GREENHOUSE GAS MANAGEMENT IMPLEMENTATION PLAN

2019–2030
CIVIC OPERATIONS

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Edmonton

TABLE OF CONTENTS

CONTEXT

Climate change has emerged as the next unprecedented social, economic, and environmental challenge facing society today. It poses a serious threat to quality of life, jobs, and the physical and natural assets. Scientists believe that the human-induced production of greenhouse gas (GHG) emissions since pre-industrial times have already surpassed the Earth's "carrying capacity" of natural systems, and pose significant future risks to human well-being. As such, if GHG emissions are not reduced soon, human society is expected to be impacted by more floods, wind-storms, heat waves, and wildfires which can erode social systems, impact natural resources, and limit the ability to respond and recover. Furthermore, climate change impacts are expected to have serious negative effects on global economic growth and development.

Analysis conducted as part of the development of Edmonton's Adaptation and Resilience Plan suggests that Edmonton will not be immune to these climate impacts. Data already suggests that average winter temperatures in the Edmonton region have increased approximately four degrees celsius over the last 100 years and as the globe, including Edmonton, continues to emit greenhouse gases at the rate it currently is, that trend is expected to continue. Even to update Edmonton's drainage infrastructure to accommodate recent changes in the observed precipitation patterns is expected to cost in the range of $2.6 billion. Expected local environmental and economic impacts do not end there, further fuelling the need to urgently address the global emissions loading and for Edmonton to take leadership action to reduce its own carbon footprint.

At the same time, there is great opportunity in advancing a low carbon world; increased economic diversity, utility savings, more efficient operations, clean energy and air; and comfortable, durable buildings.

City Council has acknowledged the urgency of addressing climate change through the unanimous support of Edmonton's Community Energy Transition Strategy in 2015. The Community Energy Transition Strategy outlines over 150 actions that can be taken to reduce Edmonton's overall community greenhouse gas footprint with a target of reducing emissions 35% below 2005 levels by 2035.

PARIS AGREEMENT

The Paris Agreement is an agreement within the United Nations Framework Convention on Climate Change (UNFCCC) dealing with greenhouse gas emissions mitigation, adaptation and finance starting in the year 2020. The language of the agreement was negotiated by representatives of 196 parties (including Canada) at the 21st Conference of the Parties of the UNFCCC in Paris and adopted by consensus on 12 December 2015.

As part of the Community Energy Transition Strategy, the City commits to leading climate change action by investing in deep carbon reductions in its civic operations.

City Council has reiterated its commitment to taking a leadership role in climate change mitigation when it signed on to the Global Covenant of Mayors. The Global Covenant of Mayors for Climate & Energy is an international alliance of cities and local governments with a shared long-term vision of promoting and supporting voluntary action to combat climate change and move to a low emission, resilient society. By committing to the Covenant, Edmonton is required to set targets, create concrete action plans to achieve those targets, and maintain monitoring, measuring and reporting mechanisms to ensure it is on track to the achievement of the goals.

PAN CANADIAN FRAMEWORK

To demonstrate Canada's commitment to the Paris Agreement, the federal government led the collaborative development of The Pan Canadian Framework for Clean Growth and Climate Change – a collective plan to grow the economy while reducing emissions and building resilience to adapt to a changing climate. The plan aims to reduce greenhouse gas emissions by 30% below 2005 by 2030 and was endorsed by eight provinces (including Alberta) and three territories in fall 2016.

In March 2018, Edmonton City Council has advanced even further in its commitment to the achievement of a low carbon future when it led the development of the Edmonton Declaration. This protocol document was an agenda item at an international Mayor's Summit held immediately prior to the Intergovernmental Panel on Climate Change's first ever Cities and Climate Change Science Conference that occurred in Edmonton. Among other things, the Edmonton Declaration is a call to action for Cities to look at developing and implementing plans that are aligned with the Paris Agreement target of reducing emissions to a level that will maintain global average temperature increases to 1.5 degrees Celsius.

In May 2018, City Council approved the Greenhouse Gas Management Plan for Civic Operations. The pathway approved by City Council commits the City to reducing GHG emissions in its civic operations to 50% of 2005 levels by 2030, while strategically seeking out opportunities to further reduce GHG emissions with the ultimate goal of carbon neutrality by 2050.

