UNITED ARAB EMIRATES
MINISTRY OF ENERGY & INFRASTRUCTURE

National Green Building
Regulation

Version 1.06 2021

Acknowledgment Letter

The Ministry of Energy and Infrastructure extends its sincere thanks and appreciation to the following Entities for their contribution of completing the federal regulation and for their tireless and mighty effort and their keenness to enrich the regulation with their precious inputs during the period of preparing the regulation, as efforts were integrated and announced for approval by the Council of Ministers in 2022.The working team show their fully cooperate and share their experience to make it succussed within an integrated scope that combines and unifies the efforts of the federal and local authorities to unify the minimum levels of energy and water consumption efficiency standards at the federal level and achieve the goals of reducing demand for energy and water resources to achieve sustainable economic development.We are very grateful to you for all that you have done and are still doing.

Department of municipal and Transport
Department of Energy -Abu Dhabi
Dubai Municipality
Dubai Electricity and Water Authority
Ras Al Khaimah Municipality
Umm Al Quwain Municipality
Fujairah Municipality
Sharjah Municipality
Emirates Green Building Council
Ajman Municipality
Ministry of industry and Advanced Technology
Sharjah Electricity, Water, Gas Authority

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Abbreviations & Definitions

101 Abbreviations

CFCs:
CFCs are odourless, colourless, non-flammable non-toxic chemicals. They vaporise easily at low temperatures making them ideal coolants in refrigerators and air conditioners. CFCs are also used in foam for seat padding and insulation. Until recently, they were used extensively in aerosol spray cans. CFCs cause stratospheric ozone depletion.

DCV:
A ventilation system that provides for the automatic reduction of outdoor air intake below design rates, when the actual occupancy of spaces served by the system is less than design occupancy. Demand is often assessed by using the measure of the amount of carbon dioxide (CO^2) in a space to reflect occupancy levels.

LPD: Lighting Power Density is the maximum lighting power per unit area.

LRV:
Light Reflective Value is A measure of the total quantity of useable and visible light reflected by a surface in all directions on a scale from 0% to 100%. Zero percent is assumed to be an absolute black and 100% represents an assumed perfectly reflective white. The blackest achievable wall finish has a LRV of approximately 5% and the whitest available finish approximately 85%.

BUA:
The Built up Area (BUA) is the total area being developed or constructed. It is the Gross Floor Area and Parking plus any Service Area of associated with the subject building or project.

MERV:
Minimum Efficiency Reporting Values, or MERVs, report a filter's ability to capture larger particles between 0.3 and 10 microns (μm).

HCFCs: any of a class of inert compounds of carbon, hydrogen, chlorine, and fluorine, used in place of CFCs as being somewhat less destructive to the ozone layer.

ODP:
The ratio of global loss of ozone due to the given substance to the global loss of ozone due to CFC-11 of the same mass.

GWP:
Global warming potential (GWP) is the heat absorbed by any greenhouse gas in the atmosphere, as a multiple of the heat that would be absorbed by the same mass of carbon dioxide (CO2).

102 Definitions

Acoustical control:
Controlling noise sources, transmission path, and/or receiver in order to reach an acceptable noise environment for a particular space.

Addition: An extension or increase in floor area or height of a building outside of the existing building envelope (walls and roofs).

Adequate:
Sufficient to satisfy a specific requirement or meet a specific need.

Air break:
A piping arrangement where a drain from an appliance or fixture discharges into an airspace and then into another fixture, receptacle, or interceptor; used to prevent back siphonage or backflow.

Air contaminants:
Unwanted airborne constituent that may reduce acceptability or adequacy of the air quality.

Air leakage:
Air that escapes from a building through a joint, coupling, junction, or the surfaces which enclose the building. The flow of uncontrolled air within a building through cracks or openings.

Air tightness (of a building):
The property of an enclosure or barrier that precludes the passage of air.

Air volume:
The amount (volume) of air delivered to a space through ventilation, typically specified in litres per second or cubic metres per minute.

ASHRAE:
American Society of Heating, Refrigerating and Air-Conditioning Engineers.

Balancing (air system):
To ensure that correct volumes of air are supplied by adjusting airflow rates through air distribution system devices (such as fans and diffusers) by manually adjusting the position of dampers, splitter vanes, extractors, etc. or by using automatic control devices,such as constant air volume or variable air volume boxes.

Brightness contrast ratio:
The ratio of illuminance between the highest and lowest illuminance value in a room.

Building commissioning:
The process of ensuring that all building systems are designed, installed, tested, and oper ated in conformity with design intent.

Chlorofluorocarbons (CFCs):
CFCs are odourless, colourless, non-flammable non-toxic chemicals. They vaporise easily at low temperatures making them ideal coolants in refrigerators and air conditioners. CFCs are also used in foam for seat padding and insulation. Until recently, they were used extensively in aerosol spray cans. CFCs cause stratospheric ozone depletion.

Demand Controlled Ventilation (DCV):
A ventilation system that provides for the automatic reduction of outdoor air intake below design rates, when the actual occupancy of spaces served by the system is less than design occupancy. Demand is often assessed by using the measure of the amount of carbon dioxide (CO^2) in a space to reflect occupancy levels.

Diversity factor:

Relates to the thermal characteristics of the building envelope, temperature swings and occupancy load.

U-Value:

a measure of the heat transmission through a building part (such as a wall or window) or a given thickness of a material (such as insulation) with lower numbers indicating better insulating properties.

Diversity coefficients:

is a quantitative measure that reflects how many different types there are in a dataset.

Solar Reflectance Index:

The solar reflectance index (SRI) is a measure of the constructed surface's ability to reflect solar heat, as shown by a small temperature rise.

Utility meter: A utility meter is any of the following metering devices used on utility mains:

- Electricity meter, a device for measuring electricity usage
- Gas meter, a specialized flow meter used to measure the volume of fuel gases such as natural gas and propane.
- Water meter, a device for measuring water usage
- Heat meter, instruments intended for measuring the heat, which, in a heat-exchange circuit, is given up by a liquid called the heat-conveying liquid.

Preambles

201 Chapter 1 – General

The national green building regulation is designed to fulfill the mandatory, minimum energy and water standards for the new buildings in the United Arab Emirates. The purpose of the NGBR is to ensure, but not to limit, the implementation of the minimum sustainability measures in the new buildings across UAE. The regulation is flexible to firstly, to ensure adherence of the existing regulations and codes to the minimum standard while not contradicting or limiting any higher standards intended by the responsible entities and Secondly, to act as a mandatory guidance to entities who are about to start implementing the efficiency measures.

