CORPORATE POLICY

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1 POLICY STATEMENT:

The City of Waterloo is committed to reducing Greenhouse Gas (GHG) emissions associated with all City-owned buildings. Reducing building GHG emissions provides environmental benefits at a local and global level, as well as social and financial benefits.

Building GHG emissions reductions are required to support the City's GHG emission reduction goals. The City of Waterloo has committed to reducing City-Owned (or Corporate) GHG emissions 50% by 2030 relative to 2010 levels and achieving net zero carbon emissions by 2050.

This Policy is divided into three (3) sections covering the life of City buildings, with the intent the provisions in each section allow the City to meet the GHG reduction goals at City-owned buildings:

2 PURPOSE:

The City of Waterloo's Green Building Policy for City-Owned Buildings provides a framework for new building construction and expansion, existing building major retrofits, and building maintenance of existing (and new) corporately owned buildings to achieve Corporate GHG emission reductions endorsed by Council.

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City-owned facilities are the largest fraction of corporate emissions, making up approximately 70% of total corporate City of Waterloo GHG emissions and represent the largest opportunity for GHG emissions reductions within City operations. Corporate fleet emissions are second, making up approximately 20% of total corporate City of Waterloo GHG emissions (and with fleet electrification, additional electrical loads will be shifted toward City facilities and sites).

The purpose of this Policy is to direct building design, construction, retrofits, and operation to achieve the City's GHG emission reduction targets of 50% reduction in GHG emissions by 2030 relative to 2010 levels and net zero emissions by 2050.

The Policy is divided into three (3) sections representing stages of City-owned buildings:

1. New building construction and expansion.
2. Existing building major retrofits.
3. Building operation, maintenance, and renewals.

Provisions in each section have the intent to reduce or eliminate GHG emissions at City-owned buildings to meet the City's GHG emission reduction target at City-owned buildings.

3 DEFINITIONS:

"Building Performance" refers to the qualitative or comparative evaluation of the building's total energy use intensity, thermal demand intensity, greenhouse gas intensity, and/or water efficiency.

"Carbon Dioxide Equivalent (CO_2e)" is a term used to define greenhouse gases that have different global warming potentials to a standard unit of global warming impact, in units of carbon dioxide equivalent.

"Carbon Offset" is a term used to define the purchase by one party of carbon dioxide emission reduction achieved by another party. The purchase funds projects (or other initiatives) which remove or prevent carbon dioxide from the atmosphere.

"Dedicated Outdoor Air System (DOAS)" is HVAC equipment that supplies 100% outdoor air to the served spaces only (no return air is mixed into the supply air).

"Electrification" refers to replacing natural gas fuelled heating systems to electrically powered systems.

"Embodied Carbon" is the carbon dioxide equivalent emissions associated with the building construction including manufacturing, transportation, installation, maintenance, and disposal of building materials.

"Global Warming Potential (GWP)" is a measure of how much energy the emission of one (1) tonne of gas will absorb over a period of time, relative to how much energy the

emission of one (1) tonne of carbon dioxide will absorb over the same period of time. The higher the global warming potential, the more heat the gas will trap within the earths' atmosphere.

"Greenhouse Gas (GHG)" are gases that trap heat in the atmosphere. Gases other than carbon dioxide can be categorized as greenhouse gases, including methane, refrigerants, nitrous oxides, and others.

"Greenhouse Gas Intensity (GHGI)" is defined as the annual Scope 1 and Scope 2 emissions in units of kilograms per carbon dioxide equivalent (kg/CO2e) emitted from the building per unit building gross area.

"Gross Area" of a building is defined as the sum of every building floor area above grade.

"Heat Recovery Ventilator (HRV)" is HVAC equipment that transfers energy from the exhaust air stream to the ventilation (outdoor) air stream thus recovering energy that would otherwise be directly exhausted and lost to the ambient.

"Life Cycle Cost (LCC)" is the total cost of a measure or package of measures considering all costs to purchase, operate, and dispose of an asset. It also includes carbon.