The following document presents an implementation plan for the Greenhouse Gas Management Plan for Civic Operations as approved by City Council on May 22nd, 2018. The approach includes a more detailed explanation of the importance of monitoring and verification in the retrofit process as well as a summary of financial planning for the plan's implementation. The attached appendix provides a summary of key tasks that will be undertaken over the next twelve years.

OUR TARGET

The Pathway approved by City Council commits the City to reducing GHG emissions in its civic operations to 50% of 2005 levels by 2030, while strategically seeking out opportunities to further reduce GHG emissions with the ultimate goal of carbon neutrality by 2050.

DEEP CARBON RETROFITS

The two case studies at the end of this document show how the City of Edmonton has already demonstrated its ability to seek deep carbon retrofits during project planning and completion. In the first case, a new fire station was directed to be constructed as net zero. In the second, a typical glass replacement in the Shaw Conference Centre will be amplified by replacing the glass with integrated solar PV. The outcome of these projects show how greater carbon reductions may be found in the modification of existing projects as opportunities arise in an effort to better align the long term policy direction and stretch targets.

GREENHOUSE GAS QUANTIFICATION METHODOLOGY

Calculating civic operations municipal GHG emissions can be complex due to the wide variety of how City services are delivered, and by who delivers them (e.g. contractors). To be relevant, GHG inventories must reflect the operations of a City and the way in which it interacts with the community. At the same time, it is important that the analysis conforms to international standards for reporting to ensure consistency and comparability. To this end, the City's 2016 GHG inventory for civic operations has been prepared in accordance with The Climate Registry (TCR) General Reporting Protocol (Version 2.1, January 2016), an internationally recognized best practices guidance document (herein referred to as the Protocol) for preparing GHG inventories. This inventory was used to estimate future year GHG emissions for the purposes of setting an appropriate GHG reduction target for the City.

Following the Protocol, an "operational control" approach was used to identify which GHG emission sources the City has operating control over, and thus should be included in the GHG inventory. For example, although the Protocol identifies wastewater and water treatment as an operational aspect of a City, these GHG emission sources are not included in Edmonton's GHG inventory as the responsibility for these operations fully resides with EPCOR. Should the City wish to influence EPCOR's performance in this area, it would be through its role as shareholder and not through its GHG management plan. Table 1 shows the sectors in which data was compiled and reported for the City's GHG emissions inventory.

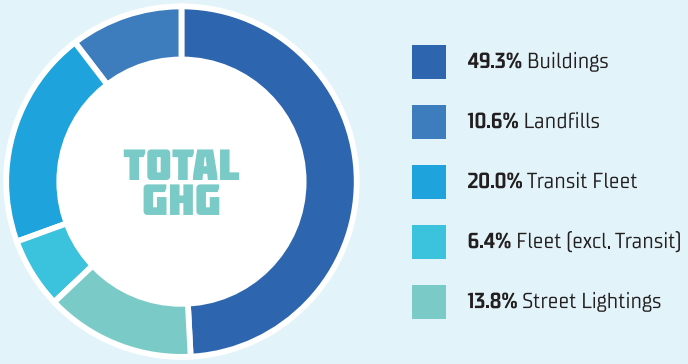
Table 1. City Reporting Sectors

REPORTING CATEGORY		EMISSION SOURCES
	**Buildings and Other Facilities**	Includes stationary and fugitive emissions (air conditioning refrigerants) as well as GHG emissions from electricity
	**Streetlights**	Includes GHG emissions from electricity related to street lighting, and traffic lights, including crosswalk signals, amber flashers, etc.
	**Vehicle Fleet**	Includes mobile combustion and fugitive emissions (air conditioning refrigerants) as well as GHG emissions from electricity for all electric vehicles and other electrified mobile equipment operated by the City
	**Transit Fleet**	Includes mobile combustion and fugitive emissions (air conditioning refrigerants) as well as GHG emissions from electricity for all electric transit vehicles and other electrified transit equipment operated by the City (e.g. LRT)
	**Solid Waste**	Includes stationary and fugitive emissions as well as GHG emissions from electricity use at City owned/operated landfills and disposal facilities

