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### Integrated Logistics Bonded Zone

DETAILED MASTER PLAN
Package C1: Detailed Master Plan and
Infrastructure Design

ANNEX 3 - SUSTAINABILITY GUIDELINES Reference: ILBZ-MAT-C1|A3-S03-R1

Date: 10-July-2021



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### Overview

Tenant Guidelines Purpose



The purpose behind these Sustainability Design Guidelines for the ILBZ project is to educate tenants in implementing sustainable design and construction features in their tenant improvement build-outs. These guidelines will help tenant design teams understand and use best practices as it relates to building's systems and design features to achieve significant reductions in energy, water and resource consumption. Suggestions for sustainable products and strategies encourage tenants to make sustainable choices when planning, designing, constructing and operating their space.

The Sustainability Design Guidelines also help tenant design teams to fully consider the tenants needs from not only an environmental consideration but also a health and wellness perspective during the design, construction and operational phases of the project. The recommendations that you will find in these guidelines include examples for sustainable strategies pertaining to a multitude of concepts that will ensure that you are not only meeting local code and ILBZ Master Plan Key Performance goals, but also creating an environment your building occupants to thrive while conserving resources.

How to Use These Guidelines



The ILBZ Master Plan's design direction aims at promoting all facilities and supporting buildings as reference points with unique character and special identity. Sustainability is the backbone of the design aiming at enhancing the Environmental and Health & Wellness performance of all the facilities designed and operated. The overarching design concept is to enforce the combination of traditional and contextual architectural trends with contemporary and innovative state of the art technologies. The architectural language implemented advance a message rooted in the past while promoting aspiration of the future.

These Design Guidelines are meant to inspire design teams and tenants to reach beyond conventional design to create inviting places for your employees, visitors and businesses to thrive.

Each section has the following guidance:

- Overarching Statement
- Key Performance Indicators Intent
- Understanding
- Mandatory Requirements
- Target Requirements



How to Use These Guidelines (cont.)



#### **Key Performance Indicators (KPI's)**

The sustainability vision and goals for KKIA ILBZ Masterplan will be realised and monitored through a number of Key Performance Indicators. The responsibility for achieving these are spread across various providers and firms associated with the project during the design, construction and occupancy phases of the project. The intent of these KPI's are addressed throughout this document and the actual metrics intended to be achieved are in the Detailed Master Plan, Annex E Document and highlighted in green by each indicator. Where there is a KPI intent you see the associated Icon noted here.

**Tenant Policies and Plans** 

**Energy** 

Water

Air

**Materials** 

**Waste Management** 

**Site** 

Construction



How to Use These Guidelines (cont.)



#### **Overarching Statement**

Provides an overview and specific environmental issues or concerns regarding the key concepts that are identified. These statements are addressed in each of the following sections.

Tenant Policies and Plans - Energy - Water - Air - Environmental Quality - Materials - Waste - Site - Health and Wellness - Waste Management and Construction.

#### **Understanding**

The Understanding topic provides additional information as it relates to the subtopics in each section. The intent is to provide further awareness of the Environmental and Health and Wellness concerns and strategies in implementing the various sub-topics throughout the document. These sub-topics address issues such as solar, net-zero energy, water quality or construction waste and materials ingredients.



How to Use These Guidelines (cont.)



#### **Mandatory Requirements**

Mandatory Requirements are pulled from local code or possibly the ILBZ's Key Performance Indicators and Master Plan goals for the project. They also include industry best practices that are deemed essential strategies in designing, constructing and operating facilities such as these in today's market. By implementing many of these strategies the project has potential in energy, water and resource reductions while lowering operating costs and creating a healthy working environment for building occupants. These are required and will be tracked and monitored by the ILBZ Development team.

#### **Target Requirements**

The Target Requirements contain strategies for design, construction and operational measures for the project team to consider. By implementing many of these measures you are ensuring the creation of a healthy working environment, resource reductions and continued reduced operating costs for your project. These are optional but highly encouraged.

How to Use These Guidelines (cont.)



#### **Terms and Definitions**

The Terms and Definitions section is intended to provide additional information for the design, construction and operational teams if they come across a term or reference that is unfamiliar to them. While this is a comprehensive list it may not cover every term or definition of a sustainable project.

#### References

The References section addresses links to key code or reference standards that you will find throughout the document such as ASHRAE or the Saudi Green Building Code. You will also find references and descriptions to key rating systems that are acknowledged in the industry such as LEED, WELL and Mostadam. The intent or sometimes requirement behind various green building strategies will occasionally be referenced throughout the sections under Minimal Requirements and Target Requirements.



Value and Benefits

#### **Overarching Statement**

The purpose of developing Tenant driven sustainability policies, plans and initiatives is to put successful process and strategies in place so that you, the Tenant implements and demonstrates the best of sustainability and health and wellness practices. These intended to support, enforce, educate and guide your team with ongoing implementation of your sustainability goals.

In addition, they can support the integration of sustainability into your culture and overall community landscape and have the potential to positively impact the social, physical and economic goals at your site.

These are all intended to be addressed at your tenant site, building and operational and maintenance practices.





Policies and Plans



#### **Topics Covered**

[PP1] Construction

[PP2] Waste

[PP3] Operations and Maintenance

[PP4] Community

[PP5] Health & Wellness

[PP6] Environmental Quality







[PP1] Construction



#### **Mandatory Requirements**

#### **Construction:**

- Construction Pollution: Develop Construction Activity Pollution Prevention Policy for new construction projects.
- Construction Environmental Management Plan: Develop and implement a Construction Environmental Management Plan (CEMP) to address environmental and social impacts of construction activities.
- Construction Waste: Develop a Campus Wide Construction and Demolition Waste Management Plan (CDWMP).
- **Develop Construction Activity Pollution Prevention Policy:** To reduce pollution from construction activities including soil erosion, waterway sedimentation, and airborne dust.



[PP2] Waste



#### **Target Requirements**

#### Waste:

- Organic Waste: During operational stages, treat by composting a minimum of 10% of the generated organic waste and to meet the needs of fertilizer for green areas within KKIA-ILBZ.
- **Communal Storage:** Consider a communal storage area for large bulky items, e-waste, electronics, etc. for employees to recycle items.
- Manage Hazardous Waste: Develop an Operational Hazardous Waste Stream Plan and internal training program which addresses the management of the following hazardous wastes;
  - Recycling and materials recovery (including batteries, pesticides, lamps and mercury-containing equipment)
  - Waste receptacle access and disposal of waste
  - Waste or source reduction (including prevention, minimisation and reuse)



[PP3] Operations and Maintenance



#### **Target Requirements**

#### **Operations and Maintenance:**

- Sustainable Procurement Policy: Develop and Implement a Sustainable Procurement Policy. Promote
  purchasing practices towards Local, Small to Medium Enterprises and homegrown enterprises that sell
  products manufactured in KSA or services that are operated by local Saudi talent.
- Green Cleaning Procurement Policy: Develop and Implement a site wide interior and exterior Green Cleaning Procurement Policy
- Integrated Pest Management Policy: Develop and Implement an Integrated Pest Management Policy for building exterior and interior.



[PP4] Community



#### **Target Requirements**

#### **Community:**

- Labor Subsistence Plan: Develop and implement a Labor Subsistence Plan outlining health and wellbeing characteristics to be provided in the labour accommodation and the Mandatory Requirements as per the prevalent law and requirements.
- Emergency Preparedness Plan: Develop and implement training programs, policies and planning for community disaster and emergency preparedness. An emergency management plan is in place outlining response in the case of emergency situations within the building or surrounding community, including hazards as associated with the location:
  - Natural: flash floods, earthquake, dust storms, heatwave, etc.
  - **Humanmade**: Fire, explosions, etc.
  - Health: acute medical emergency, infectious disease outbreak, etc.
  - Technological: power loss, chemical spill, explosion, etc.





[PP5] Health and Wellness



#### **Target Requirements**

#### **Health and Wellness:**

- Nourishment: Provide Nutritional Education and Awareness and an area within your buildings where employees can get away from their work for a food or rest break.
- **Food Production:** Create space for communal food production; garden, greenhouse or hydroponic or aeroponic farming system with food bearing plants.
- **Dedicated Activity Spaces:** Provide an Exercise Facility Center for all occupants as culturally appropriate. Provide showers, lockers and equipment.
- Non-Smoking Building: Develop Non-Smoking Policy & Plans for all areas within the building.
- Non-Smoking Campus: Develop Campus wide Non-Smoking Policy & Plans for areas that do not allow smoking. For areas that may provide smoking, comply with recommended guidelines to ensure nonsmoker safety.



[PP6] Environmental Quality





#### **Target Requirements**

#### **Environmental Quality:**

- Water: Develop and implement strategies to promote safe drinking water access for all building occupants.
- Rainwater: Develop a Rainwater Management Plan that adopts, either a site infiltration or rainwater redirection strategy.
- **Light:** Develop policies that address maintained illuminance levels for roads and walkways; strategies for limiting light pollution and light trespass; glare and discomfort avoidance for non-tenant-controlled spaces.
- Thermal Comfort: Develop polices and strategies to reduce heat island effect; policies to deal with extreme temperatures; policies to manage sun exposure and ultraviolet risk for non-tenant-controlled spaces.
- **Sound:** Develop noise exposure assessment; planning for acoustics; techniques to reduce sound propagation; hearing health education for areas that might have sound or noise concerns.
- Air Quality: Develop and enforce ambient air quality which addresses traffic pollution, vehicle idling and strategies to reduce exposure to pollution.
- **Minimise Odour:** Address requirements for any odour generation within your facility located within the site boundary.

Value and Benefits

#### **Overarching Statement**

The Energy category focuses on minimising the energy consumption and carbon emissions of the built environment within the ILBZ. This section focuses on energy reduction methodologies during design via passive design, load reduction, efficient systems, and on-site clean energy sources. As well, recommendations are made to minimise energy consumption from operations through on-going commissioning and policies.





Value and Benefits (cont.)



#### **Topics Covered**

[E01] Overall Building Energy Performance

[E02] Envelope Thermal Performance

[E03] External Air Infiltration

[E04] Solar Shading

[E05] Lighting

[E06] Equipment

[E07] Renewable Energy

[E08] Commissioning

[E09] Refrigerant Management







#### **Key Performance Indicators**



#### **Key Performance Indicators Intent**

The Energy category, has several performance targets indicated. These are directly related to the KPI's for the project. To meet the requirements the design team should address energy conservation and carbon emission reduction through a high-performance envelope, lighting and equipment load reduction, efficient systems, and on-site clean renewable energy sources.

The table to the right outlines the Energy KPIs related to each individual Energy Topic.

Topic	Related KPIs
[E01] Overall Building Energy Performance	Building energy consumption to be at least 20% better than ASHRAE 90.1-2013
[E02] Envelope Thermal Performance	Envelope Thermal Performance: Roof U <sub>max</sub> =0.15 W/m²/K and Walls=0.11 W/m²/K Cool Roofs: SRI=75 for not less than 75% of roof surface Window Thermal Performance: U <sub>max</sub> =1.7 W/m²/K and SHGC=0.21
[E03] External Air Infiltration	Envelope Air Tightness: 1.25 L/s/m <sup>2</sup> @ 75 Pa)
[E05] Lighting	Lighting Power Reduction: 25% lower than SBC 601-2018
[E07] Renewable Energy	On-Site Renewable Energy: Net Zero Carbon -or- 60% rooftop & 50% surface parking canopy coverage



#### [E01] Overall Building Energy Performance



#### **Understanding**

Limits on overall building energy performance allow for energy and carbon emission targets to be established, while allowing flexibility in design. Reducing overall building energy consumption and carbon emissions has positive cost, health, and environmental impacts.

#### **Mandatory Requirements**

Buildings must consume at minimum 20% less energy than an ASHRAE baseline building over a typical meteorological year. Conduct whole-building energy simulation using appropriate energy modeling software, to compare the total building energy consumption (kWh) to baseline prescribed by ASHRAE Standard 90.1-2013. Energy Simulation protocols to follow ASHRAE Standard 209-2018 – Energy Simulation Aided Design for Buildings except Low-Rise Residential Buildings.







#### **Target Requirements**

• **Net zero carbon building:** In which the building produces on site, or procures, renewable energy or high-quality carbon offsets to offset the annual carbon emissions from building energy consumption. The tenant has a period of up to 3 years to demonstrate compliance with the net zero carbon balance.

Note: See Compliance Pathway Appendix for calculation procedures and recommendations.



[E02] Envelope Thermal Performance





#### **Understanding**

A high-performance envelope provides an essential thermal barrier to control heat gain/loss between the conditioned interior spaces and extreme outdoor conditions. These guidelines focus on control of solar gains to reduce cooling load through windows, reducing solar gain through opaque surfaces, and reducing conductive heat gain through the building envelope. A high-performance thermal envelope will decrease energy consumption (i.e. cooling) and costs as well as improve thermal comfort while not impairing passive daylight performance for the industrial buildings (ex. high placement of small windows to provide deeper daylight penetration).

#### **Mandatory Requirements**

- Opaque Envelope:
  - Thermal performance to meet Saudi Energy Conservation Code for Climate Zone 1 (SBC 601 2018):
    - i.e. for non-residential metal buildings, assembly U<sub>max</sub> values (W/m<sup>2</sup>°C) for Roof = 0.369, Walls = 0.193, Floors = 0.408
  - Roof reflectivity (albedo) not less than 75% of roof surfaces of buildings and covered parking spaces shall meet SRI ratings as per SBC 1001 2018 (Table 408.3.1 i.e. SRI<sub>aged</sub>=64 for flat roof)
     OR vegetative roof.





#### **Mandatory Requirements (cont.)**

- Fenestration:
  - Window-to-Wall Ratio (WWR) not to exceed 40% for exterior envelope.
  - Vertical Fenestration performance to meet SBC 601 2018
    - i.e. for assembly,  $U_{max} = 2.89 \text{ W/m}^2{}^{\circ}\text{C}$ , SHGC<sub>max</sub>=0.25
- Skylights:
  - Not to exceed 6% of roof area
  - Skylight performance to meet SBC 601 2018
    - i.e. for assembly, U<sub>max</sub> = 1.7 W/m<sup>2</sup>°C, SHGC<sub>max</sub>=0.21



[E02] Envelope Thermal Performance (cont.)



#### **Target Requirements**

#### Opaque Envelope:

- Thermal performance for non-residential metal buildings, assembly U<sub>max</sub> values (W/m<sup>2</sup>°C) for Roof = 0.15, Walls = 0.11, Slabs = 0.1
- Roof reflectivity (albedo) not less than 75% of roof surfaces of buildings and covered parking spaces shall meet SRI ratings of 75 OR vegetative roof.

#### Windows:

- Window-Wall-Ratio (WWR) not to exceed 25% for exterior envelope.
- Non-metal, thermally broken frames, overall window performance to meet: U<sub>max</sub> = 1.7 W/m<sup>2</sup>°C, SHGC<sub>max</sub>=0.21

#### Skylights:

- Not to exceed 4% of roof area
- Skylight performance (assembly) to meet: U<sub>max</sub> = 1.7 W/m<sup>2</sup>°C, SHGC<sub>max</sub> = 0.21







#### **Understanding**

Infiltration of unwanted exterior air through the building façade to conditioned spaces results in unwanted heat gains, potential introduction of air borne contaminants (i.e. pollutants, odours), as well as the potential for decreased thermal comfort. Controlling the amount of infiltration through the building envelope through envelope and HVAC design, construction practices, and air seal/barrier technologies is an effective means of reducing energy consumption and improving thermal comfort.

#### **Mandatory Requirements**

- Building Air Tightness Testing: Building thermal envelope air tightness shall be tested and the air leakage rate of the total area of the BTE shall not exceed 1.25 L/s/m<sup>2</sup> @75Pa (In accordance with SBC 1001 – 2018, Section 605.1.2.2)
- **Building Air Curtains:** Where employed at building or warehouse entrances, design should achieve min velocity of 2 m/s at the floor, tested in accordance with ANSI/AMCA 220.

[E03] External Air Infiltration (cont.)



#### **Target Requirements**

 Building Air Tightness Testing - building thermal envelope air tightness shall be tested and the air leakage rate shall not exceed 0.6 ACH @50 Pa





### [E] ENERGY [E04] Solar Shading



#### **Understanding**

Uncontrolled solar heat gain is a major cause of cooling energy consumption and thermal discomfort. Appropriate application of fixed and operable shading devices will be effective at decreasing cooling load and increasing comfort. It is preferred to intercept sun penetration before entering the building with opaque external overhangs, fins, and operable shading devices.

#### **Mandatory Requirements**

All vertical fenestration within 135 degrees of south to have:

- Permanent horizontal exterior shading devices / projections with projection factor of at least 0.25 and/or automatically controlled shading devices (as per SBC 1001 – 2018)
- User-controlled shading devices to prevent solar gains and glare



### [E] ENERGY [E04] Solar Shading (cont.)

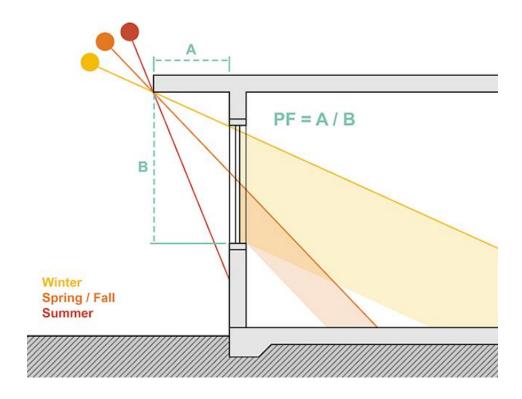


#### **Target Requirements**

All vertical fenestration within 135 degrees of south to have:

- Permanent horizontal exterior shading devices / projections with projection factor of at least 0.5 and,
- automatically controlled shading devices to prevent solar gains and glare









#### **Understanding**

For typical ILBZ building typologies, lighting is a significant contributor to both overall building energy consumption as well as a source for heat gain impacting cooling loads. Reducing lighting power density (LPD) with efficient technologies (such as LED fixtures, task tuning, and light tubes) as well as automatically controlling lighting useage when not required are effective means in reducing energy and cooling consumption.

#### **Mandatory Requirements**

- Interior Lighting Power Density to comply with SBC 601 2018, Section 9.6. For example:
  - Warehouse (medium/bulky material storage) LPD<sub>max</sub> = 6.2 W/m<sup>2</sup>
  - Warehouse (fine material storage) LPD<sub>max</sub> = 10.2 W/m<sup>2</sup>
  - Detailed Manufacturing LPD<sub>max</sub> = 13.9 W/m<sup>2</sup>
  - Office (enclosed) LPD<sub>max</sub> =  $11.9 \text{ W/m}^2$
  - Office (open plan) LPD<sub>max</sub> = 10.5 W/m<sup>2</sup>
- Exterior Lighting Power Density to comply with SBC 601 2018, Section 9.4.3.







#### **Mandatory Requirements (cont.)**

- Lighting Controls to comply with SBC 601 2018. For example:
  - Room Controls Automatic Lighting Shutoff (scheduled or occupant sensor)
  - Garage Controls automatically reduce LP to 30% when unoccupied more than 30 mins
  - Daylight Controls for side daylit areas >23m<sup>2</sup>
  - Stairwell Controls automatically reduce LP to 50% within 30 mins of occupancy
  - Exterior Lights daylight controls (off when daylit), landscape light off from midnight to 6am

#### **Target Requirements**

- Interior Lighting Power Density to be 25% lower than SBC 601 2018, Section 9.6. For example:
  - Warehouse (medium/bulky material storage) LPD<sub>max</sub> = 4.7 W/m<sup>2</sup>
  - Warehouse (fine material storage) LPD<sub>max</sub> = 7.7 W/m<sup>2</sup>
  - Detailed Manufacturing LPD<sub>max</sub> = 10.4 W/m<sup>2</sup>
  - Office (enclosed) LPD<sub>max</sub> = 8.9 W/m<sup>2</sup>
  - Office (open plan) LPD<sub>max</sub> = 7.8 W/m<sup>2</sup>
- Exterior Lighting Power Density to be 25% lower than SBC 601 2018, Section 9.4.3.







#### **Understanding**

Energy requirements for equipment loads can be a constant, and significant contributor to overall energy consumption for ILBZ typologies. Not only do equipment (or plug) loads consume electricity, but waste heat results in a secondary energy draw as cooling load. It is therefore beneficial to minimise equipment energy consumption through the implementation of efficient appliances, monitoring, and practices.

#### **Mandatory Requirements**

- Energy Efficient Appliances: Electrical appliances must have and Energy Efficiency Label from the Saudi Standards, Meteorology and Quality Organization (SASO) or ENERGY STAR or EPEAT.
- Efficient Vertical Transportation Systems: Smart Elevators-all elevators within the building are in compliance with the SBC 601 for energy efficiency measures.
- **Building Performance Monitoring**: Install real-time monitoring systems reporting energy and water consumption.
- High Efficiency Motors: Motors for HVAC systems and pumping systems will be speci efficiency, low loss and with built-in power factor compensation.





#### **Understanding**

To align with Saudi Vision 2030 guidelines to expand adoption of clean energy sources across KSA, ILBZ has a strong mandate to produce on-site renewable energy. Rooftops and vehicle shading structures provide excellent horizontal solar exposure and are ideal locations for photovoltaic electricity generation. On-site renewable energy will play an essential role in achieving the energy performance goal of a net-zero carbon site.

#### **Mandatory Requirements**

- Onsite Renewable Energy provide greater (based on annual PV energy production) of:
  - not less than 5.4 W/m<sup>2</sup> of conditioned floor area of the building or provide not less than 3% of building mechanical and service water heating and lighting energy (as per SBC 1001 - 2018)

#### OR

Photovoltaic panels to cover 60% of building roof area



## [E] ENERGY

[E07] Renewable Energy (cont.)

#### **Target Requirements**

- Onsite Renewable Energy provide greater of:
  - Photovoltaic panels to cover 60% of building roof area and 50% of surface parking shading canopies

#### OR

 Net-Zero Carbon - Photovoltaic panels sized to meet annual energy production required to offset annual carbon emissions from energy consumption on site.
 Note: See Compliance Pathway Appendix for calculation procedures and recommendations





## [E] ENERGY [E08] Commissioning





#### **Understanding**

Building Enclosure and HVAC Systems commissioning provides an important check to ensure that buildings are constructed and operate as per design intentions. Commissioning begins with a third-party check during the design process, continues with as-built performance verification, and continues with on-going maintenance and operation checks. An effective commissioning plan and execution results in increased performance, reduced energy consumption, and improved occupant comfort.