The regulation was developed in a collaborative approach through the National green code committee representing the responsible entities in each emirate; to ensure the alignment of the NGBR to the existing regulations and codes in operations.

The national green building regulation will give a base introduction of federal regulation related to sustainability, energy, and water savings in building development in emirates. It will assist the emirates that do not have an existing green building code to apply minimum efficiency standards. And it will simulate the continuous improvement of existing codes in emirates. Each Municipal in emirates will be responsible to ensure the implantation of the NGBR in their emirates.

The legislative authority may then establish that all emirates need to evaluate their existing regulations against this national standard and implement any amendments in their regulations to demonstrate to the ministry of energy and infrastructure within a predefined timeframe 1 year that the regulation they adopt achieves equivalent or higher benefits in terms of energy savings, water savings and environmental impact.

For clarity, in evaluating compliance of existing regulation with the national standard, I recommend not to require a 1-to-1 fulfilment of each parameter by each Emirate, but rather to require proof of substantial fulfilment of the final objectives (energy, water, environment) through a combination of the parameters.

All the item in Annex A in the national green building regulation will be Mandatory unless it defines to be as optional.

201.01 Purpose

The NGBR intends to support the United Arab Emirates Government **vision 2021**, which is to ensure sustainable development while preserving the environment, and to achieve a perfect balance between economic and social development. NGBR is also in line with the UAE Centennial 2071 and will contribute specifically to the pillars of a diversified knowledge economy and a happy and cohesive society. The NGBR will increase building energy and water efficiency and reduce consumption costs thereby contributing to environmental and economic sustainability and productivity.

The regulation will also support the **UAE Energy Strategy 2050**, which is considered the first unified energy strategy in the country that includes long term targets for energy supply and demand. The strategy aims to increase the contribution of clean energy in the total energy mix from 25 per cent to 50 per cent by 2050 and reduce carbon footprint of power generation by 70 percent, thus saving AED 700 billion by 2050. The strategy also seeks to increase energy consumption efficiency of the UAE by 40% in 2050. Buildings are estimated to consume 70% of total electricity in the UAE and increasing their efficiency will contribute greatly to the energy strategy targets. NGBR will contribute to the clean energy target by recommending solar rooftop for electricity and water heating as well as contribute to the energy efficiency target by mandating efficiency improvement. Add it will support reducing energy demand in the buildings sector by 51% for the year 2050.

NGBR will sustain **water security strategy's** target since the overall objectives of the strategy are to reduce total demand for water resources by 21 per cent, increase the water productivity index to USD 110 per cubic meter, reduce the water scarcity index by three degrees, increase the reuse of treated water to 95 per cent and increase national water storage capacity up to two days.

Moreover, **The National Green Building Regulation** is a main part of the UAE National Demand Side Management Program 2050, which sets the initiatives to achieve the national energy strategy target of 40% demand reduction. And add water saving The NGBR is part of the Building Codes program in the Built Environment Pillar of the national DSM program. The Building Codes program is estimated to contribute to the total Built environment energy savings by 18% in 2030 and 40% in 2050 compared to business as usual. In addition to reducing the water consumption index by 46% in the agricultural sector.

The aim of the NGBR is to achieve the following goals:

- To set minimum design requirements for all emirates.
- Enhance built environment across the UAE to preserve our resources (energy, water, waste, material) with minimum environmental impact .
- Periodically update the Green Building Codes and Regulations with alignment across Emirates (and Free Zones)
- Encourages buildings to be designed with optimal efficiency in mind from the start.
- To encourage adoption of energy and water equipment as per specification form efficiency standards by relevant authority.
- Improve quality of life and happiness .

201.02 Jurisdiction and Competent Authority

The NGBR is applicable in all emirates in United Arab Emirates (UAE) that do not possess existing local Green Building mandates.Emirates/jurisdictions where Green Building mandates exists, are not required to demonstrate 1-to-1 fulfilment of the NGBR however, such Emirates/jurisdictions shall demonstrate fulfilment of energy and water savings KPIs of the NGBR and annually report such KPIs to the MoEI in accordance with agreed Evaluation, Measurement and Verification protocols.It is expected that major updates will take place every 2 years based on the feedback which coming from the authorities

201.03 Compatibility with Existing Regulations

The provisions of the National Green Building Regulation shall support and enhance the provisions of any pre-existing regulations in case of conflict, without any effect on the continuing validity of the remaining non-conflicting provisions of the pre-existing regulations. When the requirements of the NGBR differ from the requirement of Civil Defense Department in each emirate, the requirement of Civil Defense Department in each emirate will prevail.The NGBR is issued in two languages, Arabic and English. The Arabic languages shall prevail in any case of conflict.

201.04 Building Typology

For the purpose of the NGBR, requirements are applying to the following building typologies:

At the optional period, the minimum size for each category to be detected by the local entity based on their regulations.

Residential Buildings

-Multi-Story Residential Building
-Staff Accommodation
-Labor Accommodation
-Student Accommodation
-Residential Villas - Emiratis
-Residential Villas - Investment

Commercial Buildings

-Office Building
-Mall & Shopping Center
-Retail & Showroom
-Laboratory (Private) other commercial buildings

Hospitality Buildings

-Hotel
-Motel
-Resort
-Hotel Apartment

Industrial Buildings

-Factory
-Warehouse
-Workshop

Public Buildings

-Government Building
-Educational Facility
-Healthcare Facility
-Mosque & Worship Building
-Exhibition & Festival Center, Sport Facility
-Other Public Building (Bank, Post Office, Cinema, Theatre, Museum)
Public gardens and utilities

201.05 Scope of Application

A. With regards to the building typologies identified above, the NGBR apply to:

- New buildings, on empty plots and on occupied plots, whose Building Permit application has been submitted after the Implementation Date of the NGBR
- Extensions and/or refurbishments of buildings permitted under the NGBR

B.The following building types are exempt from the regulations:

- Temporary Buildings
- Heritage Buildings

C.For mixed-use buildings, when a building comprises more than one building usage type, the whole building shall comply with the requirements of the Prevalent Usage Type, which is subject to the approval from the Competent Authority. In case the Prevalent Usage Type is not clear, the applicable building usage type for the NGBR shall be defined in coordination with the Competent Authority.

D.For projects comprising of several buildings, each building of the project must comply with the relevant regulations for that particular building type.

202 Chapter 2 – Submission Process

Compliance with the NGBR should be proven through a design stage and a construction stage submission. The applicable submission stages and the required submission evidence should be specified for each regulatory item. The checklists should be done by the authority and to be submitted to ministry of energy and infrastructure to know the percentage of NGBR implementation in each project.The submission process is described in the paragraphs 202.01 and 202.02. The Competent Authority may require a different process to be applied within their jurisdiction.

