expected that space-by-space fresh air calculations will be developed for the building. These calculations will provide the fresh air rate required for each space based on the area and occupancy. It will also ensure it is within SBC 601 requirements. Table HC-03.1 contains an example fresh air calculation for a bedroom in a multi-residential building.

Table HC-03.1 Example 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*2.5)+(0.3*20) = 11 L/s	12 L/s

Natural Ventilation:

Natural ventilation is the process of supplying air to, and removing air from, 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 2.3m^2. The minimum openable 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-03.1). It is not the total window/glazed area or the area of the part of the window that opens (unless it is fully openable).

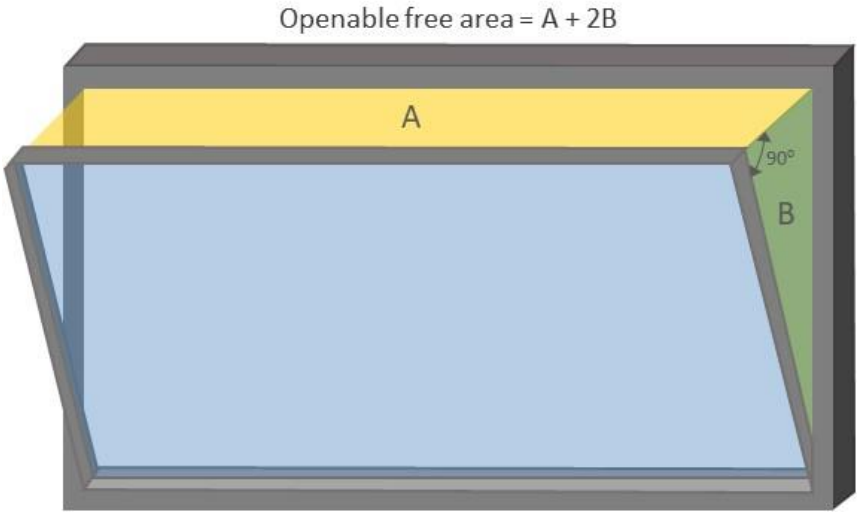


Figure HC-03.1 Openable free area

Demand Controlled Ventilation:

Demand controlled ventilation systems include CO_2 sensors. CO_2 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 4m^2 (0.25 persons per m^2). In multi-residential buildings, these may include gymnasiums, community centers and multi-purpose rooms. CO_2 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 CO_2 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 129m^2 with an expected occupancy of 30 people.

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

The occupant density in this scenario is 0.23 persons per m^2, which is less than the requirement of 0.25, therefore CO_2 sensors are not required.

Consider another example using the same gym space of 129m^2 but with an expected occupancy of 55 people.

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

The occupant density is 0.42 persons per m^2, which is higher than 0.25. Therefore, CO_2 sensors will be required in this example.

Credit Tool

N/A

Reference Documents

1. Saudi Building Code (SBC) 601 and 602, Energy-Efficient Design, Section 8 Indoor Air Quality and Ventilation Systems
2. International Mechanical Code, 2015

HC-04 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 and Sealants** A minimum of 95% (by weight) of all adhesives and sealants used in the building interior (i.e. inside the weatherproofing system) do not exceed the VOC limits of the South Coast Air Quality Management District (SCAQMD) Rule 1168. **Paints and Coatings** A minimum of 95% (by weight) of all paints and coatings used in the building interior (i.e. inside the weatherproofing system) do not exceed the VOC limits of SCAQMD Rule 1113, Green Seal GS-03 & GS-11.	1	1
2	**Composite Wood** All internal composite wood materials have maximum formaldehyde emissions as per the Supporting Guidance. **Suspended Ceiling Systems** All internal suspended ceiling systems have a maximum formaldehyde limit of 13.5ppb (or 16.5µg/m^3).	1	1
	Total	**2**	**2**

Design Stage Evidence

#	Evidence per Requirement
1	• Architectural specifications confirming the maximum allowable VOC content for adhesives, sealants, paints and coatings.
2	• Interior finishes schedule highlighting products likely to contain formaldehyde. • Specifications stating the maximum allowable formaldehyde content for internal wood finishes and suspended ceilings.

Construction Stage Evidence

#	Evidence per Requirement
1	• Purchase orders for all interior adhesives, sealants, paints and coatings used in the project. • Material safety datasheets and technical datasheets for all interior adhesives, sealants, paints and coatings with the VOC content highlighted.
2	• As-built interior finishes schedule highlighting products containing formaldehyde. • Purchase orders for all interior wood finishes and suspended ceilings used in the project. • Material safety datasheets and technical datasheets for all interior wood finishes and suspended ceilings with the formaldehyde level highlighted.

Supporting Guidance

Low VOC Materials:

Volatile organic compounds (VOCs) are found in many indoor sources including paints, coatings, adhesives and sealants. They negatively impact the indoor air quality and can cause several health concerns after long-term exposure, including the following:

- Eye, nose and throat irritation.
- Headaches.
- Damage to the central nervous system.
- Damage to the lungs, kidneys and liver.

Using low-VOC materials improves indoor air quality and can contribute towards improved health of the occupants.

Adhesives and Sealants:

The percentage of compliant adhesives and sealants is calculated as follows:

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

To comply with the credit requirement, 95% of all adhesives and sealants must be within the VOC limits specified by SCAQMD Rule 1168 (Table HC-04.1).

Table HC-04.1 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

Paints and Coatings:

The percentage of compliant paints and coatings is calculated as follows:

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

To comply with the credit requirement, 95% of all paints and coatings must be within the VOC limits specified by SCAQMD Rule 1168 (Table HC-04.2).

Table HC-04.2 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

VOC Content Information:

The VOC content of a product is found in the Material Safety Datasheet (MSD) or Technical Safety Datasheet (TSD). This document can be requested from the manufacturer. Consider the example in Table HC-04.3 of a section of the material safety datasheet for interior flat paint. As the total VOC is less than 50, this product would contribute towards this credit.

Table HC-04.3 Sample of a section of a MSD for interior flat paint

Physical and Chemical Properties	
Solubility	Miscible with water
Boiling Point/Range (°C)	100
pH	9
Total VOC (g/liter)	45

Composite Wood:

All internal composite wood materials must not exceed the formaldehyde emission limits in Table HC-04.4. The basic test method used to determine the formaldehyde emissions of products is ASTM E1333.

Table HC-04.4 Maximum formaldehyde limits for composite wood

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

Suspended Ceiling Systems:

All internal suspended ceiling systems must not exceed the formaldehyde limit of 13.5ppb (or 16.5µg/m^3). The following types of ceiling systems are deemed to automatically comply with the formaldehyde credit requirements:

- Ceramic/concrete tiles
- Organic-free mineral based systems
- Gypsum plaster
- Concrete
- Metal

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-05 Access for All

Keystone Credit	Total Number of Points Available
No	1

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 design of the building complies with the requirements of the Lifetime Homes standard.	1	1
	Total	**1**	**1**

Design Stage Evidence

#	Evidence per Requirement
1	• Completed checklist of the 16 Lifetime Homes criteria, with notes explaining how the project has achieved each criterion, signed by the project's Architect. The notes should clearly reference relevant supporting documents. • Labelled design drawings and specifications to support the checklist.

Construction Stage Evidence

#	Evidence per Requirement
1	• Updated checklist of the 16 Lifetime Homes criteria, with notes explaining how the project has achieved each criterion at construction, signed by the project's Contractor. The notes should clearly reference relevant supporting documents. • Labelled date-stamped photographs, as-built design drawings, and purchase receipts to support the checklist.

Supporting Guidance

The 16 criteria of the Lifetime Homes standard are listed below. Refer to the website for the full, detailed requirements and latest updates (http://www.lifetimehomes.org.uk/). Project teams may also wish to reference the Lifetime Homes Design Guide.

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

Credit Tool

N/A

Reference Documents

1. The Lifetime Homes Design Guide
2. Approved Document M: Access to and Use of Buildings, Volume 1: Dwellings
3. ADA Standards for Accessible Design

HC–06 Daylight and Visual Comfort

Keystone Credit	Total Number of Points Available
No	2

Aim

To design buildings which maximize the use of natural light, minimize glare and visually connect to the outdoors 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. The glazing has a minimum light transmittance (t-value) of 40% and a maximum solar factor (g-value) of 35%. **Artificial Lighting** The illuminance and uniformity targets specified in the Supporting Guidance are achieved.	1	1
2	**Views** Each living area and each bedroom have windows with a glazed area that is at least 10% of the floor area. The windows have a direct line of sight to a quality exterior view. **Glare Control** Manual or automated glare-control devices are installed on all windows of regularly occupied spaces.	1	1
	Total	**2**	**2**

Design Stage Evidence

#	Evidence per Requirement
1	**Daylight** • Floor plans, elevations and sections highlighting the living areas and bedrooms. • Simulation parameters including glazing light transmittance levels and internal surface reflectivity. • Plots from the daylight simulation software for each modelled area showing isolux contours. • Spreadsheet list of all modelled areas and the corresponding results (i.e. percentage floor area of each space that has achieved a minimum of 200 lux). • Specifications detailing the required glazing performance.