#### **Mandatory Requirements**

- Enclosure Commissioning:
  - Appoint a Building Envelope Commissioning Agent (BECxA) to produce an Envelope Commissioning Plan and oversee advanced building envelope verification as performed by C<sub>x</sub> Contractor. Building Envelope is tested for condensation, water ingress, air infiltration and thermal bridging to ensure performance is designed in accordance with ASTM, ATTMA and ASTATT standards.
- Systems Commissioning:
  - Appoint an independent Commissioning Agent (CxA) to manage the commissioning procedure.





#### **Target Requirements**

- Enclosure Fundamental Commissioning & Verification:
  - Complete the following commissioning process (CxP) activities for the building's thermal envelope in accordance with ASHRAE Guideline 0–2013 and the National Institute of Building Sciences (NIBS) Guideline 3–2012, Exterior Enclosure Technical Requirements for the Commissioning Process, as they relate to energy, water, indoor environmental quality, and durability. Commissioning authority must complete the following:
    - Review contractor submittals.
    - Verify inclusion of systems manual requirements in construction documents.
    - Verify inclusion of operator and occupant training requirements in construction documents.
    - Verify systems manual updates and delivery.
    - Verify operator and occupant training delivery and effectiveness.
    - · Verify seasonal testing.
    - Review building operations 10 months after substantial completion.
    - Develop an on-going commissioning plan.



## [E] ENERGY [E08] Commissioning (cont.)



#### **Target Requirements(cont.)**

- Systems Fundamental Commissioning & Verification:
  - Complete the following commissioning (Cx) process activities for mechanical, electrical, plumbing, and renewable energy systems and assemblies, in accordance with ASHRAE Guideline 0-2005 and ASHRAE Guideline 1.1–2007 for HVAC&R Systems, as they relate to energy, water, indoor environmental quality, and durability. The commissioning authority must do the following:
    - Review contractor submittals.
    - Verify inclusion of systems manual requirements in construction documents.
    - Verify inclusion of operator and occupant training requirements in construction documents.
    - Verify systems manual updates and delivery.
    - Verify operator and occupant training delivery and effectiveness.
    - Verify seasonal testing.
    - Review building operations 10 months after substantial completion.
    - Develop an on-going commissioning plan.



## [E] ENERGY [E09] Refrigerant Management



#### **Understanding**

Ozone and CFC refrigerants can be significant contributors to GHG emissions. Reducing an/or eliminating the use of these refrigerants on site will greatly impact the overall emissions contribution of the project.

#### **Mandatory Requirements**

• Ozone & CFC: Ensure that refrigerants, fire suppression systems and maintenance gases on Ozone Depletion Potential (ODP) of zero. The project does not use CFC's or halon- based materials.

#### **Target Requirements**

• Enhanced Refrigerant Management: Do not use refrigerants or use only refrigerants (naturally occurring or synthetic) that have an ozone depletion potential (ODP) of zero and a global warming potential (GWP) of less than 50.

Value and Benefits

#### **Overarching Statement**

This section addresses water holistically, looking at indoor use, outdoor use, specialized uses, and metering. The underlining goals are based on an "efficiency first" approach to water conservation. Strategies to reduce potable water use in buildings entail the selection of efficient plumbing fittings, fixtures, and equipment.





#### **Key Performance Indicators**



#### **Key Performance Indicators Intent**

The Water category, has several performance targets indicated. These are directly related to the KPI's for the project. To meet the requirements the design team should address water conservation through low-flow fixtures and equipment beyond SASO requirements. In addition, stressing a reduction in landscape water and recycled irrigation water.

The table to the right outlines the Water KPIs related to each individual Topic.

Topic	Related KPIs
[W02] Water Efficiency	20% reduction over SASO Water Efficiency Labelling baseline
[W04] Equipment	90% of devices (cooling coils, air handlers, etc.) that are connected to the network should collect condensate generated
[W04] Equipment	97% of water retained (not lost through network leakages) within on-site transmission system
[W08] Landscaping	Outdoor landscape irrigation systems: Irrigation systems shall be designed and installed to reduce water use by 50% from a calculated midsummer baseline
[W08] Landscaping	Recycled resource: Utilize 100% of irrigation to come from the Sewage Treatment Plant (STP) as a recycled resource.



Value and Benefits (cont.)



#### Topics to be covered:

[W01] Water Quality

[W02] Water Efficiency

[W03] Water Filtration

[W04] Equipment

[W05] Moisture Control

[W06] Drinking Water Promotion

[W07[ Metering

[W08] Landscape

[W09] Drinking Water Quality-

Operations & Maintenance











[W01] Water Quality



#### **Understanding-**

Water Quality covers aspects of the quality, distribution and control of potable water in a building. Addressing where the water is sourced, the availability and contaminant thresholds of drinking water, as well as building features targeting the management of water to avoid damage to building materials and environmental conditions. Saudi Arabia leads the world in desalinisation (20% of global production). Most new desalinisation plants are reverse osmosis. WHO reporting states that while most systems remove a significant proportion of microbial pathogens, some pathogen transfer is possible. Most plants also disinfect product water (chlorine). There may be risks during transfer whether in pipes or trucks that allow for the possibility for microbial growth. Systems that keep a constant flow and pressure have reduced risks of legionella and other contaminant growth. While the water is treated to meet local regulatory clean water standards it may be important for the tenant to fully understand the quality of water that is being consumed. Local piping, environmental conditions, and other influences on the water, post-treatment, can lead to changes in the quality at the faucet which would have an impact on human health.



[W01] Water Quality





#### **Understanding**

Legionella is a species of bacteria naturally present in many bodies of water that, if inhaled, can lead to legionellosis (commonly called Legionnaires' Disease), a type of pneumonia. Legionella is dangerous when suspended in mists or sprays that can be inhaled. This occurs most often when inappropriately treated and managed water is used in hot tubs, showers, fountains and large building refrigeration systems and forms a mist of contaminated water. Controlling Legionella risk is a complex process, but several organizations have published standards and guidelines outlining best practices and proven methods of prevention; for example, ASHRAE Standard 188, Legionellosis: Risk Management for Building Water Systems and the European Centre for Disease Prevention and Control.

#### **Mandatory Requirements**

**Legionella Management:** Develop and implement a Legionella Management Plan for all relevant water-based systems and undertake sample testing at the end of construction and commissioning.

- Formation of a team for Legionella management in the building.
- Water system inventory and production of process flow diagrams
- Hazard analysis of water assets along with Identification of critical control points.
- Maintenance and control measures, monitoring, establishment of performance limits and corrective actions. Develop documentation, verification and validation procedures

[W01] Water Quality (cont.)



#### **Target Requirements**

- Water Quality: Consider acquiring quarterly water quality report from source ensure all water quality standards are being met within acceptable limits. (See Sediment and Thresholds noted below).
- **Sediment Threshold:** Water delivered to the project for human consumption, handwashing and showers/baths meets the following threshold:
  - Turbidity less than or equal to 1.0 NTU.
  - Microorganisms Thresholds: Water delivered to the project for human consumption, handwashing and showers/baths meets the following requirement:
    - Contains 0 CFU / 100 mL total coliforms (including E. coli).



[W01] Water Quality (cont.)



#### **Target Requirements**

- Meet Dissolved Metal Thresholds: Water delivered to the project for human consumption meets the
  following thresholds: Lead less than 0.01 mg/L., Arsenic less than 0.01 mg/L., Antimony less than 0.006
  mg/L., Mercury less than 0.002 mg/L., Nickel less than 0.07 mg/L. Copper less than 1.0 mg/L., Cadmium
  less than 0.005 mg/L., Chromium (total) less than 0.1 mg/L.
- Meet Organic Pollutant Thresholds: Water delivered to the project for human consumption meets the following thresholds: Styrene less than 0.02 mg/L, Benzene less than 0.005 mg/L., Ethylbenzene less than 0.3 mg/L., Vinyl chloride less than 0.002 mg/L, Toluene less than 0.7 mg/L., Xylenes (total: m, p and o) less than 0.5 mg/L., Tetrachloroethylene less than 0.005 mg/L.
- Meet Disinfectant Byproducts Thresholds: Water delivered to the project for human consumption
  meets the following thresholds: Total trihalomethanes (sum of dibromochloromethane,
  bromodichloromethane, chloroform and bromoform) less than 0.08 mg/L Total haloacetic acids (sum of
  chloroacetic, dichloracetic, trichloracetic, bromoacetic and dibromoacetic acids less than 0.06 mg/L.

[W02] Water Efficiency



#### **Understanding**

Potable water usage in buildings constitutes a large portion of freshwater consumption. Strategies to reduce potable water use in buildings entail the selection of efficient plumbing fittings, fixtures, and equipment. Fixtures that use 20% to 50% less water than code-required levels are now widely available. Saudi Arabia, one of the world's driest countries, has implemented a national program for rationalising water consumption in the Kingdom, setting ambitious targets that include slashing usage by nearly 24-43 percent by the end of the next decade.

ILBZ Master Plan to provide centralised water treatments system (STP) for use by tenants.



[W02] Water Efficiency (cont.)

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#### **Mandatory Requirements**

#### Comply with:

ILBZ Water demand reduction low flow fixtures

Washroom taps at 4.13 bar: Target: 2.0 L/min.

Showers at 5.5 bar: Target: 8.0 L/min.

Water closet effective flush volume (single and dual): Target: 4.8 L/flush

Water closet effective flush volume (urinals): Target: 1.0 L/flush

#### OR

- Saudi Arabian Standards Organization (SASO) 1473 which has begun enforcement of new Water Efficiency Regulations and a SASO Water Efficiency Labelling programme for faucets, showers and toilets based upon their water efficiency consumption rates. Refer to SASO Table on pg. 53.
- Indoor Water Use Performance: reduce indoor water consumption and minimise load on wastewater systems through the installation of efficient fixtures, fittings and appliances.
  - Reduce indoor water consumption by at least 20% reduction over SASO Water Efficiency Labelling baseline

[W02] Water Efficiency (cont.)

## Mandatory Requirements:

SASO Maximum Flow Rates

#### Key:

LPM=litres per minute Lpf=litres per flush Lpc=low pressure condensate kPa=unit of pressure (kilopascal)



Product Type		Category	Customs Code HS Code	Maximum Flow Rate (L/Min)
		Mixer Taps for public Toilets	848180700000	1.9
Taps	Mixers	Mixer taps for private toilet	848180700000	6.0
		Kitchen mixer/taps	848180700000	6.0
		Bidet mixer/taps	848180700000	6.0
	Shower	head and taps	732490000000	9.5
	Flusher taps		84809000000	6.0
	Single	S trap	691010000005	3.0+0.5
	Flush	P trap		4.0+0.5
		S trap		(Dual Flush)
	dual flush		691010000005	Max. of the average is 3.0+0.5 as calculated by
Toilets with dual/		Bloom		(f+(5xL))/6 (S trap)
single flush system		P trap		(I+(3xL))/ 0 (3 trap)
				Max. of the average is
				4.0+0.5 as calculated by
				(f+(5xL))/6 (P trap)
				Full flush value shall not
				exceed 4.8 liters
	Flush system urinal		691090000000	1.0



[W02] Water Efficiency (cont.)

## **Mandatory Requirements:**

SASO Hydraulic Efficiency Grades

Product Type	Nomina (L	Water Efficiency Rate	
	9.5 ≥ Q nom > 8.0		В
Shower heads and shower taps/mixer taps	Q nom ≤ 8.0		A
	1.9 ≥ Q nom > 1.7		В
Taps/mixer taps for public toilets	Q nom ≤ 1.7		А
Taps/mixer taps	6.0≥(	Q nom > 5.0	В
for private toilets	Q nom ≤ 5.0		A
Toilets with dual/single flush system	(single flush)	3.0+0.5 (S trap) 4.0+0.5 (P trap)	A
	(Dual flush)	Max. of the average is 3.0+0.5 as calculated by (f+(5xL))/6 (S trap)  Max. of the average is 4.0+0.5 as calculated by (f+(5xL))/6 (P trap)  Full flush value shall not exceed 4.8 liters	A
Flush system urinal	1.0		В
	0.5 or waterless		A
Kitchen	6.0 ≥ Q nom > 5.0		В
taps	Q nom ≤ 5.0		A
Bidet taps	6.0 ≥ Q nom > 5.0		В
	Q nom ≤ 5.0		A
Flusher taps/	6.0 ≥ Q nom > 5.0		В
mixer taps	Qn	A	





[W03] Water Filtration

#### **Understanding**

The goal for filtration is to limit the presence of sediment and water-borne bacteria levels in water for human contact and consumption. Sediment filters can reduce the turbidity of water by removing suspended solids. This can solve appearance-based concerns of water quality and prepare the water for later stages of treatment. Once the water is of a low turbidity, UV disinfection systems are effective at destroying coliforms and other microbes.

#### **Mandatory Requirements**

As tenants receive drinking water from large refillable water jugs that are provided to the site.

No Mandatory Requirements



[W03] Water Filtration (cont.)



#### **Target Requirements**

(If drinking water is provided directly at the site consider the following)

#### **Provision of Drinking Water:**

• **Filtration:** Provide building occupants with access to mains supplied drinking water that incorporates filtration systems to maintain water quality and is supplied at both mains and chilled temperatures

**Filter Drinking Water:** All water from drinking water dispensers is treated within the building with the following:

- A filter designed to remove suspended solids with pore size 1.5 μm or less
- A UV disinfection system rated by NSF/ANSI Standard 55 (Class A or B) or a device rated by NSF/ANSI Standard 53 or 58 for cyst removal or reduction.
- A device rated by NSF/ANSI Standard 53 or 58 for copper and lead reduction





[W04] Equipment



#### **Understanding**

Addressing all areas within a building for potential water loss and recovery is important. By supporting high-performance, cost-effective project outcomes through an early analysis of the interrelationships among systems help to identify potential efficiencies. In some buildings, intensive appliance and process water use can exceed water use from fixtures and landscape combined. This is especially true for buildings with cooling towers or evaporative condensers.





[W04] Equipment (cont.)



#### **Mandatory Requirements-**

- 90 Percent of devices such as air handlers or cooling coils that generate condensate that collects it and are connected to network:
- 97 Percent of water retained (not lost through network leakages) within on-site transmission system: All water consuming Equipment must meet Energy Efficiency Label per Saudi Green Building Code SBC 1001, 2018.



[W04] Equipment (cont.)



#### **Mandatory Requirements (cont.)**

#### **Water Related Systems:**

- Water Budget: Perform a preliminary water budget analysis before the completion of schematic design that explores how to reduce potable water loads in the building and accomplish related sustainability goals. Assess and estimate the project's potential non-potable water supply sources and water demand volumes, including the following:
  - Indoor water demand: Assess flow and flush fixture design case demand volumes
  - Outdoor water demand: Assess landscape irrigation design case demand volume
  - **Process water demand**: Assess kitchen, laundry, cooling tower, and other equipment demand volumes, as applicable.
  - **Supply sources:** Assess all potential non-potable water supply source volumes, such as on-site graywater, municipally supplied non-potable water, and HVAC equipment condensate while minimal.



[W04] Equipment (cont.)





#### **Target Requirements**

#### **Appliance & Process Water Use:**

- Commercial Clothes Washers: CEE Tier 3A, Dishwashers-ENERGY STAR or performance equivalent, Prerinse valve sprays- (less than or equal)1.3 gpm (4.9 lpm),
- **Ice Machine:** ENERGY STAR or performance equivalent and use either air-cooled or closed-loop cooling, such as chilled or condenser water system.
- **Heat Rejection and Cooling:** No once-through cooling with potable water for any equipment or appliances that reject heat,
- Cooling Towers and Evaporative Condensers: Equip with makeup water meters, conductivity
  controllers and overflow alarms, efficient drift eliminators that reduce drift to maximum of 0.002% of
  recirculated water volume for counterflow towers and 0.005% of recirculated water flow for cross-flow
  towers.
- Cooling Towers: For cooling towers and evaporative condensers, conduct a one-time potable water analysis, measuring at least the five control parameters Ca (as CaCO3)-1000 ppm, Total alkalinity-1000 ppm, SiO2-100ppm, Cl-250 ppm, Conductivity-2000 µS/cm. (ppm = parts per million µS/cm = micro siemens per centimeter).

[W04] Equipment (cont.)



#### **Target Requirements**

#### **Provide Adequate Sink:**

Bathroom and kitchen sinks meet the following requirements:

- The sink column of water is at least 25 cm [10 in] in length (measured along flow of water, even if at an angle).
- The sink column of water is at least 8 cm [3 in] away from any edge of the sink.
- The sink basin is at least 23 cm [9 in] in width and length.

#### **Provide Handwashing Support:**

At all sink locations, the following are provided:

 Fragrance-free hand soap placed in dispensers with disposable and sealed soap cartridges., Paper towels for hand drying.





[W05] Moisture Control





#### **Understanding**

Through effective design of the building's glazing systems, plumbing assemblies and ventilation system, projects can make conditions inhospitable to mold, microbes and pests, reducing the risk to respiratory health. Mold often grows on cooling coils in HVAC systems due to moisture condensation and can be introduced into the building's indoor air. The project should include strategies for protecting the building from moisture intrusion and preventing occupants' exposure to mold spores. Develop strategies to prevent prolonged exposure of indoor air to wet/wettened surfaces contributing to moisture build up.

#### **Mandatory Requirements**

#### **Moisture Control Plan**

 Develop and implement a moisture control plan to protect stored on-site and installed absorptive materials from moisture damage.

#### **Permanent entryway system:**

 Consider permanent entryway systems that have solid backings and made with mold and mildew resistant materials.

#### **Storage of Absorptive Materials:**

Specify procedures for protecting stored and installed absorptive materials such as paper faced gypsum board
or lumber from moisture damage. Immediately remove from site and properly dispose of any materials
susceptible to microbial growth and replace with new, undamaged materials.

[W05] Moisture Control (cont.)



#### **Target Requirements**

#### **Manage Exterior Liquid Water:**

Provide a rain screen cladding system (e.g., a weather-resistant barrier integrated with flashing systems at penetrations and an air gap behind the cladding) is constructed to promote drainage and create passive ventilation to promote drying.

- Free-drainage: Design with integrated flashings to direct water to exterior(e.g., between exterior cladding, weather-resistant barriers in wall assemblies)
- Continuous air cavity: Ensure that is vented at bottom and top generates natural convection behind cladding and promotes drying
- Exterior insulation: Provides improved thermal and acoustical performance





[W05] Moisture Control (cont.)





#### **Target Requirements**

#### **Manage Interior Liquid Water:**

- To prevent leaks and water damage, one of the following is installed:
  - Readily accessible, single-throw manual shut-off (governed or activated per use)
  - Automatic shut-off at point-of-connection for all hard-piped fixtures (such as dishwashers, icemakers and clothes washers)
  - Building-wide plumbing leak detection system

#### **Isolate Moisture-sensitive Materials:**

- Address selection of moisture-tolerant materials and how moisture-sensitive materials are being protected, considering the following:
  - Exposed entryways and operable windows
  - Interior wall and ceiling assemblies in Bathrooms, Kitchens and High-humidity spaces
  - Provide mechanical exhaust for rooms that generate moisture

[W06] Drinking Water Promotion



#### **Understanding**

Research has shown that when the addition of drinking fountains is combined with education about the benefit of hydration or drinking water, consumption of plain water increases. The value of encouraging access to safe drinking water not only benefits the health and wellbeing of people it also helps to reduce excess waste from single use bottles.

## Mandatory Requirements Drinking Water:

 The building should have a minimum of one drinking fountain-water refilling station that is easily accessible by occupants.

#### Maintenance:

 Develop and implement daily maintenance procedures for drinking fountain-water refilling station.



[W06] Drinking Water Promotion (cont.)



#### **Target Requirements**

- Ensure Drinking Water Access: Provide at least one drinking water dispenser per floor located within 30 m [100 ft] walk distance of all regularly occupied floor area and in all dining areas.
- **Filtration:** Install appropriate filtration system at all drinking water dispensers.
- Water Bottles: All newly installed drinking water dispensers are designed for water bottle-refilling.
- Maintenance: The mouthpieces/outlets, protective guards and basins of drinking water fountains and dispensers is cleaned daily.
- Outdoor Access: Provide Outdoor Drinking Fountains



Outdoor Fountain



**Indoor Fountain** 

## **03 WATER** [W07] Metering





#### **Understanding**

Building-Level Water Metering allows the opportunity to support water management and identify opportunities for additional water savings by tracking water consumption. Disparities often exist between how buildings are designed to operate and how they perform. Metering of potable water usage will allow facilities management staff to monitor changes in water usage as efficiency measures are implemented.

#### **Mandatory Requirements**

#### Water Metering:

- Install water meters for monitoring internal and external water use, and to use the data to encourage
  effective management of consumption levels.
- Whole building: Provide meters at whole building level for the main supply and implement a submetering strategy.
- Sub-meter the following: At a minimum submeter potable water, process water and landscape.

[W07] Metering (cont.)



#### **Target Requirements**

#### **Sub-meter the following:**

- In addition to submetering potable water, process water and landscape. Consider additional sub-metering for:
  - Tenant spaces, water-based cooling systems, irrigation, showers, indoor and outdoor water features, external and internal hose bibs, indoor public water use, domestic hot water, boiler, reclaimed water, other process water.



Water Meters

[W08] Landscaping





#### **Understanding**

The intent behind reducing outdoor water consumption and landscape irrigation practices is because they consume large quantities of potable water, sometimes accounting for 30% to 70% of the water consumed in nonagricultural use. Good landscape design and use of native, adapted, and droughttolerant plants can dramatically reduce and even eliminate the need for irrigation while better integrating the building site into its surroundings and attracting native wildlife. Native plants also tend to require less fertilizer and fewer chemical pesticides, which degrade water quality when carried away in stormwater runoff. By developing a water budget that allows landscape professionals to consider the effects of the many design variables, such as plant types, planting density, and irrigation system elements is an affective way to address landscape water use.



[W08] Landscaping (cont.)