"Modern Equivalent" refers to replacing existing equipment with a like for similar equivalent or accepted alternative serving the same purpose and function, to meet current design needs, follow Council direction and influence climate change related capital project implementation such as reaching GHG emission targets and reach strategic plan or master plan goals.

"Renewable Energy Credit (REC)" is a certificate associated with the production of a unit of energy from a renewable generation source, such as solar photovoltaic electricity or wind power that entitles the certificate holder to claim an equal amount of energy (consumed by the holder) was generated by renewable sources. It is a type of carbon offset typically associated with energy.

"Representative Concentration Pathway (RCP)" is a trajectory scenario of greenhouse gas concentrations in the earth's atmosphere. Different scenarios are used to model different levels of possible global emissions that would lead to different (increased) greenhouse gas concentrations as a way to model future climate.

"Scope 1 Emissions" covers greenhouse gas emissions from owned or controlled sources, such as natural gas combustion in building equipment for heating or fuel combustion in a vehicle.

"Scope 2 Emissions" are indirect emissions from the generation of purchased energy that is consumed onsite, such as importing grid electricity which required carbon or greenhouse gas producing process to generate.

"Scope 3 Emissions" are all indirect emissions, not captured in Scope 2, from upstream and downstream activities.

"Thermal Energy Demand Intensity (TEDI)" is defined as the annual heating energy, from all heating sources, delivered to the building per unit building gross area.

"Total Energy Use Intensity (TEUI or EUI)" is defined as the annual amount of energy, from all energy sources, delivers to the buildings per unit building gross area.

"Zero Carbon Building (ZCB)" is a highly energy efficient building that produces onsite, or procures, carbon-free renewable energy or high-quality carbon offsets in an amount sufficient to offset the annual carbon emissions associated with building materials and operations (Zero Carbon Building Design Standard Version 2, Canadian Green Building Council).

"Zero carbon ready" refers to a building that is highly energy efficient with the goal or intent of becoming a zero carbon building at some point in the future, typically through the addition of renewable energy generation, such as solar photovoltaic panels or solar thermal heating, and/or the purchase of renewable energy credits or carbon offsets. Zero carbon ready buildings do not require overhauls to their building enclosure, mechanical, or electrical systems to become zero carbon.

4 SCOPE:

This policy applies to all City staff, consultants, contractors, vendors, and any parties involved in the design, construction, or servicing of all City-owned buildings over 100 m^2 in size, with exceptions and direction for heritage designated buildings.

This policy includes three (3) sections:

1. New building construction and expansion.
2. Existing building major retrofits.
3. Building operation, maintenance, and renewals.

Within those sections, targets and thresholds for GHG emissions, embodied carbon, energy efficiency, renewable energy generation, direction for low carbon equipment and solutions, water conservation/efficiency, and electric vehicle infrastructure are provided.

Where not specifically falling under the Policy, the intent of the Policy will be applied to all building work and projects.

5 POLICY COMMUNICATION:

This Policy will be posted on the City’s website and intranet. Staff will be advised of the new policy via distribution to the Operational Leadership Team and Corporate Management Team.

6 POLICY

The City of Waterloo Green Building Policy for City-Owned Buildings is a divided into three (3) categories, representing cycles experienced by City buildings. A framework is provided within each category to provide direction and targets for City staff to adhere to and meet when constructing, retrofitting, or maintaining buildings.

This policy is designed to align and be informed by zero carbon building standards and projects, including (but not limited to):

- Canadian Green Building Council's (CaGBC) Zero Carbon Building Design and Performance Standard (most recent version).
- Published municipal green building policies/standards, (City of Toronto's Green Building Standard).
- City of Waterloo's Corporate Greenhouse Gas and Energy Roadmap – Phase 1 (COM2021-027) and City carbon reduction projects to date

6.1 New building construction and expansion

6.1.1 Purpose

To provide a framework, modified to City of Waterloo needs, to build zero carbon buildings (new and expansion/additions) in general conformance with the Canadian Green Building Council Zero Carbon Building Standards.