	Artificial Lighting • Floor plans and lighting drawings for each relevant space. • Calculations or software input and output demonstrating the required illuminance and uniformity targets are achieved for each space. • Specifications detailing the required lighting performance.
2	**Views** • Floor plans, elevations and sections highlighting the living areas and bedrooms. • Tabulated data comparing the floor area of each living area and bedroom with the area of glazing in that room, demonstrating that the minimum 10% is achieved for each room. **Glare Control** • Drawings highlighting all regularly occupied spaces. • Specifications for all glare-control devices.

Construction Stage Evidence

#	Evidence per Requirement

1	**Daylight**
	• Confirmation that no changes have been made since the design stage submission that will impact daylight levels OR for areas that have been changed, resubmit:
	  ○ Simulation parameters including glazing light transmittance levels and internal surface reflectivity.
	  ○ Plots from the daylight simulation software showing Isolux contours.
	  ○ Spreadsheet list of all modelled areas and the corresponding results.
	• As-built floor plans, elevations and sections.
	• Manufacturers' product datasheets with the relevant glazing performance criteria highlighted.
	Artificial Lighting
	• As-built floor plans and lighting drawings for each space.
	• Confirmation that no changes have been made since the design stage submission that will impact illuminance levels and uniformity OR for areas that have been changed, resubmit calculations or software input and output demonstrating the required illuminance and uniformity targets are still achieved.
	• Manufacturers' photometric data for installed light fixtures.
	• Date-stamped photographs of installed light fixtures.

2	**Views** • As-built floor plans and elevations highlighting the location of each living area and bedroom. • Tabulated data comparing the as-built floor area of each living area and bedroom with the area of glazing in that room, demonstrating that the minimum 10% is achieved for each room. • Date-stamped photographs of quality of view. **Glare Control** • As-built drawings highlighting all regularly occupied spaces. • Manufacturers' datasheets for all installed glare-control devices.

	• Date-stamped photographs of installed glare-control devices.

Supporting Guidance

Daylight:

- Design features which impact indoor illumination levels include:
  - Building orientation.
  - Window-to-wall area ratio.
  - Atria, clerestories, courtyards and solar tubes/solar pipes.
  - Natural external shade sources such as trees and mountains.
  - Proximity to nearby buildings.
  - Indoor glare-control: window blinds, shades, curtains, louvers, screens and awnings.
  - Diffused and/or translucent glazing systems.
- The surrounding areas will impact the daylight provided and therefore should be considered when determining the layout design.
- Daylight simulation software must be used to calculate the internal daylight illuminance levels. To obtain accurate sunlight exposure, glare-control devices must not be included in the simulation parameters. Figure HC-06.1 is an example of a daylight simulation for a villa. This simulation shows how the internal daylight illuminance levels differ across spaces, depending on space dimensions and window size.

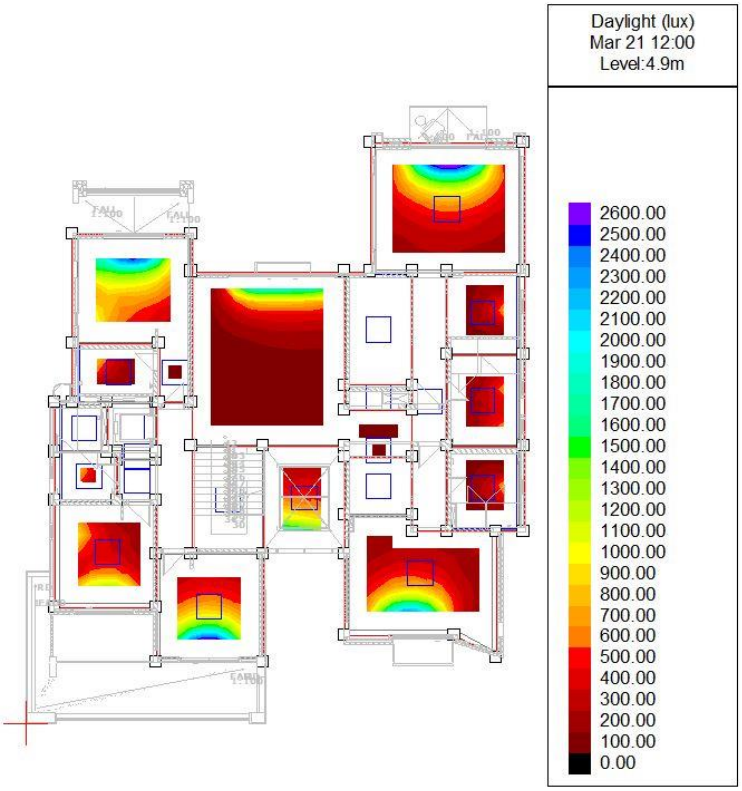


Figure HC-06.1 Example of daylight simulation for a residence

- Calculation control parameters must be based on the higher settings used for the calculation of values rather than for visualization purposes e.g. the number of inter-reflections must be set to a minimum of 7.

- If using solar tubes/pipes, use the transmission factors provided by the manufacturer. If these are not available, the following transmission factors should be used:
    - 1m tube/pipe length = 0.5
    - 2m tube/pipe length = 0.25
- Lux levels must be calculated based on a CIE standard clear sky at 10am, 12pm and 2pm on the equinox and summer solstice. Artificial light must be excluded from the calculations.
- Lux levels must be calculated 0.75m above the finished floor level (FFL).
- The simulation guidelines provided in SBC 1001 Section 808.3.2 should be followed.

Artificial Lighting:

All artificial lighting in the relevant space types must achieve the illuminance and uniformity targets in Table HC-06.1.

Table HC-06.1 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

Views:

- A quality exterior view is a view to any of the following:
    - Vegetation or fauna
    - Sky
    - Movement, such as a busy street
    - Objects a minimum of 7m from the glazing
- Identifying the surrounding areas will help determine the layout design in order to locate regularly occupied spaces at the best location where quality external views can be provided.

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-06.2.

Table HC-06.2 Glare control devices

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

Credit Tool

N/A

Reference Documents

1. Saudi Building Code (SBC) 1001 Green Buildings, Section 808.3.2 Daylight Performance Path
2. IES Lighting Measurements (LM) 83-12
3. IES The Lighting Handbook, 10th edition, Section 33 Lighting for Residences

HC-07 Acoustics

Keystone Credit	Total Number of Points Available
No	1

Aim

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

Requirements

#	Requirement	Points Available	
		Individual dwelling	Multi-residential
1	**Individual dwelling** Internal ambient noise levels are less than 35dB(A)L_{eq} in bedrooms and less than 40dB(A)L_{eq} in other areas. **Multi-residential building** Internal ambient noise levels are less than 35dB(A)L_{eq} in residential units and less than 45dB(A) L_{eq} in common areas.	1	1
	Total	**1**	**1**

Design Stage Evidence

#	Evidence per Requirement

1	• CV of qualified Acoustic Engineer and confirmation of their appointment for testing and assessments.
	• Narrative by the Acoustic Engineer which describes:
	  ○ Calculations and/or assessment of internal noise sources caused by building services.
	  ○ Calculations and/or assessment of external noise sources.
	  ○ Strategy for achieving sound level requirements.
	• Design drawings indicating noise control features such as wall thickness and material.

Construction Stage Evidence

#	Evidence per Requirement
1	• CV of qualified Acoustic Engineer and confirmation of their appointment for testing and assessments. • 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 Calculations:

- For field testing, only external noises and building system noises should be considered. All windows and external and internal doors should be closed during testing.
- Occupant noise and household equipment/appliance noise must be excluded from noise measurements and calculations.
- For building system background noise, field test reports for multi-residential buildings must be conducted in at least 50% of the total rooms inside the structure.
- For individual dwellings: testing must be conducted where sound levels are expected to be the highest e.g. near the facade facing a busy street.
- 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.

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
4. BS 8233:2014, Guidance on Sound Insulation and Noise Reduction for Buildings

HC-08 Indoor Air Quality

Keystone Credit	Total Number of Points Available
No	1

Aim

To enhance the air quality of occupied spaces by designing air-tight spaces and conducting air quality testing to confirm acceptable air pollutant levels.

