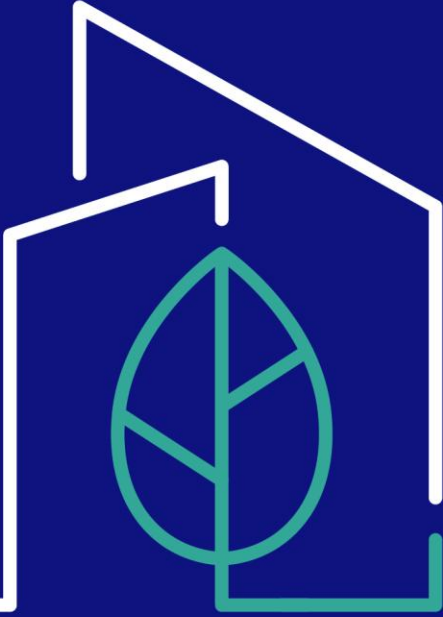




Greening Guidelines

Existing Building Greening Requirements

1st Edition
October 2025

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INTRODUCTION

The greening of buildings in Dubai is an important step to save energy and water, reduce waste and create a comfortable and well indoor built environment at a time when the world is witnessing a major climate change.

Dubai Municipality works to provide clear and simplified information to building owners and operators on ways to improve the environmental performance of buildings through rehabilitation, maintenance, and operation of buildings in response to the Dubai Demand Side Management Strategy and achieving its objectives, in cooperation with the Supreme Council of Energy and the concerned authorities in the Emirate of Dubai.

This was done by studying the applicability of the requirements of the Dubai Building Code and AL Safat standards and their feasibility for greening existing buildings, collecting data from previous retrofit projects, studying and evaluating the feasibility of measures that were used in those projects, in addition to studying any other measures or requirements based on international best practices and identifying the easiest and most feasible measures and requirements that can be applied to all existing buildings.

Based on the above assessment, the requirements for greening existing buildings were divided into three categories, the lowest of which is the silver category with the lowest cost and the highest savings, followed by the gold category with the lowest cost and acceptable savings, and the highest of these categories is the platinum category with the highest cost and the highest or acceptable savings.

The requirements for greening existing buildings mentioned in these guidelines in all their categories are optional, and the owner of the building or his representative may choose any of these requirements or combine them according to his financial capabilities or priorities for him or his building, however, the environmentally qualified building certificate is not granted unless all the requirements mentioned in the tables for each of the three categories are met, noting that to obtain a certificate for any category, the previous requirements must be met.

GREENING GUIDELINES

GREENING REQUIREMENT HEADINGS / SILVER					DIFFICULTIES OR RISKS	INITIAL COSTS	PAYBACK	SAVING	BENEFITS
1			1-1-1	INSULATION AND COATING	NO RISK	LOW	LONG RUN	LOW	✓
2			1-1-2	WINDOW FILMS	NO RISK	LOW	SHORT RUN	HIGH	✓
3			1-1-7	INFILTRATION/ AIR LEAKAGE	NO RISK	LOW	SHORT RUN	HIGH	✓
4		2-4	NATURAL VENTILATION		RISKY	LOW	NON	HIGH	✓
5		2-5	SEALING DOORS AND WINDOW FRAMES		NO RISK	LOW	LONG RUN	HIGH	✓
6		2-6	INSPECTION AND CLEANING (HVAC) EQUIPMENTS		RISKY	LOW	SHORT RUN	HIGH	✓
7		2-9	THERMAL COMFORT		NO RISK	LOW	SHORT RUN	HIGH	✓
8			3-2-1	PROGRAMABLE THERMSTATE	NO RISK	LOW	SHORT RUN	HIGH	✓
9			3-2-2	CHILLER PLANTMANAGERS (CPM)	RISKY	LOW	SHORT RUN	HIGH	✓
10			3-2-3	VFD/VSD FOR AHUs & FAHUs	NO RISK	LOW	SHORT RUN	HIGH	✓
11			3-2-4	VFD/VSD FOR CHILLED WATER PUMPS	NO RISK	LOW	LONG RUN	HIGH	✓
12			3-2-5	DIFFRENTIAL PRESSURE OPTIMIZATION	NO RISK	LOW	SHORT RUN	HIGH	✓
13			3-2-7	TIMERS FOR EXHAUST FANS	NO RISK	LOW	SHORT RUN	HIGH	✓
14			3-4-1	SWIMMING POOLS HEATING	NO RISK	LOW	SHORT RUN	HIGH	✓
15			3-4-2	SUSTAINABLE WATER HEATING SYSTEM	NO RISK	LOW	SHORT RUN	HIGH	✓
16			3-6-1	ELEVATORS	NO RISK	LOW	SHORT RUN	HIGH	✓
17			3-6-2	ESCALATORS	NO RISK	LOW	SHORT RUN	HIGH	✓
18			4-1-1	LOW FLOW	NO RISK	LOW	SHORT RUN	HIGH	✓
19		8-1	HVAC SYSTEM		NO RISK	LOW	SHORT RUN	HIGH	✓
20		8-3	WATER SAVING SYSTEM		NO RISK	LOW	SHORT RUN	HIGH	✓
21		8-5	SUSTAINABLE AWARENESS AND USERS' PARTICIPATION		NO RISK	LOW	NON	HIGH	✓
22			9-1-1	INCOMING SUPPLY AND METERING	NO RISK	LOW	SHORT RUN	HIGH	✓

GREENING GUIDELINES

23			9-1-2	MULTIPLE CONSUMER PREMISES METERING	NO RISK	LOW	SHORT RUN	HIGH	✓
24		9-2	AIR CONDITIONING METERING		NO RISK	LOW	SHORT RUN	HIGH	✓
25		9-3	WATER METERING		NO RISK	LOW	SHORT RUN	HIGH	✓

GREENING GUIDELINES

GREENING REQUIREMENT HEADINGS / GOLD					DIFFICULTIES OR RISKS	INITIAL COSTS	PAYBACK	SAVING	BENEFITS
1			1-1-4	EXTERNAL SURFACES REFLECTANCE, INCLUDING HARD SCAPES	NO RISK	LOW	LONG RUN	LOW	✓
2			1-1-5	HEAT REJECTION EQUIPMENTES LOCATIONS	NO RISK	LOW	NON	LOW	✓
3			1-1-6	AIR LOST FROM ENTRANCE /EXIT	NO RISK	LOW	LONG RUN	LOW	✓
4			1-1-8	RADIATIVE COOLING FOR BUILDING ROOFS*	NO RISK	LOW	SHORT RUN	HIGH	✓
5			1-1-9	RADIATIVE COOLING FOR BUILDING EXTERNAL WALLS*	NO RISK	LOW	SHORT RUN	HIGH	✓
6		2-1	INDOOR AIR QUALITY AND VENTILATION		NO RISK	LOW	NON	LOW	✓
7		2-2	AIR INLETS AND EXHAUST'S LOCATIONS		NO RISK	LOW	NON	LOW	✓
8		2-8	SMOKING AREAS		NO RISK	LOW	NON	LOW	✓
9		2-10	CARPET SYSTEMS		DIFICULT	LOW	NON	LOW	✓
10			2-11-1	BULDING WATER SYSTEMS	NO RISK	LOW	NON	LOW	✓
11			2-11-2	WATER FEATURES	NO RISK	LOW	NON	LOW	✓
12			3-1-3	AC COMPRESSOR OPTIMIZATIOJN	NO RISK	LOW	SHORT RUN	LOW	✓
13			3-1-4	REFRIGERANT ADDITIVE	NO RISK	LOW	SHORT RUN	LOW	✓
14			3-1-5	EVAPORATING COOLING FOR CHILLERS	RISKY	LOW	SHORT RUN	LOW	✓
15			3-2-6	CHW PUMP OPERATION OPTIMIZATION	NO RISK	LOW	SHORT RUN	LOW	✓
16			3-5-1	LED (LIGHT EMMITING DIODS)	RISKY	LOW	SHORT RUN	LOW	✓
17			3-5-2	SOLAR TUBES	NO RISK	LOW	NON	LOW	✓
18			3-5-3	LIGHTING CONTROLS	NO RISK	LOW	SHORT RUN	LOW	✓
19			4-1-2	CONTROL SYSTEMS	DIFICULT	LOW	LONG RUN	LOW	✓
20			5-1-1	PAINTS AND COATING	NO RISK	LOW	NON	LOW	✓
21			5-1-2	ADHESIVES AND SEALANTS	NO RISK	LOW	NON	LOW	✓
22		5-2	ASBESTOS CONTAINING MATERIALS*		NO RISK	LOW	NON	LOW	✓
23		5-3	LEADS AND HEAVY MATALS CONTAININ MATERIALS*		NO RISK	LOW	NON	LOW	✓
24		5-4	(ODP) OSON DEPLETION MATERIALS MANAGMENT		NO RISK	LOW	NON	LOW	✓
25		6-1	BULK WASTE COLLECTION		NO RISK	LOW	NON	LOW	✓

GREENING GUIDELINES

26		6-2	WASTE STORAGE	NO RISK	LOW	NON	LOW	✓
27		6-3	WASTE COLLECTION	DIFICULT	LOW	NON	LOW	✓
28		6-4	RECYCLING AND SEGREGATION	NO RISK	LOW	NON	LOW	✓
29		7-2	ENHANCING WATER SUPPLY SYSTEMS- Anti-scale systems	NO RISK	LOW	LONG RUN	LOW	✓
30		7-4	ENHANCING SWIMMING POOL MANAGEMENT WITH NATURAL SOLUTIONS- Anti-scale systems and natural zeolite cleaners	NO RISK	LOW	SHORT RUN	LOW	✓
31		8-2	LIGHTING SYSTEM	NO RISK	LOW	SHORT RUN	LOW	✓
32		8-4	PERFORMANCE REPORT	NO RISK	LOW	NON	LOW	✓

*Considered as Gold Category as it is a new technology.

GREENING GUIDELINES

GREENING REQUIREMENT HEADINGS / PLATINUM					DIFFICULTIES OR RISKS	INITIAL COSTS	PAYBACK	SAVING	BENEFITS
1			1-1-3	WINDOW DIMMING SYSTEMS (CONTROLS)	DIFICULT	HIGH	SHORT RUN	HIGH	✓
2			3-1-1	AC REPLACEMENT- VRF SYSTEM	DIFICULT	HIGH	LONG RUN	HIGH	✓
3			3-1-2	AC REPLACEMENT- INVERTERSPLIT	NO RISK	HIGH	LONG RUN	HIGH	✓
4			3-1-6	DC MOTORS FOR FCUA	RISKY	HIGH	SHORT RUN	HIGH	✓
5			3-1-7	VOTREX CONDENSER SUB- COOLER	DIFICULT	HIGH	LONG RUN	HIGH	✓
6			3-1-8	HYPRID EVAPORATIVE COOLING	RISKY	HIGH	SHORT RUN	HIGH	✓
7			3-1-9	DUCT WORK AIR LEACAGE	RISKY	HIGH	SHORT RUN	HIGH	✓
8		3-7	ELECTRICAL POWER GENERATION		DIFICULT	HIGH	SHORT RUN	HIGH	✓
9		4-3	EFFICIENT IRRIGATION		RISKY	HIGH	LONG RUN	HIGH	✓
10		4-4	GREY WATER REUSE		RISKY	HIGH	LONG RUN	HIGH	✓
11		4-5	COOLING TOWER WATER SUPPLY		RISKY	HIGH	LONG RUN	HIGH	✓
12		7-1	MAINTINANCE OF MECANICAL SYSTEMS		RISKY	HIGH	SHORT RUN	HIGH	✓
13		7-3	ENHANCING COOLING TOWERS - Anti-scale technology		NO RISK	HIGH	SHORT RUN	HIGH	✓
14	10	(BMS) BUILDING MANAGEMENT SYSTEM			RISKY	HIGH	SHORT RUN	HIGH	✓
15		2-3	ISOLATIONS OF POLUTANT SOURCES		RISKY	HIGH	NON	LOW	✓
16		2-7	VENTILATION FOR VEHICLE PARKING AREAS & CARBON MONOXIDE SENSORS		NO RISK	HIGH	LONG RUN	LOW	✓
17		3-3	ENERGY MANAGEMENT SYSTEMS		NO RISK	HIGH	LONG RUN	LOW	✓
18		4-2	CONDESATE DRAINAGE AND REUSE		DIFICULT	HIGH	LONG RUN	LOW	✓
19		5-5	COMPOSIT WOOD PRODUCTS		NO RISK	HIGH	NON	LOW	✓
20		1-2	PLANTED AREAS AND LOCAL SPECIES		NO RISK	LOW	NON	NON	✓
21		1-3	EXTERIOR LIGHT POWER, POLLYTION AND CONTROLS		NO RISK	LOW	NON	NON	✓
22		1-4	SHADING OF PUBLIC ACCESS		NO RISK	LOW	NON	NON	✓

GREENING REQUIREMENT			
1	ECOLOGY AND PLANNING		
	1-1	ENVELOP	
		1-1-1	INSULATION AND COATING
			Apply paint base insulation materials on internal walls and external walls and roof, with high R-values as per the International Energy Conservation Code (IECC) or ASHRAE 90.1 standards or any other equivalent standard. Consider materials like rigid foam boards or spray foam for better insulation performance. Thickness shall be as per manufacturer recommendation supported by actual case studies and technical data sheets by the manufacturer. All Paints with thermal properties shall be certified from Dubai Central Laboratory or any other laboratory, approved by the Authority.
			BENEFITS
			Savings in cooling energy and cost.
			RISKS
			NO RISK
			COST
			LOW
			PAY BACK
			LONG RUN The payback will depend on the installed heating and cooling systems. Around 3 years for the first installation of insulation
			RESOURCES
			▪ Handbook of Electricity & Water Conservation Measures (Dubai Electricity & Water Authority) ▪ Greening Your Building, A Toolkit for Improving Asset Performance, Reduce Heat Gain EN – 02 (City of Melbourne) ▪ Green Star Technical Manual – Office Design v2: Ene-1. (Green Building Council Australia) ▪ BREEAM International Refurbishment and Fit-out 2015: Mat 01 Environmental impact of materials, Mat 03 Responsible sourcing of materials.

