Better Homes Loan Program:
Feasibility Study and Program Design

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1. Background

In January 2020, Ottawa City Council approved a new Climate Change Master Plan and set new targets to reduce community greenhouse gas (GHG) emissions 100% by 2050 and corporate emissions 100% by 2040. These targets are in line with the Paris Accord and the federal government targets.

1.1 Energy Evolution

Energy Evolution is one of eight priorities in the Climate Change Master Plan and sets the framework for what it will take for Ottawa to achieve these GHG emission reduction targets. It is a carbon reduction strategy designed to manage energy consumption, promote the use of renewable energy, and advance local economic development opportunities in Ottawa. Developed in collaboration with almost 200 public and private stakeholders representing 90 organizations, Energy Evolution is a community-wide initiative with a vision to transform Ottawa into a thriving city powered by clean, renewable energy.

At the core of Energy Evolution is a comprehensive, custom-built energy, emissions, and finance model. The model incorporates growth, land use, buildings, transportation, and waste data with energy conservation, efficiency, and renewable energy pathway studies and presents two GHG emission scenarios:

- A Business-As-Planned scenario (BAP scenario)
- A 100% by 2050 target scenario (100% scenario)

The BAP scenario is a projection from today until 2050. It is designed to illustrate the anticipated energy use and emissions in Ottawa if no additional policies, actions, or strategies are implemented beyond those that are currently underway or planned. The 100% scenario explores the scope and scale of change required if Ottawa is to align with the IPCC target to limit global warming to 1.5ºC and reduce emissions by 100% by 2050. It also identifies what is thought to be the most cost effective and plausible path forward to meeting Council's GHG reduction targets.

As shown in Figure 1, reductions from the BAP, which is depicted as the thin orange line across the top, requires significant action in 5 different sectors: electricity, transportation, waste and renewable natural gas, existing buildings, and new buildings.

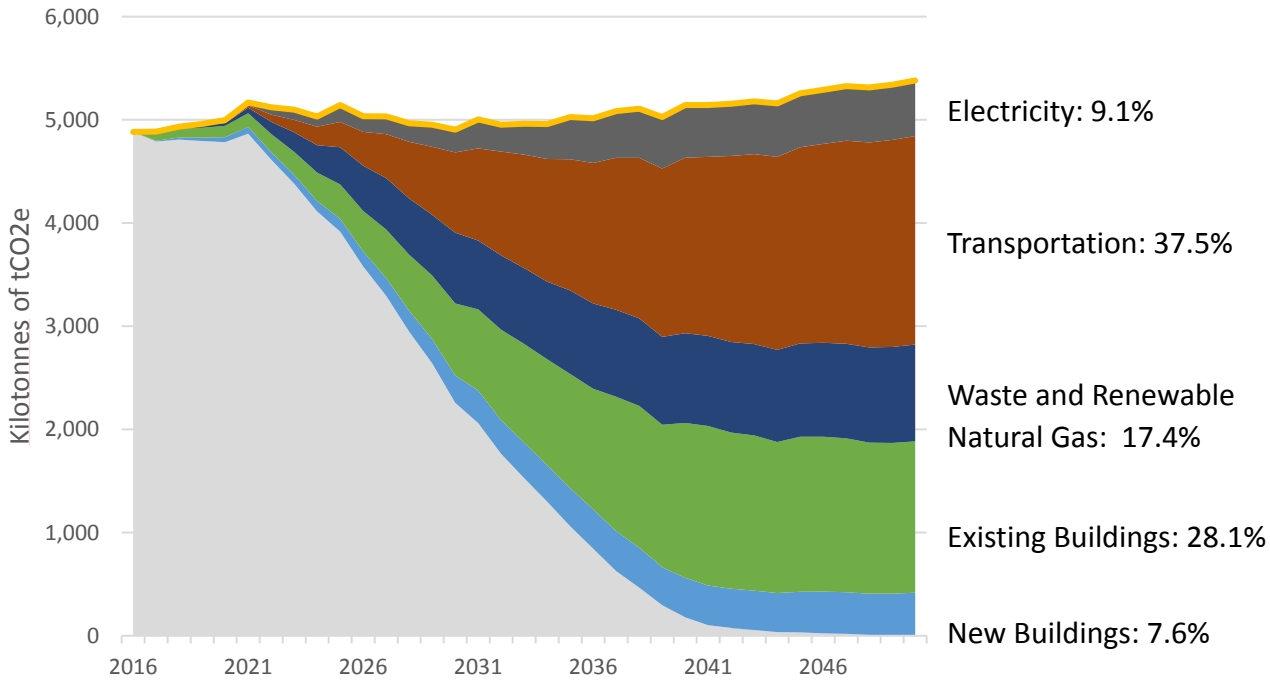

Figure 1 Projected community wide GHG emission reductions by sector to achieve the 100% scenario

In 2016, 48.2% of GHG emissions in Ottawa came from buildings, with residential buildings contributing 27.5%[1]. In the 100% Scenario, existing buildings are projected to provide 28% of the GHG reductions by 2050. Comparisons between the baseline, BAP, and 100% scenario and additional information about energy use and GHG emissions by fuel type, building type, and household can be found in Appendix A.

Integrated emissions modeling done through Energy Evolution shows that the residential building stock must be transformed the following ways over the next 30 years to achieve the necessary GHG reductions:

- Residential existing buildings must be retrofit for 70% heating savings and 30% electrical savings at a rate of 27% of buildings by 2030 and 98% by 2040 (or 327,000 single family units);
- 20% of residential roofs must have solar PV, totalling 320 MW by 2050;
- 560,350 residential heat pumps must be installed by 2040; and
- 15% of residential buildings must be served by zero carbon district energy by 2050.

[1] In 2018, the residential share of emissions was 22%.

The emissions reduction curve for part 9 residential buildings in Figure 2 shows the annual reductions required. It also shows that building retrofits need to be almost complete by 2040. This emissions curve includes residential building envelope retrofits as well as heat pumps and rooftop solar photovoltaic.

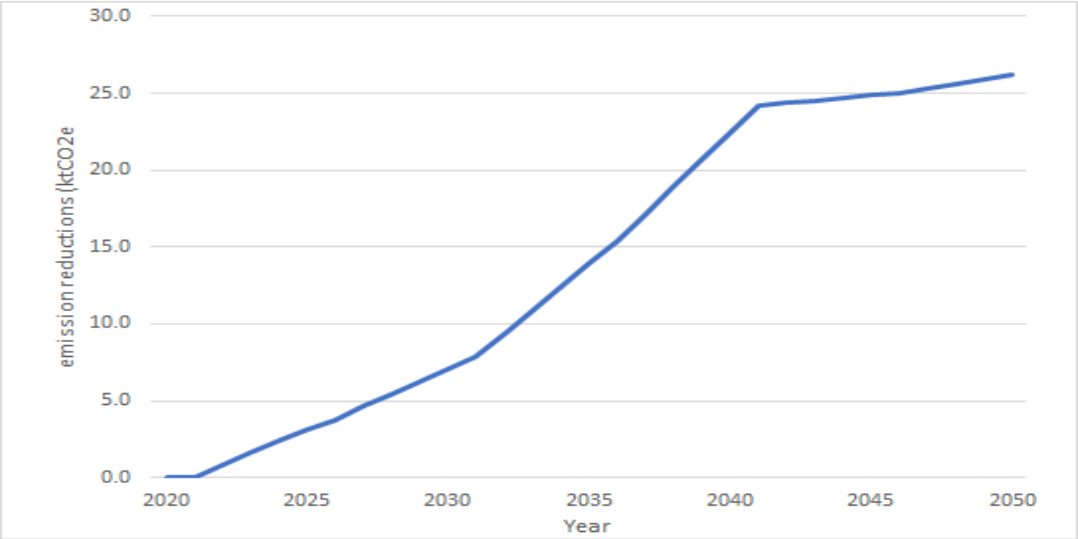

Figure 2 Emissions reduction profile for residential buildings

Financial analysis completed through Energy Evolution identifies that significant incremental investment is needed to achieve residential retrofit measures community-wide. Due to the scale of the investments, the ownership structure, and the other competing priorities for municipal investments, it is expected that the vast majority of the investments in retrofits will be private investments There is, however, a role for municipalities to play in catalyzing these investments and driving down the costs to residents while optimizing GHG reductions from the investments.

As part of the Energy Evolution status update Council received in January 2020, staff identified 20 priority projects to advance Energy Evolution. One of the projects was a Residential Retrofit Accelerator Program to accelerate residential building retrofits through marketing, information and financial mechanisms. One of the components of this program uses a Local Improvement Charge mechanism to finance energy improvements. It is also supported by many other market transformation actions that, when implemented together, increase the likelihood of success of the financing program. More details of the Retrofit Accelerator Program are provided in Appendix B.

1.2 Local Improvement Charges

Municipalities are uniquely able to offer financing tied to a property using a Local Improvement Charge (LIC) mechanism under the *Municipal Act (2001).* This mechanism is often referred to as Property Assessed Clean Energy, or PACE, in the United States. In 2012, the Ontario Ministry of Municipal Affairs and Housing authorized Ontario Regulations 322/12 and 323/12, amending O.Regs. 586/06 and 596/06 under the *Municipal Act, 2001* to:

- Expand the uses to include energy efficiency, renewable energy and water conservation in alignment with municipal goals and policies;
- Remove the burdensome LIC set-up barriers since participation is voluntary;
- Remove the right to petition or appeal against or in favour of this type of LIC;
- Include a user-pay method that covers all municipal costs including marketing, interest, and administration;
- Include repayment to the municipality as a temporary charge on the property tax bill that stays with the property not the owner; and
- Allow the owner to make lump payments to clear the outstanding balance.

Through an LIC program, municipalities can:

- Enable property owners to improve the comfort and environmental performance of their buildings;
- Target areas in transition or in need of repair, rehabilitation and redevelopment;
- Support appropriate building upgrades through expert advice and oversight;
- Stimulate private investment in property upgrades that reduce energy cost exposure to residents and businesses; and
- Stimulate local job creation in the contractor, trades, and renovation sectors.

Participation is voluntary and only affects one property. To date, programs using LICs or similar mechanisms have been offered in 14 Canadian municipalities and 36 American states to finance green technologies or improvements in homes and commercial buildings. A summary of many of these programs can be seen in Table 1[2].

[2] https://www.cleanairpartnership.org/wp-content/uploads/2020/05/FINAL-LIC-TOOLKIT-Accelerating-Home-Energy-Efficiency-Retrofits-Through-LIC-Programs-2020-1.pdf

Table 1 Comparison of Municipal LIC Retrofit Programs

	Toronto HELP	Clean Energy Financing, Nova Scotia	Town of Berwick, Nova Scotia	My Energy Improvement Plan, Nova Scotia	Halifax Solar City Program, Nova Scotia	Quebec [Inactive]	Alberta [proposed]	US HERO****
Financing								
Min financing							$3K	$2.5K
Max financing (% home value or $)	10% up to $75K	$10K-$20K	15%	$10K	75%	$10K-$20K	$50K	≤ 15-20%
Interest rate	3.7-4.3%	4-4.18%	4%	3.7-3.95%	4.75%	1%	TBD	2.75-8.35%
Term (years)	5-20	10	10	10	10	≤20	TBD	5-30
Admin/application fees	2% +	$550	5%	$199		$72.46	max 5%	varies
Early payoff option	✓	✓	✓	✓	✓	✓	✓	✓
Mortgage lender approval	✓	✗	✗	✓	✗	✗	TBD	varies
Home energy audit	✓	✓	✗	✓	N/A	✓	TBD	✗
Other credit rating info	✓	✓	✗	✗	✗	✗		✓
Performance or cost-effectiveness measures	✗	✓	✓	✓		✓	✗	varies
Contractor payor	homeowner	PDA	town	PDA		homeowner	PDA	PDA

Pre-qualified contractors	✗	✗	✓	✗	✗	✗	✓	✓
List of approved products/measures	✗	✗	✓	✗	✓	✗	✓	✓
Solar energy systems	✓	✓	✓	✓	✓	✗	✓	✓
EV infrastructure	✓				✗			
Administrator type	Municipality	Non-profit	Municipality/ Private company	Non-profit	Municipality	Non-profit	Public agency	Private company
Municipalities served	1	4	1	2	1	3	1	many
Budget surpluses for financing	✓	✓	✓			✓	TBD	✗
Other financing sources	Green bonds	loans				grant	TBD	3rd party
Years of operation	2014+	2016+	2014+	2014+		2016-2017	-	2011+
Number of participants to date	202	44	12			24	-	125,000+
Average loans	20,000	7-10,000	~6000	8,000		13,000	-	$19K
Overall program budget	$2.7 million	40 projects/yr		10 projects/yr		$500,000	-	$3 billion
Average energy reduction	30%					29%	-	

Experience in other municipalities has shown that LIC programs drive energy efficiency improvements of approximately 30% in participating buildings per retrofit. Although this is not enough to meet the 64% energy reduction target set for residential buildings in Ottawa under the Energy Evolution Strategy, it is a good start that can be improved upon over time.