Requirements

#	Requirement	Points Available	
		Individual dwelling	Multi-residential
1	**Indoor Air Quality (IAQ) Testing** A specialist contractor conducts IAQ testing for occupied areas after construction ends (but before occupancy) and the air contaminants do not exceed the maximum concentration levels in the Supporting Guidance.	1	1
2	**Tightening the Envelope** External doors for all building types are weather-stripped. For multi-residential buildings, doors between residential units and common areas are weather-stripped.		
	Total	**1**	**1**

Design Stage Evidence

#	Evidence per Requirement
1	• Project tender specifications confirming the requirement for indoor air quality testing by a specialist contractor at the end of construction.
2	• Door specifications and schedules confirming the weather-stripping requirements.

Construction Stage Evidence

#	Evidence per Requirement
1	• IAQ test report. • Company profile of the specialist testing contractor confirming qualifications and previous experience.
2	• Date-stamped photographs confirming the installation of weather-stripping materials. • Purchase orders for the weather-stripping materials.

Supporting Guidance

Indoor Air Quality Testing:

- The maximum acceptable limits for air contaminants are provided in Table HC-08.1.

Table HC-08.1 Air contaminant limits

Contaminant	Maximum Concentration
Formaldehydes	27 micrograms per m^3
PM10 Particulates	150 micrograms per m^3
Total Volatile Organic Compounds (TVOC)	500 micrograms per m^3

- Testing protocols of the above contaminants must be in line with ASTM D5197, ASTM D5466, ASTM D6196, ASTM D6345 and ISO 7708.
- Air sample testing shall be conducted as follows:
    - All interior finishes must be installed including doors, paints, carpets and acoustic panels.
    - Air samples must be collected between 1m and 2m from the finished floor level (FFL) over a minimum 4-hour period.
    - The number of sampling points must be at least 1 per 2,500m^2 of floor area, or for each continuous floor area.
- The IAQ test report must contain the following:
    - Methodology of air sampling and air testing
    - Number of samples taken
    - Concentration of air contaminants
    - Remedial measures undertaken to address any non-compliant measurements (e.g. flush-out and retesting).

Weather-stripping:

- Weather-stripping is the process of sealing air leaks around movable building components such as doors or openable windows. Weather-stripping has two primary benefits:
    - To minimize energy wastage 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 a weather-strip. 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.

Credit Tool

N/A

Reference Documents

1. ASHRAE Standard 189.1-2014, Standard for the Design of High-Performance Green Buildings
2. ASTM D5197-16 Standard Test Method for Determination of Formaldehyde and Other Carbonyl Compounds in Air
3. ASTM D5466-15 Standard Test Method for Determination of Volatile Organic Compounds in Atmospheres
4. ASTM D6196-15e1 Standard Practice for Choosing Sorbents, Sampling Parameters and Thermal Desorption Analytical Conditions for Monitoring Volatile Organic Chemicals in Air
5. ASTM D6345-10 Standard Guide for Selection of Methods for Active, Integrative Sampling of Volatile Organic Compounds in Air
6. ISO 7708 Air Quality - Particle Size Fraction Definitions for Health-related Sampling

HC-09 Active Residents

Keystone Credit	Total Number of Points Available
No	1

Aim

To provide residents with opportunities for regular physical exercise.

Requirements

#	Requirement	Points Available	
		Individual dwelling	Multi-residential
1	Residents have convenient access to either a gym or a pool for lap swimming. For multi-residential buildings, a stairway is an appealing option for accessing at least the first four floors of the building.	1	1
	Total	**1**	**1**

Design Stage Evidence

#	Evidence per Requirement
1	• Detailed design drawings and specifications, clearly labelled to confirm compliance with the minimum requirements for the gym or lap pool. • Confirmation that the residents' deeds or leases will include free access to the gym or lap pool, signed by the building owner. • If applicable, a description of how private, separate hours for women and children only will be programmed and enforced, signed by the building owner. • Detailed design drawings and specifications, clearly labelled to confirm compliance with each of the required stairway characteristics.

Construction Stage Evidence

#	Evidence per Requirement
1	• As-built drawings, date-stamped photographs and purchase receipts clearly labelled to confirm compliance with the minimum requirements for the gym or lap pool. • Confirmation that residents' deeds or leases will include free access to the gym or lap pool, signed by the building owner. • If applicable, a description of how private, separate hours for women and children only will be programmed and enforced, signed by the building owner. • As-built drawings, date-stamped photographs and purchase receipts, clearly labelled to confirm compliance with each of the required stairway characteristics.

Supporting Guidance

- A qualifying stairway must have the following characteristics:
    - Stairs must be open at the lobby level and either directly visible from the main building entrance or closer to the entrance than the lifts.
    - Access to the stairs must be visible from the corridor of each storey. If there are security doors, there must be at least 1m^2 of transparent glazing.
    - Steps must be at least 1.4m wide.
    - Lighting must be at least 215 lux on the walking surface, with a minimum Color Rendering Index (CRI) of 80.
    - Stairs must be enhanced with at least one of the following elements: a skylight, external view windows, plants, artistic work or music.
- Figure HC-09.1 provides an example of an acceptable and an unacceptable stairway layout.

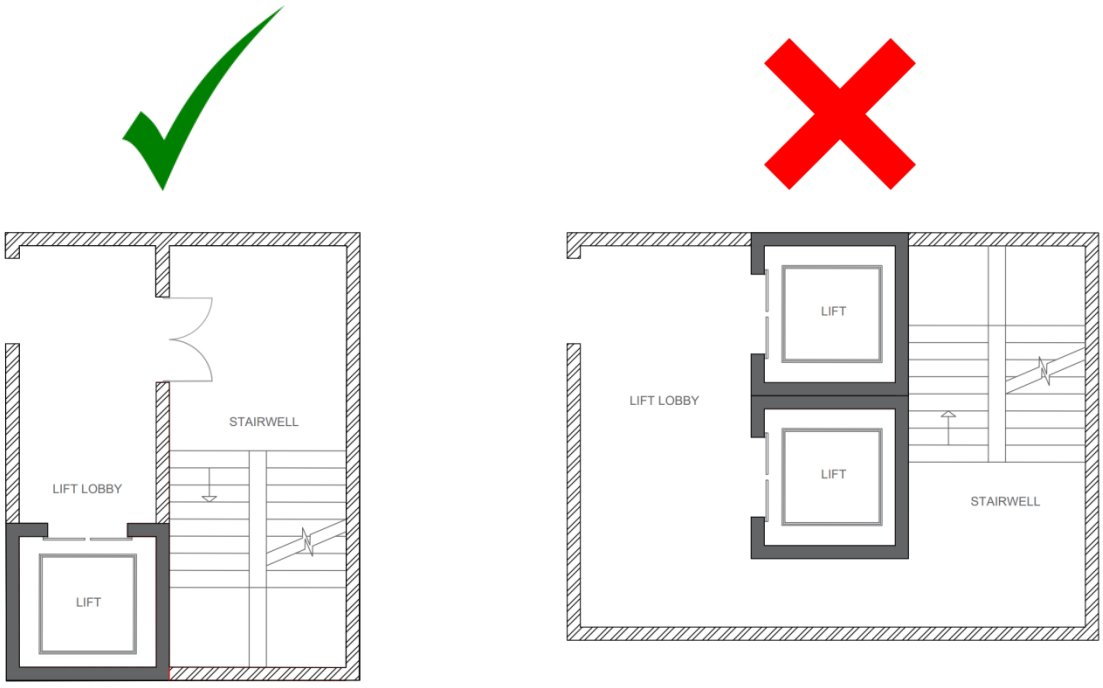


Figure HC-09.1 Acceptable stairway layout (L) and unacceptable stairway layout (R)

The layout on the left promotes the use of stairways as the door to the stairwell precedes the lift, thereby ensuring that users are aware of the stairway and are encouraged to use it.
The layout on the right does not promote the use of stairways as the access to the stairway is beyond the lifts and users may not be aware of the stairway.

- Stairs permanently enclosed by fire doors do not qualify. However, magnetic door holds are permitted if they remain open in the absence of a fire alarm.
- For individual dwellings: the gym or pool may be shared with other dwellings within a residential compound or may be located within or adjacent to the individual dwelling.
- For multi-residential buildings: the gym or pool must be within, or adjacent to, the building. Note that facilities outside the project boundary are not applicable for this credit but may qualify as amenities under credit **TC-03 Access to Amenities**.
- A qualifying gym must include the following:

    - One item of cardiovascular exercise equipment (such as a treadmill, stationary bicycle, elliptical machine or rowing machine) for every 100 residents.
    - One item of strengthening exercise equipment (such as bench-press, squat-rack or pull-up bar) for every 100 residents.
- A qualifying pool for lap swimming must have the following characteristics:
    - A length of at least 25m.
    - Be either indoors or screened for women's privacy.
    - Outdoor swimming pools should be provided with covers and with shading for the areas adjacent to the pool.
- Shared swimming pools and gyms must either have separate areas for women of equivalent size and quality, or a clear protocol for enforcing separate hours for women and children only.