6.1.2 Application

6.1.2.1 Applies to all corporately owned new buildings or expansions (excluding storage and non-occupied buildings) greater than or equal to 100 square meters (1,076 square feet) in gross building area, excluding storage or unoccupied buildings except where specifically indicated.

6.1.2.2 New buildings or expansions with gross building area less than 100 square meters shall have electric space and water heating where heating is required and solar ready roofing (where applicable).

6.1.3 Zero carbon ready building process

6.1.3.1 New building construction or expansion shall be executed according to the following process:

- Zero carbon ready feasibility study (complexity will vary based on building complexity).

- Building engineering and architectural design.
- Construction.
- Commissioning.
- Measurement and verification.

6.1.3.2 A zero carbon ready feasibility study shall be completed according to the requirements set out in this Policy.

6.1.3.3 The zero carbon ready feasibility study may occur after an initial needs assessment or building feasibility study, that determines the general shape, size, and operation of the building, or during/be part of schematic design phase to inform design. The zero carbon ready design may evolve during the design, based on project constraints or performance and proper measures will be in place to identify and rectify unforeseen developments.

6.1.3.4 Results of the zero carbon ready may be presented to Council for direction on how to proceed with a zero carbon ready building design approach. Different building GHG scenarios with associated costs shall be included to allow Council to make an informed decision. Council may or may not be engaged for medium or small value projects, or projects that follow a previously demonstrated approach.

6.1.3.5 When a direction is received from Council, that direction shall guide the design of the building systems to achieve the desired GHG emissions levels and energy performance.

6.1.3.6 An integrated design approach incorporating all designers and stakeholders shall be utilized.

6.1.3.7 An energy modelling consultant shall be retained to ensure the design process reflects the performance desired from the carbon study. Deviation from the GHG emissions targets, demonstrated through energy modelling, shall be addressed at that time.

6.1.3.8 A carbon/energy consultant may be retained to provide carbon expertise during the project and ensure the project mandates are met with respect to GHG emission reductions and energy conservation.

6.1.3.9 A building science consultant may be retained.

6.1.3.10 The roles of the energy modelling consultant, carbon/energy consultant, and building science consultant shall be further defined depending on and for each project.

6.1.3.11 An independent Commissioning (Cx) Provider and Building Envelope Commissioning (BECx) shall be retained by the City to commission the building.

6.1.3.12 Post project Measurement and Verification (M&V) shall be completed according to the requirements set out in this Policy.

6.1.4 Energy and GHG incentives

6.1.4.1 The City will apply for all available energy incentives including electricity, natural gas (if applicable), renewable energy generation, and water.

6.1.4.2 Contractors performing work for the City shall provide documentation to support the incentive applications including quotes, invoices, and specification sheets.

6.1.5 Greenhouse gas and energy requirements

6.1.5.1 New building construction or expansion shall be required to meet one of the following:

- Most recent version of Canadian Green Building Council Zero Carbon Building Design or Performance Standard (registration and certification shall be not an absolute requirement).
- Passive House levels of energy and thermal performance with net zero carbon emissions.
- Achieving building energy/GHG performance equal to or better than:

  - EUI of 100 ekWh/m^2/year.

  - TEDI of 30 ekWh/m^2/year.

  - GHGI of 0 tonnes of CO_2/m^2/year.

6.1.5.2 New construction shall not be connected to natural gas.

6.1.6 Renewable energy

6.1.6.1 Renewable energy generation systems that will be considered include:

- Solar Photovoltaic (PV).
- Solar thermal air or water heating.

6.1.6.2 For inclusion of renewable energy, required building elements shall be built “solar ready” following principles from:

- Solar Ready Buildings Planning Guide (Technical Report NRLE/TP-7A2-46078) published by National Renewable Energy Laboratory (NREL).

6.1.6.3 A plan must be developed to install solar PV panels in a realistic timeframe.

6.1.6.4 New buildings where 100% of the suitable space has been utilized with solar PV but cannot offset 100% of building electricity use will not be required to purchase carbon offsets to offset the remaining carbon emissions from electrical utility use unless directed to do so by Council.