		1-1-2	WINDOW FILMS
			Use window films with low Solar Heat Gain (SHGC) and high Visible Transmittance (VT) to maximize energy savings while maintaining natural light levels. To meet the performance criteria in Table E.5 Table E.6 and Table E.7 of Dubai Building Code requirement (E.5.2.3.2 Glazed elements). (Considering Cool Roof Rating Council (CRRC) standards and LEED guidelines.) All window films shall be certified from Dubai Central Laboratory or any other laboratory, approved by the Authority.
			BENEFITS
			▪ Reducing heat gain through the building fabric, due to heat conduction and solar gain. ▪ Savings in cooling energy and cost. ▪ Reduced discomfort to occupants near the facade.
			RISKS
			NO RISK
			COST
			LOW
			PAY BACK
			SHORT RUN
			RESOURCES
			▪ Dubai Building Code 2021 Edition, E.5.2.3.2 Glazed elements ▪ Handbook of Electricity & Water Conservation Measures (Dubai Electricity & Water Authority) ▪ Greening Your Building, A Toolkit for Improving Asset Performance, Reduce Heat Gain EN – 02 (City of Melbourne) ▪ Green Star Technical Manual – Office Design v2: Ene-1. (Green Building Council Australia)
		1-1-3	WINDOW DIMMING SYSTEMS (CONTROLS)
			Modify the windows by using sensors and microprocessors to automatically adjust shade based on available sunlight and the time of day and to provide the proper lighting and comfort and save energy.

			Integrated sensors and microprocessors with a building management system (BMS) is best practice. To meet Dubai Building Code requirement (H.7.4 Lighting controls)
			BENEFITS - promotes occupant health and wellbeing and has a positive influence on worker productivity. - reduces reliance on artificial lighting, thereby reducing energy consumption and energy bills.
			RISKS
			DIFICULT
			COST
			HIGH
			PAY BACK
			SHORT RUN
			RESOURCES - Dubai Building Code 2021 Edition, H.7.4 Lighting controls - Handbook of Electricity & Water Conservation Measures (Dubai Electricity & Water Authority) - Greening Your Building, A Toolkit for Improving Asset Performance, Lighting – Optimize Daylight LI - 06(City of Melbourne) - Green Star Technical Manual – Office Design v2: IEQ -4 - BREEAM International Refurbishment and Fit-out 2015: 6.0 Health and Wellbeing - Hea 01 Visual comfort - LEED v4 for Building operations and maintenance, Indoor Environmental Quality - EQ CREDIT: daylight and quality views
		1-1-4	EXTERNAL SURFACES REFLECTANCE, INCLUDING HARD SCAPE
			Opaque building envelope surfaces shall have an SRI value not less than 29 for Steep sloped roofs (slopes steeper than 1:6) and external walls, and not less than 78 for flat and low sloped roofs (slopes lower than or equal to 1:6) according to Dubai Building Code section E.5.7 and K.7.2.7 Heat island effect reduction , for a minimum of 75% of the roof area and 100% of the external walls. For hardscape of the development at least 50% of the hardscape shall achieve at least one of the following:

		a) demonstrate an SRI of at least as specified for opaque buildings b) use an open grid pavement system c) be shaded by vegetation d) be shaded by materials with an SRI equal to or greater than those specified for opaque buildings e) be shaded by solar panels. Follow guidelines from the LEED rating system and the Cool Roof Rating Council (CRRRC) for SRI testing methods. Ensure that the materials used for hardscapes are durable and maintain their reflective properties over time. All Hardscapes materials shall be certified from Dubai Central Laboratory or any other laboratory, approved by the Authority. for SRI properties.
		BENEFITS
		- Reducing heat gain through the building fabric, due to heat conduction and solar gain. - Savings in cooling energy and cost - Reduced discomfort to occupants near the facade.
		RISKS
		NO RISK
		COST
		LOW
		PAY BACK
		LONG RUN
		RESOURCES
		- Dubai Building Code 2021 Edition, E.5.7, B.10.5.3 - Al Sa'fat – Dubai Green Building System-2nd edition, January 2023 304.01, 304.04 - Greening Your Building, A Toolkit for Improving Asset Performance, Reduce Heat Gain EN – 02 (City of Melbourne) - Green Star Technical Manual – Office Design v2: Ene-1 - BREEAM International Refurbishment and Fit-out 2015: 6.0 Health and Wellbeing - Hea 01 Visual comfort.

		1-1-5	HEAT REJECTION EQUIPMENTES LOCATIONS
			Modify the location of individual heat rejection equipment having a power rating greater than 4.0 kW and which exhausts externally, to be installed not less than 3m above the ground level of the building.
			BENEFITS
			▪ Reduced discomfort to occupants ▪ Occupants' safety
			RISKS
			NO RISK
			COST
			LOW
			PAY BACK
			NON
			RESOURCES
			▪ Dubai Building Code 2021 Edition, H.4.3 ▪ Al Sa'fat – Dubai Green Building System-2nd edition, January 304.02
		1-1-6	AIR LOST FROM ENTRANCE /EXIT
			Loss of conditioned air from a main entrance to an air-conditioned building shall be mitigated by a lobby or door barrier system.
			Such as air curtains to prevent air loss and maintain energy efficiency, noting revolving doors are not suitable solution that cause an obstacle to accessibility.
			BENEFITS
			▪ Reduced discomfort to occupants ▪ Savings in cooling energy and cost
			RISKS
			NO RISK
			COST
			LOW
			PAY BACK
			LONG RUN
			RESOURCES

			▪ Dubai Building Code 2021 Edition, H.4.9.2 ▪ Al Sa'fat – Dubai Green Building System-2nd edition, January 501.04 ▪ Greening Your Building, A Toolkit for Improving Asset Performance, Reduce Infiltration EN - 03(City of Melbourne)
		1-1-7	INFILTRATION/ AIR LEAKAGE
			Air-conditioned buildings with a cooling load of 1 MW or greater shall achieve an air leakage that does not exceed 5 m3/h/m2 into or out of the building, at an applied pressure difference of 50 Pa. Air tightness testing shall be carried out to verify compliance, in accordance with BS EN 13829 or ASTM E779 or as approved by the Authority. Positive pressure, with respect to atmosphere, shall always be maintained in the building. Follow ASHRAE 90.1 standards and conduct regular blower door tests to maintain building envelope integrity.
			BENEFITS
			▪ Savings in heating and cooling energy and cost. ▪ Reduced discomfort to occupants near the leakage points.
			RISKS
			NO RISK
			COST
			LOW
			PAY BACK
			SHORT RUN
			RESOURCES
			▪ Dubai Building Code 2021 Edition, H.4.9 ▪ Al Sa'fat – Dubai Green Building System-2nd edition, January 501.05 ▪ Greening Your Building, A Toolkit for Improving Asset Performance, Reduce Infiltration EN - 03(City of Melbourne) ▪ BREEAM International Refurbishment and Fit-out 2015: 7.0 Energy- Ene 05 Energy efficient cold storage

		1-1-8	RADIATIVE COOLING FOR BUILDING ROOFS
			Use of high-emissivity coatings and specialized nanomaterial films or any other equivalent materials designed for radiative cooling on building roofs to reduce heat absorption and lower indoor temperatures. Radiative cooling technology employs advanced nanomaterials to emit thermal radiation in the infrared spectrum, enabling buildings to cool passively by radiating heat to the cooler atmosphere. Radiative cooling materials shall be certified from Dubai Central Laboratory or any other laboratory, approved by the Authority.
			BENEFITS
			▪ Energy Efficiency: Significant reduction in energy consumption for air conditioning, with potential savings of over 40%. ▪ CO₂ Emissions Reduction: Lower CO₂ emissions due to decreased reliance on traditional air conditioning systems. ▪ Urban Heat Island Mitigation: Mitigation of urban heat island effect, leading to cooler urban environments. ▪ Enhanced Thermal Comfort: Improved indoor thermal comfort for occupants. ▪ Self-Cleaning Surfaces: Nanotechnology ensures surfaces remain clean and self-maintaining, reducing maintenance efforts and costs. ▪ Climate Change Mitigation: Potential to mitigate climate change impacts and contribute to reversing global warming trends.
			RISKS
			▪ Minimal risks associated with proper installation and integration into existing building structures. ▪ Periodic maintenance required to ensure optimal performance, although reduced by self-cleaning properties.
			COST
			▪ LOW Moderate initial investment with low ongoing maintenance costs due to self-cleaning properties.

			PAYBACK SHORT RUN (1-3 years) depending on building usage and cooling requirements.
			RESOURCES
		1-1-9	RADIATIVE COOLING FOR BUILDING EXTERNAL WALLS
			Coating external walls with radiative cooling materials to further decrease the thermal load on buildings. Radiative cooling technology employs advanced nanomaterials to emit thermal radiation in the infrared spectrum, enabling buildings to cool passively by radiating heat to the cooler atmosphere. Radiative cooling materials shall be certified from Dubai Central Laboratory or any other laboratory, approved by the Authority.
			BENEFITS - Energy Efficiency: Significant reduction in energy consumption for air conditioning, with potential savings of over 40%. - CO₂ Emissions Reduction: Lower CO₂ emissions due to decreased reliance on traditional air conditioning systems. - Urban Heat Island Mitigation: Mitigation of urban heat island effect, leading to cooler urban environments. - Enhanced Thermal Comfort: Improved indoor thermal comfort for occupants. - Self-Cleaning Surfaces: Nanotechnology ensures surfaces remain clean and self-maintaining, reducing maintenance efforts and costs. - Climate Change Mitigation: Potential to mitigate climate change impacts and contribute to reversing global warming trends.
			RISKS - Minimal risks associated with proper installation and integration into existing building structures. - Periodic maintenance required to ensure optimal performance, although reduced by self-cleaning properties.

			COST
			LOW
			PAYBACK
			SHORT RUN (1-3 years) depending on building usage and cooling requirements.
			RESOURCES
	1-2	PLANTED AREAS AND LOCAL SPECIES	
			25% of the total planted area within the building plot, including green roofs, must utilize plant and tree species indigenous or adapted to Dubai's climate and region
			BENEFITS
			Environmental benefits
			RISKS
			NO RISK
			COST
			LOW
			PAY BACK
			NON
			RESOURCES
			- Dubai Building Code 2021 Edition, B.10.5.1 - Al Sa'fat – Dubai Green Building System-2nd edition, January 302.01
	1-3	EXTERIOR LIGHT POWER, POLLYTION AND CONTROLS	
			The average lighting power density for the exterior connected lighting load for building envelopes shall not exceed 2.2 W/m² for each illuminated wall or surface area or 16.4 W/linear meter for each illuminated wall or surface length. Permanently installed exterior lighting shall meet the following requirements: a) All exterior light fixtures on the building site, other than architectural

		accent lighting (see point b below) and Civil Aviation safety lighting, shall be shielded, such that the full light emitted by the fixture, either directly or indirectly by reflection or by refraction from any part of the fixture, is projected below the horizontal plane passing through the lowest part of the fixture (See DBC E.5.8 Figure E.7). b) Architectural accent lighting shall be aimed or shielded to prevent the lighting of the night sky. Wall washing lights shall spill no more than 10% of the lighting past the building facade. c) Downward directed lighting shall be used for lighting of signage. d) All exterior lighting shall be fitted with automatic controls, so that the lights can be set not to operate during daylight hours.
		BENEFITS
		- Environmental benefit - Social benefits - Safety
		RISKS
		NO RISK
		COST
		LOW
		PAY BACK
		NON
		RESOURCES
		- Dubai Building Code 2021 Edition, E.5.8 - Al Sa'fat – Dubai Green Building System-2nd edition, January 303.01
	1-4	SHADING OF PUBLIC ACCESS
		All pedestrian links within the plot area shall be shaded using materials that have a solar reflectance index (SRI) equal to or greater than those specified in clause 1-1-4.
		BENEFITS
		- Occupants' safety - Occupant's comfort - Environmental benefits
		RISKS
		NO RISK

			COST LOW PAY BACK NON RESOURCES ▪ Dubai Building Code 2021 Edition, B.10.5.2 ▪ Al Sa'fat – Dubai Green Building System-2nd edition, January 304.06 ▪ Greening Your Building, A Toolkit for Improving Asset Performance, Reduce Heat Gain EN – 02 (City of Melbourne) ▪ Green Star Technical Manual – Office Design v2: Ene-1
2	VITALITY		
	2-1	INDOOR AIR QUALITY AND VENTILATION	
			Hotels, shopping malls, educational facilities, government buildings, healthcare facilities (waiting and public areas in health care facilities), mosques and worship buildings, theatres, cinemas, or any other existing buildings as determined by DM in future, suitable ventilation system must be provided for the building occupants. The provided system must ensure, the air quality provided is in accordance with the technical guidelines issued by Dubai Municipality. The buildings must apply the following procedures: A. Indoor air testing for the contaminants listed in following Table must be carried out, to ensure the air quality in the building, is suitable for occupation. The maximum limit for the indoor air contaminants included in Common Air Pollutant in Existing Buildings table 2 of Technical Guidelines (119) for Indoor Air Quality for Healthy Life must not be exceeded. B. Air quality testing must be carried out by an air testing accredited company or laboratory by Emirates International Accreditation center (EIAC), and the Compliant test results must be submitted to DM. C. Air quality testing equipment must have initial and periodical calibration certificate as per manufacturer requirement from an external calibration facility accredited by DM or at least annual calibration certificate. The initial and periodical calibration certificates must be saved in a special

		register to be checked by DM to ensure the accuracy of the readings as condition of renewal the indoor air quality certificate.
		BENEFITS ▪ Reduce the health risks of sick building. ▪ Occupant's comfort ▪ health of building occupants.
		RISKS
		NO RISK
		COST
		LOW
		PAY BACK
		NON
		RESOURCES ▪ Al Sa'fat – Dubai Green Building System-2nd edition, January 401.07 ▪ Greening Your Building, A Toolkit for Improving Asset Performance, Volatile Organic Compounds (VOCs) INT - 04 (City of Melbourne) ▪ Green Star Technical Manual – Office Design v2: IEQ-13, 14 and 16, Office Interiors v1.1: IEQ- 11, 12 and 14, Office as Built v2: IEQ-13, 14 and 16. ▪ BREEAM International Refurbishment and Fit-out 2015: 6.0 Health and Wellbeing- Hea 02 Indoor air quality ▪ Technical Guidelines (119) for Indoor Air Quality for Healthy Life ▪ LEED v4 for Building operations and maintenance, Indoor Environmental Quality - EQ PREREQUISITE: minimum indoor air quality performance Required. ▪ ASHRAE 62.1 and 62.2 standards for indoor air quality.
	2-2	AIR INLETS AND EXHAUST'S LOCATIONS
		Outdoor air inlets for all ventilation systems, including doors, operable windows and mixed mode ventilation systems, shall be located at a

		suitable distance from potential sources of contamination as specified in ASHRAE 62.1, ASHRAE 62.2 and the ASHRAE HVAC applications handbook [Ref. H.17]. NOTE: This is to reduce the possibility of odor, smoke or other air contaminants entering the ventilation system. Exhaust air shall be discharged in such a way that it does not get drawn back into the building or the building ventilation system. It also shall not become a nuisance to the building occupants or occupants of nearby buildings or to pedestrians. Air inlets and exhaust louvers/vents shall be positioned such as to prevent recirculation of air and separated by a distance not less than the minimum given in Table 5-1 of ASHRAE 62.1 Air inlets and exhausts shall be located relative to prevailing wind directions, using wind rose diagrams for the building. Air inlets shall be positioned at upwind or windward direction. Exhausts (such as from kitchens, toilets, and smoke extract) shall discharge at downwind or leeward direction. Intake air shall be drawn into the system through sand trap louvers sized for at least 1 m/s across the face area of the louver, to provide an 80% or higher filtration efficiency at coarse sand grain size (355 µm to 425 µm).
		BENEFITS
		▪ Promotes occupant health and wellbeing and has a positive influence on worker productivity. ▪ Reduce the health risks of sick building. ▪ Occupant's comfort
		RISKS
		NO RISK
		COST
		LOW
		PAY BACK
		NON
		RESOURCES
		▪ Dubai Building Code 2021 Edition, H.4.10.4 ▪ Al Sa'fat – Dubai Green Building System-2nd edition, January 401.03