#### **Mandatory Requirements**

#### **Irrigation:**

- Outdoor landscape irrigation systems: Irrigation systems shall be designed and installed to reduce water use by 50% from a calculated midsummer baseline (404.1.1)
- Consider reductions achieved through plant species selection and irrigation system efficiency. Saudi Green Building Code SBC 1001 - 2018.
- Recycled resource: Utilise 100% of irrigation to come from the Sewage Treatment Plant (STP) as a recycled resource.
- **Smart controls:** The irrigation system is controlled by smart controllers, rain sensors and/or soil moisture sensors.
- **Reductions**: Additional reductions may be achieved using any combination of efficiency, alternative water sources, and smart scheduling technologies.





[W08] Landscaping (cont.)



#### **Target Requirements**

#### Landscaping:

- Current design allows for a maximum of 5% of plot area to be landscaped. Consider no turfed areas, only native landscaping on site and no outdoor water features.
- Demonstrate that the landscape does not require a permanent irrigation system beyond a maximum two-year establishment period.
- Utilise drought tolerant plant species and xeriscaping where possible



[W09] Drinking Water Quality – Ongoing Operations & Maintenance





#### **Understanding**

It is important to understand the quality of the water, the distribution and control of liquid water in a building. Understanding the potential contamination of water during the operational phases of a building involves careful building design and an operations team responsive to inspections and providing sensors which can help to mitigate the risks from water. The focus is on getting more people to increase the rate of adequate hydration in building users and reduce health risks due to contaminated water and excessive moisture within buildings through better awareness and maintenance of water quality and management. Water received as this site come from new desalinisation plants which tend to be reverse osmosis. WHO reporting states that while most systems remove a significant proportion of microbial pathogens, some pathogen transfer is possible.

#### **Target Requirements**

**Monitor Fundamental Water Parameters:** The water contaminants addressed are monitored at intervals of no less than once per year. Refer to <a href="https://v2.wellcertified.com/">https://v2.wellcertified.com/</a> for recommended monitoring period.

- Sediment Threshold: Turbidity less than or equal to 1.0 NTU
- Meet Microorganisms Threshold: Contains 0 CFU / 100 mL total coliforms (including E. coli)
- Monitor Fundamental Water Parameters are monitored at intervals of no less than once per year

[W09] Drinking Water Quality - Operations & Maintenance (cont.)





#### **Target Requirements (cont.)**

- Meet Herbicide and Pesticide Thresholds: Water delivered to the project for human consumption meets the following thresholds: Atrazine less than 0.003 mg/L., Simazine less than 0.002 mg/L. 2,4-Dichlorophenoxyacetic acid less than 0.07 mg/L.
- Meet Fertilizer Thresholds: Water delivered to the project for human consumption meets the following threshold: Nitrate less than 50 mg/L (11 mg/L as nitrogen).
- Meet Public Water Additive Thresholds: Water delivered to the project for human consumption meets
  the following thresholds: Fluoride less than 4 mg/L., Chlorine less than 4 mg/L., Chloramine less than 4
  mg/L.
- Meet Drinking Water Taste Properties: Water delivered to the project for human consumption meets the following thresholds: Aluminum between 0.05 and 0.2 mg/L, Chloride less than 250 mg/L., Fluoride less than 2 mg/L., Manganese less than 0.05 mg/L., Sodium less than 270 mg/L., Sulfate less than 250 mg/L., Iron less than 0.3 mg/L., Zinc less than 5 mg/L., Total Dissolved Solids less than 500 mg/L

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[W09] Drinking Water Quality - Operations & Maintenance (cont.)



#### **Target Requirements (cont.)**

Meet Dissolved Metal Thresholds: Water delivered to the project for human consumption are monitored annually and meets the following thresholds:

- Lead less than 0.01 mg/L.
- Arsenic less than 0.01 mg/L.
- Antimony less than 0.006 mg/L.
- Mercury less than 0.002 mg/L
- Nickel less than 0.07 mg/L.
- Copper less than 1.0 mg/L.
- Cadmium less than 0.005 mg/L.
- Chromium (total) less than 0.1 mg/L



Meet Organic Pollutant Thresholds: Water delivered to the project for human consumption are monitored annually and meets the following thresholds:

- Styrene less than 0.02 mg/L.
- Benzene less than 0.005 mg/L.
- Ethylbenzene less than 0.3 mg/L.
- Vinyl chloride less than 0.002 mg/L
- Toluene less than 0.7 mg/L.
- Xylenes (total: m, p and o) less than 0.5 mg/L
- Tetrachloroethylene less than 0.005 mg/L

[W09] Drinking Water Quality - Operations & Maintenance (cont.)





#### Target Requirements (cont.)

#### **Meet Disinfectant Byproducts**

**Thresholds:** Water delivered to the project for human consumption are monitored annually and meets the following thresholds:

- Total trihalomethanes (sum of dibromochloromethane, bromodichloromethane, chloroform and bromoform) less than 0.08 mg/L.
- Total haloacetic acids (sum of chloroacetic, dichloracetic, trichloracetic, bromoacetic and dibromoacetic acids less than 0.06 mg/L.

#### **Meet Herbicide and Pesticide Thresholds:**

Water delivered to the project for human consumption are monitored annually and meets the following thresholds:

- Atrazine less than 0.003 mg/L.
- Simazine less than 0.002 mg/L.
- 2,4-Dichlorophenoxyacetic acid less than 0.07 mg/L

#### **Meet Fertilizer Thresholds**

Nitrate less than 50 mg/L (11 mg/L as nitrogen)

#### **Meet Public Water Additive Thresholds**

- Fluoride less than 4 mg/L.
- Chlorine less than 4 mg/L
- · Chloramine less than 4 mg/L.

[W09] Drinking Water Quality - Operations & Maintenance (cont.)



#### **Target Requirements (cont.)**

#### **Meet Drinking Water Taste Properties:**

Water delivered to the project for human consumption are monitored annually and meets the following thresholds:

- Aluminum between 0.05 and 0.2 mg/L
- Chloride less than 250 mg/L.
- Fluoride less than 2 mg/L.d.
- Manganese less than 0.05 mg/L.
- Sodium less than 270 mg/L.
- Sulfate less than 250 mg/L.
- Iron less than 0.3 mg/L.
- Zinc less than 5 mg/L.
- Total Dissolved Solids less than 500 mg/L

#### **Test and Display Water Quality:**

- Lead
- Copper
- Turbidity
- Coliforms

Most recent water quality results are made available to occupants by Visual display or Hosting data on a website accessible to occupants.



Value and Benefits



#### **Overarching Statement**

People spend approximately 90% of their time indoors. Poor air quality and exposure to indoor pollutants leads to a variety of poor health outcomes, with both short- and long-term consequences. As a result, this section addresses air as an essential component of building occupant health and well-being.

Providing fresh, clean air requires consideration of the many potential pathways for air-born pollutants to occupied breathing zones. Outdoor pollutants can be minimised by limiting the source, controlling the pathways of outdoor air to occupied spaces and filtering the outdoor air before entering the breathing zones. Indoor pollutants impact on occupants can be minimised with source reduction, physical separation, exhaust, and dilution with clean air sources. All play important roles in maintaining safe, clean air quality for enhanced occupant health and well-being.

#### Key Performance Indicators



#### **Key Performance Indicators Intent**

The Air category, has several performance targets indicated. These are directly related to the KPI's for the project. To meet the requirements the design team should meet the air quality requirements through pollutant source reduction strategies and ongoing air quality performance testing.

The table to the right outlines the Air KPIs related to the individual Topic.

Topic	Related KPIs
[A01] Overall Air Quality	The following thresholds are met through performance testing following construction:  PM2.5 less than 25 µg/m3  PM10 less than 50 µg/m3  Formaldehyde less than 27 ppb  Total VOC less than 500 µg/m3  Carbon Monoxide less than 9 ppm  Ozone less than 51 ppb  Radon less than 0.15 Bq/L in the lowest occupied level of the project



Value and Benefits (cont.)

#### **Topics Covered**

[A01] Overall Air Quality

[A02] Indoor Air Quality

[A03] Air Filtration

[A04] Smoke-Free Environment

[A05] Pollution Infiltration Management

[A06] Source Separation





## **04 AIR**[A01] Overall Air Quality



#### **Understanding**

The overall air quality strategies are in place to provide acceptable levels of air quality for occupants of ILBZ buildings. Inhalation exposure to indoor pollutants can lead to a variety of poor health and well-being outcomes, including (but not limited to) head-aches, dry throat, eye irritation, asthma, respiratory disease, poisoning and cancer. Clean air for occupants is an essential aspect of a healthy building.

#### **Mandatory Requirements**

- Indoor Air Quality (IAQ) Management Plan: Develop and implement an IAQ Management Plan during construction stage and undertake building flush-out prior to occupancy.
- Indoor Air Quality (IAQ) Testing: A specialist contractor conducts IAQ testing for occupied areas and the
  end of construction, prior to occupancy.
- IAQ Testing: post construction, pre-occupancy testing for air pollutants in accordance with the SBC 1001 2018 VOCs Section 804.2

[A01] Overall Air Quality (cont.)

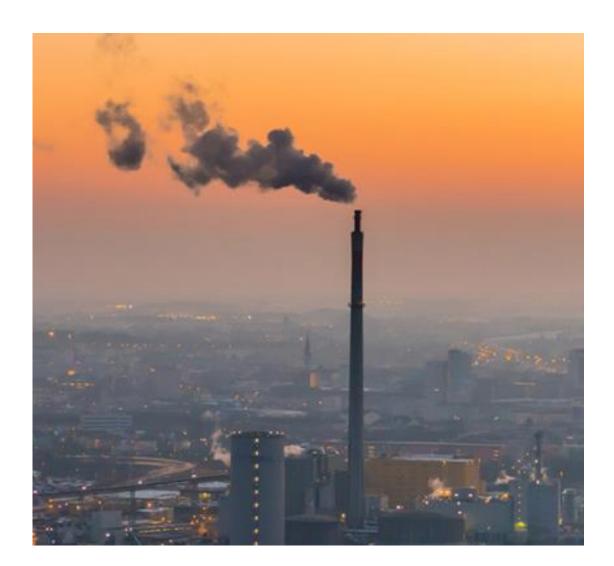


#### **Target Requirements**

The following thresholds are met through performance testing following construction:

- PM<sub>2.5</sub> less than 25 μg/m<sup>3</sup>
- PM<sub>10</sub> less than 50 μg/m<sup>3</sup>
- Formaldehyde less than 27 ppb
- Total VOC less than 500 µg/m³
- Carbon Monoxide less than 9 ppm
- Ozone less than 51 ppb
- Radon less than 0.15 Bq/L in the lowest occupied level of the project





### **04 AIR**[A02] Indoor Air Quality





#### **Understanding**

Life safety and odour management is maintained with "minimum acceptable levels" of outdoor air (OA) but improved indoor air quality can benefit health and productivity. Additional outside air through passive, natural ventilation as well as advanced ventilation strategies can achieve these goals (when OA quality permits), without increasing cooling energy consumption.

#### **Mandatory Requirements**

- Outdoor air levels to meet, at a minimum, the supply rates described by ASHRAE 62.1 2010.
- When outdoor air conditions permit (i.e. PM<sub>2.5</sub> and PM<sub>10</sub> levels are moderate), natural ventilation to be encouraged via operable windows. Confirm that natural ventilation is an effective strategy for the project by following the flow diagram in the Chartered Institution of Building Services Engineers (CIBSE) Applications Manual AM10, March 2005, Natural Ventilation in Nondomestic Buildings

Note: Outdoor air quality can be monitored in real-time from sites such as: <a href="https://www.iqair.com/ca/saudi-arabia/ar-riyad/riyadh">https://www.iqair.com/ca/saudi-arabia/ar-riyad/riyadh</a>

[A02] Indoor Air Quality (cont.)



#### **Target Requirements**

- Demand control ventilation system: CO<sub>2</sub> sensor are installed in all densely occupied areas of the building larger than 50m<sup>2</sup>. The systems are capable of modulating the fresh air supply rates for those areas based on sensor feedback, through an appropriate ventilation system such as a variable air volume (VAV) box.
- Displacement ventilation system: Implemented for heating and/or cooling based on ASHRAE
  Guidelines RP-949, REHVA Guidebook No. 01, or ASHRAE UFAD Guide: Design Construction and
  Operations of Underfloor Air Distribution Systems.



## **04 AIR**[A03] Air Filtration



#### **Understanding**

The annual average PM<sub>2.5</sub> rating for the region typically far exceeds WHO recommendations. Exposure to high PM levels can lead to respiratory conditions that lead to illness or death. Therefore, adequate indoor air quality requires that mechanically ventilated spaces implement air filtration and document a maintenance protocol for installed filters. Improving central air filtration to a minimum of MERV 13 has also been recommended by ASHRAE as an effective means of reducing air-born pathogens, such as SARS-CoV-2 causing COVID-19.

#### **Mandatory Requirements**

- Minimum MERV 13 (ePM<sub>1</sub>) filter media for all air intakes
- Sand traps to be provided in all air intake outlets
- Set operations and maintenance manual for filter cleaning and replacement frequency.



[A03] Air Filtration (cont.)



#### **Target Requirements**

- Minimum MERV 13+ (ePM<sub>1</sub>) filter media for all air intakes
- Filter is equipped with on-board pressure sensors or filter change indicator that signal when filter requires replacement
- Activated carbon filters or a combination of particulate/carbon filters in the main air ducts to filter recirculated air -OR- a standalone aircleaning device that utilises a carbon filter to treat the air.





[A04] Smoke Free Environment

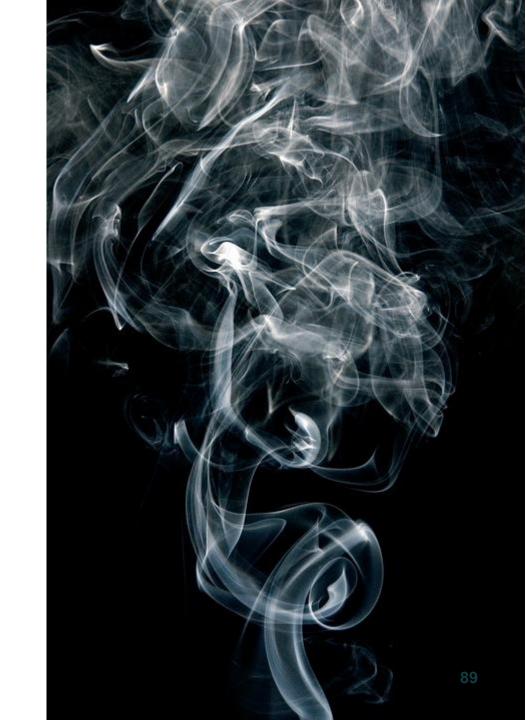


#### **Understanding**

Exposure to tobacco smoke is an important cause of ill health for both smokers and those exposed the secondhand smoke. Inhalation of tobacco smoke can lead to significant health issues, such as asthma attacks, respiratory infections, coronary heart disease, stroke, and cancer. The most effective way to limit exposure to tobacco smoke at ILBZ is to provide a 100% smoke-free environment for occupants in both indoor and outdoor spaces.

#### **Mandatory Requirements**

- Indoor: Smoking and the use of e-cigarettes is prohibited in interior spaces.
- Outdoor: Smoking is prohibited within 7.5m of all entrances, operable windows, and building air intakes – or in a designated smoking area.
- Signage: Signage to be provided to clearly communicate these bans.



#### [A05] Pollution Infiltration Management



#### **Understanding**

When outdoor air quality is poor, there is need for measures that minimise or prevent the introduction of potentially harmful substances into indoor spaces via unintended pathways. Indoor air quality and thermal comfort can be compromised by leaks and gaps that break the building's air barrier. As well, pollutants can be transferred to occupied spaces by the occupants themselves.

#### **Mandatory Requirements**

Create a pollution infiltration management plan to consider:

- Envelope commissioning
- OA intakes
- Vehicle Idling
- Permanent Entryway Systems
- Attached parking Garages





[A05] Pollution Infiltration Management (cont.)



#### **Target Requirements**

- **Envelope commissioning**: To be performed in accordance with ASHRAE Guideline 0-2013 and the National Institute of Building Sciences (NIBS) Guideline 3-2012 by an independent professional (see aligned recommendation in section 02 Energy Commissioning).
- OA intakes: To be located at minimum separation distance from pollutant sources (see SBC 601 2018 Table 8.1 for recommended distances).
- Vehicle Idling: Prohibit vehicle idling at site. Appropriate enforcement signage, visible from loading zones, to be provided. Consider Fleet Vehicles to be electric, check 09 Site – Parking for further clarification.
- **Permanent Entryway Systems**: Must catch and hold dirt particles and prevent contamination of the building interior. Acceptable permanent entryway systems include: Permanently installed grates, Grilles, Slotted systems that allow for cleaning underneath, and Rollout mats that are cleaned on a regular basis.
- Attached parking Garages: Limit vehicular exhaust entry, maintain garage pressure below adjacent occupiable spaces, use vestibule to provide airlock, and/or limit migration of air from garage to occupied spaces.

# **04 AIR**[A06] Source Separation



#### **Understanding**

Many harmful pollutant sources with the potential to negatively impact our indoor air quality, are used/stored within our buildings. Strategies are required that isolate the key sources of odours, germs, pollution or humidity through doors or dedicated exhaust.

#### **Mandatory Requirements**

Source Separation: Identify potential sources of indoor air pollutants and create a separation
management and harm reduction plan to minimise negative indoor air quality impacts to any adjacent,
regularly occupied spaces.

#### **Target Requirements**

Source Separation: All bathrooms, kitchens, rooms for cleaning and chemical storage, rooms with high-volume printers and copiers, and high humidity areas to be separated from regularly occupied spaces with self-closing doors and/or vestibules

#### -OR-

utilise exhaust fans so that return air is expelled outdoors rather than recirculated.

# INDOOR ENVIRONMENT QUALITY (IEQ)

#### **05 INDOOR ENVIRONMENTAL QUALITY**

Value and Benefits



#### **Overarching Statement**

Good indoor environmental quality balances visual, acoustic and thermal comfort. Spaces that embody these attributes are calming, satisfying, more productive, and have great overall benefit to human health. The practices outlined in this section of the guideline can minimise the negative effects of glare and bright light, hot or cold exposure and loud noises or vibrations.

#### **Topics Covered**

[IEQ1] Daylight

[IEQ2] Visual Quality

[IEQ3] Visual Comfort

[IEQ4] Thermal Comfort

[IEQ5] Acoustic Comfort



#### Add image



# **05 IEQ** [IEQ1] Daylight

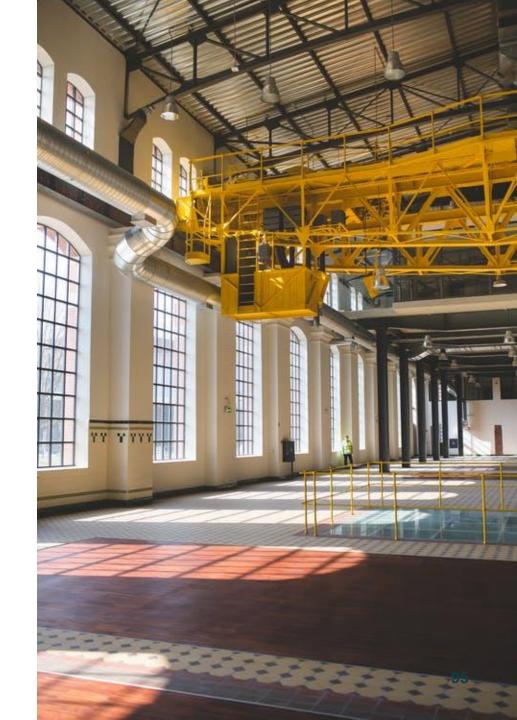


#### **Understanding**

The intent is for projects to design spaces to integrate daylight into indoor environments so that daylight may be used for visual tasks along with electric lighting. It also provides individuals with a connection to outdoor spaces through view windows. Exposure to daylight has been proven to have a substantial impact on mood, circadian health and productivity. Indoor daylight access and balance with solar heating gains should be accounted for at all stages of building planning from architectural and façade design to interior design and layout.

#### **Mandatory Requirements**

 Daylight design to comply with Section 808 Daylighting of SBC 1001 – 2018.



### **05 IEQ**[IEQ1] Daylight



#### **Target Requirements**

- Daylight: Design buildings which maximise the use of natural light, minimise glare and visually connect to the outdoors to enhance health, productivity and learning. Design minimum daylight illuminance of 300 lux is achieved for at least 75% of regularly occupied areas. Glazing: The glazing has a minimum light transmittance value of 40% and a maximum solar factor (g-value) of 35%
- Access to Daylight: To connect building occupants with the outdoors, reinforce circadian rhythms, and reduce the use of electrical lighting by introducing daylight into the space. Provide manual or automatic (with manual override) glarecontrol devices for all regularly occupied spaces.



# **05 IEQ**[IEQ2] Visual Quality



#### **Understanding**

Visual abilities of individuals are dependent on the properties of the lighting environment and the light entering the eye. Visibility and the ability to perform a task require a minimum threshold of illuminance, which may be achieved by incorporating electric lighting with adequate daylighting strategies. As well, using electric light with high color rendering can improve people's perception of a space, and low color rendering can impact the ability to differentiate between objects and perceive the surroundings accurately. Identifying and utilising lighting fixtures that emit a high quality of light and do not display signs of flicker contributes to a comfortable and healthy space.

#### **Mandatory Requirements**

- Visual Acuity: All indoor and outdoor spaces (including transition areas) comply with illuminance recommendations specified in one of the following lighting reference guidelines; IES Lighting Handbook 10th Edition, EN 12464-1: 2011. ISO 8995-1:2002(E) (CIE S 008/E:2001) or GB50034-2013
- **Develop lighting plan:** That addresses tasks or activities considered for visual lighting design in the project. All tasks and activities regularly undertaken by occupants are considered, target of illumination and Age ranges for the majority of occupants.

#### **05 IEQ**

[IEQ2] Visual Quality (cont.)



#### **Target Requirements**

All electric lighting (excluding decorative fixtures, emergency lights and other special-purpose lighting) used in regularly occupied spaces shall comply with the following:

- Color Rendering Index Quality: Shall have a CRI ≥ 80
- Manage Flicker: Meet at least one of the following requirements for flicker:
  - A minimum frequency of 90 Hz at all 10% intervals from 10% to 100% light output.
  - LED products with a "low risk" level of flicker (light modulation) of less than 5%, especially below 90 Hz operation as defined by IEEE standard 1789-2015 LED.
- Task Lighting: Provide user task lighting at each workstation and specialty functions within the warehouse space as appropriate.



