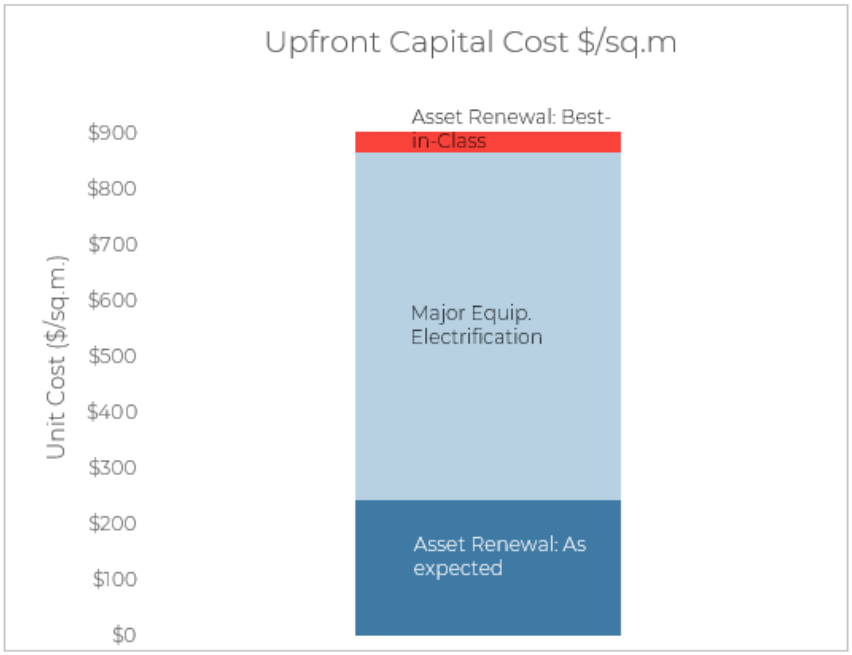
LARGE MIXED-USE BUILDINGS

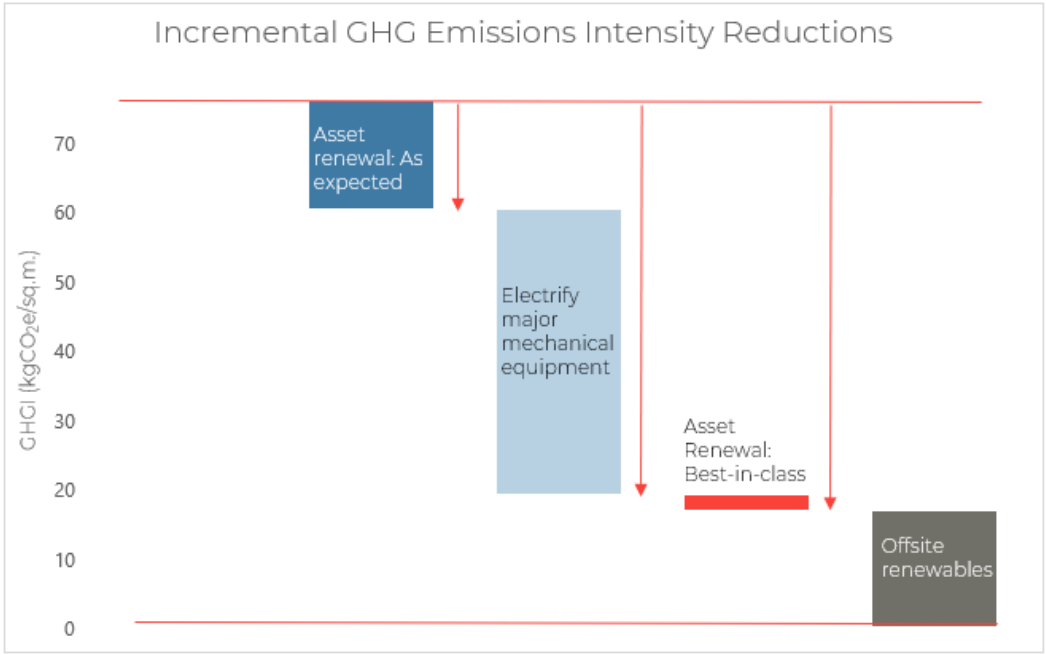
CITY OF OTTAWA: ZERO CARBON READY RETROFIT PATHWAY

Large mixed-use buildings for commercial and institutional purposes with an average construction around 1980 and an average gross floor area (GFA) of approximately 79,000 sq.m.

Typically, these buildings are found in the downtown core of the City or represent multi-building campuses or retail complexes that share a common set of energy meters. These buildings are also often owned and managed separately, with occupants having rented or leased spaced.

The charts below depict the upfront capital and greenhouse gas (GHG) intensity reduction of three progressive retrofit pathways, as defined below.