Credit Tool

N/A

Reference Documents

1. Gehl Institute, https://gehlinstitute.org/
2. New York City Departments of Design and Construction, Health and Mental Hygiene, Transportation, City Planning: Active Design Guidelines, Promoting Physical Activity and Health in Design

HC-10 Outdoor Space

Keystone Credit	Total Number of Points Available
No	1

Aim

To provide an outdoor space which gives residents a connection to nature and a sense of wellbeing.

Requirements

#	Requirement	Points Available	
		Individual dwelling	Multi-residential
1	**Individual dwelling** A private outdoor space is provided that is large enough for residents to sit outside comfortably. The outdoor space is adequately sized and shaded with a seating area and landscaping/vegetation. **Multi-residential building** A private outdoor space is provided for each residential unit/apartment that is large enough for residents to sit outside comfortably, and/or a communal outdoor space is provided for use by all residents. The outdoor space(s) are adequately sized and shaded with a seating area and landscaping/vegetation.	1	1
	Total	**1**	**1**

Design Stage Evidence

#	Evidence per Requirement
1	• Drawing showing the location and size (m^2) of the outdoor space(s), the seating area, landscaping/vegetation and shading. • Calculations demonstrating that there is sufficient space for the required number of residents to sit outside comfortably.

Construction Stage Evidence

#	Evidence per Requirement
1	• As-built drawing showing the location and size (m^2) of the outdoor space(s), the seating area, landscaping/vegetation and shading. • Date-stamped photographs of the outdoor space(s).

Supporting Guidance

- The following are examples of appropriate outdoor spaces:
  - Garden
  - Courtyard

    - Terrace (roof or other)
    - Patio
    - Balcony
- A relevant guideline must be used to determine the minimum size of the outdoor space.
    - **Private outdoor space**: the space should be sized to accommodate, as a minimum, the design occupancy of the individual dwelling or residential unit/apartment. For example, the London Plan: Housing SPG recommends a minimum of 5m^2 is provided for a 1-2 person dwelling plus an extra 1m^2 for each additional occupant.
    - **Communal outdoor space**: the space should be sized to accommodate, as a minimum, 25% of the design occupancy of the multi-residential building. For example, the Metric Handbook: Planning and Design Data provides guidance on the minimum space requirements for people when sitting, standing and circulating.
- The shading of the outdoor space should be in compliance with credit **HC-01 Outdoor Thermal Comfort**.

Individual Dwelling – Sizing of Private Outdoor Space:

As an example of sizing the private outdoor space for an individual dwelling, assume that a villa is designed with 4 bedrooms and 1 maid's room, and the design occupancy is 9 persons. The size of outdoor space that needs to be provided within the plot can be calculated as follows:

Outdoor area for the first two persons = 5 m²

Outdoor area for the remaining 7 persons = 7 x 1 m² = 7 m²

Minimum size of outdoor space = 5 + 7 = 12 m²

Multi-Residential Building – Sizing of Private Outdoor Space:

Table HC-10.1 provides example calculations for the sizing of private outdoor space for different apartment types in a multi-residential building.

Table HC-10.1 Example calculations for private outdoor space in multi-residential buildings

Apartment Type	Occupancy	Requirement	Minimum Size of Private Outdoor Space (m²)
Studio	1 Person	1-2 Person = 5 m²	5 m²
1 Bedroom	2 Persons	1-2 Persons = 5m²	5 m²
2 Bedroom	4 Persons	1-2 Persons = 5m² Additional = 2 m²	7 m²
2 Bedroom + Maid	5 Persons	1-2 Persons = 5m² Additional = 3 m²	8 m²

Multi-residential Building – Sizing of Communal Outdoor Space:

As an example of sizing the communal outdoor space for a multi-residential building, consider an 18-storey building containing 2 and 3-bedroom apartments that are equally distributed across the building. The total design occupancy of the building is 360 people. To comply with this credit, the communal

outdoor space should accommodate at least 25% of the total occupancy. Therefore, in this example, the space should be sized to accommodate a minimum of 90 people.

Credit Tool

N/A

Reference Documents

1. London Plan – Housing Supplementary Planning Guidance (SPG), March 2016
2. Metric Handbook: Planning and Design Data, 6th edition

Materials and Waste

10 Materials and Waste

Under Vision 2030's National Transformation Program (NTP) and Integrated Waste Management program, KSA is addressing the challenge of growing waste production rates by increasing the efficiency of its waste management sector and by establishing comprehensive recycling projects. Mostadam for Residential Buildings supports this Vision by introducing credits which reduce construction waste by at least 30% and which reward the use of recycled materials in the development's construction. Project teams which target Materials and Waste credits will also positively impact the environment by reducing upstream carbon emissions through the use of recycled and recyclable construction materials.

Figure 13 Materials and Waste credits

MW-01 Construction Waste Management

Keystone Credit	Total Number of Points Available
No	1

Aim

To reduce the long-term environmental impacts associated with disposing of construction and demolition waste by recovering, reusing and recycling materials.

Requirements

#	Requirement	Points Available	
		Individual dwelling	Multi-residential
1	Prior to the start of any site construction activities, the main Contractor develops a construction and demolition waste management plan (CDWMP). The main Contractor and any sub-contractors are responsible for implementing the CDWMP.	1	1
2	The Contractor implements monthly monitoring of the CDWMP and a minimum of 30% of waste (by weight or volume and excluding hazardous waste) is diverted from landfill.		
	Total	**1**	**1**

Design Stage Evidence

#	Evidence per Requirement
1	• Extract from the project tender specifications confirming the requirement for the Contractor to develop and implement the CDWMP.
2	• Extract from the project tender specifications confirming the requirement to divert a minimum of 30% of construction waste from landfill.

Construction Stage Evidence

#	Evidence per Requirement
1	• Project-specific CDWMP.

2	• Construction Waste Management Tool.
	• Monthly reports including:
	  ○ Calculations confirming the amount of waste generated, reused, recycled and sent to landfill.
	  ○ Waste receipts from the appointed waste haulers.

Supporting Guidance

Construction and Demolition Waste Management Plan (CDWMP):

For the development and implementation of an effective CDWMP, the construction team must have a full understanding of their overall site procedures and works (such as cutting on-site or pre-fabricating off-site). This understanding is crucial for predicting the expected waste generated from the site. Project duration, scope of construction, specified building materials, number of site workers and availability waste treatment facilities are examples of factors that need to be taken into consideration when developing the CDWMP.

Table MW-01.1 details the required contents of the CDWMP. The principal Contractor is responsible for monitoring site construction waste to check performance against landfill diversion targets to ensure that high standards are maintained with the emphasis being on continual improvement.

Table MW-01.1 CDWMP contents

Construction and Demolition Waste Management Plan		
#	Content Description	Content Requirements and Guidance
1	**Basic Project Details**	Project name, project targets i.e. minimum of 30% of waste (by weight or volume, excluding hazardous waste) is diverted from landfill, project schedule, Client and Contractor's name.
2	**Waste Forecasting**	Estimate waste arising from all construction activities using suitable benchmarks. Waste forecasting should cover the following: • Type of activity • Waste stream e.g. packaging • Waste type e.g. plastic • Reuse or off-site destination • Forecasted quantities and calculated quantities (by weight or volume)
3	**Waste Management and Recovery Actions**	The CDWMP should adhere to the waste hierarchy (Figure MW-01.1) by reducing, reusing and/or recycling waste materials. The following measures can be implemented to reduce waste: • Ensure only the necessary quantities of materials are procured to avoid having excess materials. • Avoid double packaging for materials. This can be achieved by approaching suppliers and agreeing to minimize packaging at the source. • Avoid receiving individual items as this will result in extra packaging and additional waste generation. • Use re-usable shuttering material. • Avoid using temporary support systems when possible, as these are usually discarded as waste at the end of the project. • Avoid the use of disposable materials at site offices such as plastic plates and cups. • Use double-sided printing and promote the use of soft copies.