			Greening Your Building, A Toolkit for Improving Asset Performance, Ventilation Rates INT - 05 (City of Melbourne)
	2-3	ISOLATIONS OF POLLUTANT SOURCES	
			All buildings with activities producing hazardous fumes or chemicals (such as print rooms and laboratories) shall be provided with dedicated air extraction systems for those spaces. The system shall create negative pressure and exhaust the fumes or chemicals, to prevent them from entering adjacent rooms, with ensure regular maintenance and monitoring. BENEFITS - Promotes occupant health. - Occupant's comfort RISKS - IMPLEMENTATION SHOULD BE VERIFIED FROM THIRD PARTY TO ENSURE CONTINUOUS EFFECTIVENESS COST HIGH PAY BACK NON RESOURCES - Dubai Building Code 2021 Edition, H.4.10.5 - Al Sa'fat – Dubai Green Building System-2nd edition, January 401.0 - BREEAM International Refurbishment and Fit-out 2015: 6.0 Health and Wellbeing- Hea 02 Indoor air quality
	2-4	NATURAL VENTILATION	
			Natural ventilation of occupied spaces via windows, doors or other openings is permitted but shall not be relied upon to provide ventilation and thermal comfort. Hybrid solutions by combining natural ventilation with mechanical systems is the best practice, With the importance of educating users on optimal usage practices. Operating mechanisms for such openings shall be accessible so that the openings are readily operable by the building occupants.

			BENEFITS - Promotes occupant health. - Occupant's comfort RISKS - Technology must be coupled with information so that users have full control. - Incorrect use and practices may lead to wasted energy due to the combination of natural ventilation and air conditioning COST LOW PAY BACK NON RESOURCES - Dubai Building Code 2021 Edition, H.4.11 - Al Sa'fat – Dubai Green Building System-2nd edition, January 401.05 - Greening Your Building, A Toolkit for Improving Asset Performance, Individual Control INT - 07 (City of Melbourne) - Green Star Technical Manual – Office Design v2 IEQ-10, Office Interiors v1.1: IEQ-8, Office as Built v2: IEQ-10. - BREEAM International Refurbishment and Fit-out 2015: 6.0 Health and Wellbeing- Hea 02 Indoor air quality - LEED v4 for Building operations and maintenance, Indoor Environmental Quality - EQ PREREQUISITE: minimum indoor air quality performance Required
	2-5	SEALING DOORS AND WINDOW FRAMES	
			Doors and window frames on the building exteriors must be sealed from any openings. This must be with a nonflammable materials and with materials that prevent the transmission of air and sound that may occur as a result of difference in pressure across the exterior of the building. Sealing materials shall conform to Sections 4 to 7, Ch. 1 of UAE FLSC [Ref. E.1]. They shall also prevent the transmission of air and sound that might occur as a result of pressure differences across the exterior of the building. Air

		leakage shall be controlled in accordance with part H of Dubai building code. For best practice follow ASTM E2112 for proper installation of windows and doors. Use materials that comply with UAE Fire and Life Safety Code (FLSC) and ensure regular inspections and All sealants' products shall be certified from Dubai Central Laboratory or any other laboratory, approved by the Authority. for green building requirements.
		BENEFITS
		- Promotes occupant health. - Occupant's comfort - Savings in cooling energy and cost.
		RISKS
		NO RISK
		COST
		LOW
		PAY BACK
		LONG RUN
		RESOURCES
		- Dubai Building Code 2021 Edition, E.5.6 - Al Sa'fat – Dubai Green Building System-2nd edition, January 401.08 - Greening Your Building, A Toolkit for Improving Asset Performance, Reduce Infiltration EN - 03(City of Melbourne)
	2-6	INSPECTION AND CLEANING (HVAC) EQUIPMENTS
		The cleanliness of HVAC equipment and systems must be maintained. All its parts must be inspected and cleaned in accordance with the standard specifications approved by Dubai Municipality and in accordance with the technical guidelines issued by Dubai Municipality. Specialized maintenance companies, approved by Dubai Municipality must carry out this inspection and cleaning. This can also be carried out by the building operator, if sufficient evidence can be provided on their qualification for carrying out these tasks.

			BENEFITS - Savings in cooling energy and cost - Promotes occupant health RISKS - If proper metering and monitoring strategies and plans are not implemented, then the inspection effectiveness will not be sufficient COST LOW PAY BACK SHORT RUN RESOURCES - Al Sa'fat – Dubai Green Building System-2nd edition, January 401.09 - Greening Your Building, A Toolkit for Improving Asset Performance, Maintenance Plan GEN - 01(City of Melbourne) - Green Star Technical Manual – Office Design v2: MAN-1 - BREEAM International Refurbishment and Fit-out 2015: 6.0 Health and Wellbeing- Hea 02 Indoor air quality
	2-7	VENTILATION FOR VEHICLE PARKING AREAS & CARBON MONOXIDE SENSORS	
			Mechanical ventilation systems with real-time monitoring and control shall be Implemented to ensure the carbon monoxide (CO) concentration within enclosed parking areas (see B.7.2.3.2 & H.4.12.11) is maintained below 50 ppm. The concentration shall be maintained by providing at least six outside air changes per hour, or by installing a variable air volume ventilation system that is controlled by an input response from the CO monitoring equipment. CO monitoring equipment shall be installed, with at least one CO sensor per 400 m2 floor area of parking. An audible alarm shall be triggered when the CO concentration reaches or exceeds 75 ppm in at least 5% of the monitored locations. Outdoor air shall be provided for each parking level.

		Occupied areas, such as offices, shopping centers, hotels, elevator lobbies, waiting rooms and ticket booths connected to an enclosed parking space, shall be supplied with conditioned air under positive pressure when compared with the adjoining parking area. For smoke clearance purposes, ventilation systems shall be capable of providing ten air changes per hour and shall meet the requirements of Section 3.5, Ch. 10 of UAE FLSC [Ref. H.1]. Where a building management system (BMS) is installed, CO concentration shall be monitored to allow real time profiling and management of air quality. CO monitoring equipment shall be checked and recalibrated every 6 months or according to manufacturer specification by a specialized calibration company, certified by the Authority. Natural ventilation of vehicle parking areas shall conform to B.7.2.3.2 and NFPA 88A. Where Exhaust fan automation based on Carbon Monoxide (CO) sensors modulates its operation depending upon CO concentration inside the basement car park and only runs the fan when required. These systems are available as stand-alone systems or can be integrated with the existing BMS system. Integrated CO sensors with a building management system (BMS) for automated alerts, real-time air quality management, and ensure regular calibration and maintenance by certified professionals is best practice.
		BENEFITS
		▪ Promotes occupant health ▪ Savings in cooling energy and cost.
		RISKS
		NO RISK but ▪ Ensure regular monitoring and maintenance of CO sensors. ▪ Risks of humidity and bad smell must be evaluated

			COST HIGH PAY BACK LONG RUN RESOURCES ▪ Dubai Building Code 2021 Edition, H.4.12.11 ▪ Al Sa'fat – Dubai Green Building System-2nd edition, January 401.10 ▪ BREEAM International Refurbishment and Fit-out 2015: 6.0 Health and Wellbeing- Hea 02 Indoor air quality ▪ Handbook of Electricity & Water Conservation Measures (Dubai Electricity & Water Authority)
	2-8	SMOKING AREAS	
			Smoking is prohibited in all public areas in accordance with Local Order No 11 – 2003 and Federal Law No. (15) of 2009 on Combating Tobacco. Places where smoking is allowed shall be determined in accordance with the conditions listed in the Manual of regulating smoking in public places issued by the Authority. This manual defines the public places where smoking is strictly prohibited and places where smoking is allowed under specific conditions. Designated smoking areas shall be at least 7.5 m away from the entrances of the building, doors and operable windows and outdoor air intakes of ventilation systems. An annual permit is issued from the competent department of the Authority for all places where smoking is allowed, upon submission of all required documents and drawings mentioned in the guideline.
			BENEFITS
			▪ Promotes occupant health.
			RISKS
			NO RISK
			COST
			HIGH
			PAY BACK
			NON

			RESOURCES ▪ Dubai Building Code 2021 Edition, B.10.4 ▪ Al Sa'fat – Dubai Green Building System-2nd edition, January 401.11 ▪ LEED v4 for Building operations and maintenance, Indoor Environmental Quality - EQ PREREQUISITE: Environmental tobacco smoke control
	2-9	THERMAL COMFORT	
			Use advanced HVAC systems with precise control capabilities of providing the range of internal conditions according to Table 3 - Thermal and Physical Comfort in Technical Guidelines (119) for Technical Guidelines for Indoor Air Quality for Healthy Life, for 95% of the year.
			BENEFITS ▪ Savings in cooling energy and cost. ▪ Promotes occupant comfort
			RISKS
			NO RISK
			COST
			LOW
			PAY BACK
			SHORT RUN
			RESOURCES ▪ Dubai Building Code 2021 Edition, H.4.7 ▪ Al Sa'fat – Dubai Green Building System-2nd edition, January 402.01 ▪ Greening Your Building, A Toolkit for Improving Asset Performance, Controls – Air Handling HVAC - 06(City of Melbourne) ▪ BREEAM International Refurbishment and Fit-out 2015: 6.0 Health and Wellbeing- Hea 04 Thermal comfort ▪ LEED v4 for Building operations and maintenance, Indoor Environmental Quality - EQ CREDIT: thermal comfort ▪ Technical Guidelines (119) for Technical Guidelines for Indoor Air Quality for Healthy Life

	2-10	CARPET SYSTEMS	
			For public and commercial buildings, each new carpet system (Carpets or new permanently installed carpet padding) shall be certified from Dubai Central Laboratory or any other laboratory, approved by the Authority. Carpets are not allowed to be used in labor accommodation, educational facilities, or any other places as determined in part H of Dubai building code (H.4.10.3 Indoor air quality)
			BENEFITS
			Improved indoor air quality and Promotes occupant health
			RISKS
			Difficulties of Material availability
			COST
			LOW
			PAY BACK
			NON
			RESOURCES
			- Dubai Building Code 2021 Edition, H.4.10.3 - Al Sa'fat – Dubai Green Building System-2nd edition, January 404.03 - Greening Your Building, A Toolkit for Improving Asset Performance, Internal Finishes & Fittings INT - 03(City of Melbourne) - Green Star Technical Manual – Office Design v2: IEQ-13,14 - Green Star Technical Manual – Interior v1: MAT - BREEAM International Refurbishment and Fit-out 2015: 6.0 Health and Wellbeing- Hea 02 Indoor air quality
	2-11	TREATMENT AGAINST MICROBIOLOGICAL BACTEREA GROWTH (WATER QUALITY)	
		2-11-1	BULDING WATER SYSTEMS
			A proper and effective method shall be implemented to control microbiological bacteria growth in building water systems, cooling towers, and internal and external water features. One of the following control methods shall be used: a) pasteurization;

		b) chemical treatment (biocides, chlorine, etc.); c) silver copper ionization; d) filtration systems. The above treatment systems are effective throughout the water system downstream to the point of application. e) Ultraviolet light UV and Ozone O can be used to treat water at or very close to the point of application. The choice depends on the building, the water systems it serves, the source of the incoming water supply, and the capital and on-going maintenance costs. The designer shall formulate a strategy to maintain water quality and minimize the risk of Legionella bacteria for each manufactured water system from the point of supply to point of use. The suitability of the materials used in the construction of the manufactured water system shall not adversely affect water quality. Water systems shall not use materials that aid microbial growth. Any cooling water system, including its make-up water tanks, shall be provided with a suitable automatically controlled water treatment system (e.g., an automatic biocide dosing device) for management of corrosion, scaling, fouling and microbial growth. All such treatment systems should always work effectively when the water-cooling system is in operation. It is recommended that hot water should be stored at 60 °C and distributed so that, after one minute of running, a temperature of at least 50° C is attainable at outlets. Cold water storage and distribution should be at 20 °C or below.
		BENEFITS
		Promotes occupant health.
		RISKS
		NO RISK But risk assessment should be conducted to Identify and assess the risk of legionellosis from work activities and water sources on premises and determining any necessary precautionary measures. The premises must

			Carrying out a legionella risk assessment and ensuring it remains up to date and is a key duty when managing the risk of exposure to legionella bacteria. The risk assessment should consider and evaluate: • Clear allocation of management responsibilities • Competence and training of key personnel. • A description of the water system, including an up-to-date schematic diagram. • An evaluation of the risk including factors promoting the growth of legionella • Safe operating procedures for the water system, including controls in place to control risks.
			COST
			LOW
			PAY BACK
			NON
			RESOURCES
			▪ Dubai Building Code 2021 Edition, H.5.6.1 ▪ Al Sa'fat – Dubai Green Building System-2nd edition, January 406.01 ▪ Technical Guidelines for Legionella Control in Water System (DM-HSD-GU44-LCWS2)
		2-11-2	WATER FEATURES
			All water features that have a water storage volume of over 1,000 l shall be designed, installed, operated, treated and maintained to minimize the risk of Legionella bacteria or microbiological bacteria growth in accordance with Guidelines mentioned in Dubai Building Code part H (H.5.6.1) Regular maintenance and testing measures required must also be carried out for water features, the water features that produce spray or aerosol should be maintained clean and that a regular regime of testing be in place. Keeping the system clean reduces the nutrients available for bacteria growth. Regular visual inspections should be made. To avoid the build-up of dirt, organic matter or other debris, the water basin of the water feature should be cleaned. Mechanical filtration can be used to help

			reduce this debris. This includes, but is not limited to cooling towers, evaporative condensers, hot and cold-water systems, warm water systems, evaporative air coolers, spas, water features, fountains, misters, etc. BENEFITS - Promotes occupant health. RISKS NO RISK COST LOW PAY BACK NON RESOURCES - Dubai Building Code 2021 Edition, H.5.6.1 - Al Sa'fat – Dubai Green Building System-2nd edition, January 406.02 - Greening Your Building, A Toolkit for Improving Asset Performance, Reduce DHW Demand DHW - 01(City of Melbourne) - Technical Guidelines for Legionella Control in Water System (DM-HSD-GU44-LCWS2)
3	ENERGY EFFICIENCY		
	3-1	HVAC SYSTEMS	
		3-1-1	AC REPLACEMENT- VRF SYSTEM
			Replace the A/C system with a high-efficiency Variable Refrigerant Flow (VRF) system with high (COP) Coefficient of Performance and (SEER) Seasonal Energy Efficiency Ratio values, which that the compressor operates according to the load requirement, as the compressor is installed with variable speed drive and able to regulate refrigerant flow rather than simply perform ON/OFF operations. Typically, these units usually have multiple indoor units installed on single outdoor unit.