6.1.7 Renewable energy credits and carbon offsets

6.1.7.1 The City shall not be required to purchase carbon offsets to offset GHG emissions unless specifically directed to do so or obtaining certification or registration for the project.

6.1.8 Zero carbon ready feasibility study

6.1.8.1 A zero carbon ready feasibility study shall be undertaken as per the process outlined in this Section.

6.1.8.2 Specific terms of reference for the study shall be developed and issued at that time that account for building type and function. Study complexity will vary according to building complexity.

6.1.8.3 The study shall identify an optimized path to achieve a net zero carbon building.

6.1.8.4 A building energy model shall be created to model building performance. Acceptable energy modelling software and standards shall be defined in the terms of reference. Energy modelling should consider electricity carbon emission factors depending on time of day (marginal emission factors).

6.1.8.5 Energy model may consider additional parametric weather files based on projected Representative Concentration Pathway (RCP) scenarios.

6.1.8.6 A LCC shall be included to account for all costs including capital, operation, maintenance, utility, and operational carbon (from energy use). A separate LCC scenario will account for embodied carbon/GHG emissions.

6.1.8.7 A table summarizing different zero carbon ready design scenarios shall be included.

6.1.8.8 The study shall be completed within a time frame that is acceptable to inform building design.

6.1.9 Energy modelling

6.1.9.1 The City shall hire an independent energy modeler to simulate building performance, which may include additional parametric weather files based on different RCP scenarios.

6.1.9.2 Energy models will generally align with:

- Schematic design phase.
- Detailed design phase.
- Construction drawings
- As-built construction.

6.1.9.3 Deviation (poor performance) from the intended building performance shall be addressed and rectified at that time.

6.1.10 Embodied carbon

6.1.10.1 The project shall demonstrate an embodied carbon emissions intensity equal to or better than 350 kg of CO_2e/m^2 of building area.

- Embodied carbon assessment shall meet at a minimum the requirements outlined in the current

version of CaGBC Zero Carbon Building Design Standard, including a LCC from a suitable software that demonstrates all life cycle components have been accounted for in the LCC.

6.1.10.2 Consultants shall provide embodied carbon estimates and supporting documentation as a report for the City.

6.1.11 Commissioning

6.1.11.1 An independent Cx Provider and (if required) BECx Provider shall be retained by the City to provide services during the design, construction, and post construction phases.

6.1.11.2 Cx and BECx will align with the latest versions of industry Cx and BECx standards, that may include standards from American Society of Heating Refrigeration and Air-Conditioning Engineers (ASHRAE), Canadian Standards Association (CSA), American Society for Testing and Materials (ASTM), North American Industry Classification System (NIBS), etc.

6.1.11.3 Building airtightness performance will be dependent on building type and size, but will target air leakage rates of 1 L/s/m2 at 75 Kilopascal (kPa) or better, confirmed through a blower door test or equivalent.

6.1.12 Measurement and verification

6.1.12.1 All new occupied building construction and expansion, excluding storage, shall be provided with a Building Automation System (BAS) or WIFI enabled and remotely accessible smart thermostat system.

6.1.12.2 An Energy Management System (EMS), if installed, will at a minimum monitor total building energy consumption. In the absence of an EMS utility data will be utilized.

6.1.12.3 One (1) year post construction M&V reporting shall report on:

- EUI, TEDI (to extent possible), and GHGI.
- Provide a snapshot of the current BAS scheduling and control set points.

- Provide an explanation and course of action to improve building performance if performance metrics are not met.
- Report on water use.

6.1.12.4 M&V reporting will generally align with either (including the above):

- ASHRAE Guideline 14.
- Most appropriate International Performance Measurement and Verification Protocol (IPMVP) Option.
- Comparison against final energy model.