# **05 IEQ**[IEQ3] Visual Comfort



#### **Understanding**

Visual glare can impair our ability to complete a task safely and comfortably. As well, visual glare has been associated with a host of health issues that range from visual discomfort and eye fatigue to headaches and migraines. As such, glare management is an integral part of lighting design. Minimising solar and electric lighting glare through space planning and lighting design will lead to an improved visual experience of the occupants in the space.

#### **Mandatory Requirements**

Manage Solar Glare: For all regularly occupied spaces exterior envelope glazing to have shading (atria
or lobbies may be excluded) and the shading is controllable by the occupants or set to automatically
prevent glare.



#### **05 IEQ**

[IEQ3] Visual Comfort (cont.)



#### **Target Requirements**

- Manage Glare from Electric Lighting: Each luminaire meets one of the following requirements for regularly occupied spaces:
  - Shielding angles required based on luminance (<20,000 cd/m² no shield, 20,000 to 50,000 cd/m² 15°, 50,000 to 500,000 cd/m² 20°, >500,000 cd/m² 30°)
  - 100% of light is emitted above the horizontal plane.
  - Fixture illuminance that does not exceed 10,000 cd/m<sup>2</sup> between 45 and 90 degrees from nadir, and/or fixture luminous intensity that does not exceed 1,000 candela between 45 and 90 degrees from nadir.
  - Unified Glare Rating (UGR) values are met as per the below conditions:
    - Luminaires installed at a height of 5 m or lower meet UGR of 19 or lower.
    - Luminaires installed at a height greater than 5 m meet UGR of 22 or lower.



# **05 IEQ**[IEQ4] Thermal Comfort





#### **Understanding**

The intent is for projects to create indoor thermal environments that provide comfortable thermal conditions to the majority of people in support of their health, well-being and productivity.

#### **Mandatory Requirements**

• Thermal environmental conditions: Buildings shall be designed in compliance with ASHRAE Standard 55 - 2013 Sections 6.1 "Design" and 6.2 "Documentation"

#### **Target Requirements**

• Support Thermal Environment: During 98% of the standard occupied hours of the year, 95% of regularly occupied spaces achieve thermal conditions representing Predicted Mean Vote (PMV) levels within +/- 0.5; PPD ≤ 10% (as per ASHRAE 55-2013, ISO 7730: 2005 or EN 15251:2007).

#### **05 IEQ**

[IEQ4] Thermal Comfort (cont.)



#### **Target Requirements (cont.)**

- Ensure Thermostat Control: All regularly occupied spaces: 1) contain thermal zones (min 1 thermal zone per 60m<sup>2</sup>), 2) temperature sensors are positioned at least 1m away from direct sunlight, air supply diffusers, mechanical fans, windows and doors, or any other significant source/sink of heat, and 3) all regular building occupants have control over temperature through thermostats or digital interface.
- Manage Relative Humidity All parts of the project except high-humidity areas meet one of the following requirements: The mechanical system has the capability of maintaining relative humidity between 30% and 60% at all times by adding or removing moisture from the air.



## **05 IEQ**[IEQ5] Acoustic Comfort



#### **Understanding**

Acoustic comfort can bolster occupant health and well-being through the identification and mitigation of acoustical comfort parameters that shape occupant experiences in the built environment.

#### **Mandatory Requirements**

- Background Noise Level: An architectural drawing is provided that indicates the projected background
  noise level (dBA or NC) attributable to HVAC equipment noise, external noise intrusion or a similar source
  (e.g., a floor plan is color-coded to indicate dBA levels between regularly occupied spaces or across
  façade elements).
- Acoustic Privacy: An architectural drawing is provided that indicates the projected acoustical performance of typical walls that separate regularly occupied spaces throughout the project (e.g., STC/R<sub>w</sub>, NIC/D<sub>w</sub> or equivalent sound transmission metrics denoted on a partition schedule from an architectural drawing set)

#### **05 IEQ**

[IEQ5] Acoustic Comfort (cont.)



#### **Target Requirements**

- Background Noise Level: Background noise levels do not exceed Average SPL (L<sub>eq</sub>) dBA 50 & dBC 75 for open workspaces and dBA 45 & dBC 70 for enclosed spaces/offices.
- Sound Reducing Ceilings: Ceiling finishes that meet the minimum NRC/ $\alpha_w$  values for open workspaces (0.7 for at least 75% of available ceiling area) and conference rooms (0.7 for at least 50% of available ceiling area).
- Sound Reducing Vertical Surfaces: Wall finishes that meet the minimum NRC/ $\alpha_w$  values for offices/dining/conference (0.7 for at least 25% of available wall area).



Reference: https://v2.wellcertified.com/

Value and Benefits

#### **Overarching Statement**

The Materials category focuses on minimising the embodied energy and other impacts associated with the extraction, processing, transport, maintenance, and disposal of building materials. In addition, the overarching goal is to reduce human exposure to hazardous building material ingredients through the restriction or elimination of compounds or products known to be toxic and the promotion of safer replacements.

#### **Topics Covered**

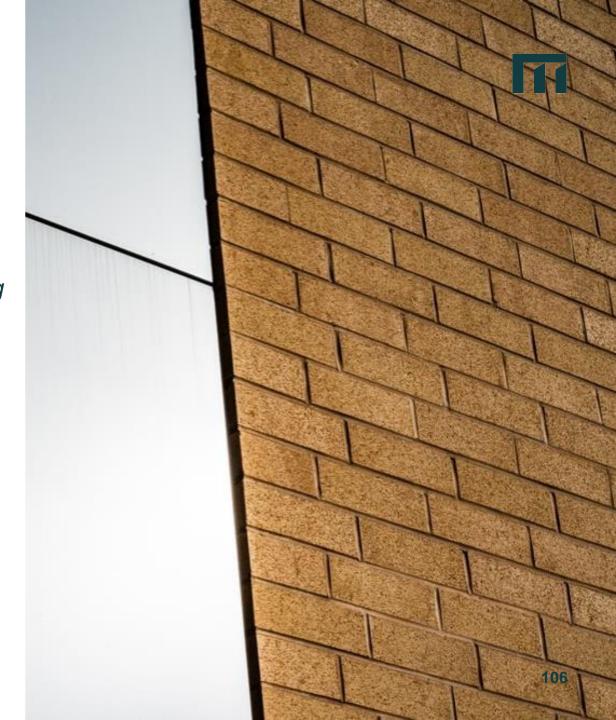
[M01] VOC's

[M02] Building Life Cycle Impacts

[M03] Material Sourcing

[M04] Material Ingredients





**Key Performance Indicators** 





#### **Key Performance Indicators Intent**

In the Materials Sourcing category, you will note several performance targets indicated. These are directly related to the KPI's for the project. To meet the requirements the design team should specify materials and the associated targets for the project. During construction it will be important to work with the contractor to ensure that they manage track and meet these targets.

The table to the right outlines the Material KPIs related to each individual Topic.

Topic	Related KPIs
[M02] Building Life Cycle Assessment	Target final design materials that have had a life cycle assessment undertaken; 10 of the twenty most design-specific prevalent materials by volume and / or area to have an LCA performed
[M03] Material Sourcing	Target 55% of total building materials used in the project, based on cost shall be used materials, recycled content, rapidly renewable recyclable materials, bio-based materials, and/or indigenous material
[M03] Material Sourcing	To support the local economy and reduced transportation impacts, specify products so that by costs 40% of construction materials are sourced within KSA.
[M03] Material Sourcing	Specify and target 25% of non-potable water used in concrete production
[M03] Material Sourcing	Target 95% of wood purchased by cost used for construction that has FSC or PEFC certification
[M04] Material Ingredients	Target: 80% of blinding and sub-base by volume produced from recycled waste materials

[M01] Volatile Organic Compounds (VOC's)





#### **Understanding:**

Mitigate associated exposure and health hazards to humans by the restriction and elimination of identified VOCs commonly used in building materials and products thereby reducing their presence in indoor air quality is highly recommended and encouraged.

#### **Mandatory Requirements: VOCs and Low-Emitting Materials:**

- Adhesive and Sealants: A minimum of 95% (by volume or weight) of all adhesives and sealants used building interior must not exceed the VOC limits of the South Coast Air Quality Management District (SCAQMD) Rule 1168. Newly applied adhesives, sealants, applied inside the building meet all VOC emission thresholds set by the California Department of Public Health (CDPH) Standard Method v.1.2-2017 for VOC emissions.
- Paints and Coatings: A minimum of 95% (by volume or weight) of all paints and coatings used in the building interior must not exceed the VOC limit of the South Coast Air Quality Management District (SCAQMD) Rule 1113, Green Seal GS-03 & GS-11. Newly applied paints and coatings applied inside the building meet all VOC emission thresholds set by the California Department of Public Health (CDPH) Standard Method v.1.2-2017 for VOC emissions.

[M01] Volatile Organic Compounds (VOC's)(cont.)



#### Mandatory Requirements: VOCs and Low-Emitting Materials: (cont.)

- Formaldehyde: Recommend that all newly installed components contain ureaformaldehyde at less than 100 ppm or the extent allowable by local code: Composite wood products, Laminating adhesives and resins, Thermal insulation.
- Suspended Ceiling Systems: All internal suspended ceiling systems must have a maximum formaldehyde limit of 13.5 ppb or (16.5 ug/m3).
- Flooring and Insulation Emissions: (90% by cost) All newly installed flooring and thermal and acoustic insulation inside the building meet the following VOC emission thresholds: California Department of Public Health (CDPH) Standard Method v.1.2-2017.



[M01] Volatile Organic Compounds (VOC's)(cont.)



#### **Target Requirements-Manage VOC's:**

- Flame Retardants: Recommend that all newly installed components contain halogenated flame
  retardants at less than 100 ppm or the extent allowable by local code: Furniture, Window and
  waterproofing membranes, door and window frames and siding, Flooring, ceiling tiles and wall coverings,
  Piping and electrical cables, conduits and junction boxes, Sound and thermal insulation.
- Phthalates: Recommend that all newly installed components contain phthalates at less than 100 ppm or the extent allowable by local code: Flooring, including resilient and hard surface flooring and carpet, Wall coverings, window blinds and shades, shower curtains, furniture and upholstery, plumbing pipes and moisture barriers.
  - Recommend that all newly installed electrical components contain phthalates at less than 1000 ppm or the extent allowable by local code in the following: Fire alarms, meters, sensors, thermostats and load break switches.

[M02] Building Life Cycle Assessment (LCA)





#### **Understanding:**

LCA is a "compilation and evaluation of the inputs and outputs and the potential environmental impacts of a product system throughout its life cycle. The entire life cycle of a product (or building) is examined, the processes and constituents identified, and their environmental effects assessed—both upstream, from the point of manufacture or raw materials extraction, and downstream, including transportation, use, maintenance, and end of life. This may be called "cradle to grave." products going directly into the landfill. Another term, "cradle to cradle" emphasises recycling and reuse at the end of life rather than disposal.

#### **Mandatory Requirements**

- Comply with Saudi Green Building Code SBC 1001, 2018 (section 505.3)
- Whole Building Life Cycle Assessment: LCA shall conform to ASTM E921 (including operational energy), demonstrate project achieves 20% improvement in environmental performance.
  - For new buildings, conduct life cycle assessment (LCA) to assess potential environmental impacts of building elements and materials through their service life. Demonstrate a reduction in material use through the service life of the building.
  - Target final design materials that have had a life cycle assessment undertaken; consider ten of the twenty most design-specific prevalent materials by volume and area.

[M02] Building Life Cycle Assessment (LCA)(cont.)



#### **Target Requirements**

- EPD's: Specify Materials that have Environmental Product Declarations which conform to ISO 14025, 14040, 14044, and EN 15804 or ISO 21930 and have at least a cradle to gate scope.
- **Third Party:** Specify third party certified products that demonstrate impact reduction below industry average in at least three of the following categories:
  - In global warming potential (greenhouse gases)
  - In CO2e; depletion of the stratospheric ozone layer
  - In kg CFC-11; acidification of land and water sources
  - In moles H+ or kg SO2; eutrophication
  - In kg nitrogen or kg phosphate; formation of tropospheric ozone
  - In kg NOx, kg O3 eq, or kg ethene; and depletion of nonrenewable energy resources in MJ.



[M03] Material Sourcing





#### **Understanding:**

Raw material extraction has a direct environmental impact on Earth's ecosystems. Unmanaged extraction practices can cause not only deforestation but also degradation of water sources, habitat loss, threats to rare and endangered species, releases of toxic chemicals, and the infringement of indigenous peoples' rights. In addition to seeking the responsible sourcing of virgin materials, teams are also encouraged to reduce raw material usage by selecting reused and recycled materials for selecting products to have been extracted or sourced in a responsible manner.

Mandatory Requirements: Comply with Saudi Green Building Code SBC 1001, 2018 (section 505)

- Material Selection: 55% of total building materials used in the project, based on cost shall be used materials, recycled content, rapidly renewable recyclable materials, bio-based materials, and/or indigenous materials.
- **Local Economy:** To support the local economy and reduced transportation impacts, specify products so that 40% of construction materials are sourced within KSA.
- Concrete: Specify and target 25% of non-potable water used in concrete production.

[M03] Material Sourcing (cont.)



#### **Target Requirements**

• Wood: Target 95% of wood purchased used for construction that has FSC or PEFC certification.







[M03] Material Sourcing (cont.)





#### **Target Requirements**

- Material Sourcing: Use a variety of different permanently installed products from at least five different
  manufacturers that have publicly released a report from their raw material suppliers which include raw
  material supplier extraction locations, a commitment to long-term ecologically responsible land use, a
  commitment to reducing environmental harms from extraction and/or manufacturing processes, and a
  commitment to meeting applicable standards or programs voluntarily that address responsible sourcing
  criteria.
- Leadership Extraction Practices: Review design concepts and identify opportunities to use and procure biobased, qualified wood as well as salvaged and recycled-content materials and products covered by extended producer responsibility.
- Select Optimised Material: All newly installed furnishings, built-in furniture, interior finishes and finish materials comply with some combination of the following programs:
  - Declare: Living Building Challenge Red List Free,
  - Declare: Living Building Challenge Compliant or Living Product Challenge label,
  - Cradle to Cradle Material Health Certified with a V2 Gold or Platinum or V3 Bronze, Silver, Gold or Platinum Material Health Score.

[M03] Material Sourcing (cont.)





#### **Target Requirements (cont.)**

- Space Flexibility: 75% of nonstructural elements (by Area) of the building has some of the following design flexibility strategies:
  - Demountable walls or moving partitions,
  - Modular or unfinished flooring and ceiling,
  - HVAC, Electrical, and Plumbing systems have the capability to adapt to spaces flexibility with minimal level of change.
  - Moveable or modular furniture.





[M04] Material Ingredients





The goal to minimise the use of hazardous building material ingredients on indoor air quality, and to help support the demand for safer chemical alternatives is important to protect the environment and health impacts of workers. In response to growing concerns over hazardous material and product ingredients, several different systems have been introduced to the market to help differentiate safer alternatives.

#### Mandatory Requirements: Saudi Green Building Code SBC, 1001, 2018

- Prohibited Materials: asbestos, urea-formaldehyde foam insulation (805.1)
- Low VOC: adhesives and sealants (806.2), paints and coatings (806.3), flooring (806.4), ceiling and wall systems (806.5), insulation (806.6).
- Non-Polluting Insulation Materials: All insulation (thermal and acoustic) must meet the following:
  - Be manufactured without the use of chlorofluorocarbons (CFCs) or hydrochlorofluorocarbons (HCFCs)
  - Have an Ozone Depletion Potential of zero (ODP=O) and a Global Warming Potential of less than five (GWP less than or equal 5.
  - Have 13.5 parts per billion (ppb) or less of added formaldehyde.
  - Be non-toxic and not release toxic fumes during combustion.

[M04] Material Ingredients (cont.)





#### **Mandatory Requirements:**

- Recycled Content: Target 30% recycled content by cost (combined post-consumer and post-industrial content) for all building materials.
- Steel & Aggregates: Target 25% minimum percentage of recycled content by cost for all steel reinforcement and aggregates used in construction.
- Blinding and Sub-base: Target: 80% by volume of blinding and sub-base produced from recycled waste materials.



[M04] Material Ingredients (cont.)





#### **Target Requirements**

- Restrict Asbestos: Specify building materials that contain asbestos less than 1% by weight:
  - Thermal insulation, surfacing materials and Wallboard/millboard, resilient floor covering, roofing and siding shingles (including metal cladding) and construction mastics.
- **Limit Mercury:** Specify that newly installed Low-mercury or mercury-free lamp technology meets the recommended maximum mercury content. This includes that illuminated exit signs, thermostats, switches and electrical relays are mercury-free.
- Restrict Lead: Drinking water systems and plumbing products are lead-free as defined by the Safe Drinking Water Act (SDWA) and certified by an ANSI Accredited third-party certification body.
  - Indoor paints and surface coatings contain less than 90 ppm total lead.
- Chemical Inventory: Specify products that use any of the following programs to demonstrate the chemical inventory of the product to at least 0.1% (1000 ppm).
  - Health Product Declaration, Cradle to Cradle, Greenscreen v1.2 Benchmark, Cradle to Cradle certified, International Alternative Compliance Path-REACH Optimisation.

[M04] Material Ingredients (cont.)





#### **Target Requirements**

- Limit Hazardous Materials: For all newly installed building materials, specify that the following building
  products and material types contain less than 100 ppm added lead.
  - Doors and door hardware, Ductwork, Conduits, Metal studs, Mirrors/glass, Roofing or flashing, Brass cooler drains, pumps, motors and valves, Vinyl blinds or wallcovering.
  - All newly installed electrical components: fire alarms, meters, sensors, thermostats and load break switches, meet the maximum concentration Lead (Pb): less than 1000 ppm, Mercury (Hg): less than 100 ppm, Cadmium (Cd): less than 100 ppm, Hexavalent Chromium: (Cr VI) less than 1000 ppm.
- Promote Ingredient Disclosure: All newly installed interior finishes and finish materials, furnishings (including workstations) and built-in furniture have some combination of the following material descriptions, with ingredients identified and disclosed to 1,000 ppm:
  - Declare Label, Health Product Declaration, Any screening and hazard disclosure method accepted in USGBC's LEED v4 MR credit: Building Product Disclosure and Optimisation - Material Ingredients, Option 1: material ingredient reporting.

Value and Benefits



#### **Overarching Statement**

Incorporating recycling infrastructure early in the design process encourages successful recycling once operations begin. Well-designed and accessible waste management infrastructure that anticipates how and where waste will be discarded helps occupants make recycling their default behavior.

The waste hierarchy remains; source reduction, reuse, recycling, and waste to energy as the four preferred strategies for reducing waste.

#### **Topics Covered:**

[WM1] Recycling and Diversion





**Key Performance Indicators** 





#### **Key Performance Indicators Intent**

In the Waste category, you will note several performance targets indicated. These are directly related to the KPI's for the project. To meet the requirements the tenant's operational team should develop strong polices, procedures and plans to implement a robust recycling process at your site. This includes strategies such as diversion, recycling and composting of organic waste at your site.

The table to the right outlines the Waste KPIs related to each individual Topic.

Topic	Related KPIs
[WM1] Recycling and Diversion	Develop an Operational Waste Diversion Strategy which diverts at least 50% of mass(Kg) of operational waste (by mass) from landfill via recycling or reuse
[WM1] Recycling and Diversion	Target 50% of materials by mass (Kg) that may be recycled and labelled as such-ISO14021. Recyclable materials to include; corrugated cardboard, mixed paper, wood, glass, plastics, and metal to be sold for recycling
[WM1] Recycling and Diversion	Target 10% by mass (Kg) of organic waste (include food waste) to be partly composted and recovered for nutrients and used as fertilizer on site. Residual waste to be recovered for energy outside KKIA-ILBZ or disposed on landfill.
[WM1] Recycling and Diversion	Target 50% by mass (Kg) for the safe collection, storage, and disposal: batteries, mercury-containing lamps and other generated hazardous waste, as well as electronic waste (by mass).

Recycling and Diversion



#### **Understanding**

In many regions materials that are all recyclable such as paper, food, glass, metals, and plastics make up the largest portion municipal solid waste. By diverting such recyclable waste from landfills, building owners can not only reduce hauling costs but also help convert recyclables into new products, reducing demand for virgin materials. Incorporating recycling infrastructure early in the design process encourages successful recycling once operations begin. Well-designed and accessible waste management infrastructure that anticipates how and where waste will be discarded helps occupants make recycling their default behavior.



[WM1] Recycling and Diversion



#### **Mandatory Requirements**

- Waste Management & Recycling: Create waste recycling areas as per jurisdiction. If services are not available, complete necessary preparation to accommodate future recycling.
- Operational Waste Management: Develop an Operational Waste Diversion Strategy which diverts at least 50% of operational waste (by mass) from landfill via recycling or reuse.
- **Dedicated Recycling Areas**: Provide dedicated areas accessible to waste haulers and building occupants for the collection and storage of recyclable materials for the entire building. Provide clearly labeled segregated waste bins throughout the site.
- **Recycling:** Target 50 percent of materials by mass (Kg) that may be recycled and labelled as such-ISO14021. Recyclable materials to include the following.
  - Recyclable materials/fractions: Corrugated cardboard, mixed paper, wood, glass, plastics, and metal to be sold for recycling.
- Recoverable materials: Target 10% by mass (Kg) of organic waste (include food waste) to be partly composted and recovered for nutrients and used as fertilizer on site. Residual waste to be recovered for energy outside KKIA-ILBZ or disposed on landfill.
- **Hazardous waste:** Target 50% by mass (Kg) for the safe collection, storage, and disposal: batteries, mercury-containing lamps and other generated hazardous waste, as well as electronic waste (by mass).

Value and Benefits



#### **Overarching Statement**

Kingdom of Saudi Arabia (KSA) and consumers are understanding the health impacts associated with food consumption and physical exercise.

These moves are heavily influenced by the rising economic burden of the lifestyle disorders which has made the region amongst the unhealthiest in the world. Health and Wellness is just one of many sectors in which the Saudi Government is investing. The Kingdom has been extremely prudent in understanding how wellness is intrinsically linked to business performance and ultimately economic growth.