			Ensure to meet the minimum Energy performance as required by MOIAT standards 5010-1 for residential systems and 5010-5 for commercial systems. BENEFITS ▪ Savings in cooling energy. ▪ Ensure feasibility and cost-effectiveness. RISKS ▪ Commission a HVAC engineer to determine technical and financial feasibility and cost effectiveness. COST HIGH PAY BACK LONG RUN RESOURCES ▪ Handbook of Electricity & Water Conservation Measures (Dubai Electricity & Water Authority) ▪ Al Sa'fat – Dubai Green Building System-2nd edition, January 502.01 ▪ Greening Your Building, A Toolkit for Improving Asset Performance, Controls - Cooling HVAC - 07 (City of Melbourne) ▪ Uaes-5010-5-2019-Labeling – Energy efficiency label for electrical appliances -Part five: commercial and central Air conditioners
		3-1-2	AC REPLACEMENT- INVERTER SPLIT
			Replace the A/C system with inverter systems with high (SEER) Seasonal Energy Efficiency Ratio values, equipped with compressor uses a variable speed drive to control the compressor motor speed to modulate cooling capacity. Capacity modulation is a way to match cooling capacity to cooling demand. These types have one indoor unit for every outdoor unit. Ensure to meet the minimum Energy performance as required by MOIAT standards 5010-1 for residential systems and 5010-5 for commercial systems. BENEFITS ▪ Saving in energy consumption and maximum demand with associated cost savings.

			RISKS NO RISK COST HIGH PAY BACK LONG RUN RESOURCES ▪ Handbook of Electricity & Water Conservation Measures (Dubai Electricity & Water Authority) ▪ Greening Your Building, A Toolkit for Improving Asset Performance, Pumps HVAC - 14(City of Melbourne ▪ Uaes-5010-5-2019-Labeling – Energy efficiency label for electrical appliances -Part five: commercial and central Air conditioners
		3-1-3	AC COMPRESSOR OPTIMIZATION where applicable retrofit the compressors of the existing ACs by AC compressor optimization devices that integrate with BMS for real-time control. These devices are sensor driven and have software algorithms designed to detect the phases of thermodynamic saturation on the evaporator and accordingly optimize compressor operations. Savings are made by reducing the overall runtime of the compressor, without changes in comfort conditions of the rooms. These retrofits are usually installed on split or window air conditioners. BENEFITS ▪ Savings in cooling energy and cost. ▪ Extends equipment life by ensuring compressors match actual demand efficiently RISKS NO RISK but ▪ Ensure compatibility with existing systems ▪ Regular maintenance and monitoring are required to ensure efficiency. ▪ Potential for operational downtime during installation and maintenance.

			COST LOW PAY BACK SHORT RUN RESOURCES - Handbook of Electricity & Water Conservation Measures (Dubai Electricity & Water Authority) - BREEAM International Refurbishment and Fit-out 2015: 13.0 Pollution- Pol 01 Impact of refrigerant
		3-1-4	REFRIGERANT ADDITIVE Use Refrigerant additives (oil additives) for the refrigerant cycle in the DX systems and chillers according to manufacturer guidelines for additives and ensure regular system checks. They are chemicals that dislodge the layer of stagnant sludge that builds up inside the refrigerant's pipeline. It then forms a protective coating to reduce the possibility of future build-ups of sludge. This will enhance the condenser's heat transfer capacity and lead to higher efficiency. This can save up to 10% for cooling equipment consumption: chillers, package units, split units, and big refrigerators BENEFITS - Savings in cooling energy and cost. RISKS NO RISK but Such additives could void the Manufacturer's warranty, so must ensure additives are compatible with existing systems COST LOW PAY BACK SHORT RUN RESOURCES - Handbook of Electricity & Water Conservation Measures (Dubai Electricity & Water Authority) - BREEAM International Refurbishment and Fit-out 2015: 13.0 Pollution- Pol 01 Impact of refrigerant

		3-1-5	EVAPORATING COOLING FOR CHILLERS
			Retrofit the existing air-cooled chillers by using advanced evaporative cooling devices that integrate with chiller controls. These create a cooler microclimate around the chiller by spraying fine droplets of water in a controlled manner onto specialized material surrounding the unit, resulting in cooler condenser air inlet temperatures. Ensure proper installation and maintenance Evaporative cooling systems should be linked to chiller operations and operate under the following conditions: • Ambient temperature 28°C: start operation • Relative humidity 70%: stop operation There are two types of cooling systems: • Misters produce a mist (droplets of water) onto a mesh that cool the air. • Wet Walls - these are walls made up of special materials. Water passes over these walls, which surround the chillers. As air passes through them, it cools.
			BENEFITS
			▪ Improve air-cooled chillers features and controls to save energy with associated cost savings.
			RISKS
			▪ applied to direct Evaporative Cooling (DEC) ▪ Water carryover to the coil is harmful to life of condenser (as water evaporates and leaves salts behind which cause corrosion) ▪ Adiabatic efficiency must be monitored ▪ Condenser coil must have coating ▪ Fan airflow can reduce due to additional pressure drop on air side
			COST
			LOW
			PAY BACK
			SHORT RON

			RESOURCES - Handbook of Electricity & Water Conservation Measures (Dubai Electricity & Water Authority) - Greening Your Building, A Toolkit for Improving Asset Performance, Cooling Towers – Energy HVAC - 12 (City of Melbourne)
		3-1-6	DC MOTORS FOR FCU Use high-efficiency DC (Direct Current) motor compatible with existing systems that saves energy in terms of capacity of the motor and its control as follows: - For the same airflow output of the FCU (Fan Coil Unit), DC motors can use 30% less energy compared to conventional AC motors. DC motors are available with built in converters and can replace existing AC motors. - DC motors can be controlled to a greater degree of precision. They can integrate with Building Management Systems and operate at variable speeds depending upon demand and load. BENEFITS - Savings in cooling energy and cost. RISKS - Care must be taken to avoid electrical interference to nearby circuits. COST HIGH PAY BACK SHORT RUN RESOURCES - Handbook of Electricity & Water Conservation Measures (Dubai Electricity & Water Authority) - Greening Your Building, A Toolkit for Improving Asset Performance, Efficient Motors and Drives EL - 02(City of Melbourne)
		3-1-7	VOTREX CONDENSER SUB- COOLER Where applicable retrofit the chillers with a Vortex Condenser sub-cooler which is a device that improves the performance of an air conditioner. Its main function is to increase the condenser's capacity by further sub-

			cooling the refrigerant. Due to this additional sub-cooling action, the overall load on the compressor decreases, resulting in increased capacity and lower energy consumption. Vortex condenser devices can couple with a refrigerant volume control function, which also manages the volume of the refrigerant passing through the condenser. This increases its capacity and reduces energy consumption
			BENEFITS
			Savings in cooling energy and cost.
			RISKS
			difficult to install
			COST
			HIGH
			PAY BACK
			LONG RUN
			RESOURCES
			Handbook of Electricity & Water Conservation Measures (Dubai Electricity & Water Authority)
		3-1-8	HYBRID EVAPORATIVE COOLING
			Replace the Package unit (DX AHU) or ducted split unit with Hybrid Evaporative Cooling systems that are standalone systems. and integrated with existing HVAC controls for optimized performance. It is called Indirect Evaporative Cooling (IDEC), as it uses evaporative cooling indirectly to pre-cool the primary air stream (supply air) without adding any moisture. It uses secondary air / ambient air to cool the water by evaporative cooling. Then, this cooled water goes through a heat exchanger, where it cools the primary air stream (supply air). A fan then circulates the cooled primary air stream. In Hybrid-IDEC systems, both indirect evaporative cooling and DX systems manage the cooling load. This increases the energy efficiency and reliability of the unit.

			BENEFITS - Improve cooling tower features and controls to save energy with associated cost savings. - To be implemented on Industrial buildings, public buildings and Commercial buildings
			RISKS
			May not be suitable for hot & humid climate
			COST
			HIGH
			PAY BACK
			SHORT RUN
			RESOURCES
			Handbook of Electricity & Water Conservation Measures (Dubai Electricity & Water Authority)
		3-1-9	DUCT WORK AIR LEACAGE
			Air ductwork shall be Re-designed, Re- built and installed using advanced sealing techniques such as aero seal(https://aeroseal.com/) and conduct regular pressure tests to ensure minimal leakage. In addition to conducting “duct cleaning” every 5 years. The following shall be pressure tested prior to Re- occupancy: a) ductwork attached to equipment and having an external static pressure of more than 250 Pa; b) ductwork exposed to external ambient conditions or within unconditioned spaces. Pressure testing shall be carried out in accordance with the Authority’s approved methodology to verify that air leakage does not exceed the permitted maximum. Ductwork leakage testing shall be carried out by a company that is specialized in commissioning of buildings and is approved by the Authority. All Duct insulations shall be certified from Dubai Central Laboratory or any other laboratory, approved by the Authority. and Civil Defense.

			BENEFITS - Savings in cooling energy and cost. - Promotes occupant comfort RISKS - Commissioning is often a weak point in the handover of buildings as it is usually constrained by time. - difficult to install COST HIGH PAY BACK SHORT RUN RESOURCES - Dubai Building Code 2021 Edition, H.4.12.6 - Al Sa'fat – Dubai Green Building System-2nd edition, January 2013 - Greening Your Building, A Toolkit for Improving Asset Performance, Re-Commissioning - Tuning GEN - 03 (City of Melbourne) - Green Star Technical Manual – Office Design v2: MAN-2 - BREEAM International Refurbishment and Fit-out 2015: 7.0 Energy - Ene 05 Energy - efficient cold storage
	3-2	HVAC CONTROLS	
		3-2-1	PROGRAMMABLE THERMSTATE
			Retrofit existing thermostats system with smart thermostats and occupancy sensors that resets setpoint, that can be Integrated with a building management system (Integrating with a building management system (BMS) is best practice for real-time control and monitoring) to optimize the operation of air conditioners, by avoiding over-cooling and idle running in air-conditioned areas to improve efficiency. Users can program the more advanced thermostat to meet their requirements. This allows control of the set point temperature automatically by using sectionalized spaces and time schedules to make sure that the

			temperature is at optimum-energy-saving levels. Some of the products can also allow the customer to centrally monitor all the AC operations and consumptions, over a smart phone or PC.
			BENEFITS
			Savings in cooling energy and cost.
			RISKS
			NO RISK
			COST
			LOW
			PAY BACK
			SHORT RUN
			RESOURCES
			- Handbook of Electricity & Water Conservation Measures (Dubai Electricity & Water Authority) - Greening Your Building, A Toolkit for Improving Asset Performance, Controls - Schedules HVAC - 10 (City of Melbourne)
		3-2-2	CHILLER PLANTMANAGERS (CPM)
			Use advanced Chiller Plant Manager (CPM) systems that offer real-time monitoring and predictive maintenance capabilities, Independently or with a BMS. To manage the chillers and ancillary equipment to improve their operational efficiency. The (CPM) functions include: - Chiller operation scheduling and sequencing: this is based on run time and loading. - Loading management and load balancing: this maintains equal loading for all operating chillers. - Dynamic Chilled Water Supply Set-point resetting: this depends on load, to maintain delta T. - Managing Primary & secondary pump operation.

			BENEFITS Savings in cooling energy and cost.
			RISKS - Only for buildings with chillers (industrial, GOVERNMENT & COMMERCIAL) - Individual comfort risk, Changes to the control system need to be made systematically and analyzed to avoid discomfort problems if insufficient cooling is provided. - In case the chilled water networks is based on a three-way valve system the CPM might not be able to make an impact, unless the three-way valve system is converted into a two-way valve system and the chillers are variable speed chillers with VFDs on the pumps.
			COST
			LOW
			PAY BACK
			SHORT RUN
			RESOURCES
			- Handbook of Electricity & Water Conservation Measures (Dubai Electricity & Water Authority) - Greening Your Building, A Toolkit for Improving Asset Performance, Chiller Efficiency HVAC – 04 (City of Melbourne)
		3-2-3	VFD/VSD FOR AHUs & FAHUs
			Install Variable Frequency Drives (VFD) or Variable Speed Drives (VSD) on the supply fan of the Air Handling Units, Fresh Air handling Units, Kitchen Exhaust Fans (KEFs) and Make-up Air Units (MAUs) to operate it at variable speeds according to a varying schedule or demand. This helps reduce unnecessary running of AHUs and FAHUs. Thus, reduces consumption. It also indirectly affects/ reduces the chillers' consumption. The VFD / VSD can be installed with feedback from field temperature sensors or CO2 sensors to maintain CO2 concentration in the recommended range of 800 PPM. The VFD / VSD can be installed in a stand-alone configuration or can be installed and managed using a Building Management System.

			BENEFITS ▪ Saving on cooling energy and cost. ▪ Extends the lifespan of exhaust equipment by adjusting fan speeds based on actual demand. ▪ Improves indoor air quality
			RISKS NO RISK but ▪ humidity and/or potential smell issues must be evaluated before applying this solution. ▪ The control systems may require regular maintenance and calibration to ensure optimal performance. ▪ Staff may need training to effectively operate and monitor the new control systems.
			COST
			LOW
			PAY BACK
			SHORT RUN
			RESOURCES
			▪ Handbook of Electricity & Water Conservation Measures (Dubai Electricity & Water Authority) ▪ Greening Your Building, A Toolkit for Improving Asset Performance, Air Handling System Upgrade HVAC - 01 (City of Melbourne) ▪ Green Star Technical Manual – Office Design v2: IEQ-3, Office Interiors v1.1: IEQ-2, Office as Built v2: IEQ-3.
		3-2-4	VFD/VSD FOR CHILLED WATER PUMPS
			Install Variable Frequency Drives (VFD) or Variable Speed Drives (VSD) with differential pressure sensors on Chilled Water Pumps (primary, secondary, etc.) for optimized performance, this allows them to operate at variable speeds according to a varying schedule or demand. Demand is sensed using a differential pressure sensor between the chilled water supply and return header. or Install DPT on Index circuit to maximize pump savings and Use valve position for DP reset.