6.1.12.5 If zero carbon certification is required, it must be directed at the onset of the project. The project would then follow the current version of CaGBC ZCB-Design during design and CaGBC Zero Carbon Building - Performance (ZCB-Performance) will be followed.

6.1.13 Water conservation

6.1.13.1 Achieve a minimum of 40% reduction of building potable water consumption over baseline water fixtures.

6.1.13.2 A green or blue roof should be considered, secondary to solar PV installations, on available space.

6.1.14 Electric vehicle infrastructure

6.1.14.1 Electric Vehicle (EV) direction shall generally follow the City's EV charging strategy.

6.2 Existing building major retrofits

6.2.1 Purpose:

The purpose of this section is to provide a framework to convert existing buildings equipment/systems to energy efficient low/net zero carbon equipment/systems required to meet GHG emission reduction targets. Timing of retrofit aligns with building infrastructure renewal requirements and includes Modern Equivalent replacements as appropriate.

6.2.2 Application

6.2.2.1 Applies to all Deep Energy Retrofits (DERs) of corporately owned buildings.

6.2.2.2 DER refers to a holistic retrofit of a building or building system(s) with the intent of achieving significant GHG emission and energy use reductions.

6.2.2.3 DER projects are generally aligned with multiple large capital replacement projects, and may include building enclosure upgrades.

6.2.2.4 DER is categorized as a non-routine replacement/upgrade of an entire building or building system(s).

6.2.3 Heritage buildings

6.2.3.1 Heritage exterior building enclosure or interior systems may or may not be altered at the direction of the heritage committee in accordance with heritage requirements.

6.2.3.2 When exterior building enclosure systems cannot be substantially altered, retrofits of heritage buildings will focus on:

- Retrofits of interiors of perimeter wall and roof systems.
- Mechanical and electrical systems.
- Controls.
- Renewable energy generation (as permissible).
- Building airtightness.
- Energy efficient cladding, windows, roofing that replicates existing heritage properties (where possible).

6.2.4 Deep energy retrofit process

6.2.4.1 A DER study, as defined in this Policy, will be undertaken prior to a DER project of sufficient size, complexity, and scope.

6.2.4.2 DER study requirements will depend on internal City capacity and successfully implemented projects of similar size, complexity, and scope.

6.2.4.3 The results of the DER study may be presented to Council for endorsement of a specific pathway to achieve deep GHG and energy savings or zero/low carbon operation of the building.

6.2.4.4 An energy modelling consultant may be retained to ensure the building redesign reflects the desired performance from the DER.

6.2.4.5 An energy/carbon consultant may be retained to ensure the GHG emissions reduction are met.

6.2.4.6 A building science consultant may be retained for major building enclosure upgrades.

6.2.4.7 The City shall retain an independent Cx Provider for the project.

6.2.4.8 Post DER project M&V shall be undertaken according to this Policy.

6.2.5 Energy and GHG incentives

6.2.5.1 The city will apply for all available energy and GHG incentives including electricity, natural gas (if applicable), renewable energy generation, and water.

6.2.5.2 Contractors performing work for the City shall provide documentation to support the incentive applications including quotes, invoices, specification sheets, and proof of disposal.

6.2.6 Greenhouse gas and energy requirements

6.2.6.1 DER projects will generally target the following energy and GHG performance improvements:

- 50% - 70% reduction in building EUI.
- For projects involving building enclosures, a 25% - 50% reduction in TEDI.
- 100% reduction in GHGI (net zero carbon emissions).

6.2.7 Deep energy retrofit feasibility study

6.2.7.1 A specific scope of work shall be developed for the DER study at the time of the project.

6.2.7.2 For large holistic projects, the DER study shall conform to, at a minimum, currently published study guidance documentation required for grant funding.

6.2.7.3 Multiple scenarios/pathways shall be assessed to achieve the targeted GHG emissions reduction.

6.2.7.4 A LCC shall be included to account for all costs including capital, operation, maintenance, utility, and operational carbon (from energy use). A separate LCC scenario will account for embodied carbon/GHG emissions.