CURRENT GREENHOUSE GAS EMISSIONS PROFILE (2016)

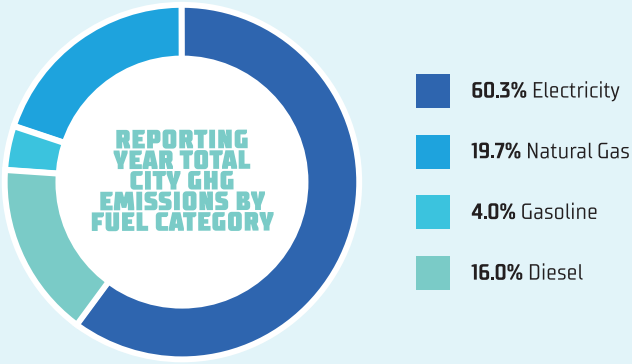
For the 2016 reporting year, approximately 49% of the City's civic operations GHG emissions came from buildings and facilities like recreation centers and pools; 26% came from transportation which includes corporate service vehicles as well as transit fleet; 14% came from the operation of streetlights and traffic signals; and, 11% came from the decomposition of waste at City operated landfills (Figure 1).

Figure 1. GHG Emissions By Sector



In 2016 more than 40% of Alberta's generation capacity was natural gas-fired and 51% was coal-fired. This led to over 60% of the City's Civic Operations GHG emissions to come from electricity use in buildings, and to power streetlights and transit vehicles (LRT) (Figure 2). Diesel and gasoline used in the operation of fleet, equipment, and other transit vehicles accounted for 23% of the GHG inventory. Lastly, natural gas use to heat buildings contributed 16% to the total GHG inventory.

Figure 2. GHG Emissions by Fuel Source



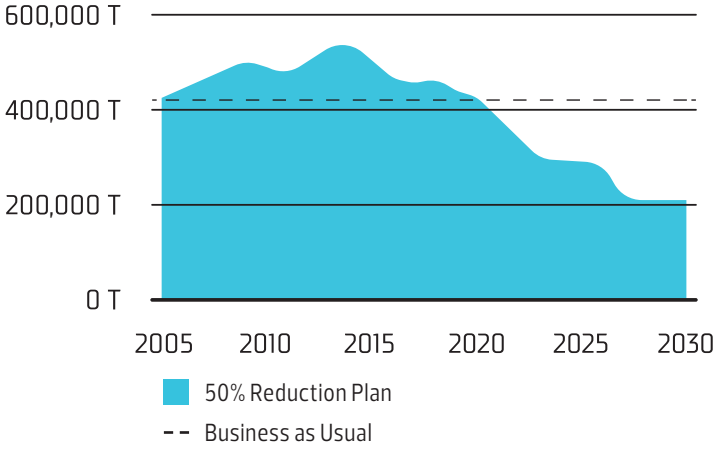
PATHWAY TO CLIMATE ACTION

Between 2005 and 2016, Civic Operations GHG emissions have increased by 24.7%. This increase in GHG emissions is not atypical for many Cities during this period; emissions increase as City services expand to meet the needs of a growing population. However, if absolute targets are to be achieved, the future state requires the reduction in emissions to occur at a faster rate then the growth of emissions.

While many GHG reduction projects are currently underway, the City's population is growing and is projected to increase by more than 20% by 2030. As Edmonton's population grows the demand for civic services will also increase and will result in increased GHG emissions. Based on the City's current pace, Edmonton's Civic Operations GHG emissions are projected to only grow 6% by 2030. The relatively low forecasted increase is attributable to the expected reduction in carbon intensity of the Alberta grid. Without the savings resulting from the province's greening grid the City's emissions would grow significantly more than 6%.

To reduce the City's civic operations GHG emissions significant action must be taken to improve energy efficiency, increase renewable and low-carbon fuel sources on-site, and there must be a commitment to procure green electricity. To assess the potential GHG reductions and financial implications of the actions available to Edmonton, this report forecasts a "Business as Usual" (BAU) GHG emissions to 2030 and compares to the adopted GHG reduction target to estimate what the City's GHG profile would look like in 2030 after a series of actions were implemented (see Figure 3).