Existing LIC programs have been successful by helping overcome some of the most significant barriers to deep energy retrofits of homes including:

- Ownership term uncertainty and long payback period – Home ownership in Ottawa is approximately 7yr whereas retrofits often have a 10 to 20-year payback period, so longer than homeowners expect to stay in their home
- Limited understanding of how energy efficiency affects real estate value – Homeowners are not confident they will be able to recoup the investment at the time of sale
- Limited knowledge and motivation to retrofit – Proposed program provides expert advice and streamlines the retrofit process for a homeowner
- Access to long-term, fixed cost financing – Municipalities have access to fixed cost, long term financing that they can make available to homeowners through LICs. LIC programs also encourage private investors in energy retrofits by bundling portfolios of retrofits to achieve the scale of cashflow required by many private investors and by providing quality assurance
- Lock-in – By providing expert advice, the program can steer away from sunsetting technologies and fuels

Given that:

- Significant energy and efficiency improvements in residential buildings will be required to meet Ottawa's GHG emission reduction targets;
- Municipalities are uniquely positioned to offer LICs that are tied to the property;
- Ottawa can access fixed rate, long term financing at better terms than is available in the private market; and
- Experience in other municipalities has demonstrated that financing programs like LICs have driven energy efficiency improvements and reduced barriers to energy retrofits for homeowners,

Staff assessed whether an LIC program is feasible for Ottawa.

2. Feasibility Study

To assess the feasibility of a new LIC program in Ottawa, staff completed an analysis of:

- The financial feasibility of residential retrofits
- The financial feasibility of Ottawa delivering a new LIC program
- Type and location of buildings to retrofit
- Potential GHG emission reductions

- Co-benefits and co-harms

2.1 Financial Feasibility of Residential Retrofits

As part of the financial analysis completed through Energy Evolution, a Revolving Loan tool was developed to project the capital needs and annual returns of each action in the Energy Evolution model independently or combined. When evaluated as individual measures, 18 of the 26 capital-intensive actions in the 100% scenario result in net savings in present dollars, discounted at 4.5% over the period from 2020 to 2050.

Figure 3 illustrates the marginal abatement cost for each of the actions in terms of the cost or savings per tonne of GHG emissions reduced. Savings include all savings associated with the action, including reduced energy expenditures, operating expenses, and avoided carbon price costs. Note that while actions are presented individually in Figure 3, there are feedback effects between the actions which re more accurately accounted for in the full GHG model that created the scenarios. According to the model, all these actions are required to achieve the 100% reduction target.

This marginal abatement cost analysis indicates which actions will be driven by market forces to be achieves and which are most likely to need incentives to be realized. Another approach to realizing actions with reduced paybacks is through bundling, which can help offset those actions with a less attractive paybacks.

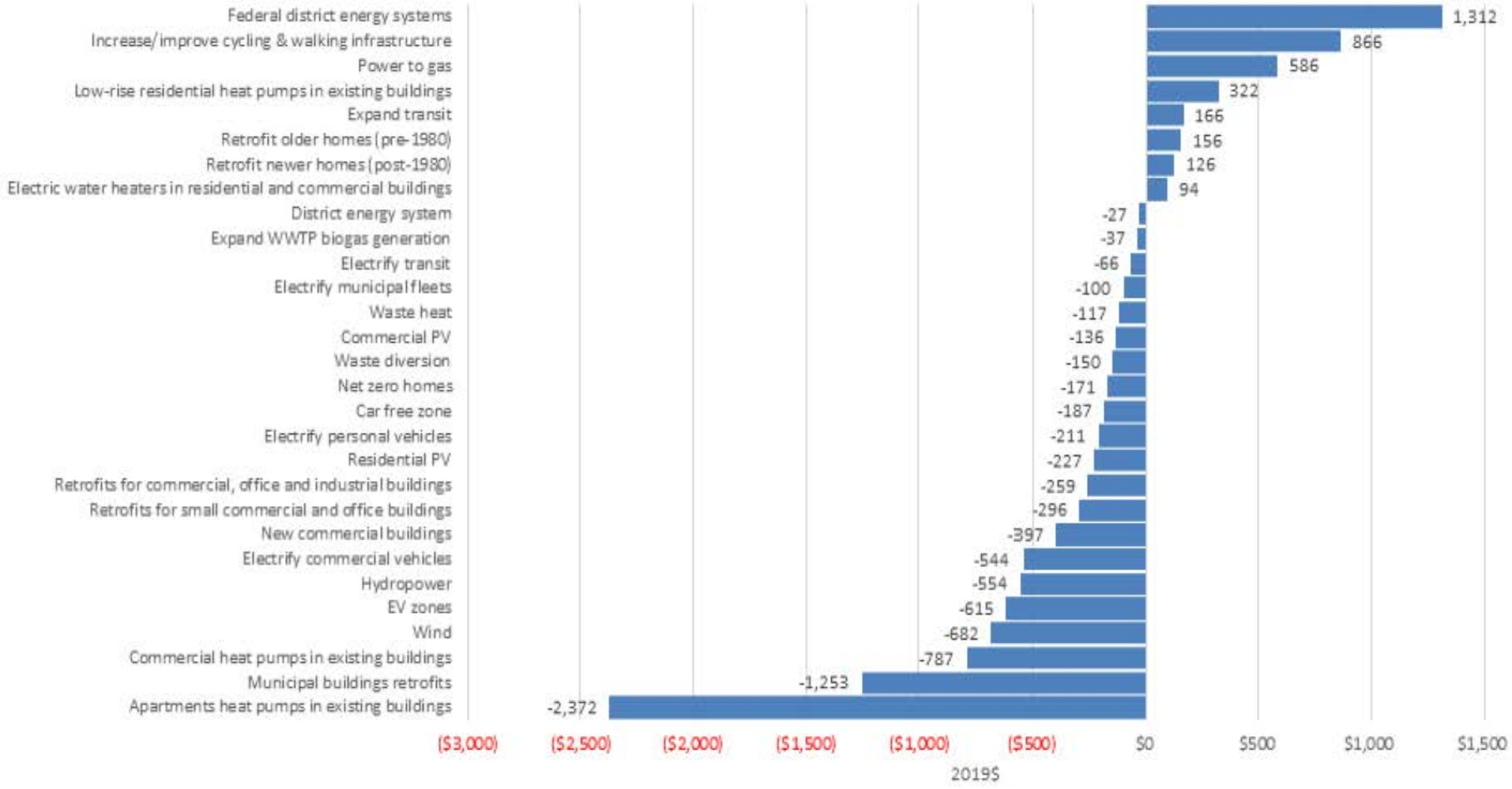

Figure 3 Marginal abatement costs of actions in the 100% Scenario

To assess the financial feasibility of financing residential retrofits, an assessment of each component that makes up a retrofit was first completed. This analysis assumes that homeowners are borrowing funds at 4% interest rates for 20-year amortization periods on average. Figures 4 and 5 show the investment and savings profiles for building envelope retrofits for part 9 residential buildings built pre and post 1980 respectively. Figure 6 shows the investment and savings profile for heat pumps in the part 9 residential building stock and Figure 7 the same for rooftop solar photovoltaic installations. The analysis presented in the figures below show that solar PV has the best return on investment followed by envelope retrofits while heat pumps lose money compared to BAP. This suggests that the actions should be bundled to result in a net profit for all, as shown in Figures 8. It also suggests that a focus needs to be on driving down the cost for the end user of heat pumps through techniques such as bulk purchases, contractor training, and incentives.

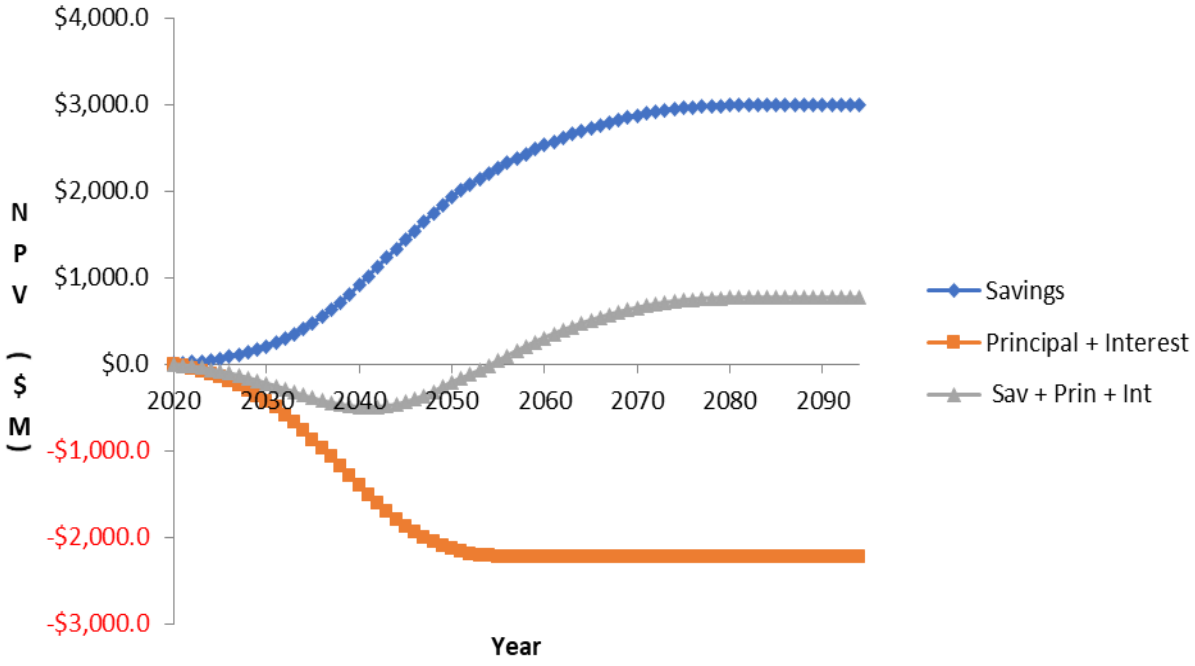

Figure 4 Return on investment profile for building envelope retrofits for part 9 residential buildings older than 1980.