#### **Topics Covered:**

[HW1] Biophilia and Culture

[HW2] Food and Nutrition

[HW3] Community - Access and Safety

[HW4] Movement and Activity





Biophilia and Culture



#### **Understanding**

Biophilia and Culture are linked in that combined they can help support a healthy community that is thriving and inspiring for all.

**Culture** is represented by creating "Sense of Place", for all that work and visit the ILBZ site. The ability to understand and characterise the relationship between people and spatial settings.

**Biophilia** is the importance of implementing design features that supports the needs of humans to have an innate tendency to seek connections with nature and other forms of life.





[HW1] Biophilia and Culture (cont.)



#### **Understanding(cont.)**

Biophilia - Biophilic urbanism has progressed the path in which nature is more purposefully brought back into cities and projects. This is not just between buildings and infrastructure, but also into the physical interior spaces which can provide connectivity between people and nature and provide local context. Scientific research and studies have effectively demonstrated that humans need to connect with nature in order to maintain physical and mental health in the modern urbanized world. These studies have defined specific geometrical properties found in the structure of nature and in the built environment which have a positive and uplifting influence on human physical and mental conditions. These properties applied to design can therefore enhance the quality of life for people.





[HW1] Biophilia and Culture (cont.)

#### **Mandatory Requirements**

- Heritage and Culture: To promote design practices that reflect KSA's cultural and regional heritage, promote local traditions and showcase authentic KSA architecture and vernacular.
  - Specify local materials such as stone cladding on building.
- Outdoor Space: Provide outdoor spaces within the project boundary that is adequately sized to accommodate, at a minimum 25% of the design occupancy of the building. Provide seating, landscaping, vegetation and adequate shading for pedestrians.



[HW1] Biophilia and Culture (cont.)



#### **Target Requirements**

- Indoor Vegetation: Develop and implement a strategy incorporating features of indoor vegetation in the building and incorporate living green walls with low maintenance vegetation where possible.
- Provide Access to Nature: Integrate and encourage occupant access to nature within the building and
  project site by the use and installation of Plants, Water, Light, Nature, Indirect connection to nature
  through use of natural materials, patterns, colors or images, space layout. Addressing placement of
  natural elements along common circulation routes, shared seating area and rooms to enhance occupant
  exposure.
- Provide Restorative Indoor Spaces: Provide designated indoor space to all regular building occupants
  to support restorative practice for the practice of contemplation, relaxation and restoration. Spaces should
  address Accessible design, Lighting (e.g., dimmable light levels), Intrusive noise and Sound masking
  (e.g., water feature, natural sounds), Thermal comfort, Nature elements, Calming aesthetics, and Visual
  privacy.

[HW2] Food and Nutrition

#### **Understanding**

The Global Burden of Diseases, Injuries, and Risk Factors (GBD) study showed that in Saudi Arabia, the average levels of consumption of fruits, vegetables, nuts, whole grains, and seafood were less than optimal, and the average levels of consumption of processed meats, red meats, total fatty acids, and sodium were higher than optimal. Poor nutrition is a major contributor to and modifiable risk factor of numerous preventable chronic diseases. Dietary patterns around the world are influenced by a complex mixture of personal, cultural and environmental factors, including the local food environment.

The relationship between the local food environment and healthy consumption is interrelated. By designing in healthier options within your food services can have a positive and lasting impact on your employees.



[HW2] Food and Nutrition (cont.)





#### **Mandatory Requirements**

Ensure Fruit and Vegetable Availability: Work with your food caterer or supplier and when food is provided or sold at your site, ensure that the selection includes a variety of fruits and vegetables as specified. This may include:

- Packaged foods: Provide at least two varieties of fruits and vegetables
- Prepared Foods: Provide at least four varieties of fruits and at least four varieties of vegetables.
- Promote Visibility: When fruit and Vegetable foods are sold or provided make them visible to the building occupants.



[HW2] Food and Nutrition (cont.)





#### **Target Requirements**

- **Nutritional Information:** Provide nutritional information including; Total calories, Macronutrient content (total protein, total fat and total carbohydrate) in weight and as a percent of the estimated daily requirements (daily values), Total sugar content.
- **Ingredient Labeling:** Provide a list of primary ingredients that is clearly displayed at point-of-decision on packaging, menus or signage.
- Refined Ingredient: Provide Labeling of foods and beverages sold or provided on site are
  prominently labeled at point-of-decision to indicate high sugar content or partially hydrogenated oils.
- Mindful Eating: Tenants are encouraged to provide Designated Eating Spaces for employees.
- Food Preparation: Provide employee dining spaces that includes:
  - Cold storage, Countertop surface, Sink and amenities for dish and hand washing, Device for reheating food (e.g., microwave, toaster oven), Dedicated cabinets or storage units available for employee use and Reusable eating utensils, including spoons, forks, knives and microwave-safe plates and cups.

[HW3] Community- Access and Safety



#### **Understanding**

**Communities** are characterised by groups of people with diverse characteristics who are linked by social ties, share common perspectives and engage in joint action and experiences in shared settings or locations. Designing built spaces in a way that enables all individuals to access, participate and thrive within the systems and structures of each community is essential to shaping individual and collective health outcomes.

It is key for project teams to consider design approaches that address the physical determinants of health and well-being by making buildings inclusive, accessible and safe for all. Accessible spaces are not just compliant with code but also incorporate universal design principles that support diverse ability and mobility and encourage people of all backgrounds to use a space.



[HW3] Community- Access and Safety





#### **Understanding**

**Safety** measures in the form of Emergency Management Plans can enhance communication, minimise confusion and improve personnel coordination during emergency situations. Establishing an effective emergency management plan requires awareness of local conditions and potential hazards, the needs of vulnerable groups and building response capabilities. Providing a database of building emergency equipment and supplies, an emergency notification system or readily accessible emergency resources such as first aid kits and defibrillators can increase response time and help improve survival.





[HW3] Community- Access and Safety



#### **Mandatory Requirements**

- Access for All: Ensure that all occupants and visitors of varied physical abilities have easy access to all building facilities per local code requirements. Consider applying Universal Design principles.
- Safety and Security: Develop and implement a Safety and Security Strategy that includes: Building assessment and identification of risk factors and Mitigation Strategy and details of methods applied as per the tenant's unique situation.



[HW3] Community- Access and Safety (cont.)



#### **Target Requirements**

- Integrate Universal Design: Design project to comply with universal design principles as guidance to accommodate a diverse range of occupant abilities.
  - Physical access: Accommodate entry and exit points to enable entrance to the space, flexible use of space and usability beyond the requirements of local laws or code
  - Developmental and intellectual health: Develop strategies that use color, texture, images and other perceptible information to support individuals with varying cognitive abilities (e.g., learning disabilities)
  - Wayfinding: Incorporate strategies to help individuals intuitively navigate through spaces (e.g., signage, maps, symbols, mobile and digital technologies, information systems)
  - **Inclusion:** Develop and implement operational programs and processes (e.g., braille, auditory cues) that are inclusive of individuals with disabilities,
  - Technology: Offer technology (e.g., audio and visual equipment, web access) that incorporates the
    needs of individuals with disabilities, made available to all occupants at no cost,
  - **Safety:** Remove barriers to safety to reduce anxiety, and to support easy access to all built features and spaces.

[HW4] Movement and Activity



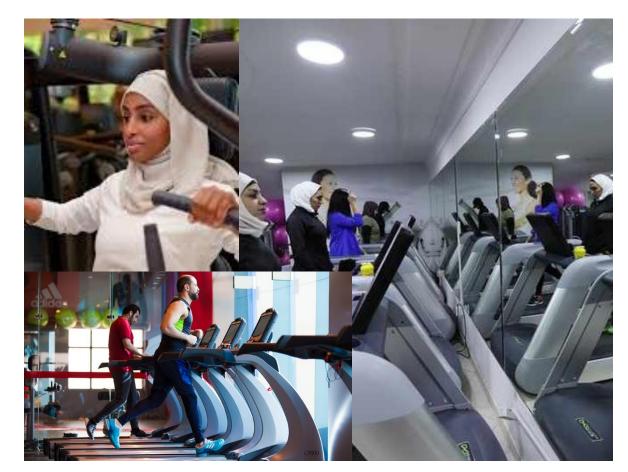


#### **Understanding**

Physical inactivity, has emerged as a primary focus of public health due to a rise in premature mortality and chronic diseases attributed to, type 2 diabetes, cardiovascular disease, depression, stroke, dementia and some forms of cancer.

Saudi Vision 2030 targets to improve the ratio of individuals exercising once a week from 13% to 40% to not only increase the awareness and importance of exercise but to also implement strategies to increase workplace activity.

Within the ILBZ, tenants and design professionals can focus on creating spaces that enhance and encourage health and well-being. When done well these strategies keep people moving, supports personal health and inspire their best work.



[HW4] Movement and Activity (cont.)



#### **Mandatory Requirements**

- Active Lifecycle: If stairwells are designed within the space, then provide an aesthetically pleasing stairwell for accessing at least the first or second floor of the building.
  - Exterior Active Design: Provide On-site pedestrian destinations such as:
    - Covered outdoor plazas or open-air space that provides seating and biophilic elements.
    - A walking path or trail
    - Trees, planters and/or other landscaped elements

#### **Target Requirements**

 Education: Provide education that discusses the importance of physical activity and workstation ergonomics. This might include trainings, brochures, videos, postures, pamphlets, newsletters or other written or online information.





[HW4] Movement and Activity (cont.)



#### Target Requirements (cont.)

- **Physical Exercise:** Building occupants have convenient access to either a gym or other method of physical exercise.
- Circulation Networks: Consider aesthetically pleasing design elements for Stairwells and Corridors:
  - Aesthetics: Music, Artwork, Light levels of at least 215 lux [20 fc] when in use, Views of an interior atrium, courtyard or daylight via windows or skylights, Natural design elements (e.g., plants, water features, images of nature)., Gamification.
  - **Signage:** Implement point-of-decision signage that encourages stair use.
  - Visibility: Promote Visible Stairs which are located either physically or visibly before elevators/ escalators.





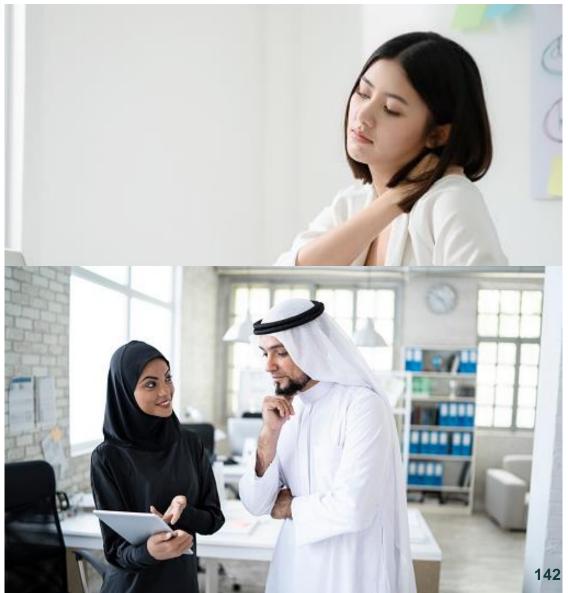
[HW4] Movement and Activity (cont.)

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#### **Target Requirements (cont.)**

- **Ergonomics:** Implement strategies that address:
  - Provide computer monitors at workstations, including laptops with adjustability.
  - Provide desks with sit stand capabilities
  - Ensure seating can adjust easily to the user
  - Provide standing support such as footrests or footrails and anti-fatigue mats or cushions
- **Self-Monitoring:** Provide subsidized Self-Monitoring tools that address:
  - Watches or devices for employees to track their physical activity and personal metrics. Metrics may include steps, active minutes or intensity, distance, activity type or floors climbed.





## SITE

#### **09 SITE**

#### Value and Benefits



#### **Overarching Statement**

The Site Category addresses the potential of heat gain of hardscapes within a hot climate zone along with pervious surfaces to support rainwater runoff. Also addressed is strategies which rewards thoughtful decisions about building location, alternative transportation and parking, pedestrian access and connection with amenities. This category specifically addresses on-site ecosystem services, features of the surrounding community and how this infrastructure affects occupants' behavior and environmental performance.

#### Topics to be covered

[S01] Rainwater Management

[S02] Site Lighting

[S03] Urban Heat Island

[S04] Transportation / Mobility / Parking





#### 09 Site

Key Performance Indicators





#### **Key Performance Indicators Intent**

In the Transportation / Mobility / Parking category, you will note performance targets indicated. These are directly related to the KPI's for the project. To meet the requirements the tenant's design and operational team should develop a comprehensive parking plan to include preferred parking for carpool/flexcars, ultra low emission and electric vehicles. While not a KPI, consideration should also be given to the infrastructure to support a growing electric fleet.

The table to the right outlines the Site KPIs related to each individual Topic.

Topic	Related KPIs
[S02] Site Lighting	Uplight: Target 3% maximum of the project not to exceed the percentages shown (page 149-table top right) of total lumens emitted above horizontal plain
[S02] Site Lighting	Light Trespass: Target 2 lux maximum to not exceed the vertical illuminances (page 149-table bottom right) at the lighting boundary. Calculation points may be no more than 1.5m apart. Vertical illuminances must be calculated on vertical planes running parallel to the lighting boundary with the normal to each plane oriented toward the property, extending from grade to 10m above the height of the highest luminaire.
[S04] Transportation / Mobility / Parking	Parking: Do not exceed minimum code requirements for parking capacity and provide 15% of parking spaces for carpool/flex cars, Ultra Low Emission high mpg Vehicles and non fossil fuel vehicles.

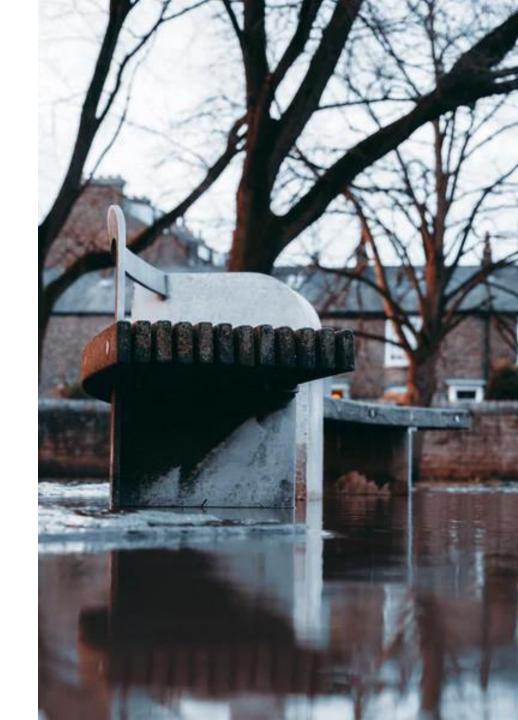
[S01] Rainwater Management



#### **Understanding**

Rainwater runoff happens when there is water overflow from the ground or roof causing excess stormwater or rainwater overflow. This runoff can cause flooding and dispersion of pollutants onto other properties and site boundaries. By utilising companion strategies such as pervious pavements, open grid paving systems and open graded aggregate systems, green roofs or stormwater collection swales or basins allows this runoff water to soak into the ground as opposed to runoff.

Rainwater management is the process that reduces runoff. These strategies include detaining, retaining and providing a discharge point for rainwater to be infiltrated into the ground water.



[S01] Rainwater Management (cont.)





#### **Mandatory Requirements:**

**Sewage, Flood and Rainwater Management:** Ensure appropriate sewage strategy is in place and to minimise the risk of localised flooding, surface water run-off and water body that cause pollution during peak rainwater discharge.

- Increase pervious surfaces onsite to promote filtration. Pervious pavement and permeable unit paving shall have infiltration rate not less than 82 LPM/m2. Saudi Green Building Code SBC 1001, 2018
- Changes to rain and flood patterns as a result of climate change should be considered for the life of the design.

#### **Target Requirements**

**Reduce Runoff:** Rainwater Management Reduce runoff volume and improve water quality by replicating the natural hydrology and water balance of the site, based on historical conditions and undeveloped ecosystems in the region. In a manner best replicating natural site hydrology processes, manage on site the runoff from the developed site for the 95th percentile of regional or local rainfall events using low-impact development (LID) and green infrastructure.

## **09 SITE**[S02] Site Lighting



#### **Understanding**

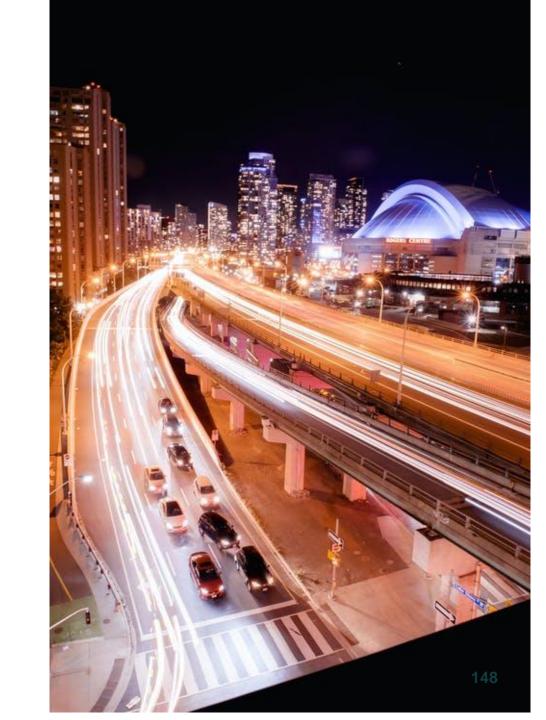
Light Pollution Reduction intent is to increase night sky access, improve nighttime visibility, and reduce the consequences of development for wildlife and people.

#### **Mandatory Requirements**

- Light Pollution Control, Uplight, and Light Trespass and Glare
  - Project must comply with Saudi Green Building Code SBC 1001 - 2018 section 409 Site Lighting.

#### **Target Requirements**

 Classify the project under one lighting zone using the lighting zones definitions provided in the Illuminating Engineering Society and International Dark Sky Association (IES/IDA) Model Lighting Ordinance (MLO) User Guide.



[S02] Site Lighting (cont.)



#### **Target Requirements (cont.)**

- Uplight: Project not to exceed the percentages shown (tabletop right) of total lumens emitted above horizontal plain.
- Light Trespass: Do not exceed the vertical illuminances (table bottom right) at the lighting boundary. Calculation points may be no more than 1.5m apart. Vertical illuminances must be calculated on vertical planes running parallel to the lighting boundary with the normal to each plane oriented toward the property, extending from grade to 10m above the height of the highest luminaire.
- Internally Illuminated Exterior Signage: Do not exceed a luminance of 200 cd/m² (nits) during nighttime hours and 2000 cd/m² (nits) during daytime hours.

MLO lighting zone	Maximum allowed percentage of total luminaire lumens emitted above horizontal
LZ0	0%
LZ1	0%
LZ2	1.5%
LZ3	3%
LZ4	6%

MLO lighting zone	Vertical illuminance
LZ0	0.05 fc (0.5 lux)
LZ1	0.05 fc (0.5 lux)
LZ2	0.10 fc (1 lux)
LZ3	0.20 fc (2 lux)
LZ4	0.60 fc (6 lux)



[S03] Urban Heat Island



#### **Understanding**

By increasing the solar reflectance of the urban surface such as roofs or pavement helps to reduce the solar heat gain, lowers surface temperatures, and decreases the outflow of thermal infrared radiation into the atmosphere. Building materials, such as cool roofs reduce cooling-energy use in air-conditioned buildings and increases comfort in unconditioned buildings; and cool roofs and cool pavements mitigate summer urban heat islands, improving outdoor air quality and comfort. Dark-colored parking lot surfaces trap heat, raising ambient air temperatures, which in turn necessitate more energy for cooling.



[S03] Urban Heat Island



#### **Mandatory Requirements:**

- **Design Hardscape SRI:** Solar Reflectance Index (SRI) for at least 50% of site, hardscape materials to have SRI value of not less than 30 [Section 408.2] Saudi Green Building Code SBC 1001, 2018
- **Heat Island Effect:** Improve the microclimate through appropriate material selection, Specify three-year aged Solar Reflectance Index (SRI) values for the hardscape, shade structures and roofs should meet:
  - Hardscape 90% has an SRI ≥ to 45.,
  - Shade structures: 100% has an SRI ≥ to 75.
  - Roofs has an SRI ≥ to 75.
- Heat Island Reduction: Implement roof and nonroof strategies to minimise effects on microclimates and human and wildlife habitats by reducing heat islands. Non roof measures to include:
  - Plantings, shading, vegetated structures, reflective paving materials, covered pathways and parking structures.



[S04] Transportation / Mobility / Parking



#### **Understanding**

When integrated into the ILBZ's surrounding community, a building can offer distinct advantages to owners and building users. For the tenant proximity to street networks creates walkable and bikeable locations which can enhance health by encouraging daily physical activity.

When encouraging development in locations shown to have multimodal transportation choices or otherwise reduced motor vehicle use, you are helping to reduce greenhouse gas emissions, air pollution, and other environmental and public health harms associated with motor vehicle use.

Parking demand can be reduced by locating projects places well served by transit, or by instituting transportation demand management strategies, such as providing preferred parking for carpools.





[S04] Transportation / Mobility / Parking



#### **Mandatory Requirements**

- **Parking:** Do not exceed minimum code requirements for parking capacity and provide 15% of parking spaces for carpool/flex cars, Ultra Low Emission high mpg Vehicles and non fossil fuel vehicles.
- **Bicycles:** If GFA>929 m2 provide long-term bicycle parking and storage and onsite changing room and shower facilities (1/20 bike parking spaces) [Section 407.2] Saudi Green Building Code SBC 1001, 2018
- HOV priority parking: If GFA>929 m2 for 5% parking spaces [Section 407.4] Saudi Green Building Code SBC 1001, 2018



[S04] Transportation / Mobility / Parking (cont.)



#### **Target Requirements**

- Green Vehicles: Designate over 15% of all parking spaces used by the project as preferred parking for green vehicles.
  - Distribute preferred parking spaces proportionally among various parking sections between short-term and long-term spaces.
  - Provide alternative-fuel fueling stations such as Electric Vehicle Charging or Install liquid or gas alternative fuel fueling facilities or a battery switching station.
  - On-site fleet to have at least one yard tractor that is powered by electricity, propane, or natural gas and create policies to reduce truck idling.
- Sustainable Commuting: Install Electric Vehicle Supply Equipment (EVSE) for at least 3% of site parking. Parking must be fully shaded and reserved for the use of electric vehicles OR 6% of total parking spaces are within the project boundary are Electric Vehicle (EV) ready.
- Sustainable Operations: Implement either 50% or 100% electric sustainable operational transport for material-handling equipment.