			The differential pressure will change according to the demand in the case of a system installed with two-way valves. In other cases, with BMS, other feedback inputs like delta T can also be added to govern the VFD / VSD operation. This helps to reduces both unnecessary running and consumption of the chilled water pumps. BENEFITS ▪ Savings in cooling energy and cost. RISKS NO RISK But If delta t is used to modulate pump, then occupant comfort may be compromised. Pump motors must be verified if they can work with a VFD COST LOW PAY BACK LONG RUN RESOURCES ▪ Handbook of Electricity & Water Conservation Measures (Dubai Electricity & Water Authority) ▪ Greening Your Building, A Toolkit for Improving Asset Performance, Air Pumps HVAC - 14 (City of Melbourne)
		3-2-5	DIFFERENTIAL PRESSURE OPTIMIZATION
			Use advanced control systems with real-time monitoring to optimize the differential pressure of chilled water pumps to slow the operation, without any resulting cooling issues, for the best performance and the lowest energy use. The differential pressure in the line ensures the optimum speed operation of the VFD / VSD. As the load decreases, the Differential Pressure (DP) also decreases. This means that VFD / VSD reduce pump speeds, to maintain the set- point of the DP. DP set points can be over-engineered, so it is necessary to check the DP setting to avoid unnecessary running of the chilled water pumps.

			In this case, it is best to install a DP sensor in the line and link the Sensor to the chilled water pump VFD / VSD. To optimize the differential pressure, do automatically & continuously using valve position based on 'trim and respond' using controls rather manually. BENEFITS - Savings in cooling energy and cost. RISKS - NO RISK but installed for chilled water pumps COST LOW PAY BACK SHORT RUN RESOURCES - Handbook of Electricity & Water Conservation Measures (Dubai Electricity & Water Authority) - Greening Your Building, A Toolkit for Improving Asset Performance, Air Pumps HVAC - 14 (City of Melbourne)
		3-2-6	CHW PUMP OPERATION OPTIMIZATION
			As an alternative of (DIFFERENTIAL PRESSURE OPTIMIZATION) requirements mentioned above, use advanced control systems with real-time monitoring to optimize Chilled water pump operation. The chilled water pump optimization provides better control of a pump to improve its efficiency. Variable Pressure Control in Variable Flow Pumping Systems improve these controls. A variable pressure system (VPS) also allows the pump to oscillate between a maximum and minimum pressure, according to the flow requirement. This functionality results in operation nearer to the best operating curve of the pump and save energy. Pump operation optimization is an alternative control measure to differential pressure optimization and are not systems that work in parallel

			BENEFITS Savings in cooling energy and cost.
			RISKS NO RISK but installed for chilled water pumps
			COST
			LOW
			PAY BACK
			SHORT RUN
			RESOURCES - Handbook of Electricity & Water Conservation Measures (Dubai Electricity & Water Authority) - Greening Your Building, A Toolkit for Improving Asset Performance, Air Pumps HVAC - 14 (City of Melbourne)
		3-2-7	TIMERS FOR EXHAUST FANS
			Use exhaust fans timers to control the operation of the exhaust fans, so that they can be switched off when not in use, such as at night or early morning. The programmable timers and integrate them with the building management system (BMS) for optimal performance and energy savings is best practice.
			BENEFITS Savings in cooling energy and cost.
			RISKS
			NO RISK
			COST
			LOW
			PAY BACK
			SHORT RUN
			RESOURCES Handbook of Electricity & Water Conservation Measures (Dubai Electricity & Water Authority)

			BREEAM International Refurbishment and Fit-out 2015: 16.0 Checklists -3 Environmentally Aware- Table75: Checklist A1 - Environmentally aware requirements
	3-3	ENERGY MANAGEMENT SYSTEMS	
			Use Advanced Energy Management Systems (comprehensive integrated web-based energy-management software) that offer real-time data analysis and reporting with some peripheral hardware, such as non-invasive transducers, that measure electrical use. They help establish best practices across all energy functions including energy monitoring, scrutiny, and surveillance. Some Energy Management Systems do not come with equipment controls. This means they require a building management system to operate them. The EMS software collects data from the electricity used in buildings to analyse operational consumption patterns and identifies ways to reduce it when used inefficiently, or unnecessarily. As well as reducing electricity bills, a BMS can help prolong the life of electrical equipment in buildings. This system can be installed independently or integrated with existing BMS. Ensure proper training for operators to maximize system benefits.
			BENEFITS
			- improving the environmental performance of a building or tenancy - help prolong the life of electrical equipment in buildings.
			RISKS
			NO RISK but Some Energy Management Systems do not come with equipment controls. This means they require a building management system to operate them. The level of detail available will depend on how many meters are used to monitor energy use in the building. Older buildings may have only one meter.

			COST HIGH PAY BACK LONG RUN RESOURCES ▪ Handbook of Electricity & Water Conservation Measures (Dubai Electricity & Water Authority) ▪ Greening Your Building, A Toolkit for Improving Asset Performance, Energy Audit GEN - 11 (City of Melbourne) ▪ BREEAM International Refurbishment and Fit-out 2015: 7.0 Energy - Ene 02 Energy monitoring
	3-4	WATER HEATING SYSTEMS	
		3-4-1	SWIMMING POOLS HEATING
			Use high-efficiency heat pumps such as Inverter Heat Pumps to be used to cool as well as heat swimming pools water. When heating water, pool heat pumps transfer the heat from the ambient air surrounding the unit to the water. When cooling it, the pumps remove the heat from the water. Generally, despite the heat pumps are more expensive than normal gas or resistance electric heaters. However, the cost to run a heat pump is dramatically lower than the gas or electric heater. Regularly maintain them to ensure longevity and performance
			BENEFITS
			▪ Savings energy and cost.
			RISKS
			NO RISK
			COST
			LOW
			PAY BACK
			SHORT RUN

			RESOURCES ▪ Handbook of Electricity & Water Conservation Measures (Dubai Electricity & Water Authority) ▪ Greening Your Building, A Toolkit for Improving Asset Performance, Efficient DHW Generation DHW - 03 (City of Melbourne) ▪ BREEAM International Refurbishment and Fit-out 2015: 7.0 Energy - Ene 08 Energy efficient equipment ▪ Technical Guidelines (81) on Public Swimming Pools Safety ▪ Technical Guidelines (80) on Private Swimming Pools Safety
		3-4-2	Sustainable water heating system Central or decentralized hot water systems shall be configured utilizing a sustainable hot water heating technology with high-efficiency collectors and storage tanks, such as solar hot water, except in buildings where: a) such a hot water system would be impractical due to tenancy, metering, and pipework distribution constraints; or b) hot water generation utilizing local point-of-use electric water heaters would provide a more energy-efficient design solution. The percentage heating contribution from the solar hot water heating system depends on the occupancy and estimated hot water usage profile. The system designer shall target 75% of the total hot water daily demand being produced by the solar hot water system. To reduce system standing losses, all hot water storage vessels and distribution pipework shall be insulated. Ensure regular maintenance and inspections to maintain performance All Solar water heating systems and solar collectors or other Sustainable water heating system shall be certified from Dubai Central laboratory and supplied from registered supplier. or any other laboratory, approved by the Authority.
			BENEFITS ▪ Savings energy and cost.

			RISKS NO RISK but - may hot water system would be impractical due to tenancy, metering, and pipework distribution constraints. - may hot water generation utilizing local point-of-use electric water heaters would provide a more energy-efficient design solution. COST LOW PAY BACK SHORT RUN RESOURCES - Dubai Building Code 2021 Edition, H.5.3 - Al Sa'fat – Dubai Green Building System-2nd edition, January 504.02 - Greening Your Building, A Toolkit for Improving Asset Performance, Efficient DHW Generation DHW - 03 (City of Melbourne)
	3-5	LIGHTING	
		3-5-1	LED (LIGHT EMMITING DIODS)
			Retrofit the existing lighting such as fluorescent tubes, incandescent lamps, and halogen lamps with LED lighting will result in substantial energy savings. Light Emitting Diode (LED) lamps have revolutionized energy efficient lighting. They are solid-state lighting elements that are extremely energy-efficient, that will Increase lifetime, reducing the need for frequent replacements, reduce heat generation and reduce the required power.
			BENEFITS - Increase lifetime. - reducing the need for frequent replacements Reduce heat generation. - reduce the required power
			RISKS Ensure that new arrangement does not cause visual discomfort due to glare or reflections.

			COST LOW PAY BACK SHORT RON RESOURCES ▪ Handbook of Electricity & Water Conservation Measures (Dubai Electricity & Water Authority) ▪ Greening Your Building, A Toolkit for Improving Asset Performance, Lighting - Efficiency LI - 01 (City of Melbourne) ▪ Green Star Technical Manual – Office Design v2: ENE 05 and ENE 06 62 ▪ BREEAM International Refurbishment and Fit-out 2015: 6.0 Health and Wellbeing - Hea 01 Visual comfort ▪ LEED v4 for Building operations and maintenance, Sustainable Sites - SS CREDIT: Light Pollution Reduction
		3-5-2	SOLAR TUBES Use the Solar tubes which are reflector tubes that help capture sunlight and harvest daylight without increasing the thermal load of the building. The solar tube is a simple device consisting of a collector dome assembly that collects sunlight. Light is then diverted to the required area using a tube made of different reflective materials. The diffuser at the end reduces the glare and helps remove the heat of the light. OR /AND Use skylights with low Solar Heat Gain (SHGC) and high Visible Transmittance (VT) to maximize energy savings while maintaining natural light levels. To meet the performance criteria in Table E.5 Table E.6 and Table E.7 of Dubai Building Code requirement (E.5.2.3.2 Glazed elements). (Considering Cool Roof Rating Council (CRRC) standards and LEED guidelines.)
			BENEFITS ▪ Reduce heat generation.

			▪ reduce the required power. ▪ Promotes occupant comfort
			RISKS
			▪ NO RISK but only applied for industrial buildings
			COST
			LOW
			PAY BACK
			NON
			RESOURCES
			▪ Handbook of Electricity & Water Conservation Measures (Dubai Electricity & Water Authority) ▪ Dubai Building Code 2021 Edition, E.5.2.3.2 Glazed elements
		3-5-3	LIGHTING CONTROLS
			Use Lighting control devices in rooms and areas to optimize their operations, improve efficiency, and make energy savings. such as dimmers, Timers, Photocell, Motion Sensor, and Occupancy Sensor Switches. in accordance with the following requirements: a) Occupants shall be able to control or switch off lighting when daylight levels are adequate or when spaces are unoccupied. b) In common areas that are not regularly occupied (such as corridors and lobbies), lighting levels shall be automatically reduced when the space is unoccupied, to a maximum of 25% of the normal level. c) In offices and education facilities, all lighting zones shall be fitted with occupant sensor controls capable of switching normal lighting on and off based on occupancy level, with the following exceptions. 1) Lighting required for safety purposes is excluded. 2) If the average design lighting power density value is less than 6 W/m² of gross area, these controls do not need to be provided. d) In offices, artificial lighting within 6 m of exterior windows should be fitted with lighting controls. Where lighting controls are fitted, they shall

		incorporate photocell sensors that can adjust electric lighting levels to supplement the levels of daylight when required. The combination of artificial light and daylight shall provide an illumination level at the working plane between 400 lux and 500 lux. When 100% of daylight is available, illumination might exceed 500 lux.
		BENEFITS
		- Promoting occupant health and wellbeing. - The ability to maintain optimal electric lighting levels will contribute to energy savings.
		RISKS
		NO RISK but - Many lighting control systems have failed because of human factors. - Poorly located infra-red occupancy sensors switch on office lights. - Some spaces will need a small light left on so that an occupant is not left in complete darkness, should the lights turn off unintentionally
		COST
		LOW
		PAY BACK
		SHORT RUN
		RESOURCES
		- Dubai Building Code 2021 Edition, H.7.4 - Al Sa'fat – Dubai Green Building System-2nd edition, January 502.06 - Greening Your Building, A Toolkit for Improving Asset Performance, Lighting – Controls LI - 03 (City of Melbourne) - Green Star Technical Manual – Office Design v2: IEQ-5 and IEQ 7, Office Interiors v1.1: IEQ-4 and IEQ-6, Office as Built v2: IEQ-7 - BREEAM International Refurbishment and Fit-out 2015: 6.0 Health and Wellbeing - Hea 01 Visual comfort - LEED v4 for Building operations and maintenance, Indoor Environmental Quality - EQ CREDIT: Interior Lighting

3-6	ELEVATORS AND ESCALATORS		
	3-6-1	ELEVATORS	
		Elevators shall retrofit to include controls to conserve energy. The following features shall be incorporated in traction drive elevators: a) AC variable voltage and variable frequency (VVVF) drives on non-hydraulic elevators; b) energy-efficient lighting, including controls that turn off lights when the elevator has been inactive for a maximum of 5 min. The energy-efficient lighting shall provide an average luminous efficacy greater than 70 lumens per circuit Watt inside the elevator; and c) a standby condition for off-peak periods. NOTE: advanced regenerative drives where feasible should be used where they are shown to save energy and ensure regular inspections to maintain energy efficiency. Ensure proper calibration and maintenance of control systems	
		BENEFITS	
		Savings energy and cost.	
		RISKS	
		NO RISK	
		COST	
		LOW	
		PAY BACK	
		SHORT RUN	
		RESOURCES	
		- Dubai Building Code 2021 Edition, D.6.1 - Greening Your Building, A Toolkit for Improving Asset Performance, Efficient Motors and Drives EL - 02 (City of Melbourne) - BREEAM International Refurbishment and Fit-out 2015: 7.0 Energy - Ene 06 Energy efficient transportation systems	

		3-6-2	ESCALATORS
			Escalators and moving walks shall retrofitted to include the following features to conserve energy: a) Reduced speed control. When no activity has been detected for a maximum of 3 min, the escalator or moving walk shall reduce to a slower speed. b) Use on demand. When no activity has been detected for a maximum of 15 min, the escalator or moving walk shall shut down. On-demand escalators and moving walks shall feature energy efficient soft-start technology. For both features, photocell activation detectors shall be placed at the top and bottom landing areas. Ensure proper placement and calibration of photocell activation detectors and ensure regular maintenance to optimize performance.
			BENEFITS
			Savings energy and cost.
			RISKS
			NO RISK
			COST
			LOW
			PAY BACK
			SHORT RUN
			RESOURCES
			- Dubai Building Code 2021 Edition, D.6.2 - BREEAM International Refurbishment and Fit-out 2015: 7.0 Energy - Ene 06 Energy efficient transportation systems
	3-7	ELECTRICAL POWER GENERATION	
			Use high-efficiency solar panels and inverters and integrate with the building's electrical system for optimal performance.