202.01 Design Stage Submission

The NGBR design stage evidence should be submitted, along with the other documents and drawings required for the Building Permit application, as per the requirements of the Competent Authority. The relevant sections should be demonstrating compliance with the NGBR are to be clearly highlighted in documents, calculations and drawings.
The applicant has to ensure that the project fulfils all applicable requirements of the NGBR without any conflict and/or contradiction with other documents and drawings required as part of the Building Permit application. And the building permit will only be issued by the local authority if the building design complies with the NGBR KPIs.
The submission process shall be as per the local entity requirement without any conflict or fixed methodology.

202.02 Construction Stage Submission

The NGBR construction stage evidence should be recorded on a monthly basis. The recorded evidence must be submitted to the Competent Authority upon request.The Competent Authority may conduct site visits at any time to review the compliance with the NGBR requirements. The NGBR construction stage evidence should be submitted, along with the other documents and drawings required for the Completion Certification application, as per the requirements of the Competent Authority. The relevant sections demonstrating compliance with the NGBR are to be clearly highlighted in the material datasheet and technical product information documents.

The applicant has to ensure that the project fulfils all applicable requirements without any conflict and/or contradiction with the other disciplines documents and drawings. The Completion Certificate issuance depends on the project's compliance with the NGBR along with other requirements as defined by the Competent Authority and without any conflict with local entities procedures.The Competent Authority will be responsible about completion certificate that will only be issued by the Municipalities/Free zones

Green Building Code Specification

Annex A – Green Building Code

Green Building Regulations

The National Green Building Regulations apply to the building types specified in 201.04 Building Typology.

301 Chapter 1 – Energy Efficiency

301.01 Building Envelope Performance

Intent:
To reduce the heat gain through the building's façades and roof and consequently minimise the cooling load which represents a significant component of the total building energy consumption.

Applicable Building Types:

1.Residential buildings (small and large)
2.Hospitality
3.Commercial buildings (small and large)
4.Public buildings (small and large)

Requirements:

The building envelope performance requirements are categorised separately for opaque elements (such as external walls and roofs) and glazed elements (such as windows, glazed walls and skylights).

Opaque glazed elements (with back insulated panels) are considered as opaque elements, and therefore must meet the required u-value of the walls.

Requirements for Opaque Elements:
The average u-value of the external walls and roofs (that are exposed to ambient conditions) must not exceed the following thresholds:

- Average external wall u-value ≤ 0.48 W/m²K, (this includes the block work and structural columns and beams).
- Average roof u-value ≤ 0.30 W/m²K.
- Individual Private Villas are exempt from the above specified external wall u-value if 200 mm thermal blocks with u-value of maximum 0.5 W/m²K are used.
- All applicable building types, except for Individual Private Villas, must insulate the external structural columns and beams to avoid heat bridges.

Requirements for Glazed Elements:

The optimum choice of windows is important as glazing gains and loses heat quickly and often makes up a large proportion of the building envelope.

For glazed portions of external walls and roofs, the average u-value and Solar Heat Gain Coefficient (SHGC) should not exceed the following values:

- Average window (glazing and frame) u-value ≤ 2.2 W/m²K.
- If average window u-value is not available, the project may comply with a glazing center pane u-value ≤ 1.8 W/m²K with a thermally broken frame.
- Skylight centre pane u-value ≤ 1.8 W/m²K.
- Window and skylight SHGC ≤ 0.3.

Exception(s):

Buildings that are not air-conditioned do not have to comply with this article.

301.02 HVAC Design Parameters

Intent:

To prevent oversizing of the air conditioning equipment by considering local weather conditions, required indoor conditions and the building envelope performance.

Applicable Building Types:

1.Residential buildings (small and large) – excluding Individual Private Villas
2.Hospitality
3.Commercial buildings (small and large)
4.Public buildings (small and large)
5.Industrial buildings

Requirements:

The cooling load must be calculated in accordance with the following design parameters:

Building Envelope Parameters

The heat transfer coefficients for walls, roofs and glazing must be the actual design coefficients and must comply with article 301.01 'Building Envelope Performance.

Outdoor Condition

- Dry bulb temperature: 46°C
- Wet bulb temperature: 29°C
- Relevant location coordinates

Safety factors

The safety factors applied must be no greater than the following:

- Sensible Heat: 10%
- Latent Heat: 5%

Indoor Condition of the Building

For all regularly occupied rooms, excluding spaces dedicated to manufacturing, production and storage:

- Dry bulb temperature: 24°C +/- 1°C
- Relative humidity: 50% +/- 10%

The diversity coefficients set out in ASHRAE Fundamentals 2013 shall be used.

Exception(s)

Buildings that are not air-conditioned do not have to comply with this article.

301.03 HVAC Efficiency & Controls

Intent:

To promote efficient Heating, Ventilation and Air Conditioning (HVAC) systems and to ensure adequate controls are available to the building occupants to adjust the set-point temperature and ventilation settings.

Applicable Building Types:

1.Residential buildings (small and large)
2.Hospitality
3.Commercial buildings (small and large)
4.Public buildings (small and large)
5.Industrial buildings

Requirements: HVAC Efficiency

All HVAC equipment and systems must comply with the minimum full load energy efficiency requirements (EER/COP) listed in Table 1, Table 2, Table 3 and Table 4. Chilling packages must additionally comply with the minimum part load efficiency requirements (IPLV) specified in Table 4. In addition, labelled according to ESMA standards & labels.

National Green Building Regulations – Electrically Operated Unitary ACs

Table 1

Equipment Type	Rated Capacity (kW at T3)	Minimum Efficiency Full Load		Rating Conditions
		Energy Efficiency Rating (EER, Btu/h/W at T3)	Coefficient of Performance (COP at T3)	
Window AC	All	7.51	2.20	Tested as per ESMA standard no. UAE.S ISO 5151:2017
Non-ducted AC	All	8.31	2.44	
Ducted split and packaged AC	RC < 40	8.80	2.58	Tested as per ISO 13253
	40 ≤ RC < 70	8.59	2.52	
	70 ≤ RC < 223	8.27	2.42	
	223 ≤ RC	7.95	2.33	

National Green Building Regulations – Multi-Split and VRF

Table 2

Equipment Type	Rated Capacity (kW at T3)	Cooling Seasonal Performance Factor (CSPF Btu/h/W at T3)	Integrated Part Load Value (IPLV at T3)	Rating Conditions
Multi-split	RC <40	NA	4.59	Tested as per ESMA standard no. UAE.S ISO 15042
	40 ≤ RC < 220	NA	4.45	
	220 ≤ RC	NA	4.35	
VRF	RC <40	14.84	NA	Tested as per ESMA UAE.S ISO 16358-2013/Amd.1:2019
	40 ≤ RC < 220	13.78	NA	
	220 ≤ RC	13.25	NA	