[S04] Transportation / Mobility / Parking (cont.)



#### **Target Requirements**

- Access to Quality Transit: Locate any functional entry of the project within a 1/4-mile (400-meter) walking distance of existing or planned bus, streetcar, or rideshare stops, or within a 1/2-mile (800-meter) walking distance of existing or planned bus rapid transit stops, light or heavy rail stations or commuter rail stations.
- Access to Public Transportation: Design building entrances for pedestrians located within 200 meters of bus stop or metro/commuter rail.
- Access to Amenities: Provide a pedestrian entrance within 350m safe walking distance to a mosque or grocery store.



Value and Benefits

#### **Overarching Statement**

**Construction Sourcing** is to give preference to the purchase of materials that boost the local economy and provide the added benefit of reduced transportation impacts.

**Construction Waste Management** addresses reducing the long-term environmental impacts associated with the disposal of construction ad demolition waste by recovering, reusing and recycling materials.

Construction Environmental Management goal is to reduce adverse environmental and social impacts of construction activities by implementing environmental management best practices.

#### Topics to be covered

[C01] Material Sourcing

[C02] Construction Waste Management

[C03] Construction Environmental Management



**Key Performance Indicators** 



## **Key Performance Indicators Intent**

In the Construction category, you will note several performance targets indicated. These are directly related to the Material KPI's for the project. To meet these requirements the construction team should ensure that purchased materials will comply with the associated targets for the project.

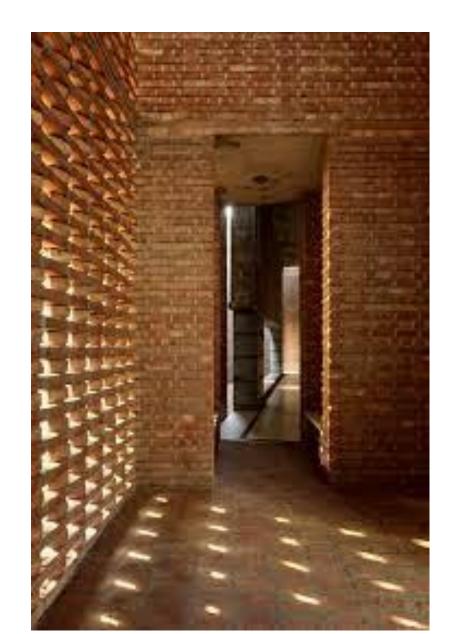
Topic	Related KPIs
[C01] Construction - Material Sourcing	Target 50% of materials by mass that may be recycled and labelled as such (based on ISO 14021 Standard for Environmental Labels and Declarations)
[C01] Construction - Material Sourcing	Target 30% of recycled content by dollar value (combined post-consumer and post-industrial content)
[C01] Construction - Material Sourcing	Target 80% of final design materials that have had a life cycle assessment undertaken, consider only the twenty most design-specific prevalent materials by volume and area.
[C01] Construction - Material Sourcing	Target 25% of non-potable water used in concrete production
[C01] Construction - Material Sourcing	Target 50% of wood purchased used for construction that has FSC, PEFC certification and Target 5% of materials in fit-out from rapidly renewable sources (e.g. biocomposites) By area finally installed.
[C01] Construction - Material Sourcing	Target 80% of blinding and sub-base produced from recycled waste material

[C01] Construction-Material Sourcing

#### **Understanding**

Supporting the sourcing of materials within your local community can have a significant and positive outcome in the construction process. When materials are sourced locally, the product has less distance to travel to the site reducing the overall carbon footprint. In addition, materials such as stone that is sourced locally encourages vernacular building styles, supports the local economy, and connects users directly with the impacts of their choices.





[C01] Construction - Material Sourcing



#### **Mandatory Requirements**

- Construction Materials: Target 50% of materials by value that may be recycled and labelled as such (based on ISO 14021 Standard for Environmental Labels and Declarations)
- Target 30% of recycled content by value (combined post-consumer and post-industrial content)
- Target 80% of final design materials that have had a life cycle assessment undertaken, consider only the twenty most design-specific prevalent materials by volume and area.
- Target 25% of non-potable water used in concrete production.
- Target 50% of wood purchased used for construction that has FSC, PEFC certification.
- Target 5% of materials in fit-out from rapidly renewable sources (e.g. biocomposites) By area finally installed.
- Target 80% of blinding and sub-base produced from recycled waste material
- Construction local materials: Use of materials that are extracted, processed and/or manufactured within the Gulf Cooperation Council area.



[C02] Construction - Waste Management



#### **Understanding**

Reducing waste at the source is one strategy to address waste management because it avoids environmental harms throughout a material's life cycle, from supply chain and use to recycling and waste disposal.

Source reduction encourages the use of innovative construction strategies, such as prefabrication and designing to dimensional construction materials, thereby minimising material cutoffs.

Other areas of focus include stringent construction waste management goals that are set at the beginning of the project and managed and tracked throughout the duration of the construction phase.









#### **Mandatory Requirements**

- Waste: Saudi Green Building Code SBC 1001, 2018. Develop strategies to ensure that a minimum of 50% of nonhazardous construction waste shall be diverted from the landfill.
- Management Plan: Develop a Campus Wide Construction and Demolition Waste Management Plan (CDWMP).

#### **Target Requirements**

• **Waste:** Develop strategies to ensure that over 50% up to 95% of nonhazardous construction waste shall be diverted from the landfill.



[C03] Construction – Environmental Quality



#### **Understanding**

To promote the well-being of construction workers and building occupants by minimising indoor air quality problems associated with construction and renovation. Construction activities adversely affect indoor air quality (IAQ) when they generate dust, toxic substances, or other contaminants, which can cause health problems not only for construction workers but also those who occupy the building long after construction is complete. Incorporating IAQ best practices during construction can protect building occupants from airborne pollutants, toxins and dust associated with the construction process.





[C03] Construction – Environmental Quality (cont.)





#### **Mandatory Requirements**

**Indoor Air Quality (IAQ) Management Plan:** Develop and implement a Construction IAQ Plan for the construction and preoccupancy phases of the building. Ensure that the following is addressed:

- **SMACNA:** During construction, meet or exceed all applicable recommended control measures of the Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guidelines for Occupied Buildings under Construction, 2nd edition, 2007, ANSI/SMACNA 008–2008, Chapter 3.
- **Moisture:** Protect absorptive materials stored on-site and installed from moisture damage.
- **Filtration:** Do not operate permanently installed air-handling equipment during construction unless filtration media with a minimum efficiency reporting value (MERV) of 8, as determined by ASHRAE 52.2–2007.
- **Tobacco:** Prohibit the use of tobacco products inside the building and within 25 feet (7.5 meters) of the building entrance during construction.
- Moisture: Develop and implement a moisture control plan to protect stored on-site and installed absorptive materials from moisture damage.





#### **Mandatory Requirements**

- Construction Environmental Management Plan: Develop and Implement a Construction Environmental Management Plan (CEMP) to address environmental and social impacts of construction activities The implementation of the CEMP should address the following:
  - Comprehensive Environmental Impact Assessment (EIA)
  - Construction Control Plan
  - Construction noise pollution monitoring plan
  - Construction Waste Management Plan (required see Construction Waste section)
  - Energy and water consumption reduction plan
  - Water Conservation
  - Site Audit Plan
  - Construction materials transportation and procurement plan







#### **Mandatory Requirements**

- **Develop Construction Activity Pollution Prevention Policy.** Policy plan should address the following:
  - To reduce pollution from construction activities by controlling soil erosion, waterway sedimentation, and airborne dust.
  - Ensure that all projects implement erosion and sedimentation control (ESC) measures during construction.
  - Local code requirements may be followed if they are equally stringent or more stringent than the CGP and NPDES.



# Compliance Pathways

#### Compliance Pathways



This compliance pathway document is intended to serve as a proof of concept and guide for ILBZ tenants to achieve two of the key recommended sustainability measures outlined in the Tenant Sustainability Guidelines: **Net Zero Carbon** and **Water Efficiency.** 

#### 1. Net Zero Carbon

The net zero carbon pathway outlines calculation methodologies for estimating on-site, annual energy consumption and carbon emissions for tenant buildings as well as options for offsetting with on-site renewable energy or, if necessary, off-site carbon credits.

The pathway calculations highlight that warehouse buildings have a relatively low energy footprint, making it possible to offset annual carbon by covering as little as 31% of the roof with PV when following the Sustainability Guideline's *Target Requirements*(49% when following *Mandatory Requirements*), providing an opportunity for net-positive carbon design. Light Industrial buildings have higher energy requirements resulting in carbon offset strategies including maximum rooftop PV coverage, shading structure PV coverage, and possibly offsite carbon credits.



#### Compliance Pathways



Typical buildings will be a hybrid of these space types, and the Apple DC case study shows that net zero carbon can be achieved with approximately 54% rooftop coverage. The compliance pathway illustrates that the high-performance envelope, lighting, equipment, and other strategies outlined as *Target Requirements* in the Energy section of the Sustainability Guidelines are extremely beneficial to achieving net zero carbon.

Note: Individual calculations/simulations unique to the design will be required for each tenant building to comply with the Net Zero Carbon guideline.

#### 2. Water Efficiency

The water efficiency pathway outlines calculation methodologies for comparing indoor water use performance with a SASO baseline to achieve water saving goals exceeding 10% better.

A case study example shows that the use of low flow flush fixtures as recommended by the Design Guidelines can result in indoor water savings exceeding 25%.







# Net Zero Carbon Compliance Pathway

#### Compliance Pathways – Net Zero Carbon





#### Pathway to Net Zero Carbon

This pathway is a series of compliance checks performed to show potential pathways to achieving the Target Requirements of net zero carbon for a tenant site.

Net zero carbon for the site is defined as offsetting the carbon consumed through Scope 1 and 2 emissions (on-site energy consumption) with on-site renewable energy, or offsite carbon credits.

The preferred path is to produce enough on-site renewable energy each year to offset the year's energy consumption (net zero site energy). For some high-energy building types, it is acknowledged that it may not be feasible to produce enough on-site renewable energy to achieve net zero site energy. Thus, the off-site carbon credits offer an opportunity to achieve net zero carbon.

#### **EMISSIONS**

**Direct:** natural gas, diesel, biogas, and others.



**Indirect:** electricity grid, district heating/cooling.

### AVOIDED EMISSIONS

**Off-site Green Power:** renewable energy credits.



**On-site Green Power:** solar PV, wind, solar thermal, others.



#### Compliance Pathways – Net Zero Carbon

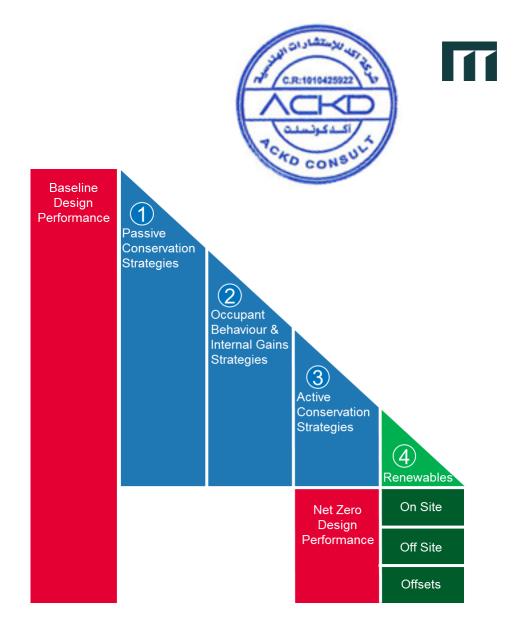
The first step in achieving a net zero carbon design is to minimise the emissions through energy consumption at the site level. This can be achieved through three steps:

- 1. Passive Design Strategies
- 2. Occupant Behavior and Internal Gain Strategies
- 3. Active Conservative Strategies

Once the emissions from building energy consumption are minimised, a practical application of onsite renewable energy strategies can be applied.

The Tenant Sustainability Guidelines offer a number of energy and emission reduction strategies to achieve the overall net zero carbon goal.

It is acknowledged that some building types require more energy and therefore are more difficult to achieve net zero. For this reason, a range of common ILBZ building types and performance scenarios were considered.



#### Compliance Pathways – Net Zero Carbon



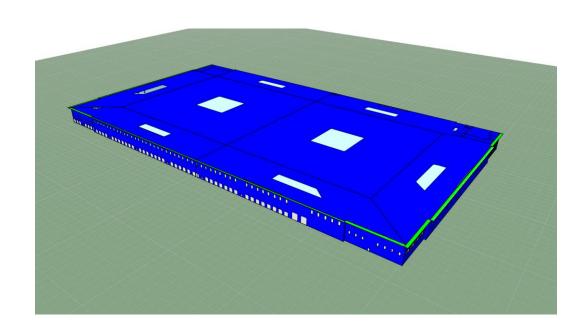
The net zero carbon compliance pathway considers two common ILBZ building types for comparison:

- 1. A low-energy consuming Warehouse building, and
- A high-energy consuming Light Industrial / Manufacturing building.

The compliance pathway study then considers two performance scenarios for each building type as outlined in the Tenant Sustainability Guidelines:

- 1. Compliance with **Mandatory Requirements**
- 2. Compliance with **Target Requirements**

The energy and emissions for each building type has been predicted using hourly, whole-building energy simulation software (IES VE). For each typology/performance scenario, the predicted energy and carbon performance is compared to potential rooftop photovoltaic energy production to determine if on-site net-zero carbon is achievable.





Compliance Pathways – Net Zero Carbon

#### **Building Type 1: Warehouse**

For the warehouse building prototype, it was assumed that 97% of the floor area was storage-type warehouse and the remaining 3% office.

The key characteristics of a warehouse building type are the low occupancy (20 m²/occ for office & 100 m²/occ for warehouse) and equipment (2.6 W/m²) loads and moderate lighting loads (6.4 W/m²).

#### **Warehouse – Mandatory Requirements**

The initial model inputs were assumed to meet the **Mandatory Requirements** outlined in the Tenant Sustainability Guidelines. When not defined by the guidelines, it was assumed that the building complies with SBC 601/1001 (2018) & ASHRAE 90.1. These inputs, and other model assumptions are summarised in the model input table to the right.

Construction	1 storey   Slab on Grade
Location   Climate	Riyadh, Saudi Arabia   SAU_Riyadh.404380_IWEC.epw
Primary Space Types   Occupancy	Warehouse, Office (97%/3% Warehouse/Office) Design day occupants: 20 m²/occ (Office); 100 m²/occ (Warehouse)
Temperature & Humidity Set Points	Warehouse: Heating – None  Cooling – 27°C (continuous) Office: Heating – None  Cooling – 24°F Setpoint, 27°C Setback
Occupancy Schedule	24/7 (warehouse); M-F 8:00 am to 6:00 pm (office)

Envelope	
Above Grade Wall Performance	USI-0.193 (as per SBC 601)
Roof Performance	USI-0.369, SRI=0.64 (as per SBC 601)
Gross Window to Wall Ratio	4%
Gross Skylight to Roof Ratio	6%
Glazing Performance	USI-2.89, SHGC: 0.25 (as per SBC 601)
Skylight Performance	USI-1.7, SHGC: 0.21 (as per SBC 601)
Building Air Leakage	0.2462 l/(s*m²-envelope) @ 5 Pa (as per SBC 1001)
Space Level	
Equipment Load	2.57 W/m <sup>2</sup> area-weighted average (2.15 W/m <sup>2</sup> warehouse/16.15 W/m <sup>2</sup> office)
Lighting Power Density	6.37 W/m <sup>2</sup> area-weighted average (6.24 W/m <sup>2</sup> warehouse/10.55 W/m <sup>2</sup> office)
Occupant Load (Sensible/Latent)	73.3 W/person, 58.6 W/person (office)

System Level – Warehouse and Office	
HVAC Type	Packaged Single-Zone Rooftop Units
Airside Heat Recovery	None
Airside Economizer	None
Space Heating	n/a
Space Cooling	Water-cooled Chiller: COP 5.5
Outdoor Air Rates	Per ASHRAE 62.1
Supply Air Rates	Auto sized based on 13°C cooling supply air temperature
Fan Power	1 W/cfm (office); 0.5 W/cfm (warehouse)

#### Compliance Pathways – Net Zero Carbon

#### **Warehouse – Target Requirements**

The second model inputs were assumed to meet the **Target Requirements** outlined in the Tenant Sustainability Guidelines. This included improved thermal performance for envelope and glazing as well as reductions in lighting (35%) and equipment (20%) loads due to energy efficient product selections and sensor controls.

These inputs, and other model assumptions are summarised in the model input table to the right.



Construction	1 storey   Slab on Grade
Location   Climate	Riyadh, Saudi Arabia   SAU_Riyadh.404380_IWEC.epw
Primary Space Types   Occupancy	Warehouse, Office (97%/3% Warehouse/Office) Design day occupants: 20 m²/occ (Office); 100 m²/occ (Warehouse)
Temperature & Humidity Set Points	Warehouse: Heating – None  Cooling – 27°C (continuous) Office: Heating – None  Cooling – 24°F Setpoint, 27°C Setback
Occupancy Schedule	24/7 (warehouse); M-F 8:00 am to 6:00 pm (office)

Envelope	
Above Grade Wall Performance	USI-0.11
Roof Performance	USI-0.15 SRI=0.75
Gross Window to Wall Ratio	4%
Gross Skylight to Roof Ratio	6%
Glazing Performance	USI-1.7, SHGC: 0.25
Skylight Performance	USI-1.7, SHGC: 0.21
Building Air Leakage	0.2462 l/(s*m²-envelope) @ 5 Pa (as per SBC 1001)
Space Level	
Equipment Load	2.1 W/m² area-weighted average (20% reduction from Minimum)
Lighting Power Density	4.14 W/m <sup>2</sup> area-weighted average (35% reduction from minimum – 25% LPD savings and 10% sensor savings)
Occupant Load (Sensible/Latent)	73.3 W/person, 58.6 W/person (office)

System Level – Warehouse and Office	
HVAC Type	Packaged Single-Zone Rooftop Units
Airside Heat Recovery	None
Airside Economizer	Outdoor air Temp Control (OA=<21C)
Space Heating	n/a
Space Cooling	Water-cooled Chiller: COP 5.5
Outdoor Air Rates	Per ASHRAE 62.1
Supply Air Rates	Auto sized based on 13°C cooling supply air temperature
Fan Power	1 W/cfm (office); 0.5 W/cfm (warehouse)

#### Compliance Pathways – Net Zero Carbon

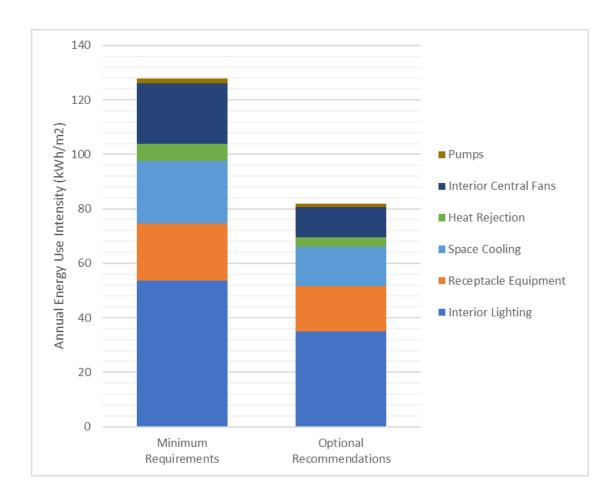


#### **Building Type 1: Warehouse – Energy Results**

The simple building energy model results show the end-use breakdown for a Warehouse are highly attributable to lighting (42%), cooling (18%), fans (17%), and equipment (16%).

The results show that following the **Mandatory Requirements** outlined in the Energy Section of the Tenant Sustainability Guidelines will result in an energy use intensity (EUI) of over 128 kWh/m² for the warehouse typology. Upgrading to the **Target Requirements** results in over 35% energy savings to an EUI of 82 kWh/m².





#### Compliance Pathways – Net Zero Carbon

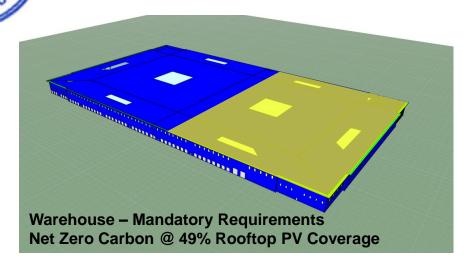


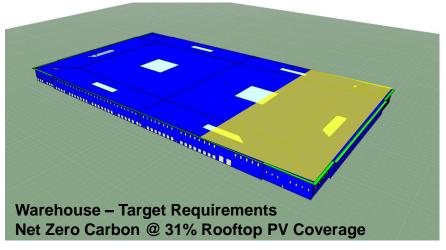
#### **Building Type 1: Warehouse – On-site Carbon Offsets**

For the site, it is assumed that rooftop photovoltaic panels can be implemented with an installed capacity of 0.15 kW/m² at an annual production rate of 1740 kWh/kW. This results in approximately 261 kWh/m²/yr of clean, renewable electricity generation on site.

To offset the annual energy consumed by a Warehouse following the **Mandatory Requirements** of the Tenant Sustainability Guidelines would require a PV installation covering 49% of the warehouse rooftop. Following the **Target Requirements** of the Tenant Sustainability Guidelines would require a PV installation covering 31% of the warehouse rooftop.

Both pathways could result in net-zero carbon design within the site boundary, with additional rooftop area to produce additional PV electricity for a net-positive design.





Compliance Pathways – Net Zero Carbon

#### **Building Type 2: Light Industrial**

For the light industrial / manufacturing building prototype it was assumed that 97% of the floor area was light industrial (manufacturing / assembly) and the remaining 3% office.

The key characteristics of a light industrial building type are the increased occupancy and activity level (20 m²/occ for office & 50 m²/occ for light industrial), and high equipment loads (10.9 W/m²) and lighting loads (13.8 W/m²).