			The power generation shall be 10% of the electrical load of the building (excluding electrical loads for fire extinguishing system, air conditioning units and air conditioning system pumps). If sufficient space is not available to achieve the above percentages, then the electrical power shall be generated to cover 30% of the lighting load of the common areas, provided that the capacity of the solar panels shall not be less than 20 kWp. Ensure proper installation and maintenance of solar panels.
			BENEFITS
			Savings energy and cost.
			RISKS
			Difficulties due to: - Sufficient space may not be available - Approvals to connect to the grid
			COST
			HIGH
			PAY BACK
			SHORT RUN
			RESOURCES
			- Al Sa'fat – Dubai Green Building System-2nd edition, January 504.03 - Greening Your Building, A Toolkit for Improving Asset Performance, Renewable Energy – Greenpower TM RE - 01 (City of Melbourne)
4	WATER SAVING		
	4-1	EFFICIENT FIXTURES	
		4-1-1	LOW FLOW
			The following efficient Water-flow reducers fittings shall be used: a) Aerators mixes air and water to maintain the pressure and to reduce water consumption. whether installed on the faucet or directly in the water supply line; with a flow rate less than or equal to the flowing rates:

			<table><tr><td>Fixture type</td><td>Maximum flow rate</td></tr><tr><td>Showerheads</td><td>8 l/min</td></tr><tr><td>Hand washbasins</td><td>6 l/min</td></tr><tr><td>Kitchen sinks</td><td>7 l/min</td></tr><tr><td colspan="2">b) Dual flush toilets; with a flow rate less than or equal to 6L for full flush and 3Lfor part flush</td></tr><tr><td colspan="2">c) Urinal flush; with a flow rate less than or equal to 2.4L per flush in non-public facilities, and 1L per flush or waterless in public facilities</td></tr><tr><td colspan="2">* It is recommended to use further efficient (minimum) market available flow rates, as applicable.</td></tr><tr><td colspan="2">* Faucets installed for specialized application may be exempted from meeting the flow rates, subject to Authority approval.</td></tr><tr><td colspan="2">* Water-flow reducers fittings used, and flow rates are subjected to the latest updates of Dubai building code.</td></tr></table>	Fixture type	Maximum flow rate	Showerheads	8 l/min	Hand washbasins	6 l/min	Kitchen sinks	7 l/min	b) Dual flush toilets; with a flow rate less than or equal to 6L for full flush and 3Lfor part flush		c) Urinal flush; with a flow rate less than or equal to 2.4L per flush in non-public facilities, and 1L per flush or waterless in public facilities		* It is recommended to use further efficient (minimum) market available flow rates, as applicable.		* Faucets installed for specialized application may be exempted from meeting the flow rates, subject to Authority approval.		* Water-flow reducers fittings used, and flow rates are subjected to the latest updates of Dubai building code.	
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			▪ BREEAM International Refurbishment and Fit-out 2015: 9.0 Water - Wat 04 Water efficient equipment ▪ LEED v4 for Building operations and maintenance, Water Efficiency- WE PREREQUISITE: Indoor Water use Reduction Required
		4-1-2	CONTROL SYSTEMS
			The following devices - automatically cut off the water limiting the overuse of faucets, either after a lack of motion or a set time water efficient fittings - shall be used: a) Sensor-controlled water faucets (proximity detection) or push-button faucets in all public facilities; b) Cisterns serving single or multiple urinals in public, commercial and industrial buildings with manual or automatic flush controls that operate based on usage patterns. Only sanitary flushing shall be possible in the event of building closure or shutdown (including overnight). * Leak detection systems should be used when applicable and setting up adequate timers is a must in this case.
			BENEFITS
			▪ Savings water and cost.
			RISKS
			▪ Difficulties due to: Sensor taps require energy to operate, that needs power source and fittings. ▪ Sensors and timers are more efficient in high use areas. ▪ Sensors and timers could be uncomfortable to the users.
			COST
			LOW
			PAY BACK
			LONG RUN
			RESOURCES

			▪ Dubai Building Code 2021 Edition, H.5.2.2 ▪ Al Sa'fat – Dubai Green Building System-2nd edition, January 601.01 ▪ Handbook of Electricity & Water Conservation Measures (Dubai Electricity & Water Authority) ▪ Greening Your Building, A Toolkit for Improving Asset Performance, Water – Demand Management WA - 01 (City of Melbourne) ▪ Green Star Technical Manual – Office Design v2: Wat-1 ▪ BREEAM International Refurbishment and Fit-out 2015: 9.0 Water - Wat 02 Water monitoring
	4-2	CONDENSATE DRAINAGE AND REUSE	
			Where the cooling load is greater than 350 kW, Condensate water produced by: a) Air-conditioning equipment; b) Air handling units; and c) Equipment handling a mixture of return air and outside air, where the outside air is not preconditioned. Shall be collected and disposed of appropriately and shall be recovered and reused. The condensate water can be re-used for irrigation, toilet flushing, cooling towers, or other onsite purposes wherein it will not come into direct contact with the human body. The condensate water can also be re-used for heat recovery Condensate collection pans and drainage pipes shall be installed to provide proper drainage and to prevent any stagnant water. An air break of not less than 25 mm shall be provided between the condensate piping and the wastewater pipe.
			BENEFITS
			▪ Savings water and cost.
			RISKS
			▪ Difficult and can be applicable in specific buildings ▪ Proper filtration should be applied to avoid metals or heavy metals Pollution especially when used for irrigation.
			COST
			HIGH

			PAY BACK
			LONG RUN
			RESOURCES
			▪ Dubai Building Code 2021 Edition, H.5.2.3 ▪ Dubai Building Code 2021 Edition, H.5.2.4 ▪ Dubai Building Code 2021 Edition, H.4.8.2 ▪ Al Sa'fat – Dubai Green Building System-2nd edition, January 601.02 ▪ Al Sa'fat – Dubai Green Building System-2nd edition, January 601.03 ▪ Al Sa'fat – Dubai Green Building System-2nd edition, January 502.10
	4-3	EFFICIENT IRRIGATION	
			Where applicable, Exterior landscaping (including green roofs) shall be irrigated using non-potable water such as (greywater recycling systems and condensate reuse systems for examples), or by drip or subsoil water delivery systems. All irrigation systems shall incorporate backflow prevention devices if they are connected to a potable water source in any location. The backflow prevention devices shall be installed in line with the manufacturer's requirements. Water disinfection shall be provided for above-ground sprinkler irrigation systems that create an aerosol of water droplets. The irrigation system shall be served from the water recycling plant or via a separate dedicated plant that includes a storage tank, pumps, filtration and water treatment plant. The irrigation water supply shall be fed from a dedicated pipework distribution system. Isolation and drain valves shall be provided to enable the system to be easily maintained. All system irrigation system components shall be clearly labelled to prevent the risk of cross-connection to other building water distribution systems. NOTE 1: Disinfection of the water supply is not required for subsurface

		landscape irrigation systems. NOTE 2: Dispersal disinfection filtration systems provide an effective means of treatment for water irrigation systems. NOTE 3: Soil additives are recommended to maintain humidity levels for a longer period and enhance soil fertility, Natural zeolite, particularly clinoptilolite, is a versatile and highly effective mineral known for its physical and chemical properties that enhances soil fertility, increases water retention, and reduces the need for chemical fertilizers and pesticides.
		BENEFITS
		Savings water and cost.
		RISKS
		- Treatment systems must be well maintained to ensure that there are no risks to human health. - The type of reuse allowed is determined by the quality of the treated water and must be approved by the Environmental Protection Authority
		COST
		HIGH
		PAY BACK
		LONG RUN
		RESOURCES
		- Dubai Building Code 2021 Edition, H.5.2.5 - Dubai Building Code 2021 Edition, H.5.4.6 - Al Sa'fat – Dubai Green Building System-2nd edition, January 601.04 - Greening Your Building, A Toolkit for Improving Asset Performance, Water – Recycling WA - 05 (City of Melbourne) - Green Star Technical Manual – Office Design v2: Wat-1, Emi-6 - BREEAM International Refurbishment and Fit-out 2015: 9.0 Water - Wat 04 Water efficient equipment - LEED v4 for Building operations and maintenance, Water Efficiency-WE CREDIT: Outdoor Water use Reduction Required

	4-4	GREY WATER REUSE
		The building must be provided with a system for the collection and reuse of greywater including condensate water regardless if it is connected to the sewage system or standalone system (minimum of 15% for Golden, 30% for Platinum). If the system is installed for the collection and reuse of greywater produced within the building or uses Treated Sewage Effluent (TSE) from an external source, the following must be complied: A. The building must have dual-plumbing system for the collection and recycled use of drainage water (greywater). Pipes that transport greywater must be color-coded differently from the pipes that are used for potable (drinking standard) water and must be labelled 'Not Suitable for Drinking.' B. There must be a minimum air break of 25 mm between any potable water sources and greywater collection systems. C. Greywater can be re-used for irrigation, toilet flushing, cooling towers, or other onsite purposes wherein it will not come into direct contact with the human body. It must also be treated to the standard set forth by Dubai Municipality. D. Recycling water system must be clearly identified and labelled with appropriate signages as mentioned in Dubai Building Code For all new commercial car washing facilities, at least 50% of the wastewater generated must be recovered and re-used.
		BENEFITS ▪ Savings water and cost. ▪ Reduced load on the sewerage system
		RISKS ▪ Treatment systems must be well maintained to ensure that there are no risks to human health. ▪ The type of reuse allowed is determined by the quality of the treated water and must be approved by the Environmental Protection Authority

			COST HIGH PAY BACK LONG RUN RESOURCES ▪ Al Sa'fat – Dubai Green Building System-2nd edition, January 603.01 ▪ Greening Your Building, A Toolkit for Improving Asset Performance, Water – Recycling WA - 05 (City of Melbourne) ▪ Green Star Technical Manual – Office Design v2: Wat-1, Emi-6 ▪ BREEAM International Refurbishment and Fit-out 2015: 9.0 Water - Wat 01 Water consumption
	4-5	COOLING TOWER WATER SUPPLY	
			Potable water supplied by DEWA shall not be used for heat rejection purposes. Where cooling towers are used, treated sewage effluent (TSE), seawater or recycled water shall be used to meet the water demand for all heat rejection purposes. Secondary water sources shall be approved by DEWA. A separate totalizing meter shall be fitted on the water supply line to the individual cooling towers. A daily log of water use shall also be kept. Water treatment plant will be required to remove impurities from the cooling tower feed water and the circulatory water. Leaving cooling tower water untreated can lead to organic growth, fouling, and corrosion of the system. This reduces the efficiency and service life of the cooling tower plant. The type of water treatment system required depends on a number of factors including: a) type of cooling tower; b) quality of water feed required;

		c) cooling tower manufacturer's requirements; d) chemistry of make-up and circulation water; e) whether or not blowdown will be treated for reuse in the cooling tower; and f) type of heat exchanger. Typically, water treatment systems shall include filtration and ultrafiltration, ion exchange/softening, chemical addition of inhibitors and biocides and an automated monitoring system. The water treatment system shall regulate and control the levels of alkalinity, chlorides, hardness, iron levels, organic matter, silica, sulphates, total dissolved solids, and total suspended solids in the system.
		BENEFITS
		▪ Savings water and cost. ▪ Reduced load on the sewerage system
		RISKS
		▪ Treatment systems must be well maintained to ensure that there are no risks to human health. ▪ can be applicable in specific buildings.
		COST
		HIGH
		PAY BACK
		LONG RUN
		RESOURCES
		▪ Dubai Building Code 2021 Edition, H.5.2.8 ▪ Al Sa'fat – Dubai Green Building System-2nd edition, January 603.02 ▪ Greening Your Building, A Toolkit for Improving Asset Performance, Cooling Tower – Water HVAC - 13 (City of Melbourne) ▪ Green Star Technical Manual – Office Design v2: Wat-4

5	MATERIALS AND RESOURCES		
	5-1	LOW EMMITING MATERIALS	
		5-1-1	PAINTS AND COATING
			All paints and coatings used in the building should not exceed the allowed limits for Volatile Organic Compound (VOC) specified by Dubai Municipality. Paints and coatings shall be certified from Dubai Central Laboratory or any other laboratory, approved by the Authority. The maximum limit for the indoor air contaminants stated in part H of Dubai building code Table H.4 (H.4.10.3 Indoor air quality) shall not be exceeded.
			BENEFITS
			- Improved indoor air quality. - Promotes occupant health. - Reduced energy and water use in the production of materials
			RISKS
			NO RISK but applicable when regular maintenance
			COST
			LOW
			PAY BACK
			NON
			RESOURCES
			- Dubai Building Code 2021 Edition, H.4.10.3 - Al Sa'fat – Dubai Green Building System-2nd edition, January 404.01 - Greening Your Building, A Toolkit for Improving Asset Performance, Internal Finishes & Fittings INT - 03 (City of Melbourne) - Green Star Technical Manual – Office Design v2: IEQ-13,14 - Green Star Technical Manual – Interior v1: MAT - BREEAM International Refurbishment and Fit-out 2015: 6.0 Health and Wellbeing- Hea 02 Indoor air quality

			LEED v4 for Building operations and maintenance, Materials and Resources- MR PREREQUISITE: Facility Maintenance and Renovation Policy Require
		5-1-2	ADHESIVES AND SEALANTS
			All adhesives, adhesive bonding primers, adhesive primers, sealants and sealant primers used in the building should not exceed the allowed limits for Volatile Organic Compound (VOC) specified by Dubai Municipality and shall be certified from Dubai Central Laboratory or any other laboratory, approved by the Authority. The maximum limit for the indoor air contaminants stated in part H of Dubai building code Table H.4 (H.4.10.3 Indoor air quality) shall not be exceeded.
			BENEFITS
			- Improved indoor air quality. - Promotes occupant health. - Reduced energy and water use in the production of materials.
			RISKS
			NO RISK but applicable only if the existing buildings under maintenance, addition, or alteration
			COST
			LOW
			PAY BACK
			NON
			RESOURCES
			- Dubai Building Code 2021 Edition, H.4.10.3 - Al Sa'fat – Dubai Green Building System-2nd edition, January 404.02 - Greening Your Building, A Toolkit for Improving Asset Performance, Volatile Organic Compounds (VOCs) INT - 04 (City of Melbourne)

			- Green Star Technical Manual – Office Design v2: IEQ-13, 14 and 16, Office Interiors v1.1: IEQ- 11, 12 and 14, Office As Built v2: IEQ-13, 14 and 16. - BREEAM International Refurbishment and Fit-out 2015: 6.0 Health and Wellbeing- Hea 02 Indoor air quality
	5-2	ASBESTOS CONTAINING MATERIALS*	
			Asbestos-containing materials shall be removed. Applicable if only the building under construction
			BENEFITS
			- Improved indoor air quality. - Promotes occupant health.
			RISKS
			NO RISK but Asbestos waste must only be removed from a building or structure and disposal by a Licensed body. applicable only if the existing buildings under maintenance, addition, or alteration.
			COST
			LOW
			PAY BACK
			NON
			RESOURCES
			- Dubai Building Code 2021 Edition, H.10.6.3 - Al Sa'fat – Dubai Green Building System-2nd edition, January 701.03 - Greening Your Building, A Toolkit for Improving Asset Performance, Asbestos Removal GEN - 10 (City of Melbourne) - Green Star Technical Manual – Office Design v2: IEQ-11, Office Interiors v1.1: IEQ-9, Office as Built v2: IEQ-11. - BREEAM International Refurbishment and Fit-out 2015: 6.0 Health and Wellbeing- Hea 02 Indoor air quality

	5-3	LEADS AND HEAVY METALS CONTAINING MATERIALS*	
			Paints, or other materials that might contain a percentage of lead or other heavy metals that is more than the prescribed limits set by DM, shall be removed, unless the metal is encapsulated in systems such as a photovoltaic cell. All paints and materials containing lead, or other heavy metals shall be certified from Dubai Central Laboratory or any other laboratory, approved by the Authority. Applicable if only the building under construction
			BENEFITS
			- Improved indoor air quality. - Promotes occupant health.
			RISKS
			NO RISK but applicable only if the existing buildings under maintenance, addition, or alteration
			COST
			LOW
			PAY BACK
			NON
			RESOURCES
			- Dubai Building Code 2021 Edition, H.10.6.4 - Al Sa'fat – Dubai Green Building System-2nd edition, January 2010 - BREEAM International Refurbishment and Fit-out 2015: 6.0 Health and Wellbeing- Hea 02 Indoor air quality
	5-4	(ODP) OSON DEPLETION MATERIALS MANAGEMENT	
			For existing equipment: A. CFC and halon-based materials shall not to be used for any purposes. B. From 1 January 2030, HCFC based materials or any other material having any ODP are not to be used for any purposes. C. The venting or direct discharging of any refrigerants during equipment maintenance is strictly prohibited. D. Recovery, reclamation, recycling, and reuse of refrigerants must be always practiced.