National Green Building Regulations – Heat Pumps

Table 3

Equipment Type	Rated Capacity (kW at T3)	Minimum Efficiency Full Load		Rating Conditions
		Energy Efficiency Rating (EER, Btu/h/W at T3)	Coefficient of Performance (COP at T3)	
Water source heat pump unit	All Capacities, Entering fluid temperature of 30°C	8.35	2..45	Tested as per ESMA standard no. UAE.S ISO 13256-1:1998 & UAE.S ISO 13256-2:1998
Ground water source heat pump unit	All Capacities, Entering fluid temperature of 25°C	9.2	2.7	

National Green Building Regulations – Chilling Packages

Table 4

Equipment Type	Rated Capacity (kW at T1)	Minimum Efficiency Full Load		Integrated Part Load Value (IPLV at T1)	Rating Conditions
		Energy Efficiency Rating (EER, Btu/h/W at T1)	Coefficient of Performance (COP at T1)		
Water cooled chiller positive displacement (reciprocating)	All	15.19	4.45	5.63	Tested as per UAE.S AHRI 550/590
Water cooled chiller positive displacement (rotary and scroll)	RC < 264	16.01	4.69	5.87	
	264 ≤RC<528	17.03	4.99	6.29	
	528 ≤RC<1,055	18.19	5.33	6.52	
	1,055 ≤RC<2,110	19.69	5.77	6.77	
	2,110 ≤ RC	21.26	6.23	7.04	
Water cooled chiller (centrifugal)	RC < 528	21.71	6.36	6.77	
	528 ≤ RC	23.51	6.89	7.04	

HVAC Controls:

- The HVAC control system of the building shall be subdivided into independent control areas, corresponding to the various regularly occupied rooms or areas of the building.
- The set-point temperature and ventilation of each control area must be independently controllable, regardless of the set-point temperature and ventilation of other control areas in the building. A thermostat must be provided in each control area to allow occupants to adjust the set-point temperature and ventilation of the area.
- The HVAC control system must be capable of shutting down and starting up the HVAC equipment for the specific control area whenever required by the occupants of the same control area.
- In case of a central building HVAC system, the HVAC control system must shut down the central cooling equipment when the set-point temperature of all control areas has been reached, or when the thermostat for all control areas has been switched off.

Energy Recovery

An energy recovery system must be provided for all buildings with an outdoor air requirement of more than 1,000L/s. The energy recovery system must be capable of handling at least 50% of the total exhausted air and must have at least a 70% sensible load recovery efficiency.

Exception(s):

The following systems are exempt from the energy recovery requirement:

- Laboratory fume hood system.
- Systems exhausting toxic, flammable or corrosive gases, fumes or dust.
- Commercial kitchen hoods for the collection and removal of grease vapour

301.04 Lighting Efficiency

Intent:

To reduce the electricity consumption by mandating energy efficient lighting fixtures and lighting controls.

Applicable Building Types:

1.Residential buildings (small and large) – excluding Individual Private Villas
2.Hospitality
3.Commercial buildings (small and large)
4.Public buildings (small and large)
5.Industrial buildings

Requirements:

Lighting Efficiency

All internal and external light fittings of the building must be Light Emitting Diodes (LEDs) or meet, at minimum, ESMA 3 star requirements. And must comply with a Lighting Power Density (LPD) of 6.5 W/m2. All internal and external light fittings in hospitality buildings and large residential, commercial and public buildings must meet, at a minimum, ESMA 3 star requirements And must comply with a Lighting Power Density (LPD) of 6.5 W/m2. Government buildings must additionally comply with a Lighting Power Density (LPD) of 6.5 W/m2. Or as per each local entity regulations.

Lighting Controls

- At least one light switch or dimmer must be provided near the entrance of each room.
- Office, residential and government buildings must provide occupancy or motion sensors in corridors, staircases and public bathrooms. The area in front of elevators and lifts is excluded from this requirement. These occupancy or motion sensors must be capable of automatically switching the lighting off when the areas are unoccupied.
- Exterior lighting must be equipped with automatic lighting controls which may be of the following two types:
  - Daylight sensor that automatically turns the exterior lights off if sufficient daylight is present
  - Astronomical time switch or programmable schedule control that automatically turns the exterior light off during daytime hours.
- Exterior lighting and interior common area lighting must also be controllable from a central control panel or the building management system (BMS), in case of failure of the automatic controls, or for exceptional usage purposes.

Exception(s):

The following lighting types are exempt from the lighting efficiency requirements:

- Coloured lighting.
- Lighting for specialized plant, machinery and equipment.
- Lighting for plant growth.
- Lighting for visually impaired persons with special lighting needs.
- Display lighting for museums, monuments and art galleries.
- Lighting for sports.
- Specialized medical lighting to carry out examination or surgery e.g. in hospitals, medical centres, or doctors' and dentists' surgeries.
- Stage lighting in theatres and TV studios.

301.05 Energy Metering

Intent:

To monitor the energy performance of the building and provide data that is critical in identifying improvement opportunities in energy consumption and understanding energy usage patterns.

Applicable Building Types:

1.Residential buildings (large)
2.Hospitality
3.Commercial buildings (large)
4.Public buildings (large)

Requirements:

- All buildings must be fitted with energy meters (of tariff class accuracy) to measure electricity consumption of the facility as a whole.
- Energy meters must be installed for each tenant unit in multi-tenant buildings.
- For buildings where chilled water is produced internally or externally procured and supplied to individual tenants or building areas, individual chilled water meters must be installed to measure the supply of chilled water to each unit.
- Energy sub-meters shall be installed for government buildings and for hotels with more than 150 rooms. The energy sub-meters must use the BMS, wireless network or other comparable communication infrastructure. The energy sub-meters shall monitor the following main energy consuming systems:
    - Cooling and fans
    - Domestic hot water
    - Lighting and other equipment can be monitored on the same sub-meter(s). Each floor has to be monitored separately.

301.06 Air Tightness

Intent:

To optimize the air tightness of the building and minimize air leakage.

Air leakage control is essential to optimize the energy performance of the building. If the building envelope is not sufficiently air tight, cold air leaks out and hot air enters through gaps and cracks, resulting in a higher energy consumption. Air leakage may also cause condensation issues, accelerating mould growth.