Figure 3. Trajectory of GHG Emission Reduction



The Greenhouse Gas Management Plan for Civic Operations features a variety of technologies, policies, and strategies such as:

- City-Owned Building Energy Efficiency Retrofits
- Installation of Microgeneration Solar Photovoltaics on City-Owned Buildings & Properties
- LED Street Light Replacements
- Purchase of Electric Busses to Replace Diesel Powered Busses
- Purchase of Renewably Generated (Green) Electricity.

HOW THIS PLAN WAS DEVELOPED: PRINCIPLES OF THE PLAN

The plan was developed through a lens of seeking deep carbon reductions through actions that are both operationally achievable and financially prudent. The goals of this plan align with those identified in the City's environmental strategic plan, The Way We Green, of sustainable sources and uses of energy, creating energy systems resilient to disturbances and of Edmonton eventually becoming a carbon-neutral city. Avoiding and reducing energy use through greater energy efficiency and effective energy management are prioritized as the most effective methods to reduce GHG emissions, while replacing high carbon energy sources with low carbon sources, or renewable energy sources, form another major component of the plan. The plan also presents an opportunity for the City to position itself as a leader in energy transition to the greater community.

While operational improvements are important for decreasing the overall GHG production of the City's civic operations, there are limitations to GHG savings that can be obtained while maintaining current, as expected service levels and structural safety of facilities. This creates the need for the diverse profile of approaches outlined in Table 2: GHG reduction impacts.

As visible in Table 2, the importance of green electricity cannot be understated. Purchasing renewable electricity provides the City with a strong pathway towards GHG reduction targets while supporting the development of the local renewable energy industry (both in the Edmonton region but also in the greater Alberta context).

Table 2. Impact of Actions in GHG Planning Scenarios (Totals over three budget cycles (2019-30)).

GHG REDUCTION IMPACTS

		50% REDUCTION PLAN (TONNES GHG REDUCED)
	**Building Retrofit**	45,000
	**Solar PV**	10,000
	**LED Street light**	5,500
	**Electric Bus**	17,800
	**Green Electricity**	169,000 (100% of Electricity Consumption)
Total		247,000

IMPLEMENTATION ACTION

It is anticipated that achieving a minimum of a 50% reduction in greenhouse gases by 2030 will put Edmonton civic operations on a trajectory to minimizing its contribution to global emissions to a level that is aligned with a 1.5˚C to 2.0˚C carbon budget. This will help to ensure that future generations have the same access to a sustainable future.

Implementation of this plan will need to be integrated, accountable, and dynamic. The plan's implementation can be broken down into three core areas that are further explored in the appendix to this document:

- Management Action: Governance, Reporting, and Accountability,
- Process Alignment, Change, and Support,
- Infrastructure and Asset Changes.

MANAGEMENT ACTION: GOVERNANCE, REPORTING, AND ACCOUNTABILITY

The Plan will be governed by a cross-corporate accountability framework as it will both impact and be implemented by various City departments. This framework will take a dynamic steering and adaptive management approach.

An accountability process will be developed with many departments to provide oversight for plan implementation, ongoing monitoring, and evaluation of the plan's progress including regular reporting to the Executive Leadership Team on the overall progress of the actions.

PROCESS ALIGNMENT, CHANGE, AND SUPPORT

Successful implementation requires that core business is aligned and integrated with the principles and actions outlined in the plan. An example of this is Edmonton's recent decision to align the procurement of its electricity with the carbon reduction goals in the plan by purchasing 100% green electricity.

INFRASTRUCTURE AND ASSET CHANGES

The change of the physical assets of the City lead to a significant amount of greenhouse gas reductions as outlined in the plan. With the abovementioned framework developed rollout of retrofits, solar installations, LED streetlights, and electric buses will be enabled.