#### **Light Industrial – Mandatory Requirements**

The initial model inputs were assumed to meet the **Mandatory Requirements** outlined in the Tenant Sustainability Guidelines. When not defined by the guidelines, it was assumed that the building complies with SBC 601/1001 (2018) & ASHRAE 90.1. These inputs, and other model assumptions are summarised in the model input table to the right.

Construction	1 storey   Slab on Grade
Location   Climate	Riyadh, Saudi Arabia   SAU_Riyadh.404380_IWEC.epw
Primary Space Types   Occupancy	Manufacturing, Office (97%/3% Manufacturing/Office) Design day occupants: 20 m²/occ (Office); 50 m²/occ (Manufacturing)
Temperature & Humidity Set Points	Manufacturing: Heating – None  Cooling – 27°C (continuous) Office: Heating – None  Cooling – 24°F Setpoint, 27°C Setback
Occupancy Schedule	24/7 (manufacturing); M-F 8:00 am to 6:00 pm (office)

Envelope	
Above Grade Wall Performance	USI-0.193 (as per SBC 601)
Roof Performance	USI-0.369, SRI=0.64 (as per SBC 601)
Gross Window to Wall Ratio	4%
Gross Skylight to Roof Ratio	6%
Glazing Performance	USI-2.89, SHGC: 0.25 (as per SBC 601)
Skylight Performance	USI-1.7, SHGC: 0.21 (as per SBC 601)
Building Air Leakage	0.2462 l/(s*m²-envelope) @ 5 Pa (as per SBC 1001)
Space Level	
Equipment Load	10.92 W/m <sup>2</sup> area-weighted average (10.76 W/m <sup>2</sup> manufacturing/16.15 W/m <sup>2</sup> office)
Lighting Power Density	13.80 W/m <sup>2</sup> area-weighted average (13.9 W/m <sup>2</sup> manufacturing/10.55 W/m <sup>2</sup> office)
Occupant Load (Sensible/Latent)	73.3 W/person, 58.6 W/person (office); 170W/person, 255 W/person (Manufacturing)

System Level – Manufacturing and Office	
HVAC Type	Packaged Single-Zone Rooftop Units
Airside Heat Recovery	None
Airside Economizer	None
Space Heating	n/a
Space Cooling	Water-cooled Chiller: COP 5.5
Outdoor Air Rates	Per ASHRAE 62.1
Supply Air Rates	Auto sized based on 13°C cooling supply air temperature
Fan Power	1 W/cfm (office); 0.5 W/cfm (manufacturing)

#### Compliance Pathways – Net Zero Carbon

#### **Light Industrial – Target Requirements**

The second model inputs were assumed to meet the **Target Requirements** outlined in the Tenant Sustainability Guidelines. This included improved thermal performance for envelope and glazing as well as reductions in lighting (35%) and equipment (20%) loads due to energy efficient product selections and sensor controls.

These inputs, and other model assumptions are summarised in the model input table to the right.



Construction	1 storey   Slab on Grade
Location   Climate	Riyadh, Saudi Arabia   SAU_Riyadh.404380_IWEC.epw
Primary Space Types   Occupancy	Manufacturing, Office (97%/3% Manufacturing/Office) Design day occupants: 20 m²/occ (Office); 50 m²/occ (Manufacturing)
Temperature & Humidity Set Points	Manufacturing: Heating – None  Cooling – 27°C (continuous) Office: Heating – None  Cooling – 24°F Setpoint, 27°C Setback
Occupancy Schedule	24/7 (manufacturing); M-F 8:00 am to 6:00 pm (office)

Envelope	
Above Grade Wall Performance	USI-0.11
Roof Performance	USI-0.15 SRI=0.75
Gross Window to Wall Ratio	4%
Gross Skylight to Roof Ratio	6%
Glazing Performance	USI-1.7, SHGC: 0.25
Skylight Performance	USI-1.7, SHGC: 0.21
Building Air Leakage	0.2462 l/(s*m²-envelope) @ 5 Pa (as per SBC 1001)
Space Level	
Equipment Load	8.74 W/m <sup>2</sup> area-weighted average (20% reduction from Minimum)
Lighting Power Density	8.97 W/m <sup>2</sup> area-weighted average (35% reduction from minimum – 25% LPD savings and 10% sensor savings)
Occupant Load (Sensible/Latent)	73.3 W/person, 58.6 W/person (office); 170W/person, 255 W/person (Manufacturing)

System Level – Manufacturing and Office	
HVAC Type	Packaged Single-Zone Rooftop Units
Airside Heat Recovery	None
Airside Economizer	Outdoor air Temp Control (OA=<21C)
Space Heating	n/a
Space Cooling	Water-cooled Chiller: COP 5.5
Outdoor Air Rates	Per ASHRAE 62.1
Supply Air Rates	Auto sized based on 13°C cooling supply air temperature
Fan Power	1 W/cfm (office); 0.5 W/cfm (manufacturing)

#### Compliance Pathways – Net Zero Carbon

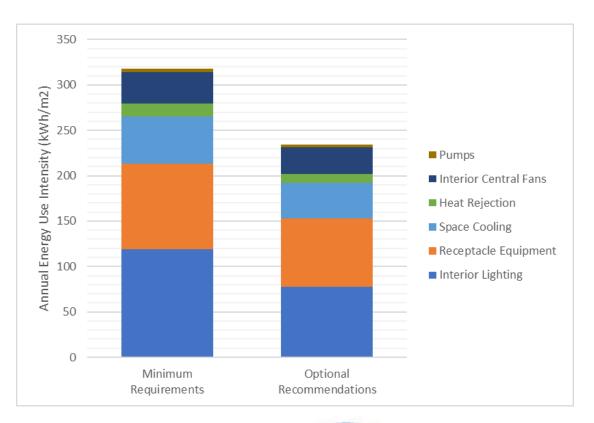


#### **Building Type 2: Light Industrial - Energy Results**

The simple building energy model results show the end-use breakdown for a Light Industrial building are highly attributable to lighting (37%), equipment (30%), cooling (16%), and fans (11%).

It is also clear that as a result of the increased occupancy, lighting and equipment gains inherent with light industry the total energy consumed has increased significantly (2.5 times) compared to the warehouse prototype.

The results show that following the **Mandatory Requirements** outlined in the Energy Section of the Tenant Sustainability Guidelines will result in an energy use intensity (EUI) of over 318 kWh/m² for the light industrial typology. Upgrading to the **Target Requirements** results in over 23% energy savings to an EUI of 235 kWh/m².





### Compliance Pathways – Net Zero Carbon

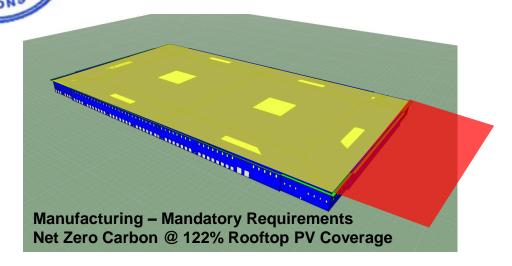


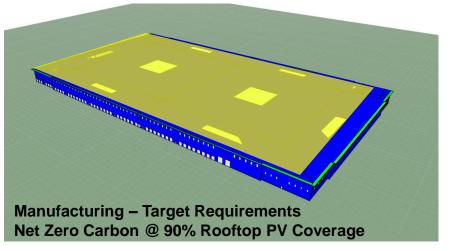
#### **Building Type 2: Light Industrial – On-site Carbon Offsets**

For the site, it is assumed that rooftop photovoltaic panels can be implemented with an installed capacity of 0.15 kW/m² at an annual production rate of 1740 kWh/kW. This results in approximately 261 kWh/m²/yr of clean, renewable electricity generation on site.

To offset the annual energy consumed by a Light Industrial building following the **Mandatory Requirements** of the Tenant Sustainability Guidelines would require a PV installation covering 122% of the rooftop. Following the **Target Requirements** of the Tenant Sustainability Guidelines would require a PV installation covering 90% of the light industrial rooftop.

Both **Minimum** and **Optional** scenarios would require that additional site PV or off-site carbon credits be attained to result in a net-zero carbon design.





Compliance Pathways – Net Zero Carbon

# **Building Type 2: Light Industrial – Off-site Carbon Offsets**

For carbon emissions that can **not** be offset with on-site renewables, off-site carbon offsets must be acquired.

The amount of carbon offsets required are based on the fuel mix of on-site energy, and the CO2 equivalent (CO2 $_{\rm e}$ ) emission factor associated with the fuels consumed. The Saudi electrical grid has a CO2 $_{\rm e}$  rate of 0.692 kg/kWh according to the SBC 1001 (2018) Table 602.3.1. On-site consumption of alternate fuels (non-electric) are given in SBC 1001 (2018) Table 6.2.3.2.





eGRID 2010 SUB- REGION ACRONYM	eGRID 2010 SUB- REGION NAME	CO2e RATE (kg/kWh)
Saudi	Saudi Arabia	0.692

# Electricity Emission Rate by eGRID Sub-Region (Table 602.3.1 SBC 1001 (2018)

STATIONAR	Y FUEL TYPE	EMISSION FACTOR
Natur	ral Gas	141
Fue	el Oil	198
Pro	pane	172
Other Fo	ossil Fuels	217
Purchased	Hot Water	191
District	Steam	205
Energy	Cooling	147

Fossil Fuel Emission Factors (Table 602.3.2 SBC 1001 (2018)

#### Compliance Pathways – Net Zero Carbon



#### **Building Type 2: Light Industrial – Off-site Carbon Offsets**

#### **Example Calculation:**

In the case of the Light Industrial building type the **Mandatory Requirements** pathway resulted in an EUI of 318 kWh/m²/yr (100% electric).

If the gross floor area of the building is 10,000 m<sup>2</sup>. The estimated annual equivalent emissions for the building is 2200 Tonne CO2e (318 kWh/m<sup>2</sup> \* 10,000 m<sup>2</sup> \* 0.692 kg/kWh).

If 75% of the rooftop is available for PV, the total annual on-site clean energy production would be 1958 MWh/yr (10,000 m<sup>2</sup> \* 0.75 \* 261 kWh/m<sup>2</sup>) equivalent to 1355 TCO2e.

Therefore, the amount of off-site carbon credits that would be required to reach a net-zero carbon performance is 845 TCO2e (2200 TCO2e - 1355 TCO2e).

#### **EMISSIONS**

**Direct:** natural gas, diesel, biogas, and others.

4

Indirect: electricity grid, district heating/cooling.

2200 TCO2e

0 TCO2e

AVOIDED EMISSIONS

Off-site Green Power: renewable

energy credits.

+

845 TCO2e

On-site Green Power: solar PV,

wind, solar thermal, othe

1355 TCO2e





#### Compliance Pathways – Net Zero Carbon



#### **Case Study: Apple Distribution Center (DC)**

As a case study example of a potential tenant, the following pathway to net zero carbon compliance has been prepared for the Apple DC project at ILBZ.

The DC has a total GFA of 17,882 m<sup>2</sup> and is comprised of two main space types, Finished Goods (i.e. Warehouse) representing 62% of the GFA and Apple Care (i.e. Light Industrial) covering 38%.

The proposed building envelope thermal performance for the DC complies with the Target Requirements pathway of the sustainability guidelines. For this analysis it is assumed that all other Target Requirements for energy performance are met as well.





#### Compliance Pathways – Net Zero Carbon



#### **Case Study: Apple Distribution Center (DC)**

Based on the previous Building Type calculations following the **Target Requirements** pathway, the expected annual EUI for the building would be 140 kWh/m<sup>2</sup> (0.62 \* 82 kWh/m<sup>2</sup> + 0.38 \* 235 kWh/m<sup>2</sup>).

The rooftop PV production capability for the ILBZ site has been estimated at 261 kWh/m²/yr. Therefore, following the **Target Requirement** pathway, 54% of the rooftop would be required to be covered with PV to achieve net zero carbon for the site.



#### **EMISSIONS**

**Direct:** natural gas, diesel, biogas, and others.

0 TCO2e

Indirect: electricity grid, district heating/cooling.

AVOIDED EMISSIONS

Off-site Green Power: renewable

energy credits.

0 TCO2e

On-site Green Power: solar PV,

wind, solar thermal, others

1734 TCO2e





# Water Efficiency Compliance Pathway

Compliance Pathways – Water Efficiency



#### Pathway to Water Efficiency

This pathway is a series of compliance checks performed to verify that recommended pathways achieve the Mandatory Requirements of indoor water use savings of at least 10% better than the requirements of the Saudi Arabian Standards Organization (SASO) Water Efficiency Regulations and Labelling Programme.

As a case study example of a potential tenant, the following pathway to water efficiency compliance has been prepared for the Apple DC project at ILBZ.

The DC has a total GFA of 17,882 m<sup>2</sup> and is expected to have 180 full-time employees. Based on these inputs and baseline water consumption characteristics a calculation of water reduction measures was performed following the water efficiency recommendations of the tenant sustainability guidelines.







#### Compliance Pathways – Water Efficiency



#### Flush Fixtures:

It was assumed that the gender breakdown of the full-time employees was 80% male and 50% female.

A targeted flush rate for toilets was set to 1 gpf (3.8 L/f) for toilets and 0.2 gpf (0.8 L/f) for urinals.

Assumptions for uses per day by employee are shown in the tables on the following page

Occupancy Type	Employees (FTE)	Visitors	Retail Customers	Students (K-12)	Residential	Other (specify)
Total	180	10	0	0	0	0
Male	145	8				
Female	35	2				

	Gender Ratio (%)	
ľ	100%	
	81%	
	19%	

Fixture In	formation	Flush Rate				
Fixture ID	Fixture Family	Fixture Type	Baseline Flush Rate (gpf)	Design Flush Rate (gpf)	Percent of Occupants (%)	
	Toilet (female)		1.19	1	100	
	Toilet (male)		1.19	1	100	
	Urinal		0.26	0.2	90	
Baseline c	ase annual flush volume (gallon	s/year)			134,411.25	
Design cas	se annual flush volume (gallons/	year)			111,170.24	

# Compliance Pathways – Water Efficiency



# Flush Fixtures (cont).

Uses per Day	,			Total Daily Uses		Total Daily Water Use			
Employees (FTE)	Visitors	Retail Customers	Students (K-12)	Residential	Other	Default	Non-default (Optional)	Baseline (gallons)	Design (gallons)
3.0	0.5	0.00	0.0	0.0		106.0		126.14	106
1.0	0.1	0.00	0.0	0.0		145.8		173.50	145.8
2.0	0.4	0.00	0.0	0.0		293.2		68.61	52.776
0.0	0.0	0.00	0.0	0.0		0.0		0.00	0
0.0	0.0	0.00	0.0	0.0		0.0		0.00	0



# Compliance Pathways – Water Efficiency



**Total Daily Water Use** 

Design

(gallons)

95.38

22.50

0.00

0.00

0.00

Baseline

(gallons)

136.25

71.10

0.00

0.00

0.00

#### Flow Fixtures:

A targeted flow rate for lavatory faucets was set to 0.35 gpm (1.3 L/min) and 0.5 gpf (1.9 L/min) for kitchen faucets.

Assumptions for uses per day by employee are shown in the tables to the right.



Fixture Information		Duration		Flow Rate		
Fixture ID	Fixture Type	Default (sec)	Non-default (sec) (Optional)	Baseline Flow Rate (gpm)	Design Flow Rate (gpm)	Percent of Occupants (%)
	Public lavatory (restroom) faucet	30		0.50	0.35	100
	Kitchen faucet			1.58	0.5	100
Baseline c	ase annual flow volume (gallons/year)					75,682.75
Design ca	se annual flow volume (gallons/year)					43,026.20

**Total Daily Uses** 

Default

545.0

180.0

0.0

0.0

0.0

Non-default

(Optional)

Uses per Day									
Employees (FTE)	Visitors	Retail Customers	Students (K-12)	Residential	Other				
3.0	0.5	0.0	0.0	0.0					
1.0	0.0	0.0	0.0	0.0					
0.0	0.0	0.0	0.0	0.0					
0.0	0.0	0.0	0.0	0.0					
0.0	0.0	0.0	0.0	0.0					

### Compliance Pathways – Water Efficiency



#### **Total Savings:**

The baseline (SASO) performance would consume over 210,000 gallons/year (795,000 L/yr) compared to 155,000 gallons/year (580,000 L/yr) for the design case.

Group Name		Baseline Case (gallons/year)		Design Case (gallons/year)		
	Annual Flush Volume	Annual Flow Volume	Annual Consumption	Annual Flush Volume	Annual Flow Volume	Annual Consumption
Apple DC	134,411.25	75,682.75	210,094.00	111,170.24	43,026.20	154,196.44

Annual baseline water consumption (gallons/year)	210,094.00	
Annual design water consumption (gallons/year)	154,196.44	
Percent water use reduction (%)	26.61%	

By following the tenant sustainability guidelines, the indoor water consumption of the case study building saved over 26.6% when compared to a code/SASO baseline.

This far exceeds the 10% Mandatory Requirements of the Tenant Sustainability Guidelines and is in line with the ambitious KSA national program for rationalising water consumption in the Kingdom, which targets reducing usage by 24-43 percent by the end of the next decade.

# TERMS & DEFINITIONS

# APPENDIX 2 TERMS & DEFINITIONS





#### **Project Start Up**

basis of design (BOD) the information necessary to accomplish the owner's project requirements, including system descriptions, indoor environmental quality criteria, design assumptions, and references to applicable codes, standards, regulations, and guidelines

**charrette** an intensive, multiparty workshop that brings people from different disciplines and backgrounds together to explore, generate, and collaboratively produce design options

**integrated project delivery** an approach that involves people, systems, and business structures (contractual and legal agreements) and practices. The process harnesses the talents and insights of all participants to improve results, increase value to the owner, reduce waste, and maximise efficiency through all phases of design, fabrication, and construction. (Adapted from American Institute of Architects).

**owner's project requirements (OPR)** a written document that details the ideas, concepts, and criteria determined by the owner to be important to the success of the project

**simple box energy modeling analysis** (also known as "building-massing model energy analysis") a simple base-case energy analysis that informs the team about the building's likely distribution of energy consumption and is used to evaluate potential project energy strategies. A simple box analysis uses a basic, schematic building form.

TERMS & DEFINITIONS (cont.)



#### **Location and Transportation**

**alternative fuel** low polluting, nongasoline fuels such as electricity, hydrogen, propane, compressed natural gas, liquid natural gas, methanol, and ethanol

**brownfield** real property or the expansion, redevelopment, or reuse of which may be complicated by the presence or possible presence of a hazardous substance, pollutant, or contaminant

**bus rapid transit** an enhanced bus system that operates on exclusive bus lanes or other transit rights-of-way. The system is designed to combine the flexibility of buses with the efficiency of rail.



TERMS & DEFINITIONS (cont.)





#### **Location and Transportation (cont.)**

**density** a measure of the total building floor area or dwelling units on a parcel of land relative to the buildable land of that parcel. Units for measuring density may differ according to credit requirements. Does not include structured parking. **development footprint** the total land area of a project site covered by buildings, streets, parking areas, and other typically impermeable surfaces constructed as part of the project

**diverse use** a distinct business or organization that provides goods or services intended to meet daily needs and is publicly available.

**electric vehicle supply equipment** the conductors, including the ungrounded, grounded, and equipment grounding conductors, the electric vehicle connectors, attachment plugs, and all other fittings, devices, power outlets or apparatuses installed specifically for the purpose of delivering energy from the premises wiring to the electric vehicle. (National Electric Codes and California Article 625)

freight village a cluster of freight-related businesses that include intermodal transfer operations. Freight villages may offer logistics services, integrated distribution, warehousing capabilities, showrooms, and support services. Such support services may include security, maintenance, mail, banking, customs and import management assistance, cafeterias, restaurants, office space, conference rooms, hotels, and public or activity center transportation.

#### TERMS & DEFINITIONS (cont.)



#### **Location and Transportation (cont.)**

**intermodal facility** a venue for the movement of goods in a single loading unit or road vehicle that uses successively two or more modes of transportation without the need to handle the goods themselves

**light rail transit** service using two- or three-car trains in a right-of-way that is often separated from other traffic modes. Spacing between stations tends to be 1/2 mile (800 meters) or more, and maximum operating speeds are typically 40–55 mph (65–90 kmh). Light-rail corridors typically extend 10 or more miles (16 kilometers).

**preferred parking** the parking spots closest to the main entrance of a building (exclusive of spaces designated for handicapped persons). For employee parking, it refers to the spots that are closest to the entrance used by employees. **previously developed** altered by paving, construction, and/or land use that would typically have required regulatory permitting to have been initiated (alterations may exist now or in the past). Land that is not previously developed and landscapes altered by current or historical clearing or filling, agricultural or forestry use, or preserved natural area use are considered undeveloped land. The date of previous development permit issuance constitutes the date of previous development but permit issuance in itself does not constitute previous development.



TERMS & DEFINITIONS (cont.)





#### **Location and Transportation (cont.)**

**rideshare** a transit service in which individuals travel together in a passenger car or small van that seats at least four people. It can include human-powered conveyances, which must accommodate at least two people. It must include an enclosed passenger seating area, fixed route service, fixed fare structure, regular operation, and the ability to pick up multiple riders.

**streetcar** a transit service with small, individual rail cars. Spacing between stations is uniformly short and ranges from every block to 1/4 mile (400 meters), and operating speeds are primarily 10–30 mph (15–50 kmh). Streetcar routes typically extend 2–5 miles (3-8 kilometers).

walking distance, the distance that a pedestrian must travel between origins and destinations without obstruction, in a safe and comfortable environment on a continuous network of sidewalks, all weather-surface footpaths, crosswalks, or equivalent pedestrian facilities. The walking distance must be drawn from an entrance that is accessible to all building users.

water budget a project-specific method of calculating the amount of water required by the building and associated grounds. The budget takes into account indoor, outdoor, process, and makeup water demands and any on site supply including estimated rainfall. Water budgets must be associated with a specified amount of time, such as a week, month, or year and a quantity of water such as kGal, or liters.

yard tractor a vehicle used primarily to facilitate the movement of truck trailers and other types of large shipping containers from one area of a site to another. It does not include forklift trucks. Also known as terminal tractor, yard truck, utility tractor rig, yard goat, or yard hustler.

#### TERMS & DEFINITIONS (cont.)



#### **Site**

**appurtenance** a built-in, nonstructural portion of a roof system. Examples include skylights, ventilators, mechanical equipment, partitions, and solar energy panels.