6.2.7.5 DERs will evaluate all building systems and equipment.

6.2.7.6 Study shall be detailed enough to inform engineering and architectural design.

6.2.7.7 Whole building energy modelling software shall be used to simulate building performance. Energy modelling will consider electricity carbon emission factors depending on time of day (marginal emission factors).

6.2.7.8 Multiple parametric weather files based on different RCP scenarios may be assessed for future climate resiliency.

6.2.8 Embodied carbon

6.2.8.1 For retrofits including building enclosure, an embodied carbon estimate shall be completed targetting a 10% reduction in embodied carbon from an established baseline.

6.2.9 Lighting

Applies to interior and exterior lighting in a DER project.

6.2.9.1 All lighting shall be converted to Light Emitting Diode (LED) lighting.

6.2.9.2 Fixture replacement and/or fixture layout redesign shall be considered in addition to LED lamp replacements.

6.2.9.3 All lighting products shall be:

- Energy Star Certified and include the product identification number; or
- Design Lighting Consortium (DLC) qualified and include the product identification number.

6.2.10 Renewable energy

6.2.10.1 Renewable energy generation systems to be considered include:

- Solar PV.
- Solar thermal air heating.
- Solar thermal water heating.

6.2.10.2 Solar PV feasibility shall account for structural capacity of existing roof sections.

6.2.10.3 LCC will be performed on renewable energy generation.

6.2.11 Renewable energy credits and carbon offsets

6.2.11.1 The City shall not be required to purchase RECs or carbon offsets when undertaking a DER construction project, unless:

- It is mandated by Council, or
- The project requires CaGBC Zero Carbon Building – Performance (ZCB-Performance) certification.

6.2.12 Energy modelling

6.2.12.1 Building energy modelling shall generally be completed at:

- Schematic design phase
- Detailed design phase.
- Construction drawings.
- As-built construction.

6.2.12.2 Building performance modelled below the established metrics shall be addressed and rectified at that time.

6.2.13 Commissioning and building enclosure airtightness

6.2.13.1 An independent Cx Provider shall be retained by the City to provide services during the design, construction, and post construction phases.

6.2.13.2 If the DER project involved significant building enclosure retrofits or modifications, an independent BECx Provider may be retained by the City to provider services during the design, construction, and post construction phases.

6.2.13.3 Cx and BECx will align with the latest versions of industry Cx and BECx standards that may include standards from ASHRAE, CSA, ASTM, NIBS, etc.

6.2.14 Measurement and verification

6.2.14.1 Whole building M&V shall be reported after one year of operation using either:

- ASHRAE Guideline 14 – Measurement of energy, demand, and water savings.
- Most appropriate IPMVP option.
- Comparison against final energy model.

6.2.14.2 One (1) year post construction M&V reporting shall:

- Report on EUI, TEDI (to extent possible), and GHGI.

6.2.14.3 Provide an explanation and course of action to improve building performance if performance metrics are not met

6.2.14.4 If zero carbon certification is required post DER, then the current version of CaGBC Zero Carbon Building Performance Standard shall be followed.

6.2.15 Water conservation

6.2.15.1 Achieve a minimum of 40% reduction of building potable water consumption over baseline water fixtures.

6.2.15.2 The DER should consider a green or blue roof secondary to solar PV if applicable.

6.2.16 Electric vehicle infrastructure

6.2.16.1 See item 1.13 Electric vehicle infrastructure.

6.3 Building operation, maintenance, and renewals

6.3.1 Purpose

6.3.1.1 The purpose of this section is to provide a prescriptive approach to ensure routine building maintenance, equipment replacement, and building operations are energy efficient and low carbon, in line with meeting City-owned building GHG emission reduction targets, using a Modern Equivalent approach.

6.3.1.2 Operation relates to on-going operation of the building through controls, schedules, set points, and procedures. Optimizing and improving operation will lead to energy and GHG reductions.

6.3.1.3 Maintenance relates to improvements through repairs or (minor) rebuilds. Items such as Light Emitting Diode (LED) lamp replacements and ensuring HVAC cooling equipment has proper refrigerant charge.