Accounting for and recognizing co-benefits

The City's actions in greenhouse gas reduction will also result in numerous co-benefits to the broader Edmonton community including:

- Job creation and economic diversification related to renewable energy, industrial ecology, green buildings, smart grid development, district energy development, and alternative transportation;
- Improved quality of life through reduced air pollutants and particulates; and
- Improved return on investment of tax payer dollars due to energy efficiency, fuel reductions, and the use of renewable energy sources.

Financial Considerations

While new energy efficiency projects will require capital budget support, net operating requirements are expected to decrease. For example, LED streetlight renewal will decrease operating requirements as the new streetlights are more efficient and therefore require less electricity. In some instances, operational savings are obtained by maintenance cost avoidance as well (e.g. LED bulbs typically also last longer than conventional lighting).

A funding mechanism is being explored which has the potential to harvest operational savings and re-apply them to new energy conservation measures in the future. This is a complex endeavour as capital and operating spending are established through separate budgeting processes and accounted for through different mechanisms. In addition, improved monitoring and verification will be required to enable the funding mechanism. The intent would be to use the operational savings to pay capital costs for future retrofit projects. As energy retrofits are predicted to generate a positive return on investment, the fund will eventually grow larger than the initial capital input.

Grants offered by the provincial and federal governments may also form a portion of the plan's funding. Grants are available to help fund energy efficiency and clean energy generation projects. For example, the Alberta Municipal Solar Program provides incentives of up to 25% of the cost of solar photovoltaic installations. Other programs offer rebates on the purchase of high efficiency products used in building energy retrofits. Pursuing these grants will help the City to achieve even more with the funds it can provide.

Behaviour, Monitoring and Verification

The long term success of building retrofits as a greenhouse gas reduction action requires careful behavioural attention, as well as the monitoring and verification of energy savings. Appropriate commissioning of new equipment, or recommissioning of existing equipment, results in significant energy savings. Effective preventative maintenance is assumed in energy retrofit designs, and is therefore necessary to achieve the expected rate of return from an energy retrofit. A Measurement and Verification program ensures energy savings are quantified. Together, these actions will allow for sustained savings from energy retrofits.

One tool that can assist in monitoring and verification and assurance of ongoing operational savings is the BOMA BEST third party certification. The BOMA BEST certification of City-owned buildings is a requirement of Policy C532, the City's Sustainable Building Policy. The environmental performance and management of existing buildings is documented and improved through the certification process. BOMA BEST certification requires the development of a preventative maintenance program and energy management plan for each facility. Measurement and verification of energy savings as well as proper commissioning of building systems are essential components of an effective energy management plan. BOMA BEST certification can therefore be used as a tool to ensure maximum results from energy retrofits. Current building management programs can be reviewed as the certification is renewed, and progress over time can be measured.

Commissioning refers to restoring or improving the operation or function of building systems. It is a key energy management activity which results in significant energy savings without significant capital investment. Appropriate commissioning is therefore necessary to achieve optimal energy savings for the inputted investment. Commissioning also reduces a building's maintenance costs for further savings.

Preventative maintenance programs protect the investment made in building by ensuring all equipment continues to function optimally. As effective maintenance is assumed in all designs, it is included in performance expectations and therefore necessary to achieve the highest energy savings at the lowest cost. An additional benefit is the minimization of disruptions from equipment failures. A preventative maintenance program should be included with every building energy retrofit.

Finally, the measurement and verification of energy savings is necessary to quantify the savings as they are obtained. Since the persistence of savings decreases over time, long-term measurement and verification provides the data to ensure savings are sustainable. This process may be as simple as before and after analysis of monthly utility bills, and can therefore be an easy-to-implement behavioural change that will support sustained energy savings after a retrofit.

Together, these changes in building operating and maintenance behaviour will ensure the best possible result from an energy retrofit, and yield the best return on investment for the initial capital costs. As savings are sustained over time, this will help secure the retrofit program's continued success.