Applicable Building Types:

1.Residential buildings (small and large) – excluding Individual Private Villas
2.Hospitality
3.Commercial buildings (large)
4.Public buildings (large)

Requirements:

- This requirement is applicable to all government buildings, Investment and Government Funded Private Villas and to all other applicable building types exceeding a BUA of 5,000 m2.
- An air barrier system shall be provided between the internal air conditioned space and the external unconditioned space.
- An air leakage site inspection shall be performed at approximately 60% completion of the building envelope. The air leakage site inspection shall be conducted by an air leakage testing company approved by the Competent Authority. The identified issues and recommended rectifications must be recorded in an air leakage site inspection report. The contractor shall rectify all major issues and provide a summary of the undertaken actions.
- Residential projects comprising multiple identical Investment or Government Funded Private Villas shall perform progressive sample testing on a representative number of villas in accordance with Table 5. For any test failure, the testing shall be entirely repeated on a new sample of villas in accordance with Table 5, until all villas in a sample pass. In all cases, the air leakage testing company shall select the villas to be tested.

National Green Building Regulations – Air Leakage Testing

Table 5

Total No. of Villas	No. of villas to be tested for air leakage
Less than 20	1
Between 20 and 49	2
Between 50 and 99	3
More than 100	4

- Government buildings shall be tested for air leakage in addition to an air leakage site inspection. The air leakage into or out of the building shall not exceed 7.5 m3 of air per hour for each square meter of the building envelope (7.5m3/hr/m²), at an applied pressure difference of 50 Pascal. The air leakage test shall be conducted by an air leakage testing company approved by the Competent Authority.

- Government buildings shall be tested for air leakage in addition to an air leakage site inspection. The air leakage into or out of the building shall not exceed 7.5 m3 of air per hour for each square meter of the building envelope (7.5m3/hr/m²), at an applied pressure difference of 50 Pascal. The air leakage test shall be conducted by an air leakage testing company approved by the Competent Authority.
- One of the following standards shall be used for the air leakage testing:
    - ATTMA Technical Standard L1. Measuring Air Permeability in the Envelopes of Dwellings
    - ATTMA Technical Standard L2. Measuring Air Permeability in the Envelopes of Buildings (Non-Dwellings)
    - CIBSE TM23
    - ISO 9972

The local entity shall work on Certified Schemes such as air leakage testing and commissioning to be followed by them.

301.07 Building Commissioning

Intent:
To ensure that all energy and water related building systems are installed correctly and commissioned in accordance with the building owner's project requirements and tender documents.

Applicable Building Types:

1.Residential buildings (large) – excluding staff, labour and student accommodations
2.Hospitality
3.Commercial buildings (large)
4.Public buildings (large)

)

Requirements:

- A commissioning agent approved by the Competent Authority shall be engaged during construction and building commissioning. The commissioning process managed by the commissioning agent must include as a minimum the following building systems:
    - HVAC systems.
    - Renewable energy systems.
    - Electrical systems.
    - Domestic hot and cold water systems.
    - On-site water treatment systems (if applicable).
- During the construction stage, the commissioning agent shall develop a commissioning plan which includes the following:
    - Overview of the commissioning process.
    - Roles and responsibilities related to building commissioning.
    - Detailed description of the commissioning activities and a schedule of commissioning activities.
    - List of commissioned systems and description of evaluation procedures.
    - Format for the commissioning evaluation checklists and testing forms, and issues and resolutions log.

- The commissioning agent shall also review the following documents:
    - Shop drawings.
    - Equipment submittals.
    - Installation method statements.
- The building commissioning shall be executed after obtaining the utility connection, and shall be managed by the commissioning agent. The testing activity may be executed by the building contractor; however, the presence of the commissioning agent is required to oversee the correct execution of each test and to document the testing results. All issues identified during commissioning shall be documented in the issues and resolutions log.

- The building commissioning shall be executed after obtaining the utility connection, and shall be managed by the commissioning agent. The testing activity may be executed by the building contractor; however, the presence of the commissioning agent is required to oversee the correct execution of each test and to document the testing results. All issues identified during commissioning shall be documented in the issues and resolutions log.

- The commissioning agent shall issue a final commissioning report, including at least the following:
    - List of the commissioned systems.
    - Copy of the evaluation checklists and testing forms completed for the commissioned systems.
    - Copy of the issues and resolutions log, detailing open and closed issues.
    - Resolution plan for open items.

302 Chapter 2 – Water Efficiency

302.01 Efficient Water Fixtures & Fittings

Intent:
To reduce potable water consumption in buildings and consequently reduce the energy needed for desalination processes.The local entities can refer to their references and regulations if any of these requirements are conflict with them.

Applicable Building Types:

1.Residential buildings (small and large)
2.Hospitality
3.Commercial buildings (small and large)
4.Public buildings (small and large)
5.Industrial buildings

Requirements:

Option 1: Flow & Flush Rates

- All water fixtures and fittings must meet the maximum allowable flush and flow rates specified in Table 6.

National Green Building Regulations – Maximum Flow and Flush Rates

Table 6

Fixture Type	Maximum Flow or Flush Rate
Shower Heads	8 litres per minute at 3 bar
Rainwater Shower Heads	9.5 litres per minute at 3 bar
Hand Wash Basin Faucets (private)	5 litres per minute at 3 bar
Hand Wash Basin Faucets (public)	1.9 litres per minute at 3 bar
Kitchen Sink Faucets	5 litres per minute at 3 bar
Ablution Faucets	6 litres per minute at 3 bar
Dual Flush Water Closets	4.5 litres full flush 3 litres part flush
Urinals	1 litre per flush

Option 2: Water Budget Calculator

- Buildings unable to comply with the specified flush and flow rates must demonstrate that their estimated water consumption will not be greater than the baseline water consumption using a Water Budget Calculator..
- The baseline water consumption is calculated in accordance with the specified flush and flow rates under Option 1 in Table 6.

302.02 Efficient Irrigation Systems

Intent:
To increase irrigation water efficiency and promote the use of alternative water sources such as recovered grey water or Treated Sewage Effluent (TSE).Landscape irrigation particularly consumes large quantities of potable water and the use of water efficient irrigation and alternative water sources can drastically reduce the potable water consumption.

Applicable Building Types:

1.Residential buildings (large) – excluding staff, labour and student accomodations
2.Hospitality
3.Commercial buildings (large)
4.Public buildings (large) – excluding laboratories

Requirements:

- All Exterior Soft Landscaping (including green roofs), excluding lawns, must be irrigated with drip or subsoil irrigation systems. Sprinkler irrigation systems may only be used for the irrigation of lawn.
- For hotels, Exterior Soft Landscaping must be irrigated using non-potable water, such as recovered condensate water, grey water or TSE, if the costs for non-potable water irrigation do not exceed the costs for potable water irrigation.