		The following measures can be implemented to reuse waste: • Reuse packaging material as alternative storage solutions onsite. • Reuse metal and wood waste to form storage containers or support material. • Crush concrete cube samples to reuse them as small size cover blocks. The following measures can be implemented to recycle waste: • Waste segregation skips are clearly labelled and color-coded (Figure MW-01.2) and installed in an area accessible to site workers. The generated waste can go directly into the relevant waste skips enabling better waste segregation. • For large scale projects where many activities are performed and there is limited access to waste skips at the activity source, it is recommended that there is a dedicated site waste management team which manages the waste collection and segregation. • All workers must undergo waste management training and have regular refresher courses. This training should cover: o Site layout. o Types of waste generated by construction activities at each stage. o Location of waste segregation skips and guidance on acceptable content. o Recycling facilities available in the surrounding area that can be used by the project.
4	**Waste Carriers**	Waste contractors collecting and removing waste from the site and which waste facilities they will be taken to.
5	**Actual Waste Movements**	Actual movements of waste onsite (reused) and offsite (sent for recycling or sent to landfill) recorded during the construction phase. All waste movements offsite should be accompanied by waste removal tickets which provide the following information as a minimum: • Date/time. • Waste removal company. • Name of driver. • Amount of waste removed. • Type of waste removed. • Name and address of company where the waste will be disposed of. • Certification of the waste disposal company.
6	**Construction Waste Management Tool**	The Construction Waste Management Tool is to be used to document the amount of waste diverted from landfill on a monthly basis and the overall diversion rate achieved for the entire construction duration. The waste calculations should exclude any excavation waste and land-clearing debris. The waste calculations can be based on either weight or volume but must be consistent throughout.

The principles of the waste hierarchy can be used to minimize waste generation onsite and the overall environmental impact (Figure MW-01.1).

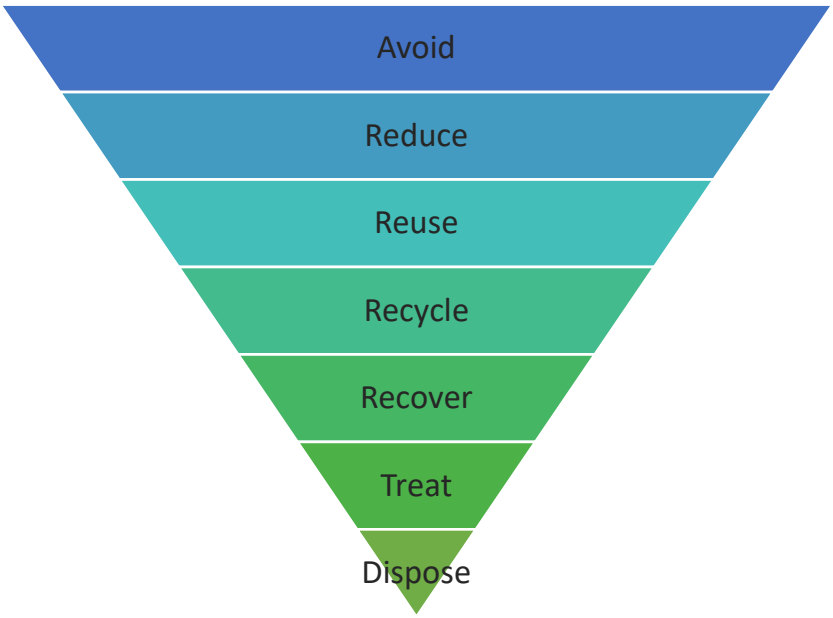


Figure MW-01.1 Waste hierarchy

Waste segregation skips should be clearly labelled and color-coded (Figure MW-01.2) to facilitate easy and efficient waste segregation by site workers.

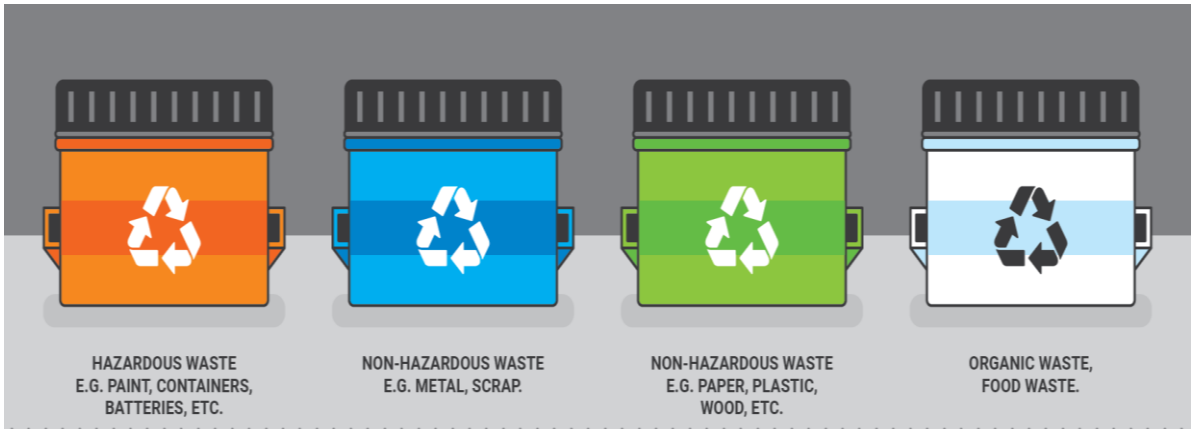


Figure MW-01.2 Waste segregation skips

Waste Diversion:

The percentage of waste that is diverted from landfill is calculated as follows (the figures should not include any hazardous waste or any excavation waste and land-clearing debris):

$$\%\, Waste\ diverted\ from\ landfill = \frac{Amount\ of\ waste\ recycled,reused,salvaged,donated\ or\ reclaimed\ (tons\ or\ m3)}{Total\ amount\ of\ waste\ generated\ (tons\ or\ m3)}$$

Credit Tool

Construction Waste Management Tool

Reference Documents

1. Saudi Building Code (SBC) 1001 Green Buildings, Section 503 Construction Waste Management
2. European Commission Directive 2008/98/EC Waste Framework Directive

MW-02 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	All thermal and acoustic insulation meets 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**

Design Stage Evidence

#	Evidence per Requirement
1	• Summary sheet listing all uses of insulation in the project. • For all insulation uses, specifications confirming compliance with each of the credit requirements.

Construction Stage Evidence

#	Evidence per Requirement
1	• Summary sheet listing all uses of insulation in the project. • 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 (CO_2). The larger the GWP, the more that a given gas warms the Earth compared to CO_2 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 laboratory can be used.

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

MW-03 Recycled Materials

Keystone Credit	Total Number of Points Available
No	2

Aim

To recognize and encourage the use of recycled materials, thereby reducing the demand for virgin materials and optimizing material efficiency in construction.

Requirements

#	Requirement	Points Available	
		Individual dwelling	Multi-residential
1	**Recycled Steel** A minimum of 50% of all reinforcing or stressing steel (by weight) used within the project boundary has a minimum of 80% post-consumer or pre-consumer recycled content.	1	1
2	**Recycled Aggregates** A minimum of 15% of all aggregates used on site (by volume) are recycled aggregates.	1	1
	Total	**2**	**2**

Design Stage Evidence

#	Evidence per Requirement
1	• Calculations by weight demonstrating compliance with the minimum percentage of recycled content. • Specifications detailing the recycled content requirement for steel.
2	• Calculations by volume demonstrating compliance with the minimum percentage of recycled aggregates. • Specifications detailing the percentage of recycled aggregates.

Construction Stage Evidence

#	Evidence per Requirement
1	• As-built calculations by weight demonstrating compliance with the minimum percentage of recycled content. • Material technical datasheets confirming the steel recycled content (pre-consumer or post-consumer). • Purchase orders for all reinforcing or stressing steel installed in the project.
2	• As-built calculations by volume demonstrating compliance with the minimum percentage of recycled aggregates.

	• Purchase orders of the recycled aggregates used in the project, confirming their source.

Supporting Guidance

Recycled materials are beneficial as they reduce demand for virgin resources and increase diversion from landfill, which reduces stress on waste management infrastructure.

Recycled Aggregates:

Recycled aggregates are those obtained from crushing concrete or asphalt (typically after demolishing a concrete structure) to reclaim the aggregate. The aggregate may be used as a base in paved roads/curbs or building foundations.

Post-Consumer Recycled Content:

Post-consumer recycled content is defined as waste material generated by households or by commercial, industrial or institutional facilities in their role as end-users of a product, which can no longer be used for its initial purpose. It includes waste recovered and recycled from construction and demolition activities.

Pre-Consumer Recycled Content:

Pre-consumer recycled content is defined as material diverted from the waste stream during the manufacturing process. It does not include the reutilization of materials such as rework, regrind, or scrap generated in a process and capable of being reclaimed within the same process that generated it.

Recycled content information can be found in the environmental section of technical datasheets that can be obtained from the manufacturer. A sample of this is provided in Table MW-03.1.

Table MW-03.1 Sample of environmental section of technical datasheet for steel bars

Material Name	Manufacturer	Recycled Content	
Deformed Steel Bars	Company Name	Pre-Consumer Content	Post-Consumer Content
		3.73%	96.27%

Credit Tool

N/A

Reference Documents

1. Saudi Building Code (SBC) 1001 Green Buildings, Section 505.1 Material Selection and Properties
2. ISO 14021: Environmental Labels and Declarations

Education and Innovation

11 Education and Innovation

To promote a culture of sustainability and to help recognize the value of sustainable homes, Mostadam ensures that residents of Mostadam-certified homes are aware of what makes their home sustainable and how their behavior has an impact on the environment. The Mostadam Guide enables the continued sustainable performance of the development by promoting best practices and successful demand side management. This category also gives owners and project teams a certain degree of freedom to exceed existing requirements under all criteria, and/or pursue sustainable ideas that are not currently covered by the rating system.