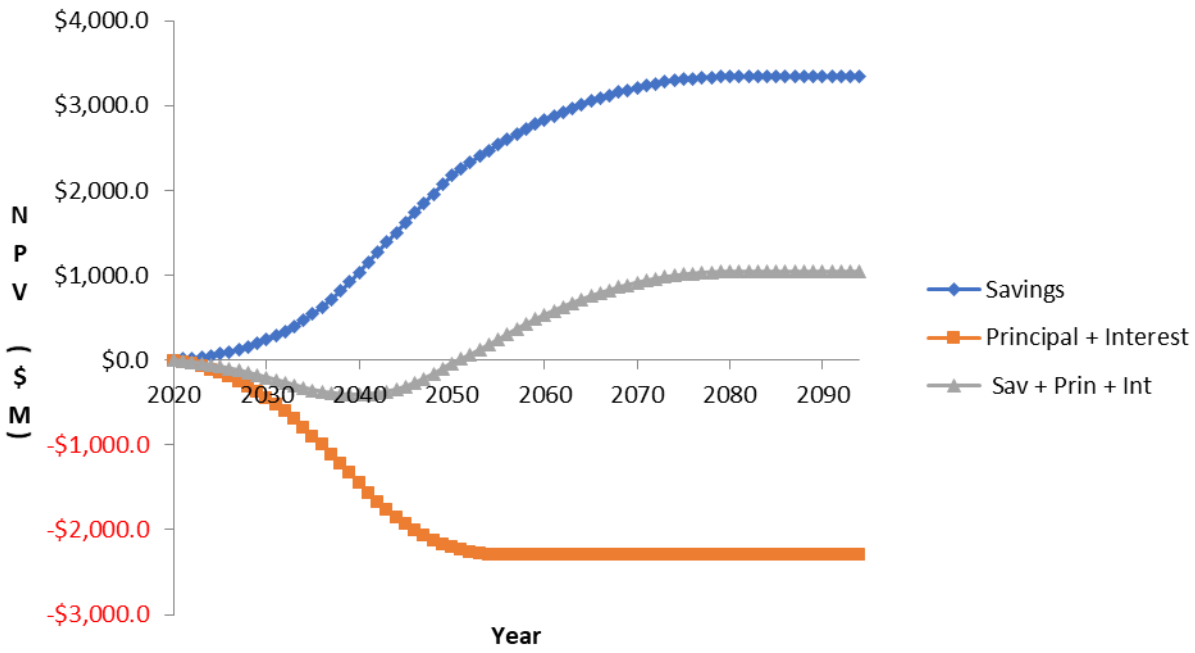

Figure 5 Investment profile for building envelope retrofits for part 9 residential buildings newer than 1980.

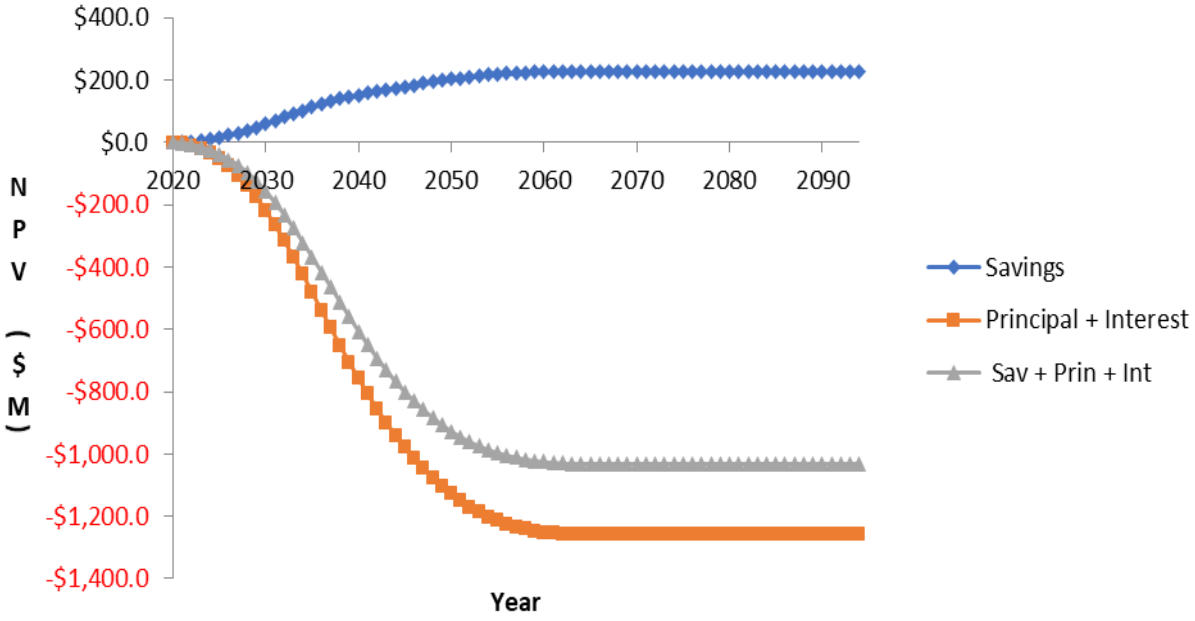

Figure 6 Return on investment profile for part 9 residential heat pumps.

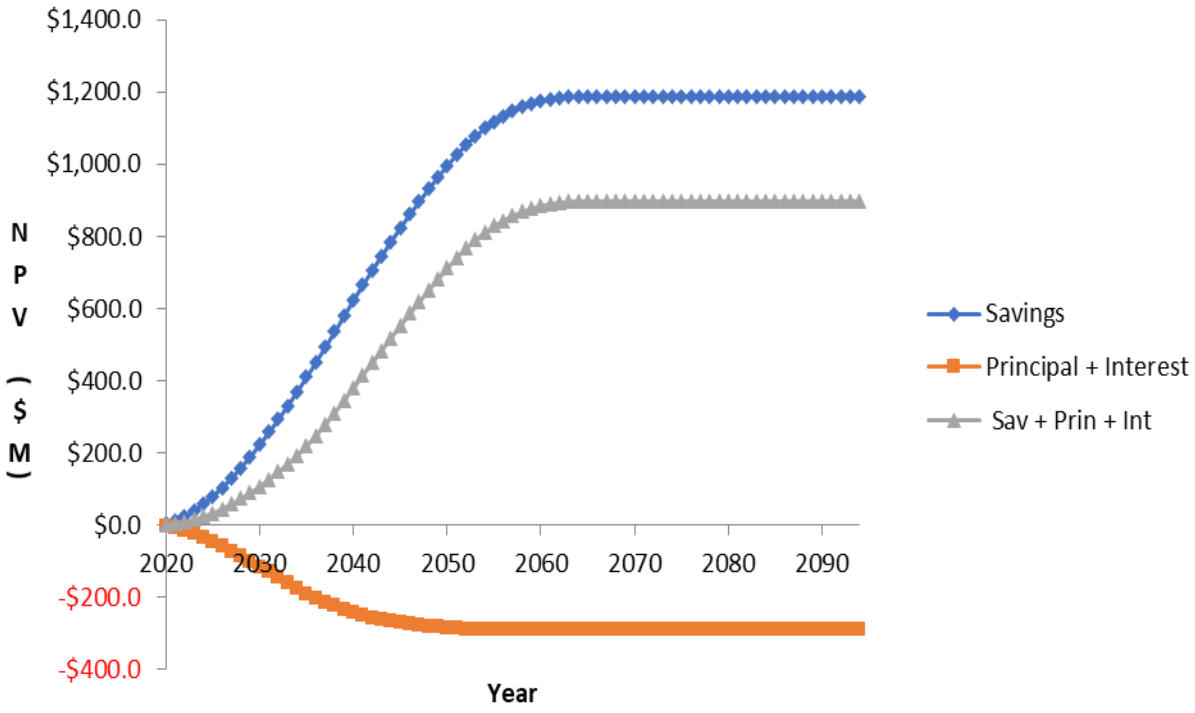

Figure 7 Return on investment profile for part 9 residential solar PV.

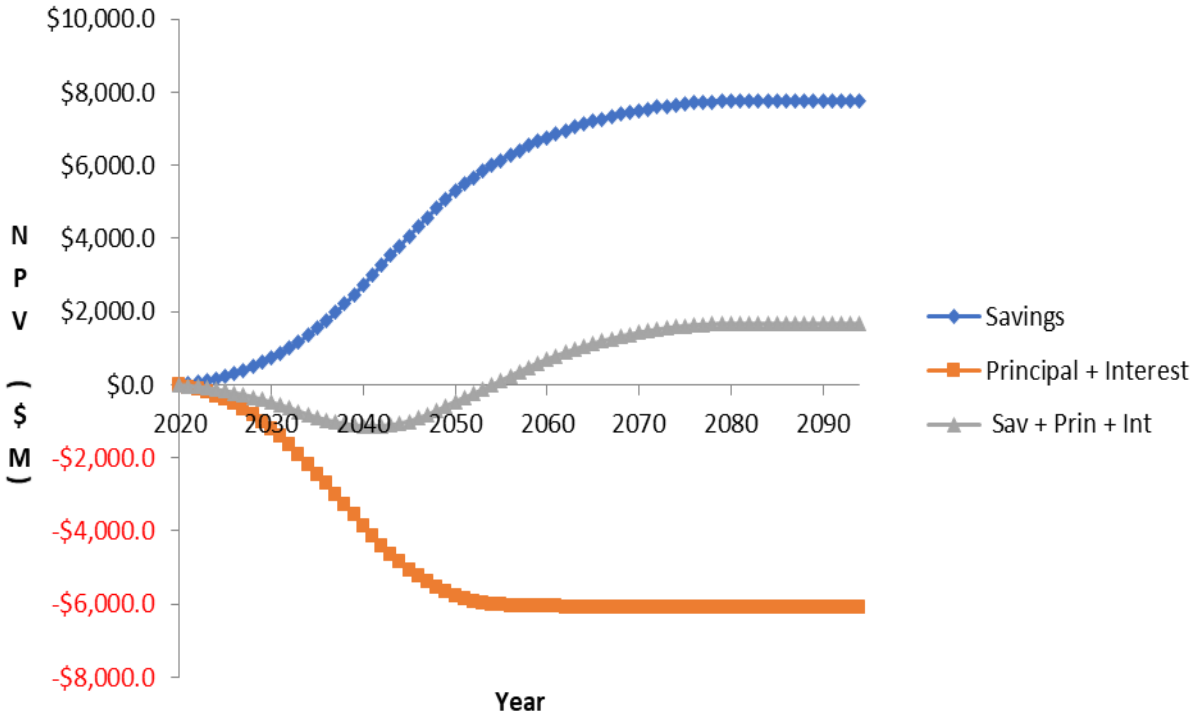

Figure 8 Savings profile for all residential retrofit actions bundled.

Given that the financial feasibility of retrofits improves when actions are bundled, a program should be designed to encourage the implementation of multiple actions at once. Given that this will have a higher capital cost and a long term payback, municipal financing through long term repayment terms tied to the property, made possible through the LIC mechanism, is seen as the most likely way to realizing these deep energy retrofits.

When looking at a single home in the target vintage (older than1960) for an assumed deep energy retrofit in 2020, the net savings to the homeowner more than pay back the retrofit costs. The assessment assumed the following retrofit measures: 70% space heating savings (as per the target set in the Energy Evolution Strategy); installation of an air source heat pump; and addition of 5kW solar photovoltaic system. The net savings for that homeowner by 2050, after paying off the loan for the retrofit, would be approximately $800,000 for a single home and $900,000 for a row house. The cumulative carbon reductions for the deep energy retrofit by 2050 would be in the range of 80,000 to 115,000 kgCO2e. The value of the loan would be approximately 16% of the current value of these homes. If solar panels are not included in the first retrofit, that percentage drops to 6%.

2.2 Financial Feasibility of Ottawa Delivering a New LIC Program

To assess the feasibility of delivering a new LIC program in Ottawa, staff estimated program uptake, and completed an analysis of capital requirements, costs per household and cashflow projections. Initial program capital requirements and scale up projections for the first five years of the program are based on experiences in other municipalities, as shown in Table 2. Then, the scale up projections are based on the retrofit requirements deemed necessary from the Energy Evolution modeling, as shown in Table 3. When combined, the program participation objectives scale from 100 in 2021 to 20,000 by 2030, as depicted in Figure 9. The capital requirements for that level of participation is depicted in Figure 10.