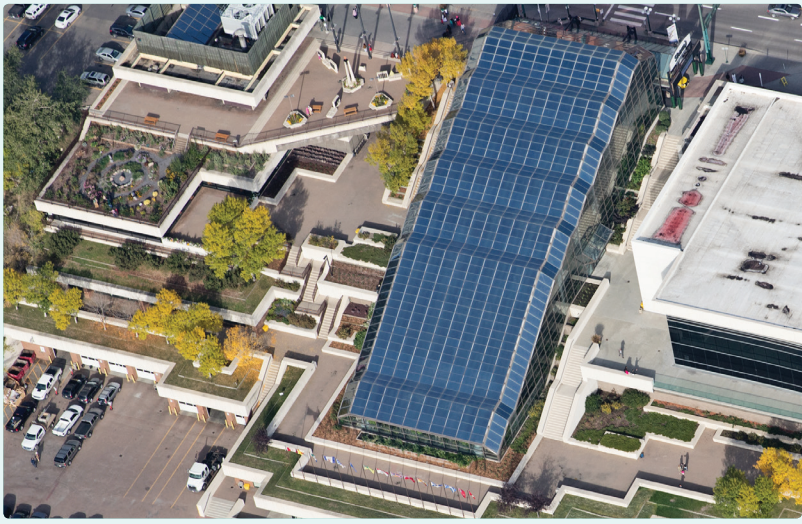
CASE STUDIES

SHAW CONFERENCE CENTRE

The Shaw Conference Centre is a meeting, entertainment and convention venue built in 1983. The building features a large glass atrium, which allows natural light to the conference level entrances, as well as adding to Edmonton's skyline. In 2015, the glazing of the atrium was at the end of its lifecycle and due to be replaced.

Rather than a traditional like-for-like glazing replacement, which offers no payback period or significant greenhouse gas reduction, it was proposed to replace the glass-sealed units with photovoltaic integrated insulated glazing units. The incremental cost between a like-for-like replacement and the photovoltaic array was easily justified as a feasibility study showed a payback period shorter than the installation's lifetime, and a reduction in greenhouse gases of 156 tonnes per year.

Beyond the winning cases for economic efficiency and greenhouse gas reduction, the project also offered the opportunity to showcase the City's environmental leadership by making use of new technological advances in a publically visible way. At the time of the study, the new solar PV plant would be Canada's largest building-integrated PV plant. The project will be easily seen from both the building's interior and as a feature of the river valley. Additionally, the solar plant's performance could be broadcast to the Shaw's website, further promoting green technology to the public. The project is expected to be completed in Fall 2019.



The Shaw Convention Centre

Rendering of Windermere fire station

WINDERMERE FIRE STATION NO. 31

As the south side of Edmonton continues to grow, Fire Rescue Services anticipated a need for a new fire station to service the Windermere and Ambleside neighborhoods, as well as the Anthony Henday Drive. Approval was received in 2013 for the design and construction of a new three-bay fire station. At that time, only LEED Silver certification was required for new City-owned buildings, but as planning began for the project, consultants were asked to provide schematic designs for two other scenarios: a building consistent with the updated C532 Sustainable Building Policy requirements (focused on improved energy efficiency) and a building that would be fully net zero.

Net zero buildings are designed to produce enough renewable energy to meet their own consumption needs. Energy producing features of the fire station will include a ground source heat pump expected to cover the building's heating and cooling requirements during normal operation, and what will be one of the City's largest solar panel installation, which will produce enough electricity to power the building. The building will also include heat recovery systems to capture heat that would be lost with exhaust in the cooking facilities, washrooms and apparatus bays, allowing for greater energy efficiency.

A net zero building does require a higher initial capital investment than the other scenarios, but utility savings over the building's lifetime are expected to exceed this initial investment. In addition to the cost savings, the net zero building is estimated to reduce greenhouse gas emissions by 7136 tonnes over a 50 year lifetime compared to the C532-level design. Given both positive returns on cost and greenhouse gas emission reductions, as well as support from City Council and the Energy Transition Advisory Committee for a net zero City-owned building, the net zero design was selected. As a result of this pilot project a request for a net zero design option is now built into the design consultation process when appropriate. This will allow the City to strategically select projects for net-zero achievement when it makes the most financial sense.