302.03 Native or Adaptive Species

Intent:
To limit the water demand for irrigation, by mandating the use of native or adaptive species of plants which thrive well in the climate of UAE without the need for excessive irrigation.

Applicable Building Types:

1.Residential buildings (large) – excluding staff, labour and student accommodations
2.Hospitality
3.Commercial buildings (large) – excluding laboratories
4.Public buildings (large)

Requirements:

For projects with total Exterior Soft Landscape areas exceeding 1,000 m2, a minimum of thirty percent (30%) of the total Exterior Soft Landscaping area, including lawns, must be landscaped using plant or tree species that are native or adaptive to the climate and soil of UAE.

302.04 Water Metering

Intent:
To monitor the water consumption of the building and provide data that is critical in identifying opportunities for improvement and understanding water usage patterns.

Applicable Building Types:

1.Residential buildings (large)
2.Hospitality
3.Commercial buildings (large)
4.Public buildings (large)

Requirements:

- All buildings must be fitted with water meters (of tariff class accuracy) to measure water consumption of the building as a whole.
- Water meters must be installed for each tenant unit in multi-tenant buildings.
- Water sub-meters must be installed for each swimming pool, and for irrigation if the Exterior Soft Landscaping area exceeds 1,000 m2.

303 Chapter 3 –Renewable Resources

303.01 Renewable Water Heating

Intent:
To promote renewable energy production and reduce dependence on grid electricity supply. Solar thermal water heaters and thermodynamic water heaters present reliable and economical solutions to produce hot water with renewable energy.

Applicable Building Types:

1.Residential buildings (large) – excluding multi-story residential buildings.
2.Hospitality.
3.Commercial buildings (large) – excluding multi-tenant buildings.
4.Public buildings (large) – excluding exhibition and festival centres, and sports facilities.

Requirements:

- This article is applicable for domestic hot water and does not cover hot water required for processing or for industrial purposes.
- All applicable building typologies must comply with one of the following options for the domestic hot water supply:
  - Option 1: Solar thermal water heating.
  - Option 2: Thermodynamic water heating such as air source heat pumps or thermodynamic solar systems.
- For the purpose of the NGBR, the average daily domestic hot water demand (Litres/day) for Labour Accommodations is defined as follows:
  - Investment Villas and Government Funded Private Villas (including annexes): 50 litres/day for each full bathroom, 30 litres/day for each toilet, 80 litres/day for each kitchen.
  - Labour Accommodations: 10 litres/day for each person, 1,000 litres/day for the central kitchen, 600 litres/day for ablution.
- The annual domestic hot water demand for Investment Villas, Government Funded Private Villas and Labour Accommodations is the daily average hot water demand multiplied by 365.
- All other building types shall calculate the annual domestic hot water demand based on the 2015 ASHRAE Handbook - HVAC Application.

- Option 1: Solar Thermal Water Heating
  - A solar thermal water heating system must be installed at an appropriate location, sized to supply at least 75% of the annual domestic hot water demand.
  - The solar thermal water heating system installations must be fitted with insulated hot water storage tanks and insulated pipes, which are sized and fitted as per the manufacturer's recommendations. The minimum hot water storage capacity shall be 75% of the daily domestic hot water demand.
  - An auxiliary back-up heat source must be provided to supply hot water when the solar thermal supply is inadequate. This secondary heat source must also be capable to regularly boost the temperature in the hot water storage tank to 60° Celsius to limit the development of pathogens such as Legionella. The boosting shall be controlled by a thermostat.
- Option 2: Thermodynamic Water Heating
  - A thermodynamic water heating system must be installed to supply at least 75% of the annual domestic hot water demand.
  - The hot water storage tank must be sized for the maximum heating capacity of the heat pump.
  - A secondary heat source must be provided if the heat pump cannot heat water up to 60° Celsius. This secondary heat source must be capable to regularly boost the temperature in the hot water storage tank to 60° Celsius to limit the development of pathogens such as Legionella. The boosting shall be controlled by a thermostat.

Exception(s):

- Buildings do not need to comply with this article if a photovoltaic (PV) system is installed at the time of construction on an area equivalent to 30% of the Net Roof Area. The PV system must be connected to the building.
- The solar thermal water heating system may provide less than 75% of the domestic hot water demand if the available Net Roof Area is not sufficient. In this case, the solar water heating system must cover the total Net Roof Area excluding the areas for MEP equipment, vents and the access areas for maintenance. The Net Roof Area is defined in the article 303.02 'Onsite PV Readiness'.

303.02 Onsite PV Readiness

Intent:
As an optional requirement, To integrate design consideration for future photovoltaic (PV) installation into the original building design, thus improving the feasibility and potential benefits of a future rooftop PV system installation on the building.Rooftop PV installations already offer substantial energy cost savings compared to utility power supply in many cases, and their economic and technical viability is expected to improve in the future. Investment in a solar-ready roof offers substantial cost savings compared to retrofitting an existing building roof for a PV system.

Applicable Building Types:

1.Residential buildings (small and large) – excluding Individual Private Villas.
2.Hospitality.
3.Commercial buildings (small and large) – excluding multi-tenant buildings.
4.Public buildings (small and large) – excluding exhibition and festival centres, and sports facilities.
5.Industrial buildings.

Requirements:

- Option 1: Solar Ready Zone
  - The total area of the solar zone shall be at least 30% of the Net Roof Area of the building.
  - The Net Roof Area of the building for the purpose of this calculation is the net roof area after excluding the area of any skylights, helipads and solar water heating equipment from the gross roof area of the building. The area of any sloping roofs, roof decks, terraces, swimming pools, HVAC equipment and vents and areas for maintenance access must be included in the Net Roof Area.
  - The total solar zone of a building may be composed of multiple separate sub-areas. A sub-area cannot be narrower than 1.5 m in any dimension.
  - The solar zone may be situated at any of the following locations:
    - Roof or overhang of the building, including roof decks or terraces.
    - Roof or overhang of an accessory structure (covered parking, service block, gazebo, etc.) located within 75m of the building.
  - The solar zone shall be free of any pipes, exhaust or intake vents, architectural features, skylights, or other building system equipment. This requirement is in place so that the solar zone remains clear for the installation of a future PV system.
  - The distance of any rooftop equipment or obstruction from the solar zone shall be at least two times the height of the highest point of the obstruction, so as to minimize the shading of the solar zone by the obstructions. This requirement does not apply to equipment or obstructions located North of the entire solar zone.
  - A solar zone located on a sloping roof surface with a slope greater than 10∞ to the horizontal is permitted only if the roof is oriented between 100∞ and 260∞ of true north (not magnetic north). This ensures adequate exposure to direct solar radiation for a future PV system.