6.3.1.4 Renewals relates to replacement or total overhaul of equipment or system components. This involves end of life or schedule replacement of HVAC units, pumps, fans, boilers, and others utilizing a modern equivalent approach where appropriate.

6.3.2 Application

6.3.2.1 Applies to building energy systems and equipment under normal operation and equipment replaced on a routine end of life or planned replacement basis.

6.3.2.2 In general, replacement equipment shall meet or exceed requirements of the most recent version of the International Green Construction Code (IGCC).

6.3.2.3 City staff will follow this Policy section to the best of their ability, however in emergency repair situations prescriptive measures may not be followed exactly due to need to install equipment and equipment or material lead times.

6.3.3 Planning

6.3.3.1 City staff shall develop a plan to convert natural gas fueled heating equipment and systems to electric powered based on replacement schedules, or proceed in a manner to maximize electrification of equipment.

6.3.3.2 The plan should include:

- Identifying where engineering designs will be required and preparing those to be in place or completed in the event of unplanned failure.
- Addressing electrical infrastructure capacity issues.
- Pathway to convert to electric power in the event converting to electric power is not feasible in the replacement time frame or at the existing building.

6.3.3.3 It is the intent all natural gas fired air and space water heating equipment will be converted to fully electric prior to 2050, if it cannot be converted now.

6.3.4 Solar PV strategy

6.3.4.1 City staff shall develop a solar PV strategy including identifying suitable solar PV installation areas and funding strategies.

6.3.5 Energy incentives

6.3.5.1 The City will apply for all available energy incentives including electricity, natural gas (if applicable), renewable energy generation, and water.

6.3.5.2 Contractors performing work for the City shall provide documentation to support the incentive applications including quotes, invoices, specification sheets, and proof of disposal.

6.3.6 New technologies

6.3.6.1 The City will strive to identify, assess, and pilot out new and emerging technologies that have significant GHG reduction potential or offer significant benefit to the building's energy and/or infrastructure performance. Pilots will be carried out on a case-by-case basis.

6.3.6.2 Successfully demonstrated and proven technologies can be incorporated into new building construction and expansion, existing building major retrofits, or building operation, maintenance, and renewals.

6.3.7 Dedicated Outdoor Air Systems (DOAS)

6.3.7.1 DOAS units are equipped with energy recovery.

6.3.7.2 When replacing DOAS units, heat pump operation shall be the primary mode of heating with electric back-up heating if possible, or natural gas fired back-up heating if electric is not possible.

6.3.7.3 Solar thermal air heating systems (referred to as solar walls) can be considered to provide renewable heating energy to DOAS units.

6.3.8 Make-up Air (MUA) units

6.3.8.1 New or replacement MUA shall be equipped with electric powered heating and shall only have natural gas back-up heating where existing electrical infrastructure is insufficient.

6.3.9 Furnaces

6.3.9.1 Applies to all residential and light commercial style forced air natural gas fired furnaces.

6.3.9.2 Furnaces shall be replaced with Air Source Heat Pumps (ASHPs) with electric resistive heat, where existing electrical infrastructure exists.

6.3.9.3 Heat pumps providing outdoor air ventilation shall be equipped with Energy Recovery Ventilators (ERVs) or Heat Recovery Ventilators (HRVs) as applicable.

6.3.9.4 Furnace and packaged type equipment will be, at a minimum, equipped with WIFI enabled smart thermostats.

6.3.10 Infrared heaters

6.3.10.1 Applies to all natural gas fired infrared tube heaters.

6.3.10.2 Where electrical infrastructure exists, natural gas infrared heaters shall be replaced with electric infrared heaters.

6.3.11 Air handling/roof top units – Built up or custom

6.3.11.1 Applies to all built-up or custom Air Handling Units (AHUs) and built-up or custom Rooftop Units (RTUs).

6.3.11.2 Built up replacements will consider:

- Converting constant volume units to variable volume, which may include adding Variable Frequency Drives (VFDs), pressure transmitters, and modulating dampers.