Table 2 Program Uptake Trends in Canadian Municipalities

LIC Program	# Private Homes	Applications as of Mar, 2020	% of Total Homes	Years
Halifax Solar City	162,920	2,700	1.7%	7
Toronto HELP	820,665	1,000	0.1%	6
Clean NS (6 municipalities)	43,065	197	0.5%	4
Average			**0.7%**	**6**
			315,845	

Private homes in Ottawa				
5yr Uptake Estimate*			**2,355**	

* Assumes program uptake is expedited to 5 years from the average of 6 due to urgency and learning from leaders

Table 3 Retrofit Program Scale Up Projections based on Energy Evolution Targets

Dwelling Type	Total Dwellings	Retro by 2030*	Retro by 2040*
Single-detached: 45%	173,283	35,090	127,363
Semi-detached: 7%	26,955	5,458	19,812
Row: 21%	80,866	16,375	59,436
Total	**385,074**	**77,977**	**283,029**

* Assumes 75% of retrofits will use LIC financing

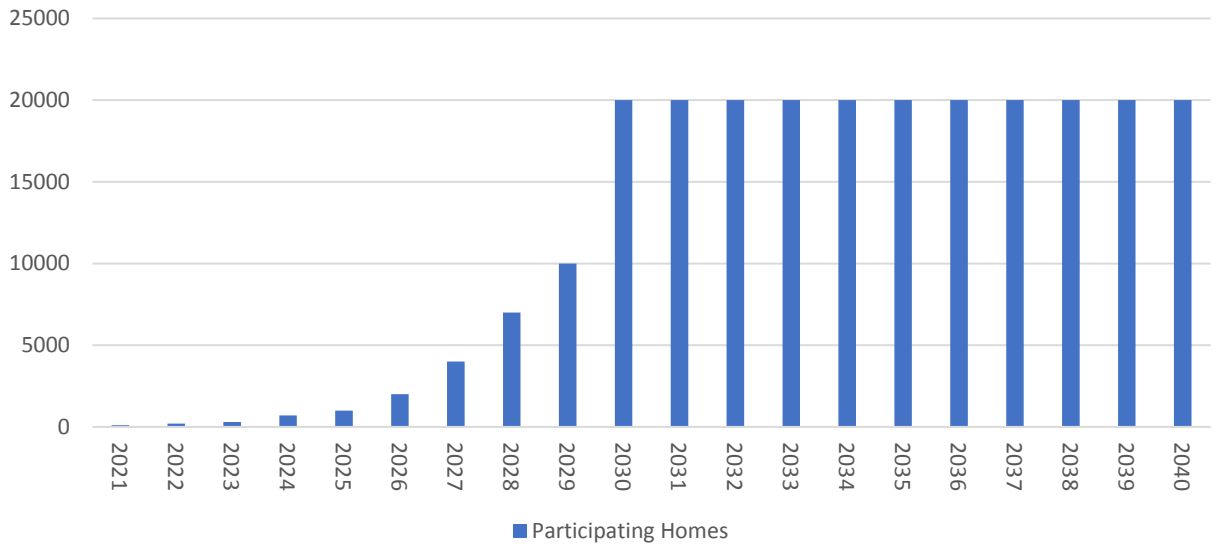

Figure 9 Annual Participation Targets based on Energy Evolution Targets

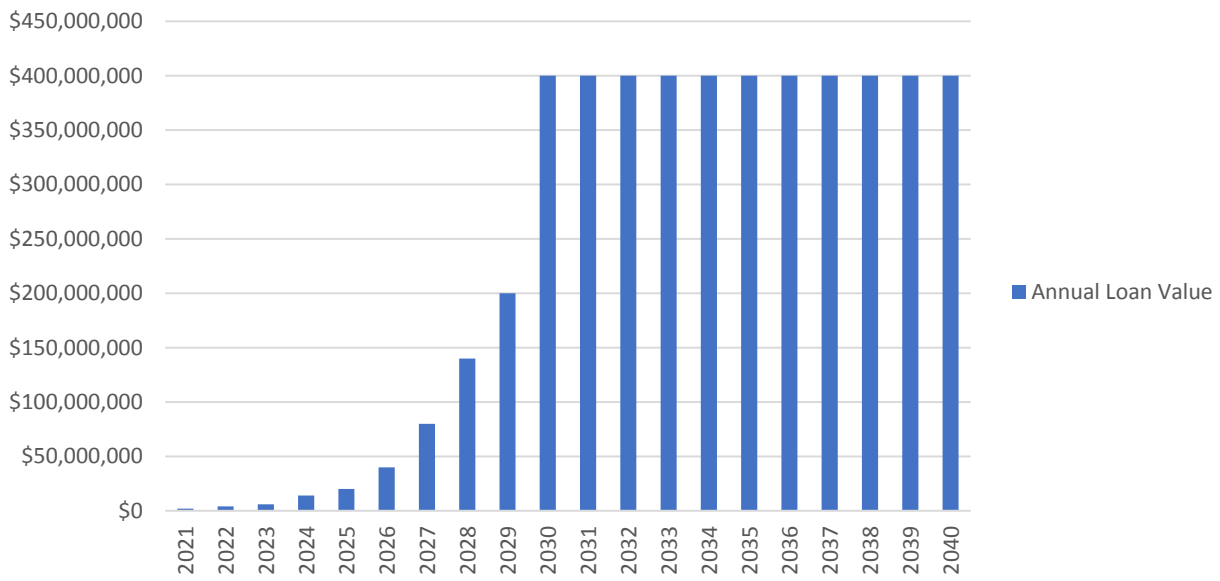

Figure 10 Annual Capital Requirements based on Energy Evolution Targets

Financial assumptions used to model the business case to finance the scale of retrofits projected are provided in Table 4.

Table 4 Financial Assumptions

City Debenture 20-year rate	2.62%
FCM 20-year Loan Interest Rate	2.5%
Interest rate to Homeowner (0.25% over debenture rate)	3.62%
Average years of repayment*	20
Total # payments (years*12 months)	240
Inflation rate on expenses	2%
Average LIC Loan	$20,000
Program Management Staffing (FTE)	1.5
Collections Staff per 500 participants (FTE)	~0.5

* Loan terms will be different depending on technologies implemented

Based on this financial analysis, the net cost per participant arrives at close to $0 once the program reaches maturity (estimated at 300 participants annually), in keeping with the non-profit approach of municipal services (see Figure 11). The program is also designed to maintain a positive cashflow while reinvesting all surpluses into incentives for participation. The cumulative cashflow projection is shown in Figure 12.

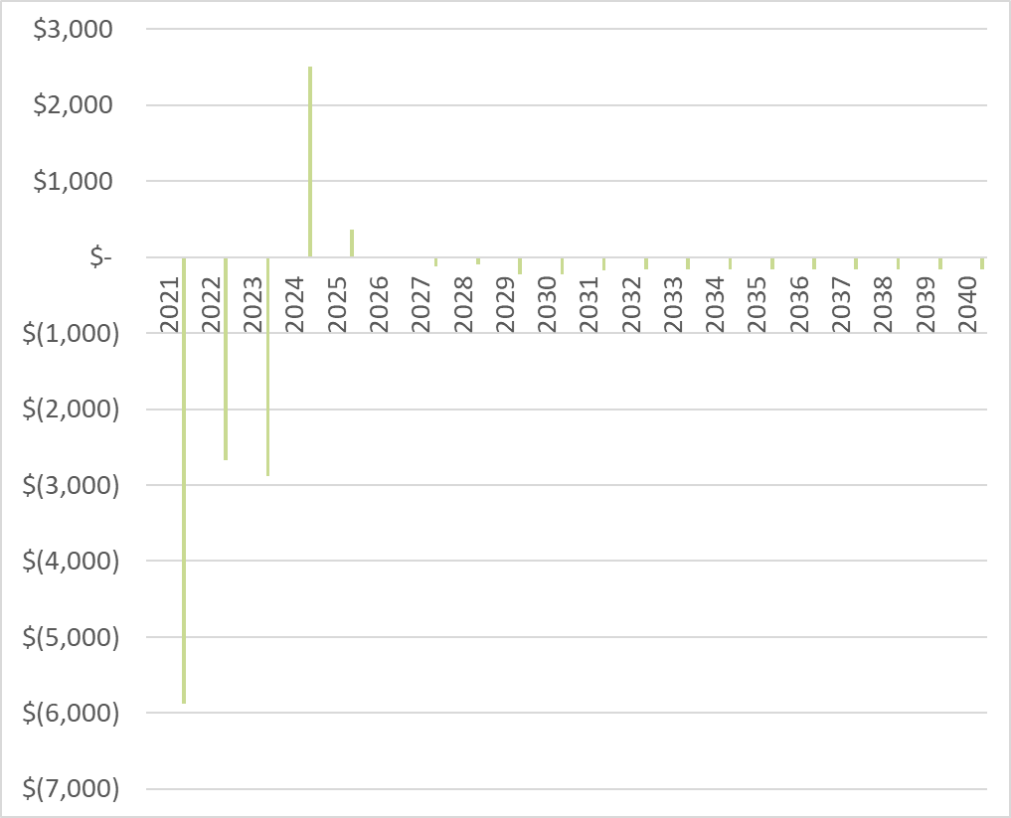

Figure 11 Net Cost per Household Participating

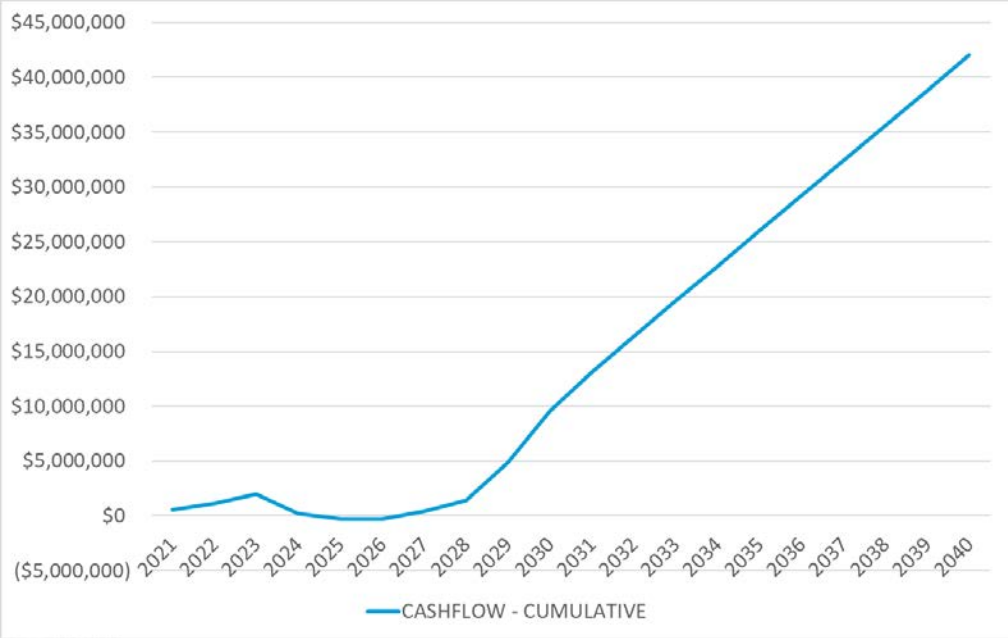

Figure 12 Cashflow Projections

2.3 Type and Location of Buildings to Retrofit

To assess where retrofits might be most effective, an analysis was done of energy saving potential at the neighbourhood level. Generally, older homes have higher potential for energy savings. To facilitate analysis, the homes were grouped by age of construction into vintages of similar energy profiles as follows:

Vintage 1: 2005-2016
Vintage 2: 1980-2004
Vintage 3: 1961-1979
Vintage 4: 1960 and older

They were also categorized by dwelling type, namely single houses, duplexes, row homes, and small apartments (up to 4 stories), as shown in Figure 13. It shows that singles and row homes are the most common in Ottawa.

The split of homes of each dwelling type by vintage are shown in Figures 14 to 17.