- A solar zone may be positioned above a usable roof deck, terrace, swimming pool or above rooftop equipment only if it is otherwise not feasible to dedicate 30% of the Net Roof Area as a solar zone. In this case, a shading structure capable of supporting a future PV installation must be considered in the design and its structural foundations must be constructed. The solar zone would be considered to be on this structure, and not directly on the roof deck, terrace, swimming pool and/or equipment.
- The weight of the PV panels (dead weight of 25 kg/m2) must be considered in the structural design of the building, including the supporting structures (if any) above usable roof decks, terraces or above rooftop equipment.
- A pathway shall be reserved for routing an electrical conduit from the solar zone to the point of interconnection with the electrical utility service (the electricity meter room or utility area).
- An area shall be reserved for inverters and metering equipment necessary for the future PV systems, either on the roof of the building, or in the electricity meter room or utility area of the building. This area shall not count towards the total solar zone area requirement. The allocated space should be appropriately sized for a PV system that would cover the entire solar zone.

- Option 2: PV Installation
  - Projects shall install a PV system on an area equivalent to 30% of the Net Roof Area. The PV system must be connected to the building.
- Option 3: Optimized Building Envelope Performance
  - Projects unable to comply with Option 1 or Option 2, shall compensate with a lower average wall u-value of 0.4 W/m^2K.

304 Chapter 4 – Materials & Resources

304.01 Construction Waste Management

Intent:
To reduce the amount of construction waste sent to landfill, thereby reducing the demand for virgin materials.

Applicable Building Types:

1.Residential buildings (small and large).
2.Hospitality.
3.Commercial buildings (small and large).
4.Public buildings (small and large).
5.Industrial buildings.

Requirements:

- Construction waste shall be segregated on site to facilitate recycling of:
  - Clean construction waste such as concrete, excavated soil and grouting mixes
  - Mixed recyclables such as plastic, cardboard and paper
  - Mixed construction waste such as contaminated plastic, rubber, foam, and carpets
  - Metals
  - Wood
  - Hazardous waste

The waste streams must be disposed at suitable facilities designated as such by the competent waste authority in the emirate.Hospitality buildings, and large public buildings and commercial buildings must recycle or reuse at least 25% (by weight or volume) of all construction and demolition waste. This requirement applies to all construction waste excluding excavated soil and land-clearing debris.Excavated soil, land-clearing debris and hazardous waste must be disposed at suitable facilities designated as such by the competent waste management authority in the emirate.Hospitality buildings, malls & shopping centres, hospitals and multi-building projects shall prepare a Construction Waste Management Plan (CWMP) outlining how they intend to achieve the targeted recycling rate.

The construction and demolition waste management plan (CDWMP) should outline how the waste diversion target will be achieved and must contain the following as a minimum:

- Anticipated waste streams and estimates of the amount of waste expected to be generated
  Identify the waste streams targeted for diversion and on-site reuse and specify methods of diversion and on-site reuse. Specify the anticipated end-destination for all types of waste generated (e.g. reused on-site, sent to landfill, sent to recycling facility etc.)
- On-site waste storage requirements such as skips for source separation. Determine the size and location of the skips. There should be waste skips provided for the following material streams:
  Concrete.

- On-site waste storage requirements such as skips for source separation. Determine the size and location of the skips. There should be waste skips provided for the following material streams:
  Concrete.
  - Metals
  - Plastic
  - Timber
  - General Waste
- All skips must be clearly labelled. If the expected waste quantities are low, the skips can be compartmentalised.
- Identify waste haulers that could be used and include the credentials of the waste hauler that will be used Identify any potential sources of hazardous waste. Seek to minimise the generation of hazardous waste and outline measures to safely store and dispose of all generated hazardous waste. Mechanism to track the movement of all waste leaving the site. This should be tracked using waste removal tickets that have details on the time and date, waste hauler company and the type and amount of waste moved. The table tracking construction waste should include the following as a minimum:
  - Total waste generated
  - Total hazardous waste generated
  - Total non-hazardous waste diverted from landfill
  - Waste generated in each waste stream
  - Waste generated in each waste stream
  - Waste diverted from landfill in each waste stream

When calculating the waste diverted from landfill, exclude excavated soil, land-clearing debris and hazardous waste. The diversion can be in weight or volume, but must be consistent over the entire project % of waste diverted from landfill= (Total amount of waste diverted from landfill)/(Total amount of waste generated)×100

Methods of diversion from landfill includes but is not limited to the following:

- Reuse
- Recycle
- Salvage
- Manufacturer's reclamation

All hazardous waste must be disposed of in a safe and appropriate manner as determined by the local authority.

304.02 Organic Waste Management

Intent:
To reduce the amount of food waste sent to landfill.

Applicable Building Types:

1.Hospitality
2.Commercial buildings (large) – only malls and shopping centres
3.Public buildings (large) – only healthcare facilities

Requirements:

- 4 & 5 star hotels, malls and shopping centres with food courts and healthcare facilities that provide food must provide a techno-economic evaluation for an on-site organic waste management equipment such as a composter, a digester or a liquefier. The evaluation shall contain the following:
  - Waste arising model with the total estimated food waste.
  - Simple payback time calculation
- The evaluated on-site organic waste management option must be implemented if the payback time is less than 7 years.

304.03 Refrigerant Requirements

Intent:
To minimize the environmental impact of refrigerants.

Applicable Building Types:

1.Residential buildings (large)
2.Hospitality
3.Commercial buildings (large)
4.Public buildings (large)

Requirements:

- All HVAC & R (HVAC and Refrigeration) equipment and systems must contain refrigerants with zero ODP or with GWP less than 100. Use table 7 as a reference.
- Fire-fighting equipment must not contain any ozone-depleting substances (such as CFCs, HCFCs, or halons).

National Green Building Regulations – Refrigerant ODP and GWP

Table 7

Chlorofluorocarbons (CFCs)	ODP	GWP
CFC-11	1.0	4,680
CFC-12	1.0	10,720
CFC-114	0.940	9,800
CFC-500	0.605	7,900
CFC-502	0.221	4,600
Hydrochlorofluorocarbons (HCFC)	**ODP**	**GWP**
HCFC-22	0.040	1,780
HCFC-123	0.020	76
Hydrofluorocarbons (HFC)	**ODP**	**GWP**
HFC-23	0	12,240
HFC-134a	0	1,320
HFC-245fa	0	1,020
HFC-404A	0	3,900
HFC-407A	0	1,700
HFC-410A	0	1,890
HFC-507A	0	3,900
Natural Refrigerants	**ODP**	**GWP**
Carbon Dioxide (CO_2)	0	1.0
Ammonia (NH_3)	0	0
Propane	0	3

305 Chapter 5 – Comfort & Well-Being

305.01 VOC Limits

Intent:
To reduce the concentration of chemical contaminants that can damage air quality and human health.