			BENEFITS - Improved indoor air quality. - Promotes occupant health. - Reduce environmental pollution RISKS NO RISK but applicable when regular maintenance COST LOW PAY BACK NON RESOURCES - Dubai Building Code 2021 Edition, H.4.13.10.2 - Al Sa'fat – Dubai Green Building System-2nd edition, January 701.05 - BREEAM International Refurbishment and Fit-out 2015 13.0 - Pollution- Pol 01 Impact of refrigerants - LEED v4 for Building operations and maintenance, Energy and Atmosphere - EA CREDIT: Enhanced Refrigerant Management
	5-5	COMPOSIT WOOD PRODUCTS	
			All composite timber products used in the interior of the building; the percentage of added urea-formaldehyde resins shall be within the limit prescribed by the Authority. Applicable if only the building under construction BENEFITS - Encourage recycling activities. - Reduce environmental pollution RISKS NO RISK but applicable only if the existing buildings under maintenance, addition, or alteration COST HIGH PAY BACK NON

			RESOURCES ▪ Dubai Building Code 2021 Edition, H.10.6.5 ▪ Al Sa'fat – Dubai Green Building System-2nd edition, January 2018 ▪ Greening Your Building, A Toolkit for Improving Asset Performance, Volatile Organic Compounds (VOCs) INT - 04 (City of Melbourne) ▪ Green Star Technical Manual – Office Design v2: IEQ-13, 14 and 16, Office Interiors v1.1: IEQ- 11, 12 and 14, Office as Built v2: IEQ-13, 14 and 16. ▪ BREEAM International Refurbishment and Fit-out 2015: 6.0 Health and Wellbeing- Hea 02 Indoor air quality: Table - 19: VOC criteria by-product type ▪ LEED v4 for Building operations and maintenance, Materials and Resources - MR CREDIT: Purchasing- Facility Maintenance and Renovation
6	WASTE MANAGEMENT		
	6-1	BULK WASTE COLLECTION	
			An area shall be provided for special and bulky wastes such as hazardous wastes, furniture, and electrical appliances. This may be within the main waste storage room(s) or in a separate location as appropriate. The area shall be appropriately sized according to the size and type of development and the expected quantities of special and bulky waste. It is recommended that an area of not less than 5 m² is provided. This storage area shall be easily accessible for residents, tenants, and waste collection contractors alike and shall not restrict access to the building.
			BENEFITS
			▪ Encourage reuse and recycling activities
			RISKS
			NO RISK but there is possibility of misuse the storage area.
			COST
			LOW
			PAY BACK

			NON
			RESOURCES
			▪ Dubai Building Code 2021 Edition, B.8.5.4 ▪ Al Sa'fat – Dubai Green Building System-2nd edition, January 702.02 ▪ Greening Your Building, A Toolkit for Improving Asset Performance, Rubbish & Recycling WST - 01 (City of Melbourne) ▪ Green Star Technical Manual – Office Design v2: Mat-1 Recycling Waste Storage
	6-2	WASTE STORAGE	
			All villas and townhouses shall be provided with a suitable area for the storage of general waste and recycling. This shall be either: a) a dedicated waste storage area within the boundary of the property with a minimum of one 240 l bin for general waste, and one 240 l bin for recycling, with a maximum allowable container size of 360 l; or b) a communal waste storage area for the consolidated storage of waste and recycling from multiple properties. This shall be adequately roofed and enclosed and located in a convenient and accessible location. Communal waste storage areas shall be provided with larger bulk containers for waste and recycling of up to 2,500 l as appropriate. Only for villas and townhouses.
			BENEFITS
			▪ Encourage recycling activities. ▪ Reduce environmental pollution.
			RISKS
			NO RISK
			COST
			LOW
			PAY BACK
			NON
			RESOURCES
			▪ Dubai Building Code 2021 Edition, B.8.5.4

			- Al Sa'fat – Dubai Green Building System-2nd edition, January 702.03 - BREEAM International Refurbishment and Fit-out 2015: 11.0 Waste - Wst 03 Operational waste
	6-3	WASTE COLLECTION	
			Where applicable for residential buildings, where building height exceeds G+3 excluding the mezzanine floor and the floor area of any story exceeds 250 m², one refuse chute shall be provided. In addition to one of the following to facilitate recycling: a) a second chute, or suitable automated separation system such as a bi-separator or tri-separator, to handle recyclable material. This shall discharge into a separate receptacle within the waste management area; or b) waste rooms provided on each floor, where recyclable waste can be stored. The waste rooms shall comply with Dubai Building Code B.8.5.2.2 (d)- (g). The number of rooms provided shall be appropriate to the size and occupancy of the building. These shall have a floor area of not less than 2 m². Recyclable waste shall be collected by the building operator daily, transported in a service elevator and discharged into a designated receptacle within the waste management area. All refuse chutes shall conform to BS 1703. Refuse chutes for collecting waste from floors to the collection room shall be not less than 600 mm in diameter. The material used shall resist corrosion, prevent dampness, be non-combustible and have a smooth inner surface. All refuse chutes shall be supplied with cleaning and fire protection systems. An area of not less than 900 mm × 1,000 mm shall be included on each floor to provide access to the refuse chute. The door entrance shall be not less than 915 mm in width. Doors shall swing outwards and be fitted with automatic door closing mechanisms. For ground floor residents, suitable access shall be provided to the main waste storage room(s) or appropriate interim storage room(s) to facilitate disposal of waste and recycling. Where the refuse chute is situated at a distance from the roads that

		surround the building, the main waste storage room(s) shall be situated near to the access roads and shall facilitate easy access by waste management contractors for removal of waste from the site. Where suitable arrangements are in place for the transfer of waste to the main waste storage area, service elevators may be used in lieu of refuse chutes. These shall be located in an area that is isolated from the main passenger elevators and close to the main waste storage area of the building. In some situations, the use of passenger elevators is permissible for transfer of waste on a scheduled basis. Interim waste storage rooms shall be provided as appropriate and conform with the requirements of Dubai building code B.8.5.2.
		BENEFITS - Encourage recycling activities. - Reduce environmental pollution
		RISKS Possibility of not having enough space
		COST
		LOW
		PAY BACK
		NON
		RESOURCES - Dubai Building Code 2021 Edition, B.8.5.7 - Al Sa'fat – Dubai Green Building System-2nd edition, January 702.04 - Greening Your Building, A Toolkit for Improving Asset Performance, Rubbish & Recycling WST - 01 (City of Melbourne) - Green Star Technical Manual – Office Design v2: Mat-1 Recycling Waste Storage
	6-4	RECYCLING AND SEGREGATION
		A sorting area for recyclable waste shall be provided within the main waste storage area(s). This shall facilitate sorting of recyclables where segregation is not undertaken at source by a building's tenants. It is recommended that the floor area of the waste storage room(s) is

			increased by not less than 5 m², to allow for additional space and maneuverability for sorting recyclable waste. waste storage rooms shall be conformed with the requirements of Dubai building code B.8.5.2.1
			BENEFITS
			- Encourage recycling activities. - Reduce environmental pollution
			RISKS
			NO RISK but the Lack of education and training can reduce the efficacy of recycling programs
			COST
			LOW
			PAY BACK
			NON
			RESOURCES
			- Dubai Building Code 2021 Edition, B.8.5.2.1 - Dubai Building Code 2021 Edition, B.8.5.3 - Al Sa'fat – Dubai Green Building System-2nd edition, January 702.05 - Greening Your Building, A Toolkit for Improving Asset Performance, Rubbish & Recycling WST - 01 (City of Melbourne) - Green Star Technical Manual – Office Design v2: Mat-1 Recycling Waste Storage - BREEAM International Refurbishment and Fit-out 2015: 11.0 Waste - Wst 01 Project waste management - LEED v4 for Building operations and maintenance, Materials and Resources- MR PREREQUISITE: Facility Maintenance and Renovation Policy Require
7	MAINTINANCE REQUIRMENTS		
	7-1	MAINTINANCE OF MECANICAL SYSTEMS	
			For all air-conditioned buildings, all mechanical, electrical, and plumbing systems in the buildings must be serviced and maintained regularly. 1. Mechanical systems must be installed in a way such that adequate access is available. This would allow for regular inspection, maintenance,

		and cleaning of the equipment, without the need to remove or dismantle any building components. 2. The building operator must ensure that a proper maintenance manual and schedule is developed for the building. This shall be based on the instructions for preventative maintenance or recommendation from equipment manufacturer or supplier or according to the latest edition of ASHRAE Standard 180 or equivalent as approved by DM. 3. The building operator must either have a service contract with a DM approved maintenance company or provide sufficient evidence that the equipment shall be properly maintained by competent members of their own staff. 4. Service records in the form of a service logbook including details of both preventative and corrective maintenance must be kept onsite and be readily available for inspection by DM staff. this clause could be divided into two different requirements (plan and contract)
		BENEFITS
		- Optimizing the performance of the building and its services - Improved indoor air quality. - Promotes occupant health. - Reduced energy, water, and cost - Extended Equipment Lifespan
		RISKS
		- Proper metering and monitoring strategies are not implemented. - High cost due to the metering and monitoring systems - Access and Space constraints - System Disruption during maintenance
		COST
		HIGH
		PAY BACK
		SHORT RUN
		RESOURCES
		Al Sa'fat – Dubai Green Building System-2nd edition, January 502.14

			- Greening Your Building, A Toolkit for Improving Asset Performance, Maintenance Plan GEN - 01 (City of Melbourne) - BREEAM International Refurbishment and Fit-out 2015: 5.0 Management - Man 05 Aftercare
	7-2	ENHANCING WATER SUPPLY SYSTEMS- Anti-scale systems	
			Install anti-scale system directly into the building's water supply line to Integrate with the existing water systems to treat water as it flows through. Anti-scale systems are designed to prevent the formation of scale in water pipes, heating systems, and other water-using appliances.
			BENEFITS - Scale Prevention: Prevents the formation of scale deposits in pipes, boilers, and water heaters, ensuring optimal performance and energy efficiency. - Extended Equipment Life: Reduces wear and tear on water-using appliances, extending their lifespan and reducing the need for frequent replacements. - Water Quality Improvement: Enhances water quality by preventing scale buildup, which can harbor harmful bacteria and reduce water flow. - Occupants' health and comfort. - Cost Efficiency: Decreases maintenance and energy costs associated with scale removal and equipment inefficiency. - Environmental Impact: Reduces the environmental footprint by minimizing the use of harsh chemicals and energy-intensive descaling processes.
			RISKS
			NO RISK but: - Minimal modifications are required. - Minimal maintenance with periodic inspections is required to ensure optimal performance and longevity of the system

			Proper usage and application training is required to ensure effective adoption.
			COST
			LOW Competitive initial investment with significant long-term savings from reduced maintenance, energy costs, and extended equipment life.
			PAYBACK
			LONG RUN The investment typically pays back within 1-2 years, considering the combined benefits of improved water system efficiency and reduced operational costs.
			RESOURCES
	7-3	ENHANCING COOLING TOWERS - Anti-scale technology	
			Install advanced automated, eco-friendly and scale removing system designed for cooling towers and district cooling plants, the system integrates seamlessly into existing cooling tower and district cooling plant infrastructure with no need for plant shutdown. This innovative anti-scale technology such as (Kashyap Auto-BFSR System) enhances process efficiency by reducing scaling, biofouling, and corrosion, resulting in improved heat transfer and significant water savings. The system includes an electrolytic chamber, hydro cyclone filter with auto-back wash, and a user-friendly display panel for monitoring conductivity or TDS.
			BENEFITS
			Water Savings: Decreases blowdown water usage by up to 80%, conserving water resources and reducing operational costs.