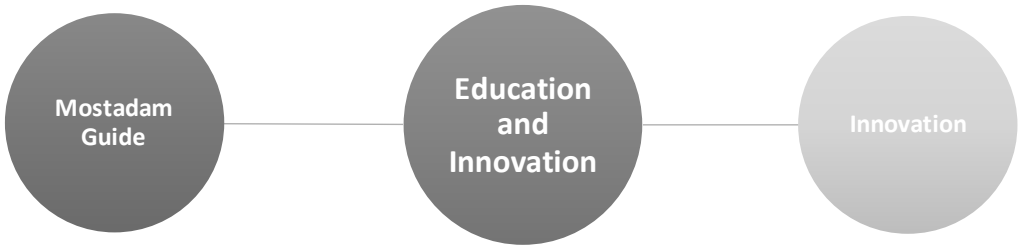


Figure 14 Education and Innovation credits

EI-01 Mostadam Guide

Keystone Credit	Total Number of Points Available
Green	2

Aim

To promote the efficient operation of Mostadam-rated buildings by providing information which enables residents 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 the owners/occupiers and provides guidance on how to live more sustainably.	2	2
	Total	**2**	**2**

Design Stage Evidence

#	Evidence per Requirement
1	• Mostadam Guide describing the building's targeted credits and the role of the occupants in ensuring the continuous sustainable performance of the building.

Construction Stage Evidence

#	Evidence per Requirement
1	• Updated Mostadam Guide describing the building's targeted credits and the role of the occupants in ensuring the continuous sustainable performance of the building. • Arabic translation of the final 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**	• Narrative describing how the project is aligned with Saudi Vision 2030. • Summary of the sustainability features of the building and the positive impact of sustainability on the environment.

		• Summary of the role of the occupants in ensuring the continuous sustainable performance of the building. • Narrative describing the positive impacts on occupant well-being and building longevity that are achieved as a result of proper maintenance and commissioning of the building and its systems. • Brief introduction to the O+E scheme of Mostadam for Residential Buildings.
1	**Site Sustainability**	• Description of the targeted Site Sustainability credits and how they were achieved. • Guidance on the management and maintenance of the landscaped areas including soil enhancement and protection, irrigation and the protection of natural assets.
2	**Transportation and Connectivity**	• Description of the targeted Transportation and Connectivity credits and how they were achieved. • A comprehensive transportation and mobility guideline for the occupants including information on the local transport options. • A directory of local establishments within a 20 km radius of the project for the following categories: o Municipal amenities: police station, fire station, city council o Healthcare providers o Schools o Grocers o Restaurants o Retailers o Recreational amenities: parks, beaches and resorts The directory should contain at least one establishment under each category and a maximum of ten under each category.
3	**Region and Culture**	• Description of the targeted Region and Culture credits and how they were achieved. • The economic, social and environmental benefits of supporting local businesses and establishments.
4	**Energy**	• Description of the targeted Energy credits and how they were achieved. • The energy efficiency commitments of the building and the role of the occupants in meeting them. • For energy 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 energy consumption data is to be shared with *Sustainable Building* and that all data will be treated as confidential. • Manuals for all installed appliances. • Specifications for the energy consuming features installed and guidance on future replacement. • HVAC maintenance requirements e.g. air-conditioning filter replacement, preventive maintenance for installed features, recommissioning schedule for major building systems. • O&M manuals for any solar hot water or PV systems installed, including the methods for cleaning the systems and how to cover them if the occupants will be away for a period of time.
5	**Water**	• Description of the targeted Water credits and how they were achieved. • The 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-SSmetering 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 *Sustainable Building* and that all data will be treated as confidential. • Manuals for all installed appliances. • Specifications for the water consuming features installed and guidance on future replacement.
6	**Health and Comfort**	• Description of the targeted Health and Comfort credits and how they were achieved. • The elimination of indoor pollutants and VOCs and its positive impact on health and wellbeing. • The benefits of exercise in preventing disorders caused by sedentary lifestyle such as diabetes, obesity, cardiovascular disease, osteoporosis and depression.
7	**Materials and Waste**	• Description of the targeted Materials and Waste credits and how they were achieved. • Benefits of using recycled and non-polluting materials.
8	**Education and Innovation**	• Description of any innovative solutions utilized in the design and/or construction of the building.
9	**Policies, Management and Maintenance**	• Description of the targeted Policies, Management and Maintenance credits and how they were achieved. • A comprehensive waste and recycling guideline for the occupants including local waste and recycling policies

		and sorting requirements, and the location of waste recycling centers. • Guidance on the sustainable procurement of products for interior spaces such as FSC wood, carpets and other interior design products, and for sustainable services such as cleaning, laundry and catering. • Lifestyle tips and guidance on how residents can lower their energy and water consumption, with particular emphasis on how occupant behavior affects building performance.

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 Innovation

Keystone Credit	Total Number of Points Available
No	2

Aim

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

Requirements

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

Design Stage 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.
	  ○ Description of the proposed achievement.
	  ○ Methodology of calculation/data collection.
	  ○ Relevant design drawings and specifications.

Construction Stage Evidence

#	Evidence per Requirement
1	**Option 1:** • Updated narrative specifying the selected Mostadam credit(s) and the percentage/ numerical improvement achieved over and above the existing requirements.

	Option 2:
	• Updated 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.
	  ○ Data sheets with calculations/relevant information.
	  ○ As-built drawings and material/product specifications.

Supporting Guidance

Option 1:

- 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-02.1.

Table EI-02.1 Eligible credits

Category	Eligible Credit	Innovation Requirement
Site Sustainability	SS-04 Ecological Enhancement	A minimum of 96% of newly landscaped species are classified as native, drought tolerant or saline tolerant.
Transportation and Connectivity	TC-02 Access to Public Transportation	The building is located within the following distances of a bus stop or a metro/commuter rail station. The minimum day-time service frequency of the bus stop and the station must be at least 30 minutes. **Individual dwelling**: 280 meters safe walking distance of a bus stop OR 560m safe walking distance of a metro/commuter rail station. **Multi-residential building**: 280m safe walking distance of a bus stop OR metro/commuter rail station.
	TC-03 Access to Amenities	**Individual dwelling:** EITHER a pedestrian entrance is located within 560m safe walking distance of 3 additional amenities OR a pedestrian entrance is located within 700m safe walking distance of 4 additional amenities. **Multi-residential building:** EITHER a pedestrian entrance is located within 280m safe walking distance of 3 additional amenities OR a pedestrian entrance is located

		within 350m safe walking distance of 4 additional amenities.
	TC-01 Electric Vehicle Provisions	**Individual dwelling:** Electric Vehicle Supply Equipment (EVSE) is installed for a minimum of two vehicles per household. **Multi-residential building:** EVSE is installed for a minimum of 4% of the parking spaces, or at least three spaces, whichever is greater.
Region and Culture	RC-01 Thriving Economy	A minimum of 36% of the construction materials (by cost) used on the development are sourced from within KSA.
Energy	E-01 Energy Performance	**Individual dwelling:** a minimum improvement of 55% is achieved over the baseline building. **Multi-residential building:** a minimum improvement of 45% is achieved over the baseline building. (Note: only the performance option is eligible for Innovation credit points).
	E-06 Renewable Energy	EITHER **Solar Water Heating:** Individual dwelling: SHW panels provide 60% of the individual dwelling's hot water demand. Individual dwelling and multi-residential building: 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 dwelling: PV panels provide a minimum of 30% of the total annual building energy demand. Multi-residential building: PV panels provide a minimum of 18% of the total annual building energy demand.
Water	W-01 Indoor Water Performance	Indoor water consumption is reduced by a minimum of 50% compared to the baseline.
	W-02 Outdoor Water Performance	The irrigation system reduces potable water use by a minimum of 90% compared to the midsummer baseline.
	W-03 Alternative Water Solutions	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	**Individual dwelling:** A minimum of 60% 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) **Individual dwelling & multi-residential building:** A minimum of 90% shading cover is provided to the following where they exist within the plot: • Pedestrian walkways • Playgrounds • Car and bicycle parking
	HC-06 Daylight and Visual Comfort	A minimum daylight illuminance of 200 lux is achieved for 60% of the net floor area of each living area and each bedroom.
	HC-07 Acoustics	**Individual dwelling:** Internal ambient noise levels are less than 28dB(A)L_{eq} in bedrooms and less than 32dB(A)L_{eq} in other areas. **Multi-residential building:** Internal ambient noise levels are less than 28dB(A)L_{eq} in residential units and less than 36dB(A) L_{eq} in common areas.
Materials and Waste	MW-01 Construction Waste Management	A minimum of 36% of the total amount of non-hazardous waste (by weight or by volume) is diverted from landfill.
	MW-03 Recycled Materials	**Recycled Steel:** A minimum of 60% of all reinforcing or stressing steel (by weight) used within the project boundary has a minimum of 80% post-consumer or pre-consumer recycled content. **Recycled Aggregates:** A minimum of 18% of all aggregates used on site (by volume) are recycled aggregates.
Policies, Management and Maintenance	PMM-01 Residential Waste Management	A minimum of 36% of residential waste is diverted from landfill.