- Incorporation of electric powered heating, either through central plant or coils.
- Incorporating energy or heat recovery.

6.3.12 Rooftop units - Packaged

6.3.12.1 Applies to all commercial packaged, constant or variable volume, gas heat/electric cool Rooftop Units (RTUs).

6.3.12.2 RTUs shall be replaced with ASHPs with electric resistive back-up heat where sufficient electrical infrastructure exists. Where electrical infrastructure is insufficient, natural gas back-up heating can be utilized.

6.3.12.3 Incorporating energy recovery in the RTU will be considered on a case by case basis according to the amount of ventilation air and operating schedule of the RTU.

6.3.13 Unit heaters

6.3.13.1 Natural gas fired or hydronically heated units heaters will be replaced with electric resistive fan coils or cabinets or split ASHP systems.

6.3.14 Cooling plants

6.3.14.1 Applies to chilled water plants, including both air cooled and water cooled plants.

6.3.14.2 Primary only chilled water systems will have a plan to convert to variable flow where possible

- Control valves will be converted from three-way valves to two-way valves as part of the plan.
- Chilled water pumps shall be retrofitted with Variable Frequency Drives (VFDs).

6.3.14.3 Floating head pressure on condensers will be implemented where possible.

6.3.14.4 Optimized controls will be implemented.

6.3.14.5 Heat recovery will be implemented where possible, including incorporating designs for heat recovery chillers at replacement.

6.3.15 Refrigeration plants

6.3.15.1 Applies to all refrigeration plants serving ice rinks and arenas, excluding mobile refrigeration plants.

6.3.15.2 Refrigeration plant control optimization will be investigated.

6.3.15.3 Evaporative condensers shall be retrofitted with floating head pressure controls and evaporative condenser fans shall be retrofitted with VFDs where suitable.

6.3.15.4 Refrigeration plans shall incorporate maximum heat recovery.

6.3.16 Heating plants

6.3.16.1 Applies to all natural gas fired boilers serving building space heating and/or connected to domestic water heating systems.

6.3.16.2 Natural gas fired boilers shall be electrified. The following factors may impact the ability or extent of the boiler to be electrified:

- Heat output requirements.
- Existing building electrical infrastructure capacity.
- Changes to utility classification should an electric boiler be installed.
- Timing of potential DER projects to the building.
- Providing supplementary heat through air-to-water heat pumps, Ground Source Heat Pumps (GSHPs), or electric resistive heating where permissible.

6.3.17 Lighting

6.3.17.1 Non-LED exterior lighting, wall packs, and lamps shall be replaced with LED equivalent with appropriate controls.

6.3.17.2 Non-LED interior lamps and fixtures shall be replaced with LED equivalents.

6.3.18 Service water heating

6.3.18.1 Domestic water heating

- Natural gas fired water heaters shall be replaced with either a combination heat pump/electric resistive service or electric resistive service water heater.

6.3.19 Ice resurfacing flood water heating

6.3.19.1 Applies to water heaters providing hot water for ice resurfacing purposes.

6.3.19.2 Make-up water to water heaters shall be pre-heated through refrigeration plant heat recovery heat exchangers.

6.3.19.3 Water heaters shall be electric powered.

6.3.20 Controls and building automation systems

6.3.20.1 Applies to all buildings and systems controlled by a centrally accessible Building Automation System (BAS).

6.3.20.2 New controls software and hardware shall follow any City developed open source BAS specification.

6.3.20.3 All buildings will have a default set of temperature set points and schedules the BAS will control to based on the building's needs.

6.3.21 Roofing

6.3.21.1 New roofing shall have increased insulation as allowable by existing parapets or existing roof and building geometry. Where permissible, parapets shall be raised to allow for increased insulation.

6.3.21.2 Roofing shall be structurally investigated to determine suitability for solar PV. Roof shall be reinforced where permissible.

7 COMPLIANCE:

In cases of policy violation, the City may investigate and determine appropriate corrective action.