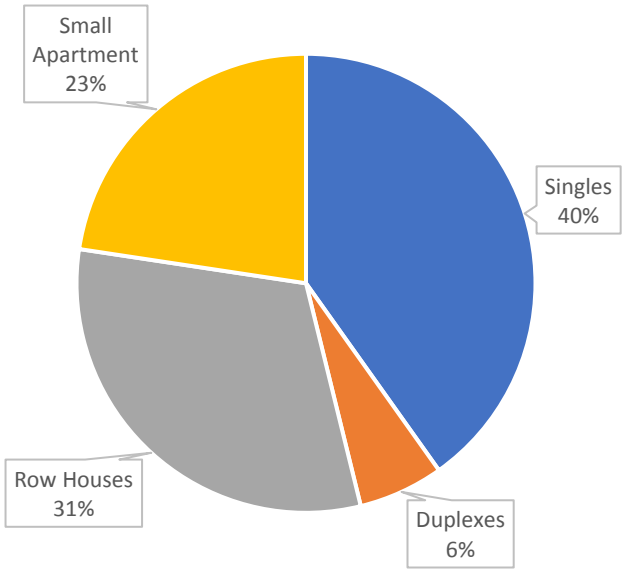

Figure 13 Homes by Dwelling Type

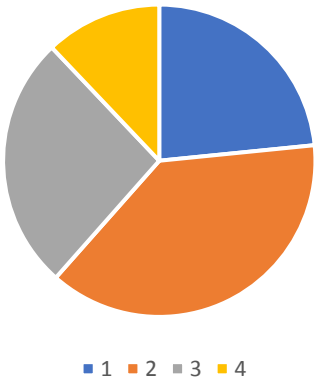

Figure 14 Single Homes by Vintage

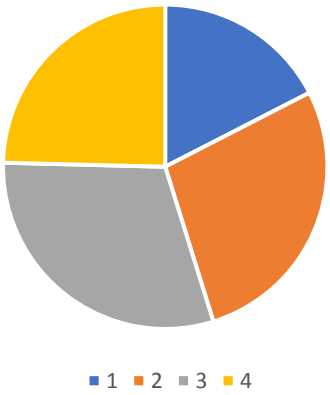

Figure 15 Duplexes by Vintage

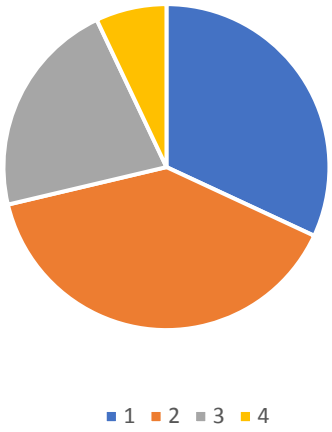

Figure 17 Row Homes by Vintage

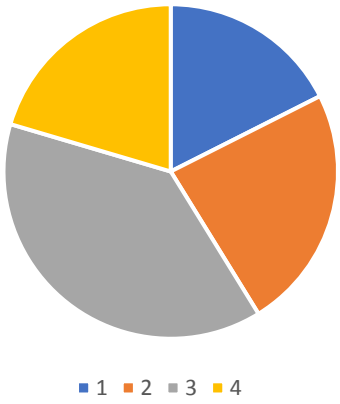

Figure 16 Small Apartments by Vintage

Given that the EnerGuide energy auditing and labeling program will be used as the assessment tool for this program and given that it does not accurately capture small apartments, the launch of this program will focus on the three other dwelling types. A second phase of the program will aim to include apartments and other rental buildings that will require a different approach to retrofitting.

As shown in Figures 14 and 15, the most common vintage in singles and rows is Vintage 2 1980 to 2004. Based on the energy performance of the homes, however, the biggest opportunity for energy savings is in the older homes, those in Vintage 4. The two sections pulled out in Figure 18 will be the buildings of focus for the initial phase of the Better Homes Loan Program.

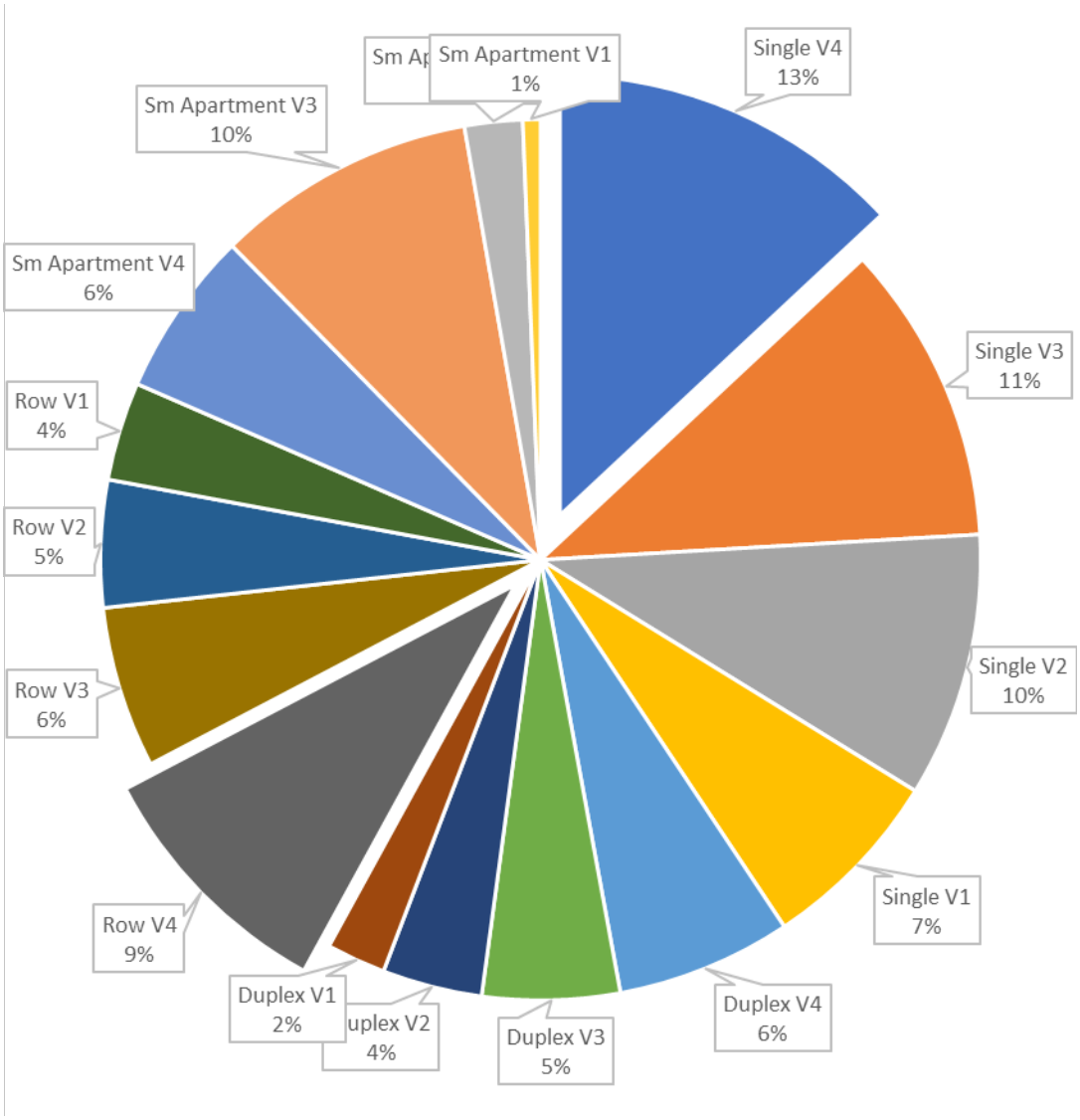

Figure 18 Energy Saving Potential per Dwelling Type and Vintage

Based on the experience in other municipalities, the following demographic conditions lead to higher uptake of retrofit programs[3]:

- Above average utility-calculated natural gas and electricity end-use consumption;
- Above average number of pre 1980 building vintages and uniform building types;
- Higher than average ratio of owner-occupied versus rental properties;
- Varying demographic and socio-economic characteristics (i.e. low-income neighbourhoods); and
- Existing community initiatives or organizations interested in being aligned with the Program to achieve efficiencies in terms of program delivery (i.e. marketing and outreach support).

[3] https://www.cleanairpartnership.org/wp-content/uploads/2020/05/FINAL-LIC-TOOLKIT-Accelerating-Home-Energy-Efficiency-Retrofits-Through-LIC-Programs-2020-1.pdf

The transportation zones with the highest density of older single and row homes were identified. Next, the demographic data from the Ottawa Neighbourhood Study was added to identify thee zones with high levels of home ownership as well as those in need of major repairs. Then, the zones that fell in the intensification areas as identified by the Official Plan were removed because they are more likely to see redevelopment with increased density. The zones in Table 5 are proposed to be the priority areas for initial program marketing and outreach efforts, however, the program will remain open to all homeowners in Ottawa if they choose to apply.

Table 5 Priority Neighbourhoods for Better Homes Loan Program Outreach

Traffic Zone	Neighbourhood	Ownership	Major Repairs Needed	Average Home Value
	Ottawa Total	65.7	5.3	
Row Houses				
1031	Manor Park	48.2	10.0	$790,976
820	Old Ottawa South	73.6	7.0	$737,481
1062	Overbrook - McArthur	39.0	11.1	$332,688
1002	Lindenlea - New Edinburgh	53.9	6.8	$675,480
621	Glebe-Dows Lake	52.7	6.7	$809,158
743	Sandy Hill	25.3	7.1	$586,470
533	Centretown	22.6	7.2	$556,213
721	Byward Market	32.7	5.6	$490,165
810	Old Ottawa East	48.6	4.8	$743,757
Single Homes				
1232	Rothwell Heights - Beacon Hill North	83.7	3.7	$452,091
1900	Chapel Hill South	90.9	2.1	$355,948
2621	Whitehaven – Queensway Terrace North	48.5	8.6	$377,227
2840	Crystal Bay – Lakeview Park	84.0	4.2	$421,019
2272	Braemar Park - Bel Air Heights - Copeland Park	64.2	5.0	$422,713
1720	Hunt Club East - Western Community	60.2	5.2	$583,122
2130	Parkwood Hills - Stewart Farm	15.9	4.8	$475,515
2160	Cityview - Crestview - Meadowlands	66.4	5.7	$428,357
1562	Elmvale - Canterbury	60.1	6.6	$379,086
Total				
2240	Carlington	34.4	11.7	$360,487
2302	Civic Hospital-Central Park	67.9	5.0	$742,921

2.4 Potential GHG Emission Reductions

To assess potential GHG emission reductions, staff used analysis from Energy Evolution that found GHG emissions were 3.6tCO2e per household in 2018. If a retrofit reduces emissions by 30%, as seen in other municipalities, the reductions per retrofit will average 1.1tCO2e. This is the initial estimate for the program as it is what has been achieved in other jurisdictions, however, in order to meet the GHG reductions in Energy Evolution, the per-retrofit carbon reductions will need to ramp up to achieve effectively net zero carbon emissions, which will be achieved through incentivizing or requiring higher performing retrofits. An increased penetration of renewable electricity on the grid and renewable natural gas in the pipeline will also facilitate the realization of these targets.

The different GHG emissions reductions possible at the 30% reduction level versus the 100% reduction level is depicted in Figure 19.