APPENDIX - CORPORATE GHG REDUCTION IMPLEMENTATION PLAN

ACTION ID	ACTION	LEAD	PARTNERS	PLAN BREAKDOWN		
				2019-2022	2023-2026	2027-2030
MANAGEMENT ACTION: GOVERNANCE, REPORTING, AND ACCOUNTABILITY						
1.1	"Establish cross-corporate governance and accountability process to provide oversight for plan implementation, ongoing monitoring and evaluation. "	Energy Transition Team	Facility GHG Steering Group	Develop working group and outline plans and processes.	Implement and update as required.	Implement and update as required.
1.2	Strategic Alignment: develop processes for identification of, communications with, and contribution to other related initiatives within the City, with EPCOR, and with external bodies.	Energy Transition Team	Facility GHG Steering Group	Develop and enact process for alignment.	Review and enact process for alignment.	Review and enact process for alignment.
1.3	Dynamic Steering & Adaptive Management: develop process for identifying internal and external forces that may impact the plan and identifying steps to take in order to adapt as required.	Energy Transition Team	Facility GHG Steering Group	Develop process for and adapt as required.	Develop process for and adapt as required.	Develop process for and adapt as required.
PROCESS ALIGNEMENT, CHANGE AND SUPPORT						
2.1	Establish processes within IIS to support decision making around, and implementation of, energy retrofits and PV installation.	Facility GHG Steering Group	ALL CoE Groups	Plan – start of cycle	Implement – start of cycle	Implement – start of cycle
2.2	Enable sustained savings in part by aligning with and implementing Internal Measurement and Verification Plans (MVP) and City Integrated Energy Management Performance Reporting Framework (EMPR).	Monitoring and Reporting Working Group	–	Identify requirements and develop monitoring and reporting plans and processes. Support quarterly and annual reporting.	Revise as needed monitoring and reporting plans and processes. Support quarterly and annual reporting.	Revise as needed monitoring and reporting plans and processes. Support quarterly and annual reporting.
2.3	Development and implementationof green electricity procurement plan including: project governance and steering.	Electricity Service Agreement & Green Electricity Procurement Working Group	Energy Management, IIS	Development of plan and potentail implementation.	Implementation started unless plan provides clear justifcation on reasons to wait.	Implementation well under way for full 100% procurement of green electricity by 2030.
2.4	Complete additional process improvements or projects that will result in GHG reductions.	ALL CoE Groups		Various activities started and planned.	Activies to be identified.	Activies to be identified.
2.5	Identify and establish enabling and empowerment efforts to build awareness or knowledge in emerging best practices or technologies to help change attitudes, promote positive cultural change, and build capacity to implement the necessary new policies or processes.	ALL CoE Groups	Facility GHG Steering Group	Continuously identify opportunities and implement.	Continuously identify opportunities and implement.	Continuously identify opportunities and implement.
2.6	Identify and solidify funding processes and opportunities.	Energy Transition Team	Financial & Corporate Services	Development of new internal processes. Continuous idenification and use of applicable external opportunities.	Refinement of internal processes. Continuous idenification and use of applicable external opportunities.	Refinement of internal processes. Continuous idenification and use of applicable external opportunities.
INFRASTRUCTURE AND ASSET UPDATES						
3.1	Energy retrofits of existing buildings	Lifecycle Management, IPD, IIS	Facility GHG Steering Group	Enough projects completed to create 15,000 tonnes of GHG savings.	Enough projects completed to create an additional 15,000 tonnes of GHG savings.	Enough projects to compelte the remaining 15,000 tonnes of GHG savings for a total of 45,000 tonnes by 2030.
3.2	Accelerated microgen solar PV program	PV Working Group	Facility GHG Steering Group	Enough projects completed to create at least 3,333 tonnes of GHG savings.	Enough projects completed to create at least 3,333 tonnes of GHG savings.	Enough projects completed to create at least 3,333 tonnes of GHG savings. For a total minimum 10,000 tonnes GHG savings by 2030.
3.3	Electric Bus Deployment	DATS ETS	Integrated Infrastructure Services (IIS)	Begin charging infrastructure planning	Complete charging and bus infrastructure development and begin bus procurement process	440 buses procured and on the road (2030+ target)
3.3	LED Street Light Replacement	Parks and Roads Services	Energy Transition Team	"46,000 units of "low hanging fruit" street light types "	–	–