In fully transitioning to Zero Carbon Ready, the analysis shows the following incremental costs vs asset renewal as expected:

UPFRONT CAPITAL COST		ENERGY COST SAVINGS		GHG EMISSIONS REDUCTION		LIFE-CYCLE COST PER TONNE SAVED (OVER 25-YEARS)	
$650/m²	+271%	$4/m²/year	-8%	45 kgCO2e/m²/yr	-72%	$425/tonne	+904%

Building System Upgrade Matrix:

	BUILDING SUB-SYSTEM	EXISTING/TYPICAL	DEEP RETROFIT UPGRADE
Large Mixed-Use Buildings	Enclosure	Roofs and walls with minimal or no insulation and high thermal bridging in walls especially. Windows are double-glazed and may soon require replacement.	Reclad exterior walls with additional insulation up to R-15 continuous. Install roof insulation including re-insulating & expanding parapets. Install triple-glazed windows with best-in-class, thermally-broken frames.
	HVAC Delivery Systems	Variable-air-volume systems or dual-duct with perimeter baseboards	Dedicated outdoor air systems (DOAS) with best-in-class replacement of heating/cooling delivery systems (variable-speed, multi-staged)
	Fuel switching	Heating systems are gas-fired hot water boilers, typical efficiency (80%). Central chiller plant with typical efficiency.	Full central, cold-climate air-source heat pump systems or ground-source heat-pump systems. Partial existing gas boilers retained for back-up only.
	Domestic Hot Water Heating & Appliances	Domestic hot water boilers are similar to (or the same as) main heating ones.	Domestic hot water heating tied into new central air-source or ground-source heat pumps.
	Solar Photovoltaic (PV)	No renewable energy systems.	Install a solar array covering 50% of roof area.

Important Life-cycle Cost & Carbon Analysis Assumptions:

Electricity Rate 11-15 ¢/kWh; Electricity Escalation 2.0%

Natural Gas Rate 19-24¢/m3; Natural Gas Escalation 2.0%

The cost of carbon timeline aligns with the November 2020 announcement by the federal government to escalate the carbon tax to $170/tonne to 2030 and was projected to stay flat until 2050

Discount rate 2.5%; Inflation 1.9%

What are the holistic benefits of the Deep Retrofit package?

Climate Resilience & Occupant Comfort. Enclosure upgrades prepare a facility for future extreme weather and energy-related risks (e.g. power outages) as well as improving indoor air quality and thermal comfort.

Alignment with space transformation. transformation is occurring in the commercial building sector which will offer opportunities to align greening/decarbonization of space with needed renewal and intensification activities, offering tenants more than just a reconfigured space in the post-COVID world.

Added Property Value. A high-level study of property value change produced by the City shows that making a more holistic investment – similar to the features of sustainably-designed new buildings - will improve commercial property value.

How do I go about implementing such a big project?

Capital Plan Alignment. The most important way to avoid additional capital costs for deep retrofit projects is to align them with existing, planned renewal for overlapping systems. For mixed use commercial buildings, the key milestones are:

- Window replacement and roof renewal projects
- Upgrades of central boiler and chiller plant
- When upgrading ventilation to improve occupant comfort, control or air-quality
- When upgrading/replacing electricity vaults that are outdated

Timing Envelope & HVAC Improvements. Completing enclosure and HVAC-delivery upgrades (esp. walls & windows and ventilation energy recovery) before fuel switching central heating systems or installing new heat pumps is a best practice to avoid oversizing equipment (and oversizing costs). That said, if chiller upgrades are needed sooner than enclosure, partial fuel switching can be accomplished in alignment with such a project and partial boiler plant can remain in service for a few years to compensate for additional loads during peak times.

Alternate Pathways. Some facilities may struggle to implement all of the recommended measures included in the Zero Carbon Ready package due to budget constraints, local electricity grid limitations, district energy opportunities, heritage concerns, etc. Of course, the package of measures is flexible, despite being holistic. For Large Mixed-Use facilities, if alternative pathways are required, it's important to remember:

- Switching away from fossil fuel heating systems will be required and some improvement to enclosure may be cost-effective to avoid prohibitive increases in electricity service to the site. Analysis of the site power capacity vs. available HVAC heating load reduction is important. Site power management technologies such as battery energy storage may be worthwhile to investigate as well.

- Where enclosure & HVAC-delivery upgrades and controls improvements are not enough to allow for full fuel-switching using air-source heat pump technology, opportunities may exist to connect to low-carbon district energy systems or to share energy with other large facility neighbours. These opportunities are site and neighbourhood specific, but are being actively promoted and developed for key areas in the City. Speak to a City of Ottawa or Ottawa Hydro representative for support.

What financial support and programs are available?

Canada Infrastructure Bank - Green Infrastructure. A program focused on the big decarbonization investments required in larger commercial and institutional facilities, the CIB may provide low-interest loans (e.g. as low as 1% for a minimum 50% GHG reduction) to support transformation, especially where other lenders are involved and projects aggregate to over $25M in financing.
A list of updated CIB aggregators and their offerings are provided on Ottawa's Better Buildings webpage.

Enbridge Gas Incentives & Rebates. Enbridge offers a variety of equipment-based and custom incentives for retrofit projects and equipment. A recent set of revised incentives have been approved by the Ontario Energy Board and are being rolled out by Enbridge in early 2023. Of unique importance is that those seeking incentives do not need to Enbridge customers, allowing facilities planning to fuel switch to electric heat pumps, for example, to access relevant incentives as well.

IESO's Save on Energy Programs. The Independent Electricity System Operator (IESO) offers complimentary incentives and rebates for electrical equipment and systems, or for wholistic facility-wide improvements as may be required for a deep retrofit project. Incentives for HVAC redesign, variable-speed motors, chiller upgrades and unitary heat pump equipment may be particularly useful to those engaging in deeper retrofits or installing facility-wide cooling for the first time alongside their decarbonization

Where else should I look for this information?

City of Vancouver – Carbon Pollution Limits for Large Commercial
City of Ottawa - Energy Evolution
City of Toronto - Net Zero Existing Buildings
Canada Green Building Council - Decarbonizing Canada's Large Buildings
Transition Accelerator – Building Decarbonization Alliance