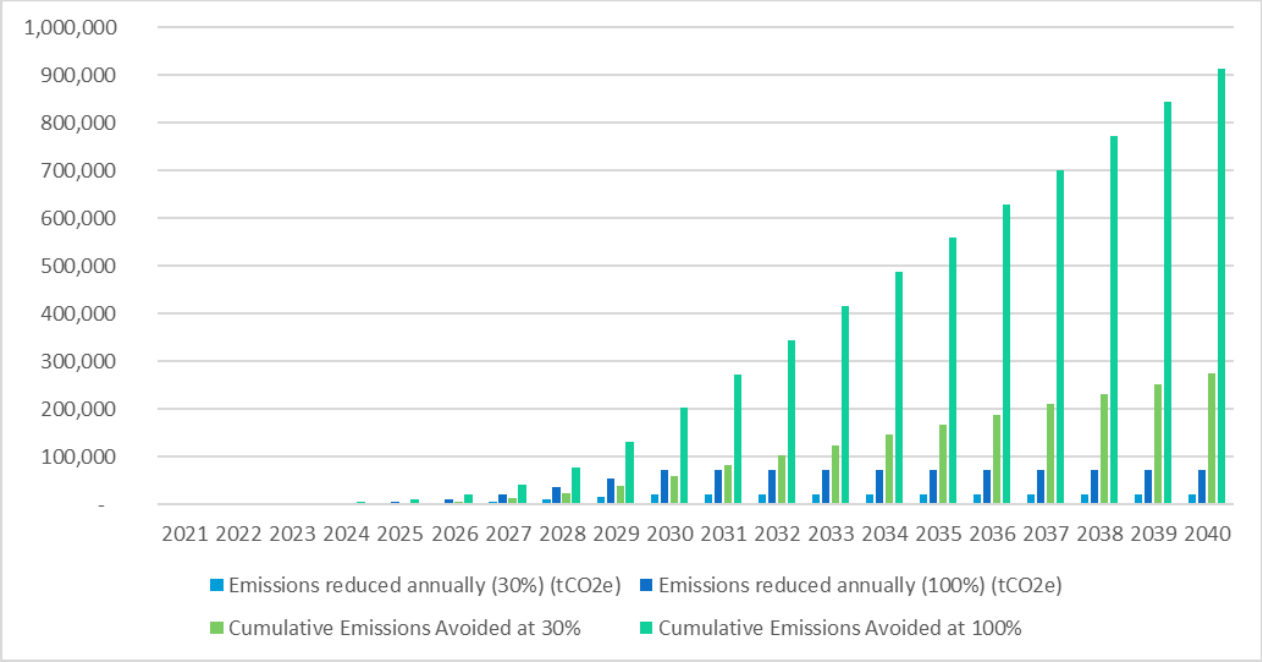

Figure 19 Emissions reductions possible from the retrofit program

2.5 Co-benefits and Co-harms

There are “collateral benefits” (called co-benefits) of emissions reductions from buildings and energy sources. The process of realizing energy conservation and emissions reductions in buildings can improve quality of life for diverse communities within Ottawa. Indicators include improvements in health, economic prosperity, and socially equity. There can also be co-harms that arise from certain actions and identifying those are also helpful to inform appropriate policy and program design. The analysis and assessment of co-benefits and co-harms from the actions related to buildings is summarized in Table 6.

Table 6 Co-benefits and Co-harms Associated with Building Actions in the 100% Scenario

1. Health			
Co-benefits/ co-harms	Impact overview	Buildings	Energy
1.1 Air quality	Improvement in air quality.		Improved: reduced natural gas combustion.
1.2 Physical activity	Increased active transportation mode share.		
1.3 Noise	Decreased exposure to engine noise.	Improved: insulation in buildings reduces exterior noise.	
1.4 Accessibility (distance)	Destinations are more accessible.		
1.5 Buildings	Building quality is improved to make buildings more comfortable and efficient, including during extreme weather events.	Improved: indoor environments from enhanced building performance requirements and retrofits.	
2. Economic prosperity			
2.1 Employment	New employment opportunities are created.	Improved: new jobs will be created in retrofit fields, as well as in new construction, as a result of enhanced building codes.	Improved: new jobs will be created in supplying, installing , and maintaining solar PV, heat pumps, district energy, biogas, and energy storage.

2.2 Household disposable incomes	The impact on household incomes is mixed.	Improved: household energy costs decline.	Improved: household energy costs decrease as a result of improved efficiency
2.3 Economic development	New economic sectors emerge.	Improved: new investment opportunities in retrofits and new builds.	Improved: new investment opportunities in renewable energy and district energy. Additionally, energy dollars will stay within the city with local generation.
2.4 Municipal finances	Municipal finances associated with existing services are more stable; New services are required. Mobilisation of capital is required to finance the actions.	Unknown: conditional on the policies and mechanisms to support retrofits.	Improved: opportunities to generate financial returns from renewable energy generation.
2.5 Innovation	The 100% scenario will stimulate innovation.	Improved: scaled up approaches to renovations, retrofits, and green building technology.	Improved: mass deployment of renewable energy systems.
2.6 Reputation	Ottawa's reputation is enhanced.	Improved: high performance buildings are further developed in Ottawa.	Improved: renewable energy and district energy improve Ottawa's reputation as a climate leader.

2.7 Social capital	People interact more as a result of mixed-use development and increased walking and cycling.		
2.8 Environmental capital	There are more opportunities for green space in Ottawa. There is reduced pressure on green space outside of Ottawa.		Improved: energy generation in the city boundaries decreases the need for new generation capacity in green spaces beyond the city.
3. Social equity			
3.1 Poverty	Housing costs increase, but the cost of transportation decreases.	Improved: social housing as retrofits and operating costs of housing decline.	Mixed: opportunities to participate in the renewable energy economy may be limited for those in poverty; district energy can provide secure and cost-effective heating and cooling.
3.2 Elderly	Accessibility for the elderly improves. The built environment is healthier.	Improved: buildings are healthier and more resilient.	Improved: air conditioning from heat pumps is widespread, reducing the impacts of heat waves on the elderly.

3.3 Children	Accessibility for children increases. The built environment is healthier.	Improved: buildings offer healthier and more resilient environments	
3.4 Intergenerational equity and resilience	The burden on future generations is decreased. Stranded costs are avoided by acting quickly where possible.	Improved: damage from climate change is reduced.	Improved: damage from climate change is reduced. Stranded costs are avoided.

2.6 Conclusion

Based on the ability:

- To bundle retrofit measures so that they are not only feasible, but potentially profitable;
- For the City to develop a financially sustaining LIC program;
- To target initial marketing and outreach efforts to homeowners that are most likely to benefit from the program; and
- To generate significant co-benefits associated with the retrofit of residential buildings;

Staff recommend that Ottawa launch a new LIC program called the Better Homes Loan Program to make it easier and more affordable for homeowners to pay for home energy improvements that contribute to meeting the City's GHG emission reduction targets, create jobs in the contractor, trades, and renovation sectors and make the building stock more comfortable, healthy, and resilient to extreme weather events.

3. Program Design

3.1 Program Overview

Through the proposed Better Homes Loan Program, Ottawa homeowners could get a low-interest loan of up to 10% of the current value assessment of their home to cover the cost of home energy improvements such as thermal envelope upgrades (basement/attic/exterior wall insulation, window/door replacements), mechanical systems (thermostats and controllers, air/ground source heat pumps, solar hot water systems), renewable energy (solar photovoltaic systems), EV chargers (Level 2), and additional rental units (up to a maximum of 30% of the value of the loan).

With low fixed interest rates and terms of up to 20-years on qualifying measures, the Better Homes Loan Program would make it easier and more affordable for homeowners to pay for these home improvements over time. Once the loan is approved, homeowners would be able to hire the contractor of their choice and complete their renovations.

An overview of the program including eligibility requirements, qualifying measures, application process and program delivery is provided below.

3.2 Eligibility Requirements

Participation in the program is voluntary and owner initiated. Eligibility requirements are as follows:

- Residential, detached, semi-detached, townhouse, residential multi-unit buildings of 3 stories or less, that fall under Part 9 of the Ontario Building Code;
- The property must have a property tax account with the City of Ottawa;
- Property tax, utility bills and all other payment obligations to the City of Ottawa for the past five years must be in good standing;
- All registered owner(s) of the property must sign a consent form agreeing to participate in the Program; and
- If required by the loan loss reserve manager, written consent from all mortgage lenders, if the property is subject to one or more mortgages.

3.3 Home Energy Assessments

A home energy assessment must be completed to demonstrate the potential to achieve cost-effective energy reductions in order to qualify for LIC funding. Ottawa's Better Homes Loan Program will use a version of the EnerGuide Rating System that provides a standard measure of a home's energy performance. This is the same system that the Federal Government used when it offered the ecoENERGY Home Retrofit Program. It provides a standardized tool and process to assess home energy efficiency and can model energy savings projects.

The property owner must have their pre and post energy assessment verified by a Certified Energy Advisor (the "CEA") or equivalent as certified by Natural Resources Canada ("NRCan"). This may be achieved as an in-house energy audit or as a data-driven analysis, such as is being contemplated by NRCan as EnerGuide Lite, that does not require an in-house visit, if it follows the EnerGuide rating system.

CEAs are experts in the field of energy efficiency and well-versed in the 'whole home' approach to home energy systems, technologies and products. The cost of the energy assessments is paid by the homeowner but may be included in the final project cost to be financed through the LIC. A homeowner may be eligible for a rebate for the cost of an energy assessment if they participate in a utility or senior government energy retrofit incentive program(s).

Upon completion of the pre-retrofit home energy assessment, a report is provided to the homeowner with the NRCan EnerGuide rating for the home and recommendations for energy improvements that could potentially increase that rating. This report must be provided to the City of Ottawa in order to access LIC funding. The City of Ottawa may also request 24 months of utility data, 12 prior to the retrofit and 12 following, for performance verification.

After the retrofit is complete, a follow-up home assessment is performed by the CEA to obtain an updated EnerGuide label and to verify the completion of work. Provided that the second assessment that the homeowner provides to the City of Ottawa indicates that the EnerGuide rating has sufficiently increased and the improvements have been completed, then the utility incentives (described in Section 1.8. – *Access to Utility Rebates & Incentives*) can be determined and the City of Ottawa can issue the final disbursement of funds net of the rebates.

The applicant can determine whether to deduct the utility incentive amounts from the final loan disbursement.

3.4 Qualifying Energy Efficiency & Water Conservation Measures

The home energy assessment must demonstrate the potential to achieve cost-effective energy reductions in order to qualify for LIC funding. Financing is designated for capital costs (not maintenance costs) with an expected useful life of 5 years or greater and for measures that are permanently affixed to a property. The non-exhaustive list of the categories of measures eligible under the Program, subject to any permitting and regulations, includes:

- Thermal envelope upgrades: attic, walls, foundation, and basement insulation and associated requirements such as attic ventilation, foundation drainage and waterproofing; air barriers; window, skylights, and exterior door replacements; tubular daylighting devices and exterior window shadings or films; air-sealing, and weather stripping.
- Mechanical systems (space heating, cooling, and ventilation): thermostats and controllers, energy or heat recovery ventilators, air source heat pumps, ground source heat pumps, biomass wood heaters, heat distribution systems, duct sealing, fans, associated electrical equipment as required.
- Mechanical systems (water heating): high-efficiency water heaters (e.g., heat pump, electric water tanks, etc.), drain water heat recovery systems, solar hot water systems.
- Renewable energy and energy storage and EV chargers: solar photovoltaic systems, electric vehicle charging stations (Level 2), battery storage devices, associated electrical and load management equipment.
- Water efficiency: low-flow toilets, hot water circulation pump and system, greywater treatment system, closed-loop shower water recovery system, rainwater harvesting system (subject to eligibility criteria).

- Health and safety measures such as environmental remediation, electrical wiring and panel upgrades that are required undertakings to permit energy improvements
- Climate adaptation improvements such as back-flow prevention valves, sump pumps, basement waterproofing, permeable pavement, and tree planting.
- Additional dwellings such as granny suites or basement apartments are eligible up to 30% of the total loan amount.
- Other: Lighting, lighting controls, audit costs, permit costs, demolition costs, paint and drywall repairs related to insulation improvements, waste removal related to retrofits new energy efficient (certified) products will be considered as additional eligible technologies.

Note that utility rebates may be available to offset some costs.

Ineligible measures include equipment or products not permanently affixed to the property, those previously installed in another home, and those that are deemed general maintenance. By recommending categories of retrofit improvements and associated measures, the City of Ottawa makes no guarantees of the materials, performance, cost-effectiveness, or any warranty of the measures supported by the Program.

The value of the loan, which will include the funding amount, total interest, and an administrative charge, cannot exceed 10% of the current value assessment (CVA) for your property. The minimum loan amount approved is $15,000 with at least 2 of the retrofit measures implemented.

3.5 Completing the Retrofit

The City of Ottawa will provide financing to homeowners for qualifying measures covered by the Program that have been:

- Recommended by the CEA;
- Verified by the City of Ottawa or the assigned Program Administrator; and
- Installed by contractors hired by the property owner.