Option 2:

The innovative solution must support one or more of the following sustainability aspects:

- Low maintenance.
- Durable.
- Flexible e.g. more easily adaptable for extensions/renovations.

Project teams will qualify their innovative solution 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

Policies, Management and Maintenance

12 Policies, Management and Maintenance

Policies, Management and Maintenance focuses on the policies that should be prepared, and the management and maintenance procedures that should be established, to ensure sustainable operation of the building. To support Vision 2030 and address the challenge of growing waste production, Mostadam for Residential Buildings requires all developments to divert a minimum of 50% of residential waste from landfill. Mostadam for Residential Buildings also rewards projects that implement building performance monitoring and develop sustainable procurement strategies.

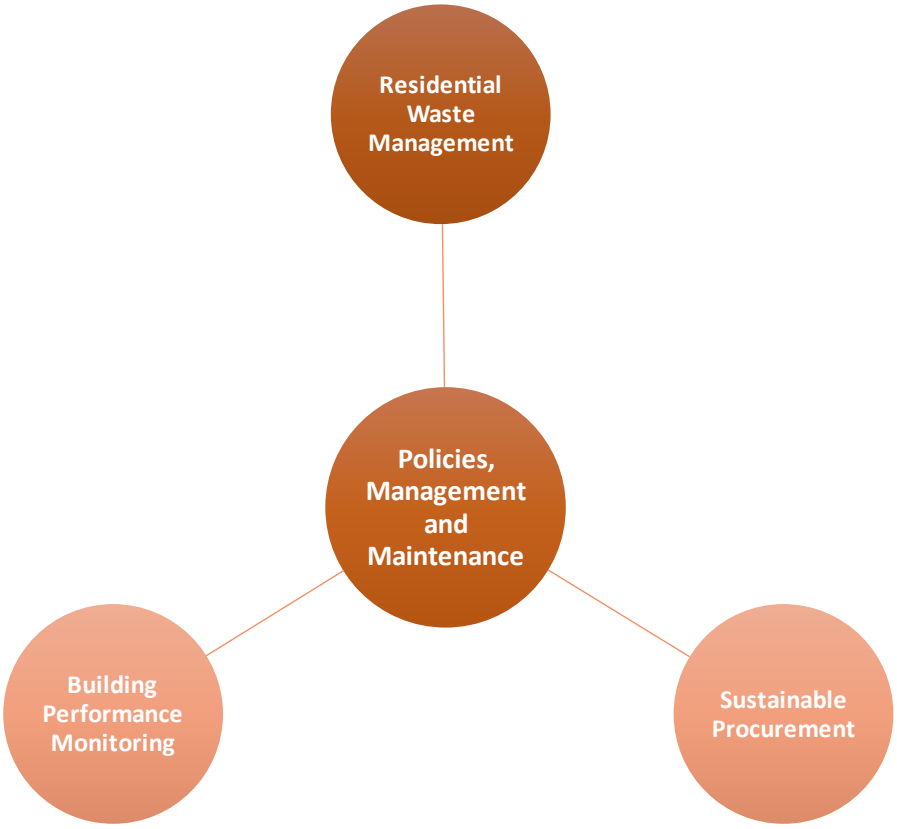


Figure 15 Policies, Management and Maintenance credits

PMM-01 Residential Waste Management

Keystone Credit	Total Number of Points Available
Green	1

Aim

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

Requirements

#	Requirement	Points Available	
		Individual dwelling	Multi-residential
1	A Residential Waste Strategy is developed and implemented that includes consideration of the following: • Reduce, Reuse and Recycle approach to waste management. • Segregation, storage and collection of waste. • Diversion of 30% of residential waste from landfill. • Existing and planned waste infrastructure in the region.	1	1
2	Segregated bins are provided within each dwelling/residential unit to enable separation of the following two waste streams: • Recyclable waste (e.g. paper, cardboard, glass, plastic, metals). • General waste.		
3	Common areas such as lobbies, gyms, pools and community centers are provided with segregated bins for recyclable waste and general waste. A communal storage area accessible to residents is provided for the following waste streams: • Electronic items • Batteries • Hazardous materials • Large bulky items A centralized waste storage area is provided, sized to allow for the segregation of all possible recyclable waste streams, with adequate access for waste collection vehicles.	N/A	
	Total	**1**	**1**

Design Stage Evidence

#	Evidence per Requirement
1	• Residential Waste Strategy.

2	• Drawings showing the location of the recycling bins and illustrating that adequate storage space has been provided for indoor recycling.
3	• Drawings highlighting all common areas such as lobbies, gyms, pools and community centers and indicating the proposed locations for waste bins. • Drawings showing the location and size of the communal storage area. • Drawings showing adequate access to the centralized waste storage area for waste collection vehicles.

Construction Stage Evidence

#	Evidence per Requirement
1	• Updated Residential Waste Strategy.
2	• As-built drawings showing the location of the recycling bins and illustrating that adequate storage space has been provided for indoor recycling. • Date-stamped photographs of the installed recycling bins.
3	• As-built drawings highlighting all common areas such as lobbies, gyms, pools and community centers and indicating the locations of the waste bins. • As-built drawings showing the location and size of the communal storage area. • As-built drawings showing adequate access to the centralized waste storage area for waste collection vehicles. • Date-stamped photographs of the common area waste bins, communal storage area and centralized waste storage area.

Supporting Guidance

Residential Waste Strategy:

Table PMM-01.1 details the required contents of the Residential Waste Strategy.

Table PMM-01.1 Residential Waste Strategy contents

Residential Waste Strategy		
#	Section Title	Content Requirements and Guidance
1	**Aims & Objectives**	Aims and objectives of the strategy.
2	**Roles & Responsibilities**	For multi-residential buildings, high-level overview of the various roles associated with residential waste management and their responsibilities.
3	**Waste Generation**	Provide an introduction to the building including location, description of spaces, occupant types/numbers and typical waste generation. Typical residential waste types are paper, cardboard, glass, plastic, metal, electrical waste and organic/compostable waste.
		A residential waste diversion from landfill target of 30% (by weight or volume) is to be implemented once the building is occupied. Diversion from landfill refers to all waste which is reused or sent for recycling.
4	**Waste Segregation &**	Segregated bins are to be provided within each dwelling/residential unit to enable separation of the following two waste streams:

	Storage	• Recyclable waste (e.g. paper, cardboard, glass, plastic, metals). • General waste. These bins should have a capacity of between 30 and 60 liters and sufficient space should be provided in the kitchen or other area where the bins might be stored.
		For multi-residential buildings, common areas such as lobbies, gyms, pools and community centers are to be provided with segregated bins for the above waste streams. The bins must have clear container identification with written labels (in Arabic and other appropriate languages), images and consistent container color.
		For multi-residential buildings, a communal storage area accessible to residents is to be provided for the following waste streams: • Electronic items • Batteries • Hazardous materials • Large bulky items
5	**Centralized Waste Storage**	For multi-residential buildings, a centralized waste storage area is to be provided on the ground floor, or in the basement if an access ramp is provided, to allow for ease of collection of waste by the waste hauler.
		The waste storage area must be sized to allow for the segregation of all possible recyclable waste streams (such as paper and cardboard, glass, plastic, metals) even if currently a third-party recycling stream is not available in the locality.
		The waste storage area must be properly ventilated (mechanically or naturally) and cooling provided if organic waste is stored internally. The door to the waste storage area must be at least 1.8m wide to allow for easy offloading of waste bins and should be lockable to prevent children from gaining access.
		The sizes of the central storage bins should be adequate for the amount of waste generated and the collection rates (as per the licensed waste operator's collection frequency), with bins generally between 120L and 500L. Figure PMM-01.1 provides an example of a central waste storage space in a multi-residential project.
5	**Waste Collection**	Investigate the availability of licensed waste operators (both existing and planned) in the region and the waste streams which can be diverted.
		Ensure there will be adequate access to the centralized waste storage area for waste collection vehicles (as per local authority specific requirements).