		▪ Chemical-Free Operation: Uses advanced electrolysis technology to treat water naturally, without harsh chemicals, ensuring an environmentally friendly process. ▪ Improved Efficiency: Enhances cooling tower performance by reducing scaling and biofouling, leading to better heat transfer and energy savings. ▪ Reduced Maintenance: Lowers maintenance costs and downtime due to the automated cleaning and draining system. ▪ Health and Safety: Prevents the spread of harmful bacteria such as Legionella by maintaining clean and safe water conditions.
		RISKS
		NO RISK but: Requires minimal maintenance due to its fully automated IoT-based system that ensures consistent and efficient operation.
		COST
		HIGH Eliminates chemical costs, reduces blowdown and makeup water usage by up to 80%, and lowers energy consumption.
		PAYBACK
		SHORT RUN The investment typically pays back within 1-3 years due to significant savings in water, chemicals, and energy.
		RESORCES
	7-4	ENHANCING SWIMMING POOL MANAGEMENT WITH NATURAL SOLUTIONS- Anti-scale systems and natural zeolite cleaners
		Integrate anti-scale systems and natural zeolite into swimming pool management systems and into pool filtration systems that offer sustainable and effective solutions to improve water quality, reduce maintenance costs, and enhance public health. These products address the challenges posed by

		scale formation, water contamination, and chemical usage, providing a cleaner and more efficient swimming pool environment.
		BENEFITS
		▪ Scale Prevention: The anti-scale system prevents the formation of scale deposits in pipes and swimming pool equipment, ensuring optimal performance and energy efficiency. ▪ Improved Water Quality: Natural zeolite effectively removes contaminants, ammonia, and other pollutants, reducing the need for high chlorine levels. ▪ Health and Safety: Reduces the formation of harmful chlorine byproducts like chloramines and effectively fights bacterial growth, including Legionella, improving overall water safety. ▪ Environmental Impact: Minimizes the environmental footprint by reducing chemical usage and improving the efficiency of water treatment processes. ▪ Cost Efficiency: Decreases maintenance costs associated with scale removal, chemical usage, and frequent cleaning.
		RISKS
		NO RISK but: Required proper usage and application training to ensure effectiveness Regular inspections and regeneration of natural zeolite media as needed to ensure ongoing benefits with minimal maintenance requirements.
		COST
		LOW Minimal modifications required, the system is competitive with other water treatment technologies, with long-term savings from reduced chemical usage, maintenance costs, and extended equipment life.
		PAYBACK
		SHORT RUN

			The investment typically pays back within 1-2 years, considering the combined benefits of improved water quality, infrastructure longevity, and reduced operational costs.
			RESOURCES
8	RE-COMMISSIONING OF BUILDING SERVICES		
	8-1	HVAC SYSTEM	
			For all existing buildings having a cooling load of 2 MW or greater, re-commissioning of ventilation, at least once in every 5 years. Where possible, the re-commissioning works should be carried out in accordance with the requirements of Dubai Building Code H8. At a minimum, systems that required to be re-commissioned should ensure that: 1. The amount of fresh air supplied from each ventilation outlet is within $\pm$ 5% of the design volume. 2. The volume of the chilled water supplied to any cooling coil is within $\pm$ 5% of the design volume. 3. All mechanical devices, including but not limited to dampers, valves, fans, pumps, motors, and actuators, operate freely and as required. 4. Filters and filter housings are sound and secure and that no unfiltered air bypasses the filter assembly. 5. Heat recovery systems are operating as designed. 6. Central plant equipment is tested to ensure that it operates through the full range of its capacity and that all design parameters are achieved. 7. Controls are checked and re-calibrated for operation, as designed. And to also ensure that any remote devices respond as required. 8. Pipe and ducts are inspected to ensure there is no air or liquid leakage. Commissioning results must be recorded and available for inspection by Dubai Municipality. Where original design requirements are not available, the contractor is to certify that after re-commissioning, the installed systems are operating correctly.

		Ensure comprehensive testing and documentation and ensure all mechanical devices, controls, and systems are thoroughly tested and calibrated. BENEFITS ▪ Improved performance of building services systems: ▪ Energy efficiency, reduce energy consumption and cost. ▪ Promotes occupant health, thermal comfort, and fresh air rates comfort ▪ Improved Indoor Air Quality RISKS NO RISK But operation may disruption during re-commissioning COST LOW PAY BACK SHORT RUN RESOURCES ▪ Al Sa'fat – Dubai Green Building System-2nd edition, January 503.02 ▪ Greening Your Building, A Toolkit for Improving Asset Performance, Re-Commissioning - Tuning GEN - 03 (City of Melbourne) ▪ Green Star Technical Manual – Office Design v2: MAN-2 DHS commissioning guide ▪ BREEAM International Refurbishment and Fit-out 2015: 5.0 Management - Man 04 Commissioning and handover
	8-2	LIGHTING SYSTEM
		For all existing buildings, re-commissioning of lighting and control systems must be carried out, at least once every 5 years. in addition of doing check on lux level every two years. Where possible, the re-commissioning works should be carried out in accordance with the requirements of Dubai Building Code H8. At a minimum, systems that required to be re-commissioned should ensure that: 1. All lighting systems and their controls operate as designed and that

		required levels of illumination are achieved. 2. Controls are checked and re-calibrated for operation, as designed. And to also ensure that any remote devices respond as required. Commissioning results must be recorded and available for inspection by Dubai Municipality. Where original design requirements are not available, the contractor is to certify that after re-commissioning, the installed systems are operating correctly.
		BENEFITS
		▪ Energy efficiency, reduce energy consumption and cost. ▪ Promotes occupant comfort
		RISKS
		NO RISK But operation may disruption during re-commissioning
		COST
		LOW
		PAY BACK
		SHORT RUN
		RESOURCES
		▪ Al Sa'fat – Dubai Green Building System-2nd edition, January 503.02 ▪ Greening Your Building, A Toolkit for Improving Asset Performance, Re-Commissioning - Tuning GEN - 03 (City of Melbourne) ▪ Green Star Technical Manual – Office Design v2: MAN-2 DHS commissioning guide ▪ BREEAM International Refurbishment and Fit-out 2015: 5.0 Management - Man 04 Commissioning and handover
	8-3	WATER SAVING SYSTEM
		For all existing buildings, re-commissioning of the water systems central plant must be carried out, at least once every 5 years. Where possible, the re-commissioning works should be carried out in accordance with the requirements of Dubai Building Code H8. At a minimum, systems that required to be re-commissioned should ensure that: 1. Central plant equipment is tested to ensure that it operates through the full range of its capacity and that all design parameters are achieved.

		2. Pipe and ducts are inspected to ensure there is no air or liquid leakage. This should be done frequently to have an automatic monitoring. Could be done through metering monitoring Commissioning results must be recorded and available for inspection by Dubai Municipality. Where original design requirements are not available, the contractor is to certify that after re-commissioning, the installed systems are operating correctly.
		BENEFITS
		▪ Reduce water consumption and costs. ▪ Promotes occupant health
		RISKS
		NO RISK But operation may disruption during re-commissioning
		COST
		LOW
		PAY BACK
		SHORT RUN
		RESOURCES
		▪ Al Sa'fat – Dubai Green Building System-2nd edition, January 503.02 ▪ Greening Your Building, A Toolkit for Improving Asset Performance, Re-Commissioning - Tuning GEN - 03 (City of Melbourne) ▪ Green Star Technical Manual – Office Design v2: MAN-2 DHS commissioning guide ▪ BREEAM International Refurbishment and Fit-out 2015: 5.0 Management - Man 04 Commissioning and handover
	8-4	PERFORMANCE REPORT
		For all existing buildings other than villas, a detailed report on the performance of the building based on the design considerations must be submitted. This should include the actual performance reports for a minimum period of 6 months, of which three months shall be thermal peak months.

			BENEFITS Improved performance of building services systems:
			RISKS
			NO RISK
			COST
			LOW
			PAY BACK
			NON
			RESOURCES - Al Sa'fat – Dubai Green Building System-2nd edition, January 503.7 - Greening Your Building, A Toolkit for Improving Asset Performance, Green Lease GEN - 05(City of Melbourne)
	8-5	SUSTAINABLE AWARENESS AND USERS' PARTICIPATION	
			For all existing buildings other than villas, the building operator must develop and provide a clear mechanism for sustainable awareness for the users of the building. This must include information on the consumption of energy and water in the building.
			BENEFITS - Improved performance of building services systems - Cost and Energy Savings - Positive Environmental Impact
			RISKS
			NO RISK
			COST
			LOW
			PAY BACK
			NON
			RESOURCES Al Sa'fat – Dubai Green Building System-2nd edition, January 503.8

			Greening Your Building, A Toolkit for Improving Asset Performance, Building User's Guide GEN - 08 (AND) Gross Lease GEN - 06(City of Melbourne)
9	METERING		
	9-1	ELECTRICITY DEMAND	
		9-1-1	INCOMING SUPPLY AND METERING
			Meters shall be installed to measure and record the electricity demand and consumption of the facility. All meters shall conform to DEWA specifications and be approved by DEWA. Tariff metering shall be in accordance with Dubai Building Code Section G.4.5. When a building tariff meter is not present, sub meters shall be installed for each individual tenancy in the building. These submeters shall be for demand management and electricity cost allocation purposes only. Virtual meters using run-hours shall not be used as submeters.
			BENEFITS
			- Allows the collection of data on major energy uses within a building for easy historical analysis. - Enables early detection of operational problems. - Makes it easy to identify energy saving solutions and quantify the benefits.
			RISKS
			NO RISK
			COST
			LOW
			PAY BACK
			SHORT RUN
			RESOURCES
			- Dubai Building Code 2021 Edition, G.4.3 - Dubai Building Code 2021 Edition, G.4.5 - Al Sa'fat – Dubai Green Building System-2nd edition, January 503.03

			- Greening Your Building, A Toolkit for Improving Asset Performance, Sub-Metering – Energy EL - 03 (City of Melbourne) - Green Star Technical Manual – Office Design v2: ENE-3 and ENE-4 - BREEAM International Refurbishment and Fit-out 2015: 7.0 Energy - Ene 02 Energy monitoring - LEED v4 for Building operations and maintenance, Energy and Atmosphere - EA CREDIT: Advanced Energy Metering
		9-1-2	MULTIPLE CONSUMER PREMISES METERING
			Multiple consumer premises include residential/ commercial buildings, industries, large utility complexes and schools. The MDBs and SMDBs, with associated metering, shall be installed in separate electrical switch rooms. Switch rooms shall be located close to the entrance boundary line. Access shall be always available for operation, testing, inspection, maintenance, and repair. For all buildings having a cooling load of at least 1 MW, or a gross floor area of 1,000 m2 or greater, additional electrical submetering (of tariff class accuracy) shall be installed. The submetering shall record demand and consumption data for each energy-consuming system in the building with a load of 100 kW or greater. All tariff metering shall be smart meters, normally provided by DEWA and restricted to one for each consumer installation, unless otherwise approved/ specified by DEWA.
			BENEFITS
			- Improved performance of building services systems - Energy Consumption Monitoring
			RISKS
			NO RISK
			COST
			LOW
			PAY BACK
			SHORT RUN
			RESOURCES
			Dubai Building Code 2021 Edition, G.4.5.2

			▪ Al Sa'fat – Dubai Green Building System-2nd edition, January 503.03 ▪ Greening Your Building, A Toolkit for Improving Asset Performance, Sub-Metering – Energy EL - 03 (City of Melbourne) ▪ Green Star Technical Manual – Office Design v2: ENE-3 and ENE-4 ▪ BREEAM International Refurbishment and Fit-out 2015: 7.0 Energy - Ene 02 Energy monitoring
	9-2	AIR CONDITIONING METERING	
			In buildings supplied by a central air-conditioning source (such as a chiller plant or district cooling), or where cooling energy is delivered individually to several consumers, smart meters approved by the Authority shall be installed to measure and record chilled water supply to air-conditioning units. The meters shall provide accurate records of consumption, which shall be determined as follows. a) Smart energy meters designed to measure the supply of chilled water shall be installed for each dwelling unit, office, or tenant. The measuring device shall measure the water flow and supply and return temperatures to determine the temperature differential for calculating the amount of cooling energy consumed. b) Where a BMS is installed, the smart metering shall be connected to allow real time profiling and management of energy consumption. c) Smart meters used shall be specifically designed for the measurement of chilled water and not for hot water. d) All smart meters shall be capable of remote data access and shall have data logging capability with local data storage. e) Virtual meters using run-hours are not acceptable as sub-meters. The meter readings and actual consumption details shall only be for energy measurement, demand management and cost allocation purposes. Using advanced smart meters with data logging capability and integrating with the building management system (BMS) for optimal performance is best practice. Ensure meters are specifically designed for chilled water and capable of remote data access.

			BENEFITS - Improved performance of building services systems - Cost and Energy Savings RISKS NO RISK COST LOW PAY BACK SHORT RUN RESOURCES - Dubai Building Code 2021 Edition, H.4.14.4 - Al Sa'fat – Dubai Green Building System-2nd edition, January 503.04 - BREEAM International Refurbishment and Fit-out 2015: 7.0 Energy - Ene 02 Energy monitoring
	9-3	WATER METERING	
			Dubai Electricity and Water Authority (DEWA) main meters shall be installed to measure and record the water demand and consumption of a building in accordance Dubai Building Code section with G.9. Each individual tenancy in a building shall have a DEWA sub-meter installed which is connected to a building main meter. Sub-meters shall also be installed to record consumption data for internal and external (e.g. irrigation) water uses, for buildings having: a) a cooling load of 1 MW or greater; and/or b) a gross area of 5,000 m2 or greater. Where a BMS is installed, metering shall be integrated into the system to allow real time profiling and management of water demand and consumption. Virtual meters using run-hours shall not be used as sub-meters. The sub-meters should be used for demand management and cost allocation purposes.

			BENEFITS - Allows the collection of data on major water uses within a building for easy historical analysis. - Enables early detection of leaks and water wastage which can also cause building damage. - Makes it easy to identify water saving solutions and quantify the benefits. RISKS NO RISK COST LOW PAY BACK SHORT RUN RESOURCES - Dubai Building Code 2021 Edition, H.5.2.6 - Al Sa'fat – Dubai Green Building System-2nd edition, January 602.01 - Greening Your Building, A Toolkit for Improving Asset Performance, Sub-Metering – Water WA - 02 (City of Melbourne) - Green Star Technical Manual – Office Design v2: WAT-02 - BREEAM International Refurbishment and Fit-out 2015: 9.0 Water - Wat 02 Water monitoring
10	(BMS) BUILDING MANAGEMENT SYSTEM		
			Buildings having a cooling load of 1,000 kW, or a gross area of 5,000 m² or greater, shall have a BMS capable of ensuring that the building's systems operate as designed and as required during all operating conditions. The system shall provide full control and monitoring of system operations, apart from diagnostic reporting. The system shall control the chiller plant and HVAC equipment as a minimum, and record energy and water consumption. It shall also monitor and record the performance of these items.

			BMS systems shall be configured to optimize energy usage, see part 3-3 Energy Management Systems.
			BENEFITS
			▪ Automate building operation. ▪ Assist with internal monitoring. ▪ Record and derive performance data for assessment and reporting. ▪ Improved performance of building services systems
			RISKS
			▪ Relying on skill of the person who operates and interrogates the system
			COST
			HIGH
			PAY BACK
			SHORT RUN
			RESOURCES
			▪ Dubai Building Code 2021 Edition, H.4.14.2 ▪ Al Sa'fat – Dubai Green Building System-2nd edition, January 503.05 ▪ Greening Your Building, A Toolkit for Improving Asset Performance, Building Management Control System GEN - 04 (City of Melbourne) ▪ BREEAM International Refurbishment and Fit-out 2015: 5.0 Management - Man 04 Commissioning and handover