The City of Ottawa will not pre-qualify contractors or procure contractors to perform energy assessments or install retrofit improvements on behalf of homeowners in connection with this Program. The homeowner will use the funds disbursed by the City of Ottawa to pay contractors directly.

The City of Ottawa is not responsible for the work quality of any contractors hired in connection with this Program and assumes no liability for the works undertaken. All retrofit improvements and renovations must adhere to applicable permitting requirements, codes, and by-laws. The homeowner is responsible for ensuring that hired contractors are licensed, bonded, and insured. Any issues that may arise relating to the quality of workmanship or post-installation performance of energy measures, for example, should be dealt with by the property owner and contractor.

3.6 Application Process

Eligible homeowners would complete the following steps as part of the proposed Better Homes Loan Program process:

- Submit a pre-qualification application form to confirm eligibility;
- Complete a home energy assessment using the EnerGuide Rating System and submit a funding request to make the planned improvements;
- Finalize a property owner agreement that confirms the funding for the planned improvements;
- Complete the improvements and submit the project completion report
- Repay the loan over time through the property tax bill

Staff will periodically review this process to ensure effective Program implementation and, where deemed appropriate, the Treasurer may make changes at their sole discretion.

3.6.1 Pre-qualification Application

Homeowners submit a pre-qualification application form that includes, but is not limited to, the following information:

- Property address to confirm location is within eligible municipality;
- Property assessment roll number to confirm no outstanding payments owed to the City of Ottawa in the last five years;
- Proof of approval by all owners on title; and
- Evidence of mortgage lender consent (if required and where applicable).

If the loan loss reserve manager requires, and a homeowner has one or more outstanding mortgage(s) associated with the property, then the homeowner must obtain (at his or her own expense) consent from the mortgage lender(s) through a form that the loan loss reserve manager will provide. If required, property owners will advise any mortgage lender(s) of their intention to participate in the Program and receive permission from the lender(s), which may include a maximum approved dollar amount, as a requirement of the Program.

Once the property owner has been prequalified by City of Ottawa, based on the above criteria, the City of Ottawa, will provide Notice to Proceed to the homeowner.

3.6.2 Energy Assessment and Funding Request

a) Energy Assessment

The homeowner completes the pre-retrofit home energy assessment in accordance with Section 5.3 *Home Energy Assessments* and submits to the City of Ottawa, the resulting Energy Assessment Report that the CEA provides to the homeowner.

That Energy Assessment Report must include:

- The current NRCan EnerGuide rating for the home;

- Recommended improvements that have been customized for the home based on existing conditions which are projected to improve the NRCan EnerGuide rating of the home;
- The estimated useful life of the proposed improvement(s);
- Estimated energy cost savings and GHGs that may be realized after installing the recommended improvements; and
- Embodied carbon considerations in the retrofit implementation.

The City of Ottawa encourages applicants to review the energy savings programs of utilities and agencies such as Enbridge Gas and the IESO's Save On Energy program. Energy efficiency and water conservation measures that are eligible under this residential retrofit program may also be eligible for rebates from utilities.

The financing advanced by the City of Ottawa will be net of any rebates or other incentives approved for the homeowner. As such, potential eligibility for utility rebates and incentives offered by Enbridge Gas, the IESO's Save On Energy program or other incentive programs is included in the Energy Assessment Report.

Any estimated cost of the works can be included in the Energy Assessment Report but will require contractor invoices to verify the costs for inclusion in the Funding Request Form.

b) Funding Request Form

Along with the Energy Assessment Report, the homeowner also will need to submit a Funding Request Form that:

- Identifies the improvements that the property owner intends to install based on the Energy Assessment Report;
- Identifies the cost for each improvement (including equipment, materials and labour costs); and
- The amount of prepayment (up to a maximum of 30% of the estimated cost of the work) being requested from the City of Ottawa upon signing the property owner agreement ("POA").

Following receipt of the Funding Request Form, the City of Ottawa or the assigned Program Administrator, will:

- Confirm the eligibility of the works (e.g. items affixed to property);
- Verify the reasonableness of retrofit costs and labour costs by consulting manufacturer pricing and prevailing labour rates; and
- Calculate the administrative costs using a formula that apportions the cost to the City of Ottawa to operate this program between participating properties as percentage of the cost of the work undertaken relative to the percentage of the cost of the work to the overall Program budget for each Program Stream;

(*n.b.* the "cost to the City of Ottawa" includes recurring costs and any non-recurring costs not covered by the grant funding that the City of Ottawa has obtained for the Program)

The above steps will enable the City, to derive the funding amount up to the maximum of 10% of the property's assessed value to include in the Property Owner Agreement. The minimum loan amount approved is $15,000 with at least 2 of the retrofit measures implemented.

3.6.3 Property Owner Agreement

After the City of Ottawa, has confirmed the acceptability of the Energy Assessment Report and the Funding Request Form, the City of Ottawa will prepare a property owner agreement ("POA") for the homeowner(s) to review and sign.

3.6.4 Completing Improvements

a) Initial Funding Disbursement

Following execution of the POA, the City of Ottawa will provide the homeowner with the initial disbursement agreed upon in the POA to a maximum of 30% of the estimated cost of the work that can be used by the homeowner to pay contractors or suppliers (i.e. security deposits).

The property owner will be contractually obligated to repay this initial disbursement to the City of Ottawa if the property owner does not complete the improvements.

The property owner can then proceed with hiring contractor(s) and performing the approved energy improvements to the property. The improvements must be completed within a reasonable timeframe, as stipulated in the POA, to be determined by the City of Ottawa in its sole discretion.

b) Final Funding Disbursement

As will be detailed in the POA, the City of Ottawa will provide the final disbursement only after the homeowner provides a copy of the post-retrofit assessment report from the CEA that:

- Includes a Certificate of Completion that attests the approved retrofit measures having been installed and provides an EnerGuide rating of the home after the retrofit measures have been completed which is greater than the original EnerGuide rating noted on the pre-retrofit assessment report from the CEA;
- Indicates the actual costs and useful life for all the works; and
- Completes a follow up evaluation survey from the City of Ottawa.

3.6.5 LIC Repayment and Disclosure

Following the City of Ottawa Treasurer's periodic certification of the local improvement roll (which occurs after the improvements on a given set of properties are complete and the final amounts of funding are confirmed) the City of Ottawa Solicitor will submit a corresponding bill for Council to adopt a by-law pursuant to Section 36.14 of O.Reg

586/06 to impose the special charges on the participating properties. For each property included in the by-law, the Treasurer will then add to the City of Ottawa's tax roll for that property each year that portion of the imposed special charge that is due in that year. These collective steps will provide priority lien status for the annual amount that the Treasurer adds to the tax roll and will ensure that any subsequent property owner who was not a party to the POA is bound to pay that amount.

To facilitate repayment of the annual special charge, the POA will require homeowners to sign up for the pre-authorized payment plan option for property tax payments. At any time, a homeowner can make advance payments, including a one-time payment of the total outstanding amount owing to clear the property of the LIC charge. Failure to make payments is treated with the same remedy as uncollected property taxes which may include penalties and interest charges.

Any subsequent owner of a property on which the City of Ottawa has imposed a special charge is required to pay the City of Ottawa the annual LIC amount even though that subsequent owner was not a party to the original POA. In addition to notice that the City of Ottawa will be providing in accordance with the provisions of O. Reg. 586/06, the City of Ottawa also will take the following steps to ensure even greater transparency of the LIC to interested parties by:

- Posting on the City of Ottawa 's website notice of the special charge by-law to impose the charge on the property in advance of its introduction and after its adoption; and
- Updating the Tax Certificate to include the full LIC amount, amount payable in the current year, outstanding amounts owing and a note to reference the by-law pursuant to which the special charge was imposed.

3.7 Program Impact Measurement and Verification

If required in the POA, the property owner(s) must consent to providing the City of Ottawa with access to the property's utility usage data in order to monitor results and evaluate the Program's effectiveness for a period of five years after completion of the retrofit. Surveys and data analysis of participants and contractors will also be used to inform tweaks to the program. For example, the pre and post energy audits and data collected through the retrofit portal will be used to track measures implemented, costs, and contractor experience. This will inform ways to improve on the success of that phase of the program to heighten the results achieved.

The program will be evaluated using the following criteria:

- Customer satisfaction
- Number of homes
- Aggregated energy/water savings (number of kWh, m3 of natural gas saved, and cubic litres saved)
- GHG reductions

- Total size of loans ($) provided to projects
- Diverse demographic reach (low income, indigenous populations, seniors and others)

Data will be collected throughout the Program and the Program will be adjusted to ensure continuous improvement.

3.8 Risk Mitigation and Quality Control

There are risks with implementing a new program. These risks and their mitigation measures are detailed below:

- Loan default risk – mitigated through payment history checks, title searches, mortgage lender consent, loan loss reserve funds, priority liens on property, and mandatory monthly direct debit payments;
- Interest rate escalation risk – mitigated through long-term fixed debt facilities and associated agreements with homeowners;
- Contractor performance risk – mitigated through pre and post energy audits following NRCan's guidelines, documentation of all retrofit measures and contractor invoices, recommended certification for contractors, recommended performance bonding of contractors, project management support tools for homeowners, the right to inspect homes and documents where necessary.
- City liability risk – mitigated through legal agreements and lack of engagement of City in individual procurement choices; and
- Participation uptake risk - mitigated by the grant in the launch years to support significant marketing and outreach and the development of a retrofit portal to enable achieving a self-sustaining program long-term.

3.9 Program Delivery

The Better Homes Loan program would be delivered internally. In the first three years, 1.5 new employees would be required to launch and implement the proposed program. Funding to cover the cost of 1.5 temporary FTEs is proposed as part of the grant portion of the FCM application. An administration fee will be charged to all applicants to contribute to the cost of program delivery, develop a loan loss reserve fund, and achieve a self-sustaining program model for future years.

Staff support to deliver the program will involve:

- Launching the proposed program, including outreach and marketing and stakeholder relations (PIED Climate Change and Resiliency);
- Processing applications (PIED Climate Change and Resiliency);
- Verifying applicant eligibility and creditworthiness (Finance);
- Preparing the LIC by-law (Legal);

- Dispersing funds (Finance);
- Recording priority lien on the property and collecting repayment (Revenue Services); and
- On-going evaluation, impact measurement and verification (PIED Climate Change and Resiliency).

Alternatively, a third-party delivery agent could be contracted to take on the outreach and marketing as well as some of the administrative tasks of the program if deemed desirable. To date, conversations with other municipalities about the potential for collaboration through a third-party delivery agent are ongoing and will be taken into consideration during final program design stages.

Capital for the first 3 years of the program is expected to come from the Federation of Canadian Municipalities (FCM) Community Energy Financing program as well as debt the City would incur from private or public sources. An application to FCM for up to a $10 million low interest loan and a $5 million dollar grant will be submitted pending Council approval. This funding requires that the City contribute $3 million in debt financing from either debentures or private sources. A letter of commitment has been received from a private lender that is willing to provide the $3 million of debt, if required.

If deemed successful following the 3-year launch phase, the program would be recapitalized. It is expected that private capital would be sought for this, and a loan loss reserve fund has been built into the program financials to facilitate access to low-interest private capital.

3.10 Next Steps

The program launch is dependent on securing financing for the program through FCM. Tasks associated with launching the Better Homes Loan Program are described below. If funding is not secured, the program design will be revisited.