**diverse extensive vegetated roof** a roof that is covered with plants and typically not designed for general access. Usually, an extensive system is a rugged green roof that requires little maintenance once established. The planting medium in extensive vegetated roofs ranges from 1 to 6 inches in depth. (Adapted from U.S. Environmental Protection Agency)

**greenfield area** that has not been graded, compacted, cleared, or disturbed and that supports (or could support) open space, habitat, or natural hydrology.

**green infrastructure** a soil- and vegetation-based approach to wet weather management that is cost-effective, sustainable, and environmentally friendly. Green infrastructure management approaches and technologies infiltrate, evapotranspire, capture and reuse stormwater to maintain or restore natural hydrology's. (Adapted from U.S. Environmental Protection Agency)

**heat island effects** the thermal absorption by hardscape, such as dark, nonreflective pavement and buildings, and its subsequent radiation to surrounding areas. Other contributing factors may include vehicle exhaust, air-conditioners, and street equipment. Tall buildings and narrow streets reduce airflow and exacerbate the effect.

TERMS & DEFINITIONS (cont.)



#### Site (cont.)

**infrared (thermal) emittance** a value between 0 and 1 (or 0% and 100%) that indicates the ability of a material to shed infrared radiation (heat). A cool roof should have a high thermal emittance. The wavelength range for radiant energy is roughly 5 to 40 micrometers. Most building materials (including glass) are opaque in this part of the spectrum and have an emittance of roughly 0.9, or 90%. Clean, bare metals, such as untarnished galvanized steel, have a low emittance and are the most important exceptions to the 0.9 rule. In contrast, aluminum roof coatings have intermediate emittance levels. (Adapted from Lawrence Berkeley National Laboratory)

intensive vegetated roof a roof that, compared with an extensive vegetated roof, has greater soil volume, supports a wider variety of plants (including shrubs and trees), and allows a wider variety of uses (including human access). The depth of the growing medium is an important factor in determining habitat value. The native or adapted plants selected for the roof should support the site's endemic wildlife populations. (Adapted from Green Roofs for Healthy Cities) low-impact development (LID) an approach to managing rainwater runoff that emphasises on-site natural features to protect water quality, by replicating the natural land cover hydrologic regime of watersheds and addressing runoff close to its source. Examples include better site design principles (e.g., minimising land disturbance, preserving vegetation, minimising impervious cover), and design practices (e.g., rain gardens, vegetated swales and buffers, permeable pavement, rainwater harvesting, soil amendments). These are engineered practices that may require specialized design assistance.

#### TERMS & DEFINITIONS (cont.)



#### Site (cont.)

manage (rainwater) on site to capture and retain a specified volume of rainfall to mimic natural hydrologic function. Examples of rainwater management include strategies that involve evapotranspiration, infiltration, and capture and reuse. master plan boundary the limits of a site master plan. The master plan boundary includes the project area and may include all associated buildings and sites outside of the project boundary. The master plan boundary considers future sustainable use, expansion, and contraction.

**multitenant complex** a site that was master planned for the development of stores, restaurants, and other businesses. Retailers may share some services and common areas.

**natural site hydrology** the natural land cover function of water occurrence, distribution, movement, and balance **open-grid pavement** system pavements that consist of loose substrates supported by a grid of a more structurally sound grid or webbing. Pervious concrete and porous asphalt are not considered open grid as they are considered bounded materials. Unbounded, loose substrates do not transfer and store heat like bound and compacted materials do.



TERMS & DEFINITIONS (cont.)





#### Site (cont.)

**reference soil** a soil native to the project site, as described in Natural Resources Conservation Service soil surveys (or a local equivalent survey outside the United States), or undisturbed native soils within the project's region that have native vegetation, topography, and soil textures similar to the project site. For project sites with no existing soil, reference soils are defined as undisturbed native soils within the project's region that support appropriate native plant species similar to those intended for the new project.

**site assessment** an evaluation of an area's above ground and subsurface characteristics, including its structures, geology, and hydrology. Site assessments typically help determine whether contamination has occurred and the extent and concentration of any release of pollutants. Remediation decisions rely on information generated during site assessments.

**site master plans** an overall design or development concept for the project and associated (or potentially associated) buildings and sites. The plan considers future sustainable use, expansion, and contraction. The site master plan is typically illustrated, with building plans (if applicable), site drawings of planned phased development, and narrative descriptions.

**solar reflectance (SR)** the fraction of solar energy that is reflected by a surface on a scale of 0 to 1. Black paint has a solar reflectance of 0; white paint (titanium dioxide) has a solar reflectance of 1. The standard technique for its determination uses spectrophotometric measurements, with an integrating sphere to determine the reflectance at each wavelength. The average reflectance is then determined by an averaging process, using a standard solar spectrum, as documented by ASTM Standards E903 and E892.

TERMS & DEFINITIONS (cont.)





#### Site (cont.)

solar reflectance index (SRI) a measure of the constructed surface's ability to stay cool in the sun by reflecting solar radiation and emitting thermal radiation. It is defined such that a standard black surface (initial solar reflectance 0.05, initial thermal emittance 0.90) has an initial SRI of 0, and a standard white surface (initial solar reflectance 0.80, initial thermal emittance 0.90) has an initial SRI of 100. To calculate the SRI for a given material, obtain its solar reflectance and thermal emittance via the Cool Roof Rating Council Standard (CRRC-1). SRI is calculated according to ASTM E 1980. Calculation of the aged SRI is based on the aged tested values of solar reflectance and thermal emittance.

**technical release** (TR) 55 an approach to hydrology in which watersheds are modeled to calculate storm runoff volume, peak rate of discharge, hydrographs, and storage volumes, developed by the former USDA Soil Conservation Service. **thermal emittance** the ratio of the radiant heat flux emitted by a specimen to that emitted by a blackbody radiator at the same temperature (adapted from Cool Roof Rating Council)

**three-year aged SR** or SRI value a solar reflectance or solar reflectance index rating that is measured after three years of weather exposure

undercover parking vehicle storage that is underground, under deck, under roof, or under a building

# **APPENDIX 2**TERMS & DEFINITIONS (cont.)



## Lighting

**BUG rating** a luminaire classification system that classifies luminaires in terms of backlight (B), uplight (U), and glare (G) (taken from IES/IDA Model Lighting Ordinance). BUG ratings supersede the former cutoff ratings.

**emergency lighting** a luminaire that operates only during emergency conditions and is always off during normal building operation

**light pollution waste** light from building sites that produces glare, is directed upward to the sky, or is directed off the site. Waste light does not increase nighttime safety, utility, or security and needlessly consumes energy.

**light trespass** obtrusive illumination that is unwanted because of quantitative, directional, or spectral attributes. Light trespass can cause annoyance, discomfort, distraction, or loss of visibility.

**mounting height,** the distance between ground level (or the workplane) and the center of the luminaire (light fixture); the height at which a luminaire is installed.

**ornamental luminaire** a luminaire intended for illuminating portions of the circulation network that also serves an ornamental function, in addition to providing optics that effectively deliver street lighting, and has a decorative or historical period appearance

**regularly occupied spaces** are areas where one or more individuals normally spend time (more than one hour per person per day on average) seated or standing as they work, study, or perform other focused activities inside a building **vertical illuminance** levels calculated at a point on a vertical surface, or that occur on a vertical plane

#### TERMS & DEFINITIONS (cont.)



#### Water

**adapted plant** vegetation that is not native to a particular region but that has characteristics that allow it to live in the area. Adapted plants do not pose the same problems as invasive species.

**blowdown** the removal of makeup water from a cooling tower or evaporative condenser recirculation system to reduce concentrations of dissolved solids

**closed-loop cooling** a system that acts as a heat sink for heat-rejecting building and medical equipment by recirculating water. Because the water is sealed within the system, some closed-loop cooling systems use non-potable water (such as recycled process water harvested from an air handler's cooling coil condensate).

**conductivity** the measurement of the level of dissolved solids in water, using the ability of an electric current to pass through water. Because it is affected by temperature, conductivity is measured at 25°C for standardization.

**conventional irrigation** a region's most common system for providing water to plants by nonnatural means. A conventional irrigation system commonly uses pressure to deliver water and distributes it through sprinkler heads above the ground.

**cooling tower blowdown** the water discharged from a cooling tower typically because increased salinity or alkalinity has caused scaling. Cooling tower blowdown may be too saline for use in landscape irrigation.

**drift** water droplets carried from a cooling tower or evaporative condenser by a stream of air passing through the system. Drift eliminators capture these droplets and return them to the reservoir at the bottom of the cooling tower or evaporative condenser for recirculation.

TERMS & DEFINITIONS (cont.)



### Water (cont.)

**evapotranspiration** the combination of evaporation and plant transpiration into the atmosphere. Evaporation occurs when liquid water from soil, plant surfaces, or water bodies becomes vapor. Transpiration is the movement of water through a plant and the subsequent loss of water vapor.

**external meter** a device installed on the outside of a water pipe to record the volume of water passing through it. Also known as a clamp-on meter.

**foundation drain** the water discharged from a subsurface drainage system. If a building foundation is below the water table, a sump pump may be required. Discharge from the sump may be stored and used for irrigation.

graywater "untreated household wastewater which has not come into contact with toilet waste. Graywater includes used water from bathtubs, showers, bathroom wash basins, and water from clothes-washers and laundry tubs. It must not include wastewater from kitchen sinks or dishwashers", "wastewater discharged from lavatories, bathtubs, showers, clothes washers and laundry sinks" (International Plumbing Code, Appendix C, Gray Water Recycling Systems). Some states and local authorities allow kitchen sink wastewater to be included in graywater. Other differences can likely be found in state and local codes. Project teams should comply with the graywater definition established by the authority having jurisdiction in the project area.

#### TERMS & DEFINITIONS (cont.)





#### Water (cont.)

**hardscape** the inanimate elements of the building landscaping. It includes pavement, roadways, stonewalls, wood and synthetic decking, concrete paths and sidewalks, and concrete, brick, and tile patios.

**hydrozone** a group of plantings with similar water needs

**industrial process water** any water discharged from a factory setting. Before this water can be used for irrigation, its quality needs to be checked. Saline or corrosive water should not be used for irrigation.

landscape water requirement (LWR) the amount of water that the site landscape area(s) requires for the site's peak watering month

**makeup water** that is fed into a cooling tower system or evaporative condenser to replace water lost through evaporation, drift, bleed-off, or other causes

**metering control** a regulator that limits the flow time of water, generally a manual-on and automatic-off device, most commonly installed on lavatory faucets and showers

**native vegetation** an indigenous species that occurs in a particular region, ecosystem, and habitat without direct or indirect human actions. Native species have evolved to the geography, hydrology, and climate of that region. They also occur in communities; that is, they have evolved together with other species. As a result, these communities provide habitat for a variety of other native wildlife species. Species native to North America are generally recognized as those occurring on the continent prior to European settlement. Also known as native plants.

TERMS & DEFINITIONS (cont.)





#### Water (cont.)

Non-potable water that does not meet drinking water standards

**peak watering month** the month with the greatest deficit between evapotranspiration and rainfall. This is the month when the plants in the site's region potentially require the most supplemental water typically a mid-summer month. (Sustainable Sites Initiative)

**potable water** that meets or exceeds local drinking water quality standards and is approved for human consumption by the state or local authorities having jurisdiction; it may be supplied from wells or municipal water systems **private meter** a device that measures water flow and is installed downstream from the public water supply meter or as

part of an on-site water system maintained by the building management team

process water that is used for industrial processes and building systems, such as cooling towers, boilers, and chillers. It can also refer to water used in operational processes, such as dishwashing, clothes washing, and ice making.

**public water supply (PWS)** a system for the provision to the public of water for human consumption through pipes or other constructed conveyances.

**rainwater harvesting** the capture, diversion, and storage of rain for future beneficial use. Typically, a rain barrel or cistern stores the water; other components include the catchment surface and conveyance system. The harvested rainwater can be used for irrigation.

TERMS & DEFINITIONS (cont.)



#### Water (cont.)

reclaimed water wastewater that has been treated and purified for reuse reference evapotranspiration rates the amount of water lost from a specific vegetated surface with no moisture limitation. Turf grass with height of 120 mm is the reference vegetation. softscape the elements of a landscape that consist of live, horticultural elements wet meter a device installed inside a water pipe to record the volume of passing water xeriscaping landscaping that does not require routine irrigation



#### TERMS & DEFINITIONS (cont.)



#### **Energy**

**baseline building performance** the annual energy cost for a building design, used as a baseline for comparison with above-standard design

**chlorofluorocarbon** (CFC)-based refrigerant a fluid, containing hydrocarbons, that absorbs heat from a reservoir at low temperatures and rejects heat at higher temperatures. When emitted into the atmosphere, CFCs cause depletion of the stratospheric ozone layer.

**combined heat and power** an integrated system that captures the heat, otherwise unused, generated by a single fuel source in the production of electrical power. Also known as cogeneration.

**commissioning** (Cx) the process of verifying and documenting that a building and all of its systems and assemblies are planned, designed, installed, tested, operated, and maintained to meet the owner's project requirements **commissioning authority** (CxA) the individual designated to organize, lead, and review the completion of commissioning process activities. The CxA facilitates communication among the owner, designer, and contractor to ensure that complex systems are installed and function in accordance with the owner's project requirements.



TERMS & DEFINITIONS (cont.)





#### **Energy (cont.)**

district energy system (DES) a central energy conversion plant and transmission and distribution system that provides thermal energy to a group of buildings (e.g., a central cooling plant on a university campus). It does not include central energy systems that provide only electricity.

**green power** a subset of renewable energy composed of grid-based electricity produced from renewable energy sources **IT annual energy** electricity consumption by information technology and telecom equipment which includes servers, networking, and storage equipment over the course of a year

**load shedding** an intentional action by a utility to reduce the load on the system. Load shedding is usually conducted during emergency periods, such as capacity shortages, system instability, or voltage control.

**natural refrigerant** a compound that is not manmade and is used for cooling. Such substances generally have much lower potential for atmospheric damage than manufactured chemical refrigerants. Examples include water, carbon dioxide, and ammonia.

**operations and maintenance** (O&M) plan a plan that specifies major system operating parameters and limits, maintenance procedures and schedules, and documentation methods necessary to demonstrate proper operation and maintenance of an approved emissions control device or system

TERMS & DEFINITIONS (cont.)



#### **Energy (cont.)**

**peak demand** the maximum electricity load at a specific point in time or over a period of time **permanent peak load** shifting the transfer of energy consumption to off-peak hours, when demand for power is lower and energy is therefore less expensive

**plug load** or receptacle load the electrical current drawn by all equipment that is connected to the electrical system via a wall outlet.

power distribution unit output the electrical power from a device that allocates power to and serves information technology (IT) equipment. Power distribution unit (PDU) output does not include efficiency losses of any transformation that occurs within the PDU, but it can include downstream non-IT ancillary devices installed in IT racks, such as fans. If the PDU system supports non-IT equipment (e.g., computer room air-conditioning units, computer room air handlers, inrow coolers), this equipment must be metered and subtracted from the PDU output reading. The metering approach should be consistent with the metering required for the power usage efficiency (PUE) category (e.g., continuous consumption metering for PUE categories 1, 2, and 3).

**power utilisation effectiveness** (PUE) a measure of how efficiently a data center uses its power; specifically, how much power is used by computing equipment rather than for cooling and other overhead process energy power resources consumed in support of a manufacturing, industrial, or commercial process other than conditioning spaces and maintaining comfort and amenities for building occupants of a building. It may include refrigeration equipment, cooking and food preparation, clothes washing, and other major support appliances. (ASHRAE)

#### TERMS & DEFINITIONS (cont.)



#### **Energy (cont.)**

process load or unregulated load the load on a building resulting from the consumption or release of process energy (ASHRAE)

**Projection factor** is the ratio of the horizontal depth of the external shading projection divided by the sum of the height of the fenestration and the distance from the top of the fenestration to the bottom of the farthest point of the eternal shading projection, in consistent units (ASHRAE 90.1-2016).

**regulated load** any building end use that has either a mandatory or a prescriptive requirement in ANSI/ASHRAE/IES Standard 90.1–2010

revenue-grade meter a measurement tool designed to meet strict accuracy standards required by code or law. Utility meters are often called revenue grade because their measurement directly results in a charge to the customer



TERMS & DEFINITIONS (cont.)



#### **Energy (cont.)**

**systems manual** provides the information needed to understand, operate, and maintain the systems and assemblies within a building. It expands the scope of the traditional operating and maintenance documentation and is compiled of multiple documents developed during the commissioning process, such as the owner's project requirements, operation and maintenance manuals, and sequences of operation

uninterruptible power supply (UPS) output the electricity provided by a unit that keeps information technology (IT) equipment functioning during a power outage. UPS output does not include efficiency losses from the unit itself but does include losses from downstream electrical distribution components, such as power distribution units, and it may include non-IT ancillary devices installed in IT racks, such as fans. If the UPS system supports non-IT equipment (e.g., computer room air-conditioning units, computer room air handlers, in-row coolers), this usage must be metered and subtracted from the UPS output reading. The metering approach should be consistent with the metering required for the power usage efficiency (PUE) category (e.g., continuous consumption metering for PUE categories 1, 2 and 3).



TERMS & DEFINITIONS (cont.)



#### **Materials and Resources**

**clean waste** nonhazardous materials left over from construction and demolition. Clean waste excludes lead and asbestos. **commingled waste** building waste streams that are combined on the project site and hauled away for sorting into recyclable streams. Also known as single-stream recycling.

**cradle-to-gate assessment** analysis of a product's partial life cycle, from resource extraction (cradle) to the factory gate (before it is transported for distribution and sale). It omits the use and the disposal phases of the product.

**dedicated storage** a designated area in a building space or a central facility that is sized and allocated for a specific task, such as the collection of recyclable waste. Signage often indicates the type of recyclable waste stored there. Some waste streams, such as mercury-based light bulbs, sensitive paper documents, biomedical waste, or batteries, may require particular handling or disposal methods. Consult the municipality's safe storage and disposal procedures or use guidelines posted on the U.S. Environmental Protection Agency website, at www.epa.gov.

**electronic waste** discarded office equipment (computers, monitors, copiers, printers, scanners, fax machines), appliances (refrigerators, dishwashers, water coolers), external power adapters, and televisions and other audiovisual equipment

TERMS & DEFINITIONS (cont.)



#### Materials and Resources (cont.)

**enclosure** the exterior plus semi-exterior portions of the building. Exterior consists of the elements of a building that separate conditioned spaces from the outside (i.e., the wall assembly). Semi exterior consists of the elements of a building that separate conditioned space from unconditioned space or that encloses semi-heated space through which thermal energy may be transferred to or from the exterior or conditioned or unconditioned spaces (e.g., attic, crawl space, basement).

**environmental product declaration** a statement that the item meets the environmental requirements of ISO 14021–1999, ISO 14025–2006 and EN 15804, or ISO 21930–2007

land-clearing debris and soil materials that are natural (e.g., rock, soil, stone, vegetation). Materials that are man-made (e.g., concrete, brick, cement) are considered construction waste even if they were on site.

**life-cycle assessment** an evaluation of the environmental effects of a product from cradle to grave, as defined by ISO 14040–2006 and ISO 14044–2006

**mixed paper** white and colored paper, envelopes, forms, file folders, tablets, flyers, cereal boxes, wrapping paper, catalogs, magazines, phone books, and photos.

**structure** elements carrying either vertical or horizontal loads (e.g., walls, roofs, and floors) that are considered structurally sound and nonhazardous

waste-to-energy the conversion of nonrecyclable waste materials into usable heat, electricity, or fuel through a variety of processes, including combustion, gasification, pyrolization, anaerobic digestion, and landfill gas (LFG) recovery

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Applicable Rating Systems







#### LEED:

Developed by the U.S. Green Building Council, LEED is a framework for identifying, implementing, and measuring green building and neighborhood design, construction, operations, and maintenance. LEED is a voluntary, market-driven, consensus-based tool that serves as a guideline and assessment mechanism. LEED rating systems address commercial, institutional, and residential buildings and neighborhood developments. LEED seeks to optimise the use of natural resources, promote regenerative and restorative strategies, maximise the positive and minimise the negative environmental and human health consequences of the construction industry, and provide high-quality indoor environments for building occupants. LEED emphasises integrative design, integration of existing technology, and state-of-the-art strategies to advance expertise in green building and transform professional practice. The technical basis for LEED strikes a balance between requiring today's best practices and encouraging leadership strategies. LEED sets a challenging yet achievable set of benchmarks that define green building for interior spaces, entire structures, and whole neighborhoods.

Applicable Rating Systems (cont.)



#### Mostadam for Commercial Buildings (D+C)

Mostadam has been developed by Sustainable Building as a comprehensive sustainability rating and certification system to address the long-term sustainability of commercial buildings in the Kingdom of Saudi Arabia (KSA). Mostadam addresses a wide range of sustainability issues important to KSA and supports the aspiration of Vison 2030. Mostadam for Commercial Buildings (D+C) is applicable to all sizes of commercial developments and there is no size minimum size required for certification. addresses a variety of building typologies are considered for rating for Commercial Buildings. This includes building types specific to this master plan, Offices/Commercial/ Government, Retail/ Restaurants, Warehouses and Mosques.







Applicable Rating Systems (cont.)



#### WELL

Developed by the International Well Building Institute, WELL is premised on a holistic view of health: human health as not only a state of being free of disease - which is indeed a fundamental component of health - but also of the enjoyment of productive lives from which happiness and satisfaction are derived. Healthy spaces protect occupants from that which can make people sick, promote practices that can keep people well, and facilitate opportunities to connect with one another and live lives to the fullest. Well's priorities are the following Features:



Air
Water
Nourishment
Light
Movement
Thermal Comfort
Sound
Materials
Mind and Community



Applicable Rating Systems (cont.)



#### **ILBZ DMP Guidelines and KPI's**

The sustainability vision and goals for KKIA ILBZ Masterplan will be realised and monitored through a number of Key Performance Indicators as noted throughout this document. The responsibility for achieving these are spread across various providers and firms associated with the project during the design, construction and occupancy phases of the scheme. The tenant is responsible for meeting the Mandatory Requirements in each section identified.



Samir Khairallah & Partners Architects Planners Engineers

□Systematica





# **END OF SUSTAINABILITY GUIDELINES**