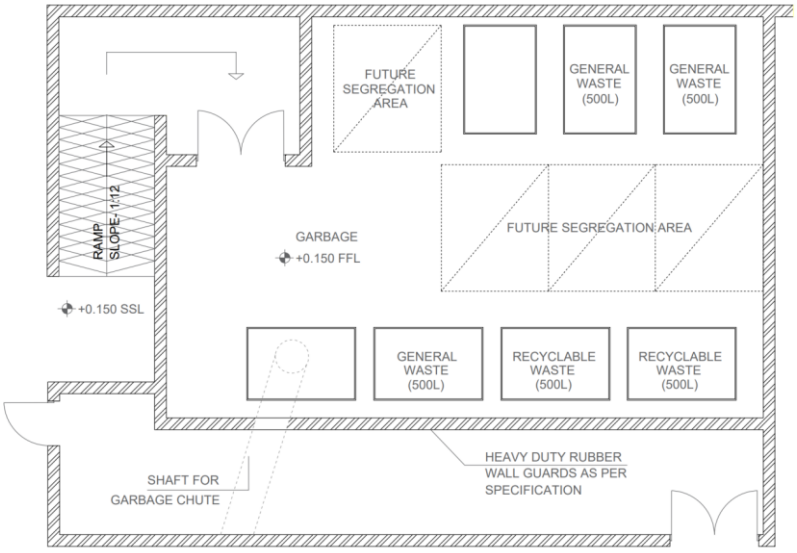


Figure PMM-01.1 Central waste storage area for a multi-residential building

Credit Tool

N/A

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-02 Sustainable Procurement

Keystone Credit	Total Number of Points Available
No	1

Aim

To encourage the purchase of sustainable products and materials that reduce adverse impacts on human health and the environment.

Requirements

#	Requirement	Points Available	
		Individual dwelling	Multi-residential
1	A Sustainable Procurement Policy (SPP) is developed that encourages the purchase of sustainable products and materials for the operation and maintenance of the building. The SPP should be included as an appendix to the Mostadam Guide (**EI-01 Mostadam Guide**).	1	1
	Total	**1**	**1**

Design Stage Evidence

#	Evidence per Requirement
1	• Draft Sustainable Procurement Policy. • Signed confirmation from the building developer/owner that the SPP will be implemented.

Construction Stage Evidence

#	Evidence per Requirement
1	• Sustainable Procurement Policy. • Signed confirmation from the building developer/owner that the SPP will be implemented.

Supporting Guidance

Sustainable Procurement Policy:

The SPP is to be implemented by both the owner and residents and will impact the purchase of products and services for the operation and maintenance of the building. Table PMM-02.1 details the required contents of the Sustainable Procurement Policy.

Table PMM-02.1 SPP contents

Sustainable Procurement Policy		
#	Section Title	Content Requirements and Guidance
1	**Aims & Objectives**	Aims and objectives of the policy.
2	**Roles & Responsibilities**	For multi-residential buildings, high-level overview of the various roles associated with procurement and their responsibilities.
3	**Policy Scope**	Description of the products and materials that are covered by the Policy, to include the following as a minimum: • Cleaning products • Paper products • Electrical equipment e.g. appliances, computers • Building finishes e.g. paints, coatings, adhesives, sealants
4	**Sustainable Products & Materials**	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 (in the case of appliances, an Energy Efficiency Label from SASO for a minimum rating of B. Or, if the appliance is not currently covered by SASO, an Energy Star label. Refer to credit **E-05 Energy Efficient Appliances** for further details). • Minimally packaged. • Recyclable. • Made from natural materials. • Produced using renewable energy.
		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)
		Detail the sustainability attributes that will be targeted for all applicable purchases and the documentation/evidence required. For each product and material type: • List the preferred attributes and any orders of priority for the attributes. • Provide examples of specific products and materials with the preferred attributes. • Provide examples of manufacturers and suppliers with appropriate

		environmental awards/certificates and internal management systems.

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.

Credit Tool

N/A

Reference Documents

1. US Environmental Protection Agency (EPA), Sustainable Purchasing Program
2. Forest Stewardship Council (FSC), https://ic.fsc.org/en
3. ISO 14001:2015 Environmental management systems
4. Carbon Trust, https://www.carbontrust.com/home/
5. EMAS (Eco-Management and Audit Scheme), http://ec.europa.eu/environment/emas/index_en.htm

PMM-03 Building Performance Monitoring

Keystone Credit	Total Number of Points Available
No	2

Aim

To install 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 installed 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**

Design Stage Evidence

#	Evidence per Requirement
1	• Drawings showing the location of the smart meters, the connected systems and the display screens (dashboards). • Specification for the functionality of the smart meters and display screens (dashboards). • Specification for the web-based application and images of the digital interface that users will experience. • Mostadam Guide (refer to credit **EI–01 Mostadam Guide)** with a section on Smart Metering providing user support for the meters and dashboards.

Construction Stage Evidence

#	Evidence per Requirement
1	• As-built drawings showing the location of the smart meters, the connected systems and the display screens (dashboards). • Purchase orders/receipts for all smart meters and display screens (dashboards). • Smart meter and display screen manufacturers' data sheets which highlight the energy and water monitoring capabilities. • Date-stamped photographs of the installed 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 provided as follows:
    - 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.
- The web-based application shall:
    - 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-06 Renewable Energy**, energy generation data (real-time and cumulative) must also be monitored and reported on the dashboard.

Mostadam Guide Content (refer to credit **EI-01 Mostadam Guide**):

The following is to be included in the Mostadam Guide:

- Smart meter 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

Glossary

13 Glossary of Terms

Term	Definition
Aggregate	Grained material used as reinforcement in composite mixes such as concrete. Examples of aggregate: sand, gravel, crushed stone, slag and recycled concrete.
As-built drawing	Drawing which represents the final constructed building, usually prepared by the Contractor.
Bathymetry survey	A surveying method used to analyze the beds of water sources such as lakes, rivers and ocean. It is typically used to identify biological features and natural habitats of a water body.
Biodegradable	Material that can be broken down naturally by microorganisms.
Blackwater	Wastewater from toilets that cannot be reused in the building.
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 air tightness	The property of a building which pertains to air exchange between the building and its exterior through infiltration and exfiltration. A building air tightness test is performed to measure this property.
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.
CO_2 sensor	A sensor which measures the CO_2 content of the area in which it is located. This is usually located in densely occupied areas, or in the return duct of an HVAC system.
Coefficient of Performance (COP)	A measure of the efficiency of a refrigeration system. It is the ratio of the amount of cooling to the energy input.
Color Rendering Index (CRI)	The ability of a light source to depict a color in its most natural form (with the most natural form of a color being lit by daylight).
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.
Compostable waste	Waste that can be decomposed and used as fertilizer, this usually includes food waste and landscape waste.
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.
Dynamic energy modeling	A computerized model of a building which calculates the momentary, peak and annual energy consumption of a building through dynamic simulation. The model incorporates the building's architectural design, mechanical, electrical and plumbing systems, anticipated building usage patterns and annual climatic data.
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.
Flood hazard area	A legally designated flood hazard area is an area that is subject to a 1% or more chance of flooding in any given year. Flood hazard areas are designated in Flood Insurance Rate Maps.
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.
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.
High-albedo surface	A surface which has a high reflectivity of light.
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	Also referred to as a single 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).
Light transmittance	The percentage of light that is transmitted through glazing.
Line of sight	A direct line from an observer's eye to a specified point.
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.
Pervious surface	Permeable or porous surfaces that allow for water absorption.
Post-consumer recycled material	Material that is recycled after it has been used by consumers.
Pre-consumer recycled material	Reuse of waste that is formed from a manufacturing process.
Radiative cooling	The removal of sensible heat from a space through the use of a cooled surface.
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.

Solar factor	Also referred to as the g-value. This is the percentage of heat that transfers through glass (i.e. the thermal transmittance of glass)
Solar heat gain coefficient	Abbreviated as SHGC. A fractional measurement of how much solar energy is emitted through glazing either directly (solar transmittance) or indirectly (through absorption and re-radiation). The ratio is between 0 and 1. The lower the ratio, the less solar energy is admitted through the glazing.
Thermal comfort	Occupants' perception of thermal satisfaction in their environment.
Thermal mass	The ability of a material to retain heat.
Thermal zone	A space or group of spaces with similar space-conditioning requirements and heating and cooling setpoints.
Thermostat control	An electronic device that measures temperature and controls the heating or cooling system accordingly.
U-value	A measure of the rate of transfer of heat through a material (i.e. thermal transmittance).
Variable Air Volume (VAV)	A type of HVAC system where the air volume is varied to meet the setpoint temperature in a thermal zone.
Variable speed drive (VSD)	An electric motor with an adjustable speed which varies based on a control signal.
WC	Water closet
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 or openable windows.

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