Q3-Q4 2020: Final program design (pending FCM funding confirmation)

- Develop strategy for high performance to incent higher GHG reductions per retrofit
- Finalize roles, responsibilities, and delivery agreements
- Finalize neighbourhood energy mapping
- Start work on online retrofit portal, a market transformation tool which helps homeowners identify the best retrofit actions to take based on their home’s energy profile and connect with qualified contractors (identified through industry certifications) to implement the measures

- Consultation with neighbourhood collaborators, contractors, relevant retail establishments
- Develop RFP(s) for service providers
- Post job competitions
- Hire staff
- Set up loan loss reserve pool and risk mitigation measures
- Set up streamlined process for credit checks, milestone payments, and collections
- Engage primary mortgage holders through consultations and participate in advocacy for CMHC backstopping

Q1/Q2 2021: Program Launch

- Launch program
- Contractor and service provider training and referral program
- 1st phase of neighbourhood outreach and digital marketing
- Implementation of additional aspects of Retrofit Accelerator Program to support BHLP (other staff in CCR will focus on this in collaboration with BHLP staff)

2022: Program Optimization

- Survey participants and contractors for feedback on program delivery
- Assess impact and tweak for optimization of cost effectiveness and GHG reduction outcomes
- Pursue bulk arrangements to reduce cost of key retrofit measures

2023: Program Evaluation and Continuation Planning

- Evaluate program impact
- Determine if program costs and revenues are self-sustaining or ways to achieve that status
- Recapitalization for years 4 onwards
- Equity and inclusion lens consultations

Appendix A: Energy Use and GHG emissions by Fuel Type, Building Type, and Household

In 2016, 48.2% of GHG emissions in Ottawa came from buildings, with residential buildings contributing 27.5%[4]. These emissions are primarily from natural gas consumption, as shown in Figure 20. By switching to electricity and reducing overall consumption, the model for 100% Scenario anticipates GHG emissions will be reduced by 99% in residential buildings by 2050 due to the low GHG emission grid in Ontario (Figure 21).

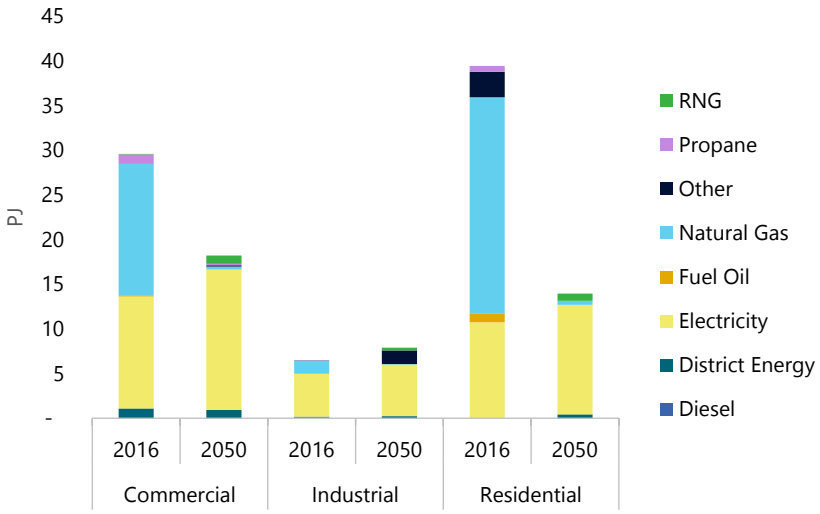

Figure 20 Energy use by fuel and building type, 2016 and 2050

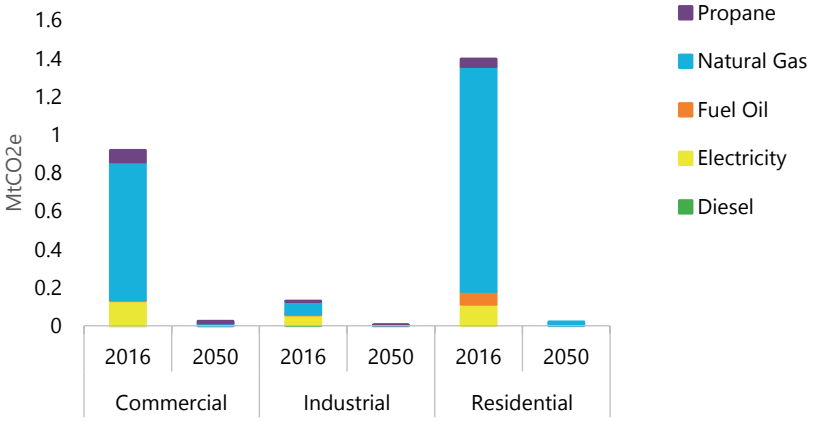

Figure 21 GHG emissions by building type and source, 2016 and 2050.

The use of energy and GHG emissions in residential buildings is dominated by space heating in 2016. The next most significant energy use and emissions is water heating, as seen in Figures 22 and 23.

[4] In 2018, the residential share of emissions was 22%.

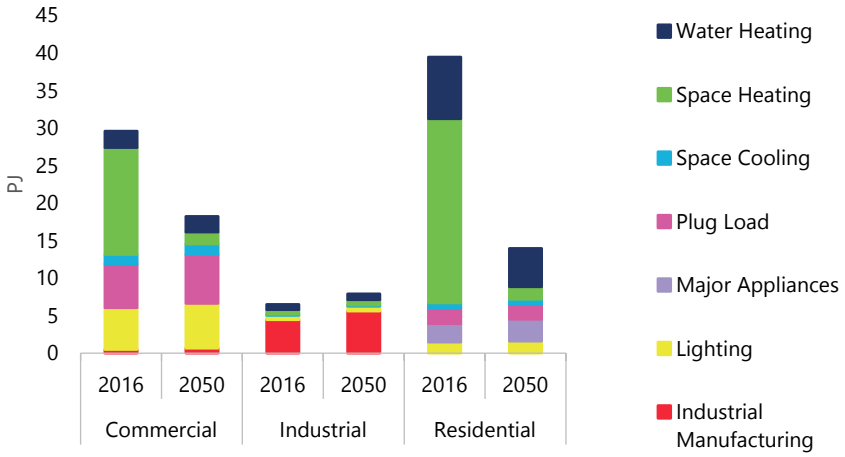

Figure 22 Energy use by building type and end use, 2016 and 2050.

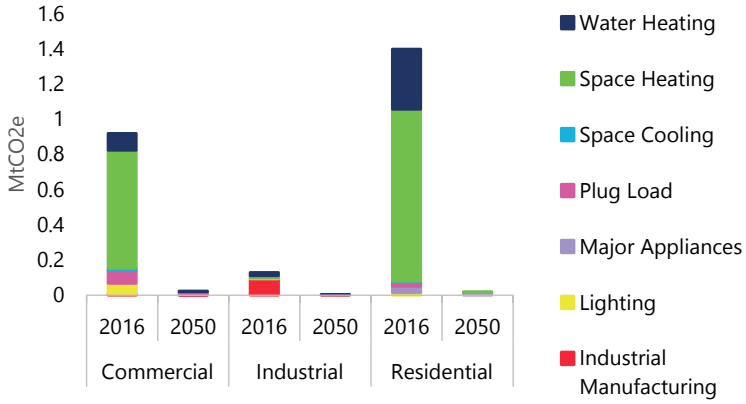

Figure 23 GHG emissions by building type and end use, 2016 and 2050.

This analysis demonstrates that effective emissions reduction programs for Ottawa should focus on reducing and electrifying space heating and water heating loads in the residential sector.

When analyzing the low carbon pathway for the residential sector, energy use per household declines from 105.6 GJ to 23.4 GJ between the baseline in 2016 and the 100% in 2050, a reduction of 78%, as shown in Figure 24. Household energy use in 2050 in the BAP scenario is projected to be lower than in 2016 due to building code improvements, asset replacement at end of life, trends towards smaller units, and decreased heating degree days, therefore the incremental energy reductions called for in the 100% scenario compared to BAP in 2050 is 64%, as depicted in Figure 24.

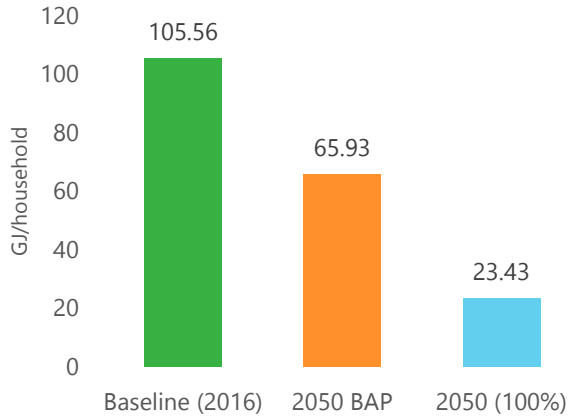

Figure 24 Residential energy per household, 100% scenario.

On the emissions side, residential GHGs decrease by 98.5% on a per household basis by 2050. These savings are a result of retrofits to existing buildings to maximize energy efficiency, net-zero standards for new dwellings, adoption of energy-efficient heating sources, and fuel switching away from fossil fuels, as shown in Figure 25.

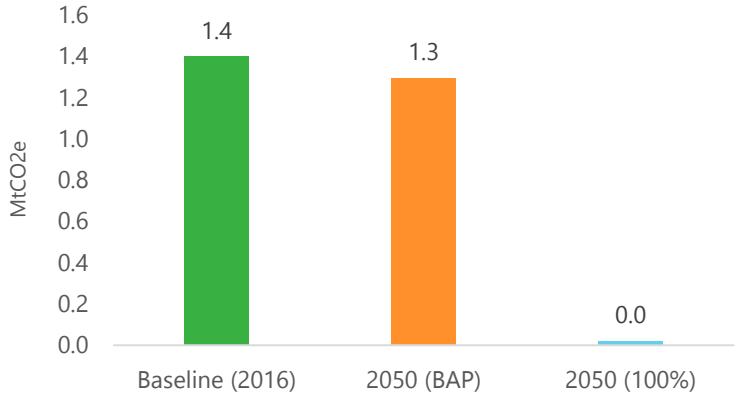

Figure 25 Residential emissions per household, 2016 and 2050.

Appendix B: Residential Retrofit Accelerator Program Components

As part of the Energy Evolution status update Council received in January 2020, staff identified 20 priority projects to advance Energy Evolution. One of the projects was a Residential Retrofit Accelerator Program to accelerate residential building retrofits through marketing, information and financial mechanisms. One of the components of this program is a Local Improvement Changes mechanism to finance energy improvements. It is also supported by many other market transformation actions that, when implemented together, increase success of the financing program.

A.1 Benchmarking and transparency

- Develop tools to track energy use and emissions in residential buildings, which then informs building owners and prospective buyers of improvement opportunities. Adjust incentive programs accordingly.

A.2 Marketing and Education

- Provide a home energy label to all small residential buildings through building archetyping based on data and machine learning
- Launch a retrofit portal to engage the homeowner and to guide them through retrofit planning, contractor selection, and project management.
- Work with utilities, industry associations, and energy educators to increase knowledge of emissions reductions strategies and opportunities amongst contractors and service providers.
- Build on the tools available from NRCan by widely sharing and providing training to service providers.
- Work with building permit office, retailers, community associations and networks, libraries, and social marketing experts to provide tools and
- information for homeowners on how to reduce GHGs in the home. Leverage equipment replacement or renovations.
- Connect homeowners with who have undergone deep energy retrofits with those considering action. Develop bulk retrofit groups in neighbourhoods supported by energy advisors.
- Implement solutions to resolve the split incentive challenge between landlords and tenants for energy retrofit costs and benefits.
- Work with existing rental unit marketing programs such as Certified Rental Building to increase energy performance requirements for participation.

A.3 Coordinating for Accelerated Reductions

- Develop financing options for deep energy retrofits including a Local Improvement Charge mechanism (more details in section 6)
- Explore the use of a Community Improvement Plan mechanism for incentivizing retrofits.
- Pursue programs to upgrade high-GHG equipment. Approach this with an affordability lens.
- Review permitting and inspection process to remove barriers that enable innovative energy solutions (ex. exterior prefabricated panels for

exterior insulation) that allow for deep retrofits without occupant relocation. It is important to note that solutions that improve efficiency while buildings remain occupied will be critical as there is not enough housing supply to temporarily relocate occupants during renovations.

A.4 Explore Legislative Tools

- Mandatory energy disclosure at time of listing (rental or sale)
- Requiring improvements in carbon and energy performance at the time of building renovations.
- Updates to Property Standards Bylaw to mandate energy and carbon performance
- Landlord licensing requirements tied to building energy performance