Applicable Building Types:

1.Residential buildings (small and large) – excluding Individual Private Villas
2.Hospitality
3.Commercial buildings (small and large)
4.Public buildings (small and large)

Requirements:

All interior wall and ceiling paints must comply with the following maximum Volatile Organic Compound (VOC) content limits:

National Green Building Regulations – VOC Content Limit

Table 8

Interior Paint Type	VOC Limit g/L
Matt (Gloss <25@60°C)	30
Glossy (Gloss >25@60°C)	100

305.02 Urban Heat Island Effect Reduction

Intent:
To improve outdoor comfort in urban areas by limiting the Urban Heat Island Effect through surface reflectivity and shading requirements.

Applicable Building Types:

1.Residential buildings (large) – excluding staff, labour and student accommodations
2.Hospitality
3.Commercial buildings (large)
4.Public buildings (large) – excluding exhibition and festival centres, and sports facilities

Requirements:

- A minimum of 75% of the building's opaque roof surfaces, excluding roof skylights, green roofs and building equipment (such as solar water heaters, PV equipment, HVAC equipment), must have a minimum initial Solar Reflectance Index (SRI) value as specified below:
  - Sloped Roofs steeper than 1:6: ≥ 29
  - Flat and Low Sloped Roofs: ≥ 78
- The initial SRI of at least 50% of the hardscape area must be greater than 29.

305.03 Minimum Indoor Air Quality

Intent:
To assure a high degree of indoor air quality for building occupants.

Applicable Building Types:

1.Residential buildings (large) – excluding staff, labour and student accommodations
2.Hospitality
3.Commercial buildings (large)
4.Public buildings (large)

Requirements:

- All air conditioned buildings must comply with the minimum ventilation rates of ASHRAE Standard 62.1- 2013.
- All particular matter filters or air cleansers shall have a Minimum Reporting Efficiency Rating (MERV) of 6.

305.04 Outdoor Thermal Comfort

Intent:
To improve outdoor thermal comfort and minimize outdoor thermal discomfort especially during summer months in public spaces and walkways.

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Applicable Building Types:

1.Residential buildings (large) – excluding staff, labour and student accommodations
2.Hospitality
3.Commercial buildings (large)
4.Public buildings (large)

Requirements:

- The following minimum percentages of shading at 13:00 on equinox must be provided for the listed hardscape areas:

National Green Building Regulations – Outdoor Shading Requirements

Table 9

Outdoor Space Type	Minimum% shading
Exterior Surface Parking with more than 10 spaces (including parking on roof surfaces)	45% (30% for hotels with 3 stars or less) of all parking spaces
Primary Pedestrian Walkways	75%
Playgrounds	50%

- Primary pedestrian walkways are defined as walkways connecting the car parking spaces with the main entrances to the buildings.
- Where cover is provided by structures such as canopies or other architectural elements, the outer surface of the shading element must have a minimum Solar Reflectance Index (SRI) of 29.
- Shade from trees is to be measured at 5-year growth.

NGBR CHECKLIST

Please return the completed checklist with your building permit application package and all supporting documents.

- ☐ New residential construction
- ☐ Addition to existing residence
- ☐ Structural or building envelope renovation
- ☐ Other
- ☐ Project owner _____
- ☐ Emirates _____
- ☐ Consultant _____
- ☐ Main Contractor _____
- ☐ Project Starting Date _____ Project Ending Date _____

Consider each item and check those applicable to your project:

- ☐ Working with any green building consultant.
- ☐ Applying any green code requirements; if yes please mention the code/regulation name.
- ☐ Participate in any green building prizes with the Project's design.

Site consideration

- ☐ Optimum solar orientation and use natural geographic/ecological features in building siting.
- ☐ Compact development and minimum disturbed site area considered.
- ☐ Surface water management: permeable lot, permanent erosion controls and/or roof run-off management.
- ☐ Landscape plan: shade trees, fire-smart varieties, low irrigation demand, drought tolerant plants, no invasive plants.
- ☐ Plan for site erosion control during construction.

Building Energy Efficiency (BC Energy Step Code)

- ☐ Work with a Certified Energy Advisor.
- ☐ Use efficient hot water distribution/domestic hot water equipment.
- ☐ Install hot water pipe insulation.
- ☐ Use appropriately sized & high efficiency HVAC equipment; minimal losses from heating and cooling distribution system.
- ☐ High performance envelope; including exterior or enhanced insulation.
- ☐ Build for minimal envelope leakage and maintain strict attention to air sealing detail during construction.Install enhanced performance windows and doors.
- ☐ Install external window blinds / shades.
- ☐ Use efficient ENERGY STAR® lighting options.
- ☐ Install ENERGY STAR® water efficient appliances, e.g., washing machine.
- ☐ Investigate renewable energy system, e.g., air source heat pump with electric or natural gas backup.Investigate drain
- ☐ water heat recovery.
- ☐ Install solar photovoltaic system, or make ready for future retrofit.

Waste Management

- ☐ Plan for recyclables, compost and waste storage on site.
- ☐ Use environmentally preferred products.
- ☐ Use construction waste management and reduction practice.

Active and Low Carbon Transportation

- ☐ Clear and safe pedestrian access and pathways.
- ☐ Bicycle storage or racks.
- ☐ Electric vehicle charging infrastructure placement (make ready for easy retrofit of "level 2" charger).

Indoor Environmental Quality (NGBR)

- ☐ Review combustion venting measures.
- ☐ Review moisture load control.
- ☐ Install outdoor air ventilation.
- ☐ Install local exhaust vents.
- ☐ Consider enhanced energy efficiency performance for distribution of space heating and cooling.
- ☐ Install high quality air filters.
- ☐ Choose low-VOC or zero-VOC (volatile organic compounds) paint.
- ☐ Use radon resistant construction practices.
- ☐ Ensure garage pollutant protection.

Water Conservation

- ☐ High efficiency fixtures and fittings (low flush toilets, low flow showerheads, tap aerators).
- ☐ Rainwater harvesting system.
- ☐ If available, greywater reuse system.
- ☐ Maintain low consumption water irrigation system.
- ☐ Ability to monitor occupant water usage. (i.e., install water meter)

Date of Checklist Submission _____

Project Manager _____